

**CENTRAL VALLEY PROJECT IMPROVEMENT ACT
PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT**

DRAFT TECHNICAL APPENDIX

Recreation

September 1997

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LIST OF ABBREVIATIONS AND ACRONYMS

Bay-Delta	San Francisco Bay/Sacramento-San Joaquin Delta
Bay-Delta Region	San Francisco Bay/Sacramento-San Joaquin Delta
BLM	U.S. Bureau of Land Management
CDEC	California Data Exchange Center
cfs	cubic foot (feet) per second
COE	U.S. Army Corps of Engineers
CPFV	commercial passenger-carrying fishing vessel
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
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
MMWD	Marin Municipal Water District
mph	mile(s) per hour
msl	mean sea level
NRA	National Recreation Area
NWR	National Wildlife Refuge
NPS	National Park Service
PEIS	Programmatic Environmental Impact Statement
RBDD	Red Bluff Diversion Dam
Reclamation	U.S. Bureau of Reclamation
SCVWD	Santa Clara Valley Water District
Service	U.S. Fish and Wildlife Service
SFWD	San Francisco Water District
SR	State Route
SRA	State Recreation Area
SSWD	South Sutter Water District
SWP	State Water Project
USFS	U.S. Forest Service
WMA	Wildlife Management Area
YCWA	Yuba County Water Agency

CHAPTER I

INTRODUCTION

Chapter I

INTRODUCTION

The Draft Programmatic Environmental Impact Statement (PEIS) summarizes the evaluation of the direct and indirect impacts of implementing a wide range of actions identified in the Central Valley Project Improvement Act (CVPIA). Details of the information used in the definition of the affected environment and analysis of the environmental consequences are presented in the technical appendices of the Draft PEIS.

This technical appendix presents a summary of recreational resources background information that was used during the PEIS preparation, and the results of the impact analyses for conditions that occurred throughout the study area, shown in Figure I-1.

The recreational resources analysis was primarily based upon changes in water levels at reservoirs and rivers, changes in refuge conditions, and associated changes in visitor use. Information from the Vegetation and Wildlife and the Surface Water and Facilities Operations technical appendices was used in the recreational resource analyses.

Information from this technical appendix was used in the Fish, Wildlife, and Recreation Economics and the Cultural Resources technical appendices.

The assumptions and results of the analyses for Alternatives 1, 2, 3, and 4 and for Supplemental Analysis 1i are presented in this technical appendix and summarized in the Draft PEIS. The assumptions and results of Supplemental Analyses 1a through 1h, 2a through 2d, 3a, and 4a are summarized only in the Draft PEIS. The assumptions related to the recreational resources analyses for Alternatives 1, 2, 3, and 4 and Supplemental Analysis 1i are presented in Table I-1. The results of the analyses are presented in Table I-2.



**FIGURE I-1
STUDY AREA**

TABLE I-1

SUMMARY OF ASSUMPTIONS FOR RECREATION ANALYSES

Alternative or Supplemental Analysis	Assumption
No-Action Alternative	Same as existing conditions.
1	Recreational Use at reservoirs will change with critical water levels which affect boat ramps, water skiing, and picnicking. Recreational use at refuges and on rivers will change with habitat quality.
1i	Same as Alternative 1.
2	Same as Alternative 1.
3	Same as Alternative 1.
4	Same as Alternative 1.

TABLE I-2

SUMMARY OF IMPACT ASSESSMENT OF RECREATION

Affected Factors	No-Action Alternative	Alternative 1	Supplemental Analysis 1i	Alternative 2	Alternative 3	Alternative 4
<i>Change from No-Action Alternative</i>						
CVP/SWP Reservoirs	Higher surface elevations than existing conditions in summer months.	Lower surface elevations on Pitt River and Sacramento River arms of Shasta Lake during off-season for boats. Higher elevations at Lake Oroville and Folsom Lake in peak and off-peak seasons improve boating and shoreline activities. Lower surface elevations at New Melones Reservoir adversely affect boating and shoreline activities.	Similar to Alternative 1.			
12-hr Recreation Visitor Days	11,400,000	< -1%				

TABLE I-2. CONTINUED

Affected Factors	No-Action Alternative	Alternative 1	Supplemental Analysis 1i	Alternative 2	Alternative 3	Alternative 4
<i>Change from No-Action Alternative</i>						
Wildlife Refuges 5-hr Recreation Visitor Days	Similar to existing conditions. 178,400	Increased opportunities for wildlife observations, hunting, and fishing. 20%	Same as Alternative 1.	Same as Alternative 1, plus additional opportunities for wildlife observations, hunting, and fishing. 40%	Same as Alternative 2.	Same as Alternative 2.
Rivers	Similar to existing conditions.	Flows maintained in optimal range for boating on upper Sacramento River and for boating and swimming on Stanislaus River during peak season. Flows below optimal range for swimming on American River during peak season.	Similar to Alternative 1.	Similar to Alternative 1.	Similar to Alternative 1.	Similar to Alternative 1.
Lake Red Bluff	Similar to existing conditions.	Same as No-Action Alternative.	Elimination of flatwater recreation.	Same as No-Action Alternative.	Same as No-Action Alternative.	Same as No-Action Alternative.

CHAPTER II

AFFECTED ENVIRONMENT

Chapter II

AFFECTED ENVIRONMENT

DESCRIPTION OF RECREATION AREAS

This technical appendix describes characteristics of recreation areas that could be affected by implementation of the CVPIA. Those recreation areas are as follows:

- CVP, State Water Project (SWP), or other reservoirs;
- rivers and streams directly dependent on downstream flows controlled by these reservoirs;
- coastal sport fisheries that would be affected by enhancement of ocean salmon fisheries;
- national wildlife refuges (NWRs) or state wildlife management areas (WMAs) that receive CVP water; and
- other facilities that provide limited recreation, such as aqueducts, canals, and private hunting clubs.

Recreation characteristics are identified for key recreation areas and potentially affected recreation areas in the Sacramento River, San Joaquin River, and Tulare Lake regions. Key recreation areas are likely to change substantially; potentially affected recreation areas are not expected to change substantially. The following information is presented, where pertinent, for each recreation area:

- type of recreation facilities and activities;
- 1992 recreation use estimates measured in 12-hour recreation visitor days (RVDs) for reservoirs, 6-hour RVDs for rivers, 5-hour RVDs for refuges, and 6-hour RVDs for ocean sport fishing;
- historical use data (1940-1982) and recent trends use data (1983-1990), presented as originally reported;
- recreation use at private hunting clubs measured in hunter days (time spent by one hunter hunting one species for one day);
- seasonality of recreation use;
- recreation quality conditions associated with lake levels or river flows; and
- origin of visitors.

For the purposes of this analysis, the regions discussed in this technical appendix vary somewhat from the study area regions shown in Figure I-1. Some of the regions shown in Figure I-1 are not addressed in this technical appendix or have been combined with other regions. These regions

are the San Francisco Bay, North Coast, Central Coast, South Coast, and Trinity River Basin regions. The descriptions of sport fishing in the San Francisco Bay Region and in the Sacramento-San Joaquin Delta have been combined in this technical appendix into a discussion of sport fishing in a region called the San Francisco Bay/Sacramento-San Joaquin Delta (Bay-Delta) Region. The description of recreation in the San Francisco Bay Region is limited to discussion of reservoir-related recreation. Impacts on recreation in the North Coast Region attributable to implementation of the CVPIA would be limited to ocean sport fishing for salmon. The Pacific Coast Region was created to characterize marine sport fishery activities for salmon, with the coastal area of the North Coast Region included as part of the Pacific Coast Region. The Pacific Coast Region includes coastal portions of California, extending from the Oregon-California border in the north to Monterey in the south. Impacts on recreation occurring in the Central Coast and South Coast regions were not assessed because implementation of the CVPIA is not expected to affect water-dependent or water-enhanced recreation in these regions. Impacts on recreation occurring in the Trinity River Basin Region are not addressed in this technical appendix.

This technical appendix therefore focuses on six geographic regions in the study area: the Sacramento River, Bay-Delta, San Joaquin River, Tulare Lake, Pacific Coast, and San Francisco Bay regions.

Actions considered under the CVPIA would result primarily in changes in reservoir levels, river flows, fish abundance, and waterfowl abundance. This chapter focuses on describing recreation activities that could be affected by implementation of the CVPIA. Most of the activities at reservoirs and rivers in the Sacramento River and San Joaquin River regions that could be affected are water dependent or water enhanced. Water-dependent activities include boating, fishing, rafting, and swimming; water-enhanced activities include camping, picnicking, hunting, and wildlife observation.

Use and activity information presented for reservoirs focuses on water-dependent and water-enhanced activities. Information for rivers is more activity-specific. The 1992 recreation use estimates for rivers in the Sacramento River Region focus on describing fishing activity because this is the primary activity occurring on these rivers that could change under the CVPIA. The use estimates for rivers in the San Joaquin River Region focus on describing boating, swimming, and fishing because these are the primary activities on these rivers that could change under the CVPIA.

The description of recreation activities in the Bay-Delta Region focuses on fishing activity for anadromous fish species and waterfowl hunting on private lands. For the Tulare Lake Region, the discussion focuses on waterfowl hunting on private lands. The description of recreation activities in the Pacific Coast Region focuses on fishing activity for anadromous fish species. The description of activities for the San Francisco Bay Region is generalized, not activity- or site-specific.

SACRAMENTO RIVER REGION

The Sacramento River Region extends from Shasta Lake at the northern end of the Sacramento Valley to the Sacramento/San Joaquin River Delta (Figure II-1). Key reservoirs in this region include Shasta Lake, Whiskeytown Lake, Lake Oroville, Folsom Lake, New Bullards Bar Reservoir, and Englebright Lake (Table II-1). Key rivers and streams in the region are 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, and Lake Natoma.

The Sacramento River Region includes NWRs, WMAs, and private hunting clubs that receive federal water (Table II-1). These NWRs and WMAs are treated as key recreation areas.

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

SAN FRANCISCO BAY/SACRAMENTO-SAN JOAQUIN DELTA REGION

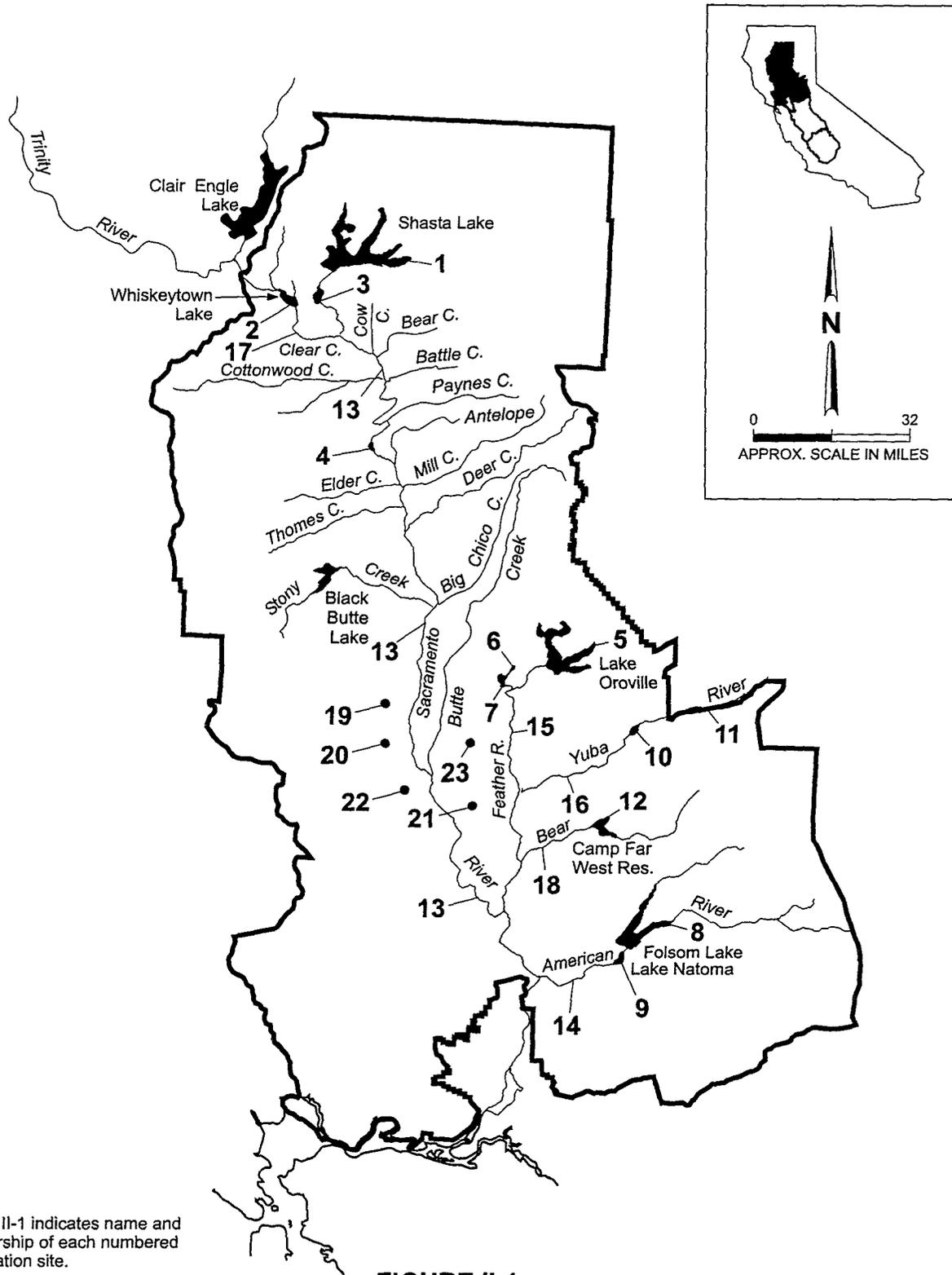
The Bay-Delta Region extends from the eastern edge of the Delta to the Golden Gate Bridge and includes the "legal delta" and San Francisco Bay. Although numerous recreation activities occur in this region, this report focuses on activities that depend on fish and wildlife abundance, primarily sport fishing for salmon, steelhead, striped bass, and sturgeon, and waterfowl hunting on private lands.

SAN JOAQUIN RIVER REGION

The San Joaquin River Region extends from the Delta in the north to the southern end of the San Joaquin Valley (Figure II-2). Key lakes and reservoirs in this region are San Luis Reservoir, Millerton Lake, New Melones Reservoir, Lake McClure, and New Don Pedro Reservoir (Table II-2). The key rivers are the San Joaquin, Stanislaus, Merced, Tuolumne, Mokelumne, and Calaveras. Other potentially affected lakes and reservoirs in the region include Bethany Reservoir, O'Neill Forebay, New Hogan Lake, and Camanche Reservoir.

The San Joaquin River Region includes NWRs and WMAs and private hunting clubs that receive federal water (Table II-2). NWRs and WMAs are treated as key recreation areas.

Major aqueducts in the region provide limited recreation opportunities and are treated as other potentially affected recreation areas. These aqueducts include the SWP's California Aqueduct and Reclamation's Delta-Mendota Canal (Table II-2).



NOTE:
Table II-1 indicates name and ownership of each numbered recreation site.

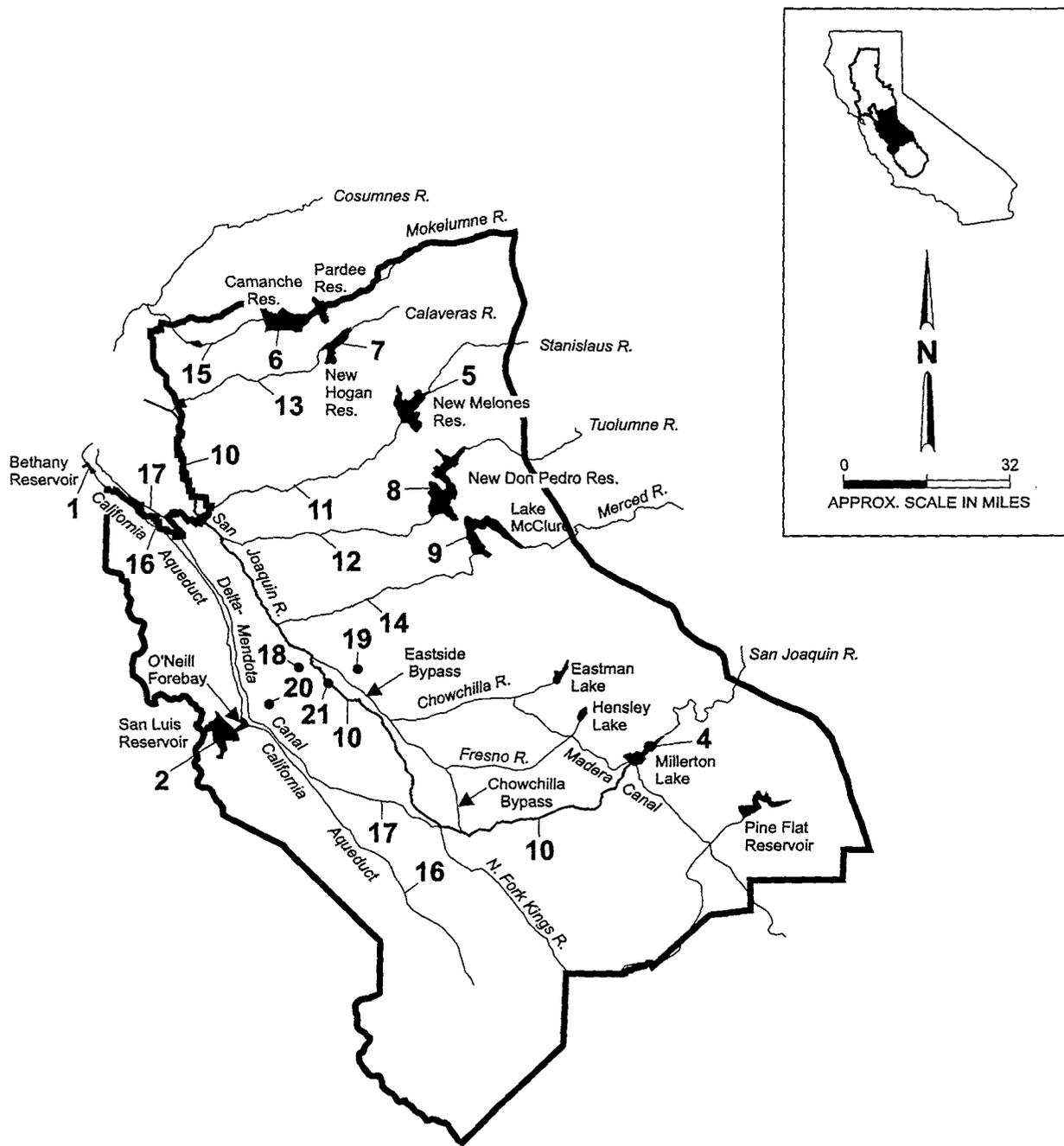
FIGURE II-1

LOCATIONS OF RECREATION AREAS IN THE SACRAMENTO RIVER REGION

TABLE II-1

**POTENTIALLY AFFECTED RECREATION AREAS
IN THE SACRAMENTO RIVER REGION**

Map Number (Figure II-1)	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	1964
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	COE/COE	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	Service/Service	1937
20	Delevan NWR	Service/Service	1962
21	Sutter NWR	Service/Service	1944
22	Colusa NWR	Service/Service	1944
23	Gray Lodge WMA	DFG/DFG	1931
NOTE: Private hunting clubs are not shown in Figure II-1 because they are scattered throughout the region.			
SOURCES: California Department of Finance, 1991; Reclamation 1989, 1993a.			
LEGEND: BLM = U.S. Bureau of Land Management COE = 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 = U. S. Bureau of Reclamation Service = 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			



NOTE:
 Table II-2 indicates name and ownership of each numbered recreation site.

FIGURE II-2
LOCATIONS OF RECREATION AREAS IN THE
SAN JOAQUIN RIVER REGION

TABLE II-2

**POTENTIALLY AFFECTED RECREATION AREAS
IN THE SAN JOAQUIN RIVER REGION**

Map Number (Figure II-2)	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	COE/COE	1963
8	New Don Pedro	MOID, TID/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	Service/Service	1966
19	Merced NWR	Service/Service	1951
20	Volta WMA	Reclamation/DFG	1952
21	Los Banos WMA	DFG/DFG	1929
NOTE: Private hunting clubs are not shown in Figure II-2 because they are scattered throughout the region.			
SOURCES: California Department of Finance, 1991; Reclamation, 1989, 1993a.			
LEGEND: COE = 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 MOID = Modesto Irrigation District NA = not applicable NWR = National Wildlife Refuge Reclamation = U. S. Bureau of Reclamation Service = U.S. Fish and Wildlife Service TID = Turlock Irrigation District WMA = Wildlife Management Area			

TULARE LAKE REGION

The Tulare Lake Region encompasses portions of Kings, Kern, and Tulare counties (Figure II-3). The region includes two NWRs and private hunting clubs (Table II-3). Kern NWR and the private hunting clubs are described in detail.

TABLE II-3**KEY RECREATION AREAS IN THE TULARE LAKE REGION**

Map Number (Figure II-3)	Recreation Area	Owner/Recreation Manager	Year Constructed/ Established
1	Kern NWR	Service/Service	1961
2	Pixley NWR	Service/Service	1961

NOTE:
Private hunting clubs are not shown because they are scattered throughout the region.

SOURCES:
California Department of Finance, 1991; Reclamation, 1989, 1993a.

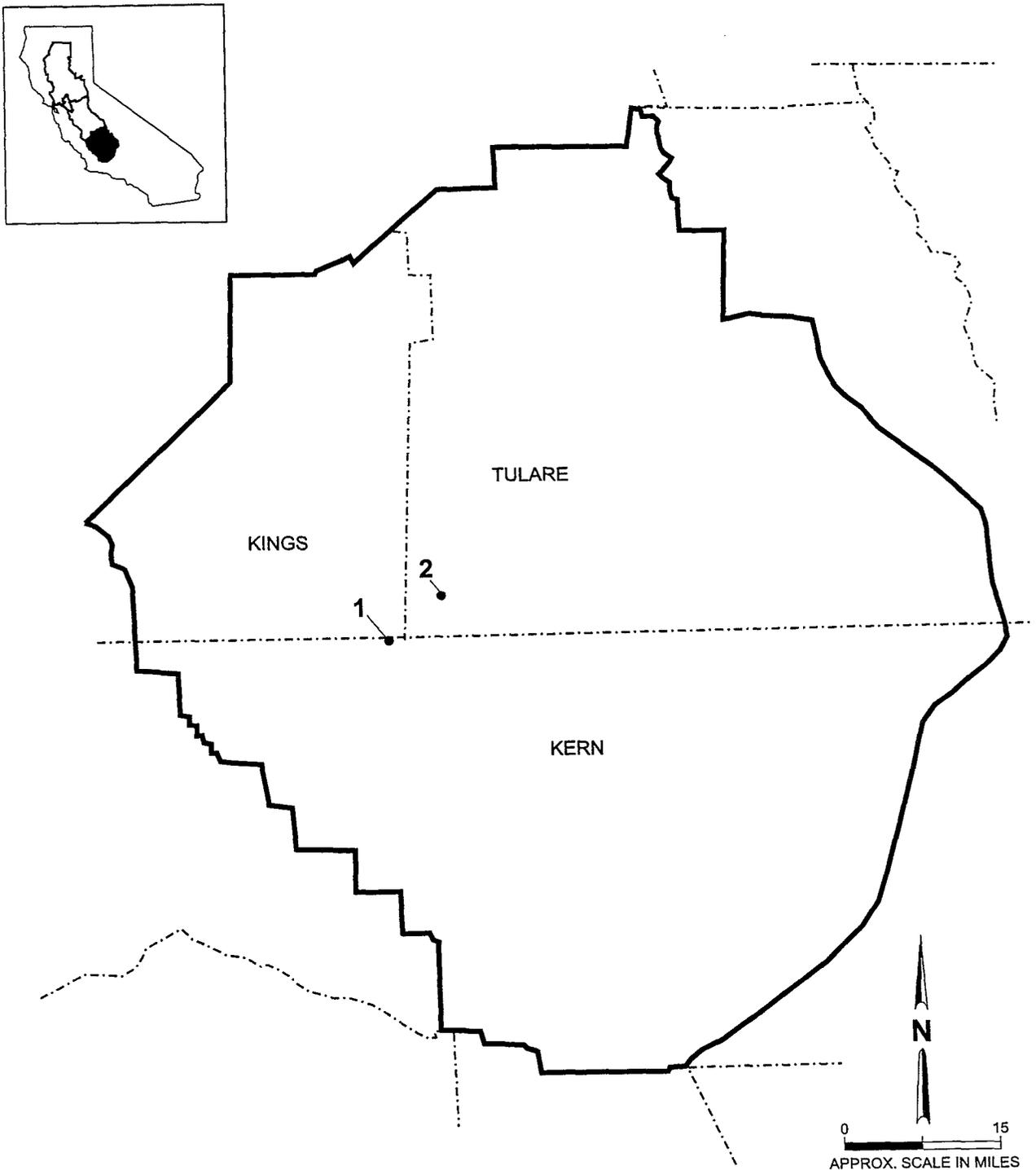
LEGEND:
NWR = National Wildlife Refuge
Service = U.S. Fish and Wildlife Service

SAN FRANCISCO BAY REGION

The San Francisco Bay Region includes lakes and reservoirs operated by the Santa Clara Valley Water District (SCVWD), the City of San Francisco Water Department (SFWD), East Bay Municipal Utility District (EBMUD), and Marin Municipal Water District (MMWD). Anderson Reservoir is owned by SCVWD, which receives CVP water. Reservoirs operated by SFWD are San Andreas Lake, Crystal Springs Reservoir, San Antonio Reservoir, and Calaveras Reservoir. San Pablo Reservoir, Briones Reservoir, San Leandro Reservoir, and Lake Chabot are operated by EBMUD. Nicaso Reservoir is operated by MMWD.

Because these reservoirs are used as storage facilities for municipal water supplies, access and activities are restricted. EBMUD allows limited non-contact water recreation usage at its lakes and reservoirs. Recreational facilities include fishing docks, picnic sites, and hiking and equestrian trails. Although recreation usage figures are presently unavailable, EBMUD typically offers recreational opportunities throughout the year.

The recreation activities at Anderson Reservoir are managed by the Santa Clara County Parks and Recreation Department. Typical activities at the reservoir include boating, water skiing, jet skiing, and picnicking during the peak season. Off-season activities include fishing. Swimming and camping are not allowed at Anderson Reservoir. Reservoir facilities include a single boat ramp, which requires reservations for weekend use. Most of the visitation at this reservoir occurs between May and September (John, pers. comm.).



NOTE:
Table II-3 indicates name and ownership
of each numbered recreation site.

FIGURE II-3
LOCATIONS OF RECREATION AREAS
IN THE TULARE LAKE REGION

STUDY PERIOD

The Historical Perspective section of this chapter describes recreation at reservoirs, rivers, and wildlife refuges in the Sacramento River and San Joaquin River regions between 1940 and 1990. Sport fishing activities are also described for the Pacific Coast and Bay-Delta regions for the period of 1940 to 1990. Recreation use trends between 1983 and 1990 are also described. The Recent Conditions section of this chapter describes recreation activities and uses at reservoirs, rivers, and wildlife refuges in the Sacramento River and San Joaquin River regions in 1992. Sport fishing activity and catch of salmon in the Pacific Coast and Bay-Delta regions are also presented.

DATA SOURCES

Data were compiled to characterize recreation conditions at reservoirs and rivers in the Pacific Coast and Bay-Delta regions, and at wildlife refuges/private hunting clubs. Data sources are cited in the text where the data are used.

LAKES AND RESERVOIRS

Descriptions of facilities and activities at lakes and reservoirs are based on reports and information provided by agencies or districts responsible for management of recreation activities. These agencies include the U.S. Forest Service (USFS), National Park Service (NPS), Reclamation, U.S. Army Corps of Engineers (COE), California Department of Parks and Recreation (DPR), California Department of Water Resources (DWR), EBMUD, SCVWD, Yuba County Water Agency (YCWA), Merced Irrigation District, and South Sutter Water District (SSWD). In some cases, data were supplemented by interviews with recreation area managers.

Agencies and districts were also the primary sources for use and visitor origin information. Most of these data were not published and were requested directly from managing agencies, including Reclamation and DWR. Activity data were compiled from published results of user surveys and interviews with recreation area managers.

Information for recreation quality conditions was compiled almost exclusively from interviews with recreation area managers.

RIVERS

Descriptions of facilities and activities along rivers are based on surveys and reports prepared by the following agencies responsible for, or involved in, management of recreation along these rivers: USFS, Reclamation, COE, U.S. Bureau of Land Management (BLM), DPR, DWR, and various county parks and recreation departments.

These agencies and departments were the primary sources for recreation use and visitor origin information. In addition, information from angler surveys conducted by the Service and California Department of Fish and Game (DFG) is incorporated to supplement the discussion of historical and current conditions.

PACIFIC COAST AND SAN FRANCISCO BAY/SACRAMENTO-SAN JOAQUIN DELTA REGIONS

Descriptions of recreation in the Pacific Coast and Bay-Delta regions focus on fishing activity for species that could be affected by the CVPIA. This activity is described in terms of angler effort and catch rates. Primary data sources are published results from surveys conducted by the Pacific Fishery Management Council, the Service, and DFG.

The description of recreation in the Bay-Delta Region also includes waterfowl hunting on private lands. Data sources for hunting on private lands are described below.

WILDLIFE REFUGES/PRIVATE HUNTING CLUBS

Descriptions of facilities and activities at NWRs and WMAs are based on visitor information published by either the Service or DFG. Information about activities on NWRs was supplemented by annual narratives published by each refuge and compiled from reports and unpublished data requested from the Service. Visitor origin data were compiled from the Service's annual narratives. For state WMAs, use data were compiled from unpublished DFG annual reports that were required as part of the Federal Aid in Wildlife Restoration Program. Information for the private hunting clubs was compiled from unpublished data requests from DFG.

HISTORICAL PERSPECTIVE

INTRODUCTION

This section presents an overview of recreation development in the geographic regions of the study area as defined for this technical appendix. A general description of how use and activities have changed in response to the development of key recreation areas is followed by a more detailed discussion of recent use trends at key recreation areas in each region.

The description of historical trends extends from 1940 to 1982. The description of recent recreation use trends at key recreation areas extends from 1983 to 1990.

SACRAMENTO RIVER REGION

Historical Trends, 1940-1982

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.

Key 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 (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 in California, with use ranging from 1.8 million to 4 million recreation days annually between 1970 and 1982 (Petrinovich, pers. comm.).

Whiskeytown Lake, which was constructed by Reclamation in 1963, also falls within the NRA, with recreation facilities managed by the NPS. Between 1970 and 1982, 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 constructed by the COE and is operated by Reclamation. DPR manages the lake's recreation facilities. Visitation is not well documented between 1955 and 1970. Between 1971 and 1977, visitation declined from approximately 2 million to less than 1 million recreation days, subsequently increased to nearly 2 million recreation days in 1978, and decreased to 1.1 million in 1982 (Petrinovich, pers. comm.).

Lake Oroville, a part of the 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 1982 to 684,000 visitors (DWR, 1989).

Other key lakes or reservoirs in the region include Englebright Lake (constructed by the COE in 1941) and New Bullards Bar Reservoir (constructed by YCWA in 1970). Visitation at both has increased steadily from 1941 to 1982. 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 1982, annual visitation at Englebright Lake increased from 66,000 to nearly 100,000 visits. Recreation use at New Bullards Bar Reservoir increased steadily from 1970 to 1982, 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, American, Feather, and Yuba 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 river flows 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 warm-water species were present below the dam site during summer periods (Service, 1950). The most common summer game fish 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 (Service, 1950). The popularity of the fishery 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 (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 (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 (DFG, 1980).

Recreation use on the lower American River (below Folsom Dam) substantially increased as a result of increased population in the Sacramento metropolitan area and establishment of the American River Parkway. Between 1967 and 1980, use was estimated to increase by 450 percent to approximately 5 million recreation user days annually (Gold, 1985). Of this total, water-dependent activities accounted for 2 million recreation user days (Gold, 1985).

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 (DFG, 1975). Between 1968 and 1974 an estimated average of 530 striped bass were landed by 2,700 anglers, 1,800 steelhead were landed by 4,800 anglers, and 644 chinook salmon were landed by 4,500 anglers annually (DFG, 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 includes 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 (Reclamation, 1989). Historically, Gray Lodge WMA has been the most popular of the five refuges in the region, accounting for approximately 57 percent of total use at all refuges in the region between 1973 and 1982. During this period, annual use averaged approximately 56,900 visitor days per year, of which an estimated 23 percent was hunting (DFG, n.d.). Use at the refuge increased approximately 95 percent between 1973 and 1982.

Sacramento NWR, established in 1937, has historically been the second most popular refuge in the Sacramento River Region, with an annual average of 27,900 visitor days between 1973 and 1982 (Forrest, pers. comm.). Nonconsumptive uses accounted for approximately 73 percent 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 8,300 visitor days between 1973 and 1982 (Forrest, pers. comm.). Nonconsumptive and consumptive uses have historically been equally popular at the refuge, each accounting for 50 percent of total use.

Sutter and Delevan NWRs, established in 1944 and 1963, respectively, have been used almost exclusively for hunting. Between 1973 and 1982, annual hunting activity averaged approximately 2,600 visitor days at Sutter NWR and 5,500 visitor days at Delevan NWR (Forrest, pers. comm.).

Recent Trends, 1983-1990

Lakes and Reservoirs. Recent use at key lakes and reservoirs in the Sacramento River Region between 1983 and 1990 has generally trended upward, except at Shasta Lake (Table II-4). Recreation use at these same lakes and reservoirs (except Shasta Lake) increased from 1983 to 1986 and then declined from 1987 to 1990. Fluctuating levels during the eight-year period suggest that changes in recreation use may have been driven partially by drought conditions.

During the eight-year period, use trends at the six key lakes and reservoirs in the Sacramento River Region were as follows:

- Shasta Lake had the highest recreation use, with an annual average of 2.38 million 12-hour visitor days; however, between 1983 and 1990 use decreased by 28 percent to approximately 2.05 million visitor days.
- New Bullards Bar Reservoir had the lowest use with an annual average of 13,800 visits; however, use increased over 300 percent between 1983 and 1990.
- Whiskeytown Lake had an annual average use of 468,000 12-hour visitor days during the eight-year period, ranging from a low of 355,000 visitor days in 1983 to a high of 604,000 visitor days in 1987; use generally increased over the eight-year period.
- Use at Folsom State Recreation Area (SRA) averaged 2.12 million visits annually over the eight-year period, ranging from a low of 1.36 million visits in 1983 to a high of 2.36 million visits in 1987.
- Use at Lake Oroville ranged from a low of 633,000 visits annually in 1984 to a high of 817,000 visits in 1986; annual use remained relatively constant over the eight-year period.
- Use at Englebright Lake averaged 120,000 visits over the eight-year period, increasing by 68 percent between 1983 and 1990.

TABLE II-4

ANNUAL RECREATION USE AND WATER LEVELS AT KEY LAKES AND RESERVOIRS IN THE SACRAMENTO RIVER REGION

Lakes and Reservoirs	1983			1984			1985			1986		
	Annual Use (thousands)	April Lake Level	Sept. Lake Level	Annual Use (thousands)	April Lake Level	Sept. Lake Level	Annual Use (thousands)	April Lake Level	Sept. Lake Level	Annual Use (thousands)	April Lake Level	Sept. Lake Level
Shasta	2,832	1,057.9	1,033.3	2,799	1,059.9	1,018.2	1,706	1,030.5	956.0	2,493	1,057.8	1,016.8
Whiskeytown	355	1,209.6	1,208.5	398	1,200.0	1,207.7	387	1,207.7	1,204.8	452	1,209.2	1,207.9
Oroville	725	NA	NA	633	NA	NA	771	882.1	794.7	817	NA	NA
Folsom	1,364	443.3	441.9	2,118	456.2	434.8	2,824	455.4	424.5	2,683	437.5	431.7
New Bullards Bar	7	NA	NA	8	NA	NA	8	1,971.0	1,848.1	14	NA	NA
Englebright	83	NA	NA	106	NA	NA	116	519.9	516.4	110	NA	NA

Lakes and Reservoirs	1987			1988			1989			1990			Average Annual Use (thousands)
	Annual Use (thousands)	April Lake Level	Sept. Lake Level	Annual Use (thousands)	April Lake Level	Sept. Lake Level	Annual Use (thousands)	April Lake Level	Sept. Lake Level	Annual Use (thousands)	April Lake Level	Sept. Lake Level	
Shasta	2,393	1,049.0	983.5	2,409	1,017.8	931.4	2,201	1,038.1	962.8	2,047	983.5	934.8	2,383
Whiskeytown	604	1,209.2	1,206.5	401	1,208.4	1,209.1	567	1,206.6	1,208.6	576	1,202.2	1,208.8	468
Oroville	816	NA	780.4	737	829.7	733.5	780	886.8	769.1	644	767.0	687.6	1,465
Folsom	2,358	438.4	405.1	1,640	414.7	369.1	2,068	460.4	422.6	1,871	417.3	359.0	2,116
New Bullards Bar	11	NA	1,872.2	12	1,901.3	1,851.8	23	1,936.9	1,876.1	26	1,926.7	1,898.3	14
Englebright	134	521.7	520.8	141	520.9	519.3	129	523.1	518.4	139	522.3	522.5	120

NOTES:
 Lake levels are reported in feet above msl.
 Annual use at Shasta and Whiskeytown lakes is reported in 12-hour visitor days.
 Annual use at Lake Oroville, Folsom Lake, Englebright Lake, and New Bullards Bar Reservoir is reported in number of visits.

SOURCES:
 Shasta: use and lake level (USFS, 1993f).
 Whiskeytown: use (NPS, 1984; 1985; 1986; 1987; 1988; 1989; 1990; 1991), lake level (California Data Exchange Center [CDEC] database maintained by California Department of Water Resources).
 Oroville: use (DWR, 1989), lake level (CDEC database).
 Folsom: use (DWR, 1989), lake level (CDEC database).
 New Bullards Bar: use (Higley, pers. comm.), lake level (CDEC database).
 Englebright: use (COE, 1992a), lake level (CDEC database).

LEGEND:
 NA = no information currently available.

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Rivers. The Sacramento, American, Feather, and Yuba rivers and Clear Creek are key 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. A comparison of angler surveys conducted in the late 1970s and early 1990s in the region provides the following information:

- Sport catch of anadromous fish in the Sacramento River decreased from approximately 8,200 chinook salmon landed in 1975 to 3,260 landed in 1990, and catch of steelhead decreased from approximately 6,900 fish in 1975 to 3,600 fish in 1990 (DFG, 1980; Wixom, pers. comm.).
- Sport catch of anadromous fish in the Feather River increased from approximately 990 chinook salmon landed in 1975 to 1,500 landed in 1990, and catch of steelhead decreased from approximately 2,900 in 1975 to 560 in 1990 (DFG, 1975; Wixom, pers. comm.).
- Sport catch of anadromous fish in the lower American River in 1990 totaled approximately 12,200 salmon, 1,200 steelhead, and 25,400 American shad (Wixom, pers. comm.).

Comparable fishing surveys are not available for Clear Creek or the Yuba River. Clear Creek does not support an important sport fishery (DWR, 1986). Fishing along the Yuba River has historically been constrained by limited public access (DFG, 1991a).

Wildlife Refuges. Key wildlife refuges in the Sacramento River Region are the Sacramento, Delevan, Sutter, and Colusa NWRs and Gray Lodge WMA. Use at all refuges between 1983 and 1990 totaled approximately 1.02 million visitor days for an annual average visitation of approximately 127,400 (Table II-5). Use includes both consumptive and nonconsumptive activities. Total use ranged from a low of 112,058 visitor days in 1984 to a high of 139,759 visitor days in 1988. The most significant decline in annual use occurred in 1989, with a decrease of approximately 15 percent from 1988 levels.

Nonconsumptive uses are primarily wildlife observation; consumptive uses are fishing and hunting. During the eight-year period, nonconsumptive uses accounted for approximately 74 percent of total use, hunting accounted for approximately 24 percent, and fishing accounted for the remaining 1 percent. Hunting use peaked in 1985 and then declined until 1990.

SAN FRANCISCO BAY/SACRAMENTO-SAN JOAQUIN DELTA REGION

Overall recreation use in the Bay-Delta Region has increased substantially since 1963, when it was estimated at approximately 2.4 million visitor days (DWR, 1978). By 1978, demand for recreation facilities in the Delta had surpassed the available supply (DWR, 1978), yet recreation use in the Bay-Delta Region has continued to increase. By 1987, annual recreation use had reached an estimated 7 million visitor days (Wade et al., 1987). Sport fishing continues to be an important recreation activity in the region.

TABLE II-5

**USE AT KEY WILDLIFE REFUGES IN THE
SACRAMENTO RIVER REGION**

Use Type (1)	Year								Average Annual Use
	1983	1984	1985	1986	1987	1988	1989	1990	
Nonconsumptive	78,783	79,879	90,736	107,549	104,942	111,015	90,168	94,480	94,694
Consumptive									
Hunting	33,357	30,539	35,100	33,896	32,521	28,744	25,768	28,887	31,102
Fishing	1,635	1,640	1,245	870	1,815	0	2,520	2,880	1,576
Subtotal	<u>34,992</u>	<u>32,179</u>	<u>36,345</u>	<u>34,766</u>	<u>34,336</u>	<u>28,744</u>	<u>28,288</u>	<u>31,767</u>	<u>32,677</u>
Total	113,775	112,058	127,081	142,315	139,278	139,759	118,456	126,247	127,371
NOTE: (1) Use is reported in number of five-hour visitor days.									
SOURCES: DFG, n.d.; Forrest, pers. comm.									

Historical Trends, 1940-1982

This section focuses on the historical aspect of sport fisheries in the Bay-Delta Region. Other recreation activities are not addressed in detail because they are not expected to be substantially affected by the CVPIA. The discussion of the trends in the region's sport fishery is based on historical data primarily gathered by DFG. 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.

Striped Bass. 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 Sacramento-San Joaquin Delta (Skinner, 1962).

Angling success for striped bass was high throughout the 1960s, with an average annual catch of approximately 750,000 fish (DFG, 1989). By 1975, however, total annual catch had fallen to 403,000 fish. This decline is also reflected in commercial passenger-carrying fishing vessel (CPFV) catch records. Between 1960 and 1969, total catch by CPFVs averaged 33,400 fish per year (Leet et al., 1992). Between 1970 and 1979, total catch fell to an average of 17,000 fish per year (Leet et al., 1992). By 1980, the annual sport catch had fallen to approximately 150,000 fish, with the total CPFV catch at 1,400 fish.

White Sturgeon. In 1954, following a 35-year moratorium on commercial and sport fishing for sturgeon, a sport fishery in the Bay-Delta 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).

Angling success for sturgeon was considered high from the mid-1960s through 1969. Total white sturgeon catch aboard 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.

Salmon. The sport fishery for chinook salmon in the Bay-Delta Region is located primarily in San Francisco Bay near the Golden Gate Bridge. Historical data on sport catch and landings of salmon are included as part of the discussion of the San Francisco Subregion of the Pacific Coast Region.

American Shad. Although shad were abundant, a sport fishery for American shad did not become well established until an exclusive sport fishery was established in 1957 (Skinner, 1962). The extent of the shad sport fishery in the Bay-Delta Region and the Sacramento River system has not been estimated; however, fishing for American shad has been described as very good during this period (DFG, 1979).

Before 1960, shad were not commonly caught in the Bay-Delta Region because no suitable harvest methods were developed. Bump-netting, which involves netting the fish in the propeller wash of slow-moving boats, was used during April-June as the shad moved upstream to spawn. One operator in the Bay-Delta Region estimated a catch of 30,000 fish by 2,500 anglers in 1954 (Skinner, 1962).

Recent Trends, 1983-1990

Striped Bass. Based on catch data collected by party boat operators, recent trends in the striped bass fishery indicate a substantial decline in harvest rates between 1983 and 1990. CPFV annual catch during this period averaged approximately 8,700 fish (Leet et al., 1992). Annual catch ranged from a high of approximately 14,200 fish in 1983 to a low of approximately 2,200 fish in 1989 (Table II-6). Between 1988 and 1990, total annual catch fell to an estimated 61,800 fish (a decline of 43 percent from the 1988 catch total) (Interagency Ecological Studies Program, 1993).

White Sturgeon. Although exact sport catch data for white sturgeon are not available, the catch rate for sturgeon is estimated to have increased by 40 percent over the last two 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. 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 (DWR, 1990).

Based on catch data collected by CPFV operators, an annual average of approximately 550 sturgeon were caught between 1983 and 1990 (Table II-6). Annual catch increased to a high of approximately 950 fish in 1986 and fell to a low of approximately 180 fish in 1990 (Table II-6).

TABLE II-6

SPORT CATCH OF IMPORTANT FISH SPECIES IN THE BAY-DELTA REGION

Species	1983	1984	1985	1986	1987	1988	1989	1990	Average
Striped bass	14,206	13,524	9,686	8,572	8,858	10,415	2,167	2,356	8,723
White sturgeon	750	530	765	952	418	386	437	181	552

NOTES:
 Catch is from CPFV reports.
 No yearly historical catch data are available for salmon and American shad.

SOURCE:
 Leet et al., 1992.

Data on sport catch of white sturgeon aboard private vessels during this period are not well documented. Exploitation rates of sturgeon have been demonstrated to closely follow abundance. In 1984, 1985, and 1986, total catch of white sturgeon was estimated at approximately 8,500, 12,000, and 7,200 fish, respectively, based on abundance estimates (DWR, 1990).

Salmon. Detailed information on the sport fishing harvest of salmon caught within the Bay-Delta Region only between 1983 and 1990 is not available; however, trends described for the San Francisco Subregion of the Pacific Coast Region help to illustrate the condition of the salmon sport fishery within the Bay-Delta Region. Between 1983 and 1990, catch and fishing effort peaked in 1987 at approximately 119,500 fish caught and 108,000 trips (Pacific Fishery Management Council, 1993a, 1993b).

Few salmon are harvested in the sport fishery in the Bay-Delta Region. Data collected in 1990-1992 indicate the relative importance of the salmon fishery in the Delta. Total catch of salmon between July 1990 and June 1991 was estimated at 34 fish; total catch between July 1991 and June 1992 was estimated at 1,860 fish. Angler effort during these periods was estimated at 7,976 hours (0.8 percent of total sport fishing effort in the Delta) and 88,715 hours (4.9 percent of total sport fishing effort), respectively (Wixom, pers. comm.).

American Shad. Detailed information on the sport fishing harvest of American shad in the Bay-Delta Region between 1983 and 1990 is not available; however, data collected in 1990-1992 suggest that a bump-net fishery is still active in the region. Total catch of American shad between July 1990 and June 1991 was estimated at 5,200 fish; total catch between July 1991 and June 1992 was estimated at 13,729 fish. Angler effort during these periods was estimated at 18,900 hours and 25,300 hours, respectively (Wixom, pers. comm.).

A comparison of recent catch data and data collected in the late 1970s suggests that the American shad sport fishery in the Bay-Delta Region has remained stable. The bump-net sport fishery catch estimate for 1981 was 10,000 fish. A comparison with an annual average of approximately 9,500 fish based on the 1990-1992 data shows that the average catch has dropped by only 5 percent.

SAN JOAQUIN RIVER REGION**Historical Trends, 1940-1982**

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 key lakes and reservoirs in the San Joaquin River Region were completed in the 1960s and 1970s. Millerton Lake, the first, was completed in 1942. Between 1970 and 1980, annual recreation use at Millerton Lake increased from 574,000 to 941,000 visitor days (Petrinovich, pers. comm.), peaking at nearly 1.1 million visitor days in 1978.

New Hogan Lake, completed in 1963 by the COE, was the second key reservoir constructed in the region. The COE manages recreation facilities at this lake. Between 1963 and 1982, use of New Hogan Lake increased from approximately 5,100 to 217,000 visitor days (Lykins, pers. comm.).

San Luis Reservoir was completed by Reclamation in 1967 and recreation facilities are now operated by DPR. Between 1967 and 1982, use increased from 33,000 to 206,000 visits. Additional recreation opportunities are provided by O'Neill Forebay facilities. Use at the forebay between 1973 and 1982 increased from 177,000 to 476,000 visits.

Lake McClure was completed in 1967 by the Merced Irrigation District. The recreation facilities are operated by the Merced Irrigation District Parks Department. Between 1969 and 1982, use at the lake increased from approximately 167,700 to 362,400 visits (Ardohain, pers. comm.).

New Don Pedro Reservoir, completed in 1971 by the Turlock and Modesto irrigation districts, is operated by the Lake Don Pedro Recreation Agency. Use during the 1970s and early 1980s ranged from 300,000 to 400,000 visits (Cornell, pers. comm.).

New Melones Reservoir, completed by the COE in 1979, was the last key reservoir constructed in the San Joaquin River Region. Reclamation operates the recreation facilities. Use in the first several years after completion was limited by low water levels. Reclamation estimated that total recreation use in 1980 was approximately 250,000 visitor days (Petrinovich, pers. comm.).

Rivers. 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 river flows 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 warm-water 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 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 cold-water 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 warm-water 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 flow conditions, and salmon habitat improvement projects have effectively maintained chinook salmon populations (Jones & Stokes Associates, 1976). As with other rivers in the San Joaquin River Region, 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 consumptive and nonconsumptive recreation opportunities. Nonconsumptive recreation opportunities, which include wildlife viewing, are provided at San Luis, Kesterson, and Merced NWRs and at Volta, Mendota, and Los Banos WMAs. Consumptive recreation opportunities, which include fishing and waterfowl hunting, are provided at Volta, Mendota, and Los Banos WMAs.

Los Banos WMA, the first wildlife refuge in the San Joaquin Valley, was established in 1929 (Reclamation, 1989). This WMA has historically been a popular site for both nonconsumptive and consumptive recreation activities. Between 1973 and 1982, total use at the WMA averaged approximately 26,600 visitors per year, of which an estimated 23 percent were hunters (DFG,

n.d.). Use at the refuge has steadily increased during this period and has ranged from a low of 21,600 visits in 1983 to a high of 26,500 visits in 1982.

Volta WMA, owned by Reclamation, has been operated by DFG since 1952 (Reclamation, 1989). It has historically been a popular site for hunting. Between 1973 and 1982, total use at the WMA averaged approximately 9,800 visitors per year, of which an estimated 61 percent were hunters (DFG, n.d.). During this period, use peaked at 12,800 visits in 1975 and subsequently declined to 6,200 visitors in 1982.

San Luis NWR, established in 1966 and expanded in 1970, Kesterson NWR, established in 1970, Merced NWR, established in 1951, and Mendota WMA, established in 1954, all supply nonconsumptive and consumptive wildlife-related recreation activities. Both hunting and fishing are allowed at San Luis NWR. Comprehensive use data for the NWRs are not available; however, overall use trends at the three NWRs probably resemble trends at the Los Banos and Volta WMAs.

Recent Trends, 1983-1990

Lakes and Reservoirs. Since 1983, recreation use at lakes and reservoirs in the San Joaquin River Region has generally declined, with increases at Lake McClure only (Table II-7). As in the Sacramento River Region, changes in recreation use during this period are probably related to drought conditions.

Listed below are important use trends during this eight-year period.

- Millerton Lake had the highest recreation use with an annual average of 611,000 12-hour visitor days; use peaked in 1988 at 852,000 visitor days and decreased to 570,000 visitor days in 1990.
- Annual use at San Luis Reservoir averaged 306,000 visits during the period, ranging from a low of 239,000 visits in 1984 to a high of 359,000 visits in 1986.
- Annual use at New Melones Reservoir averaged 520,000 12-hour visitor days; total visitation decreased by 28 percent between 1987 and 1990.
- Annual use at Lake McClure averaged 459,000 visits, with a high of 511,000 visits in 1988 and a low of 333,000 visits in 1986.
- Annual use at New Don Pedro Reservoir averaged 459,000 visits, with a high of 532,000 visits in 1986 and a low of 340,000 visits in 1988.

Rivers. Recent trends for rivers in the San Joaquin River Region are similar to those described for the historical period. Most of the water in these rivers has been diverted, resulting in decreased or intermittent flows. Although some efforts have been made to enhance river fisheries, habitat and fish populations have generally declined compared to natural conditions before the rivers were diverted. Nonconsumptive recreation pursuits, such as swimming,

TABLE II-7

**ANNUAL RECREATION USE AND WATER LEVELS AT KEY LAKES
AND RESERVOIRS IN THE SAN JOAQUIN RIVER REGION**

Lakes and Reservoirs	1983			1984			1985			1986			
	Annual Use (thousands)	April Lake Level	Sept. Lake Level	Annual Use (thousands)	April Lake Level	Sept. Lake Level	Annual Use (thousands)	April Lake Level	Sept. Lake Level	Annual Use (thousands)	April Lake Level	Sept. Lake Level	
San Luis	270	540.6	536.0	239	540.4	432.6	282	524.0	428.0	359	542.8	497.7	
Millerton	408	479.1	544.6	442	567.7	481.0	667	544.8	483.6	575	497.2	478.7	
New Melones	436	1,046.0	1,054.5	460	1,046.2	1,037.8	499	1,045.1	1,005.0	610	1,060.4	1,047.5	
McClure	510	824.0	839.0	486	818.0	796.0	428	733.0	705.0	333	824.0	820.0	
New Don Pedro	478	NA	NA	481	NA	NA	501	789.5	754.0	532	NA	NA	

Lakes and Reservoirs	1987			1988			1989			1990			Average Annual Use
	Annual Use (thousands)	April Lake Level	Sept. Lake Level	Annual Use (thousands)	April Lake Level	Sept. Lake Level	Annual Use (thousands)	April Lake Level	Sept. Lake Level	Annual Use (thousands)	April Lake Level	Sept. Lake Level	
San Luis	347	534.0	419.7	341	528.2	394.6	346	501.9	378.8	267	538.6	395.6	306
Millerton	813	510.0	482.4	852	531.4	473.4	561	540.5	470.7	570	527.3	488.4	611
New Melones	632	1,031.7	996.9	544	987.5	940.8	524	939.0	891.1	455	898.6	829.2	520
McClure	440	809.0	728.0	511	727.0	654.0	494	700.0	648.0	473	675.0	623.0	459
New Don Pedro	444	NA	719.0	340	719.2	717.6	436	749.5	737.2	455	762.6	726.4	459

NOTES:
Use at Millerton Lake and New Melones Reservoir is reported in 12-hour visitor days. Use at other reservoirs is reported in thousands of visits.
Lake levels are reported in feet above mean sea level.

SOURCES:
San Luis: use (DWR, 1989), lake level (Kolb, pers. comm.).
Millerton: use (Petrinovich pers. comm.), lake level (Johnson, pers. comm.).
New Melones: use (Petrinovich, pers. comm.), lake level (Davis, pers. comm.).
McClure: use and lake level (Ardohain, pers. comm.).
New Don Pedro: use and lake level (Cornell, pers. comm.).

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

boating, and fishing, are dispersed along the river corridors, and no single entity has comprehensively estimated recreation use along the river corridors during the eight-year period.

Wildlife Refuges. Wildlife refuges in the San Joaquin River Region include San Luis, Kesterson, and Merced NWRs and Volta, Mendota, and Los Banos WMAs. Recreation use at San Luis and Merced NWRs and Volta and Los Banos WMAs between 1985 and 1990 totaled approximately 286,000 visits for an average annual visitation of 47,700 (Table II-8). Annual use ranged from a high of approximately 69,300 visits in 1985 to a low of 35,600 visits in 1986.

**TABLE II-8
USE AT KEY WILDLIFE REFUGES IN THE
SAN JOAQUIN RIVER REGION**

Use Type (1)	1983 (2)	1984 (2)	1985	1986	1987	1988	1989	1990	Average Annual Use
Nonconsumptive	30,960	30,416	52,838	22,017	26,092	31,797	29,911	35,195	32,975
Consumptive									
Hunting	9,333	10,790	10,508	10,165	12,334	10,408	8,796	10,364	10,429
Fishing	0	5,341	5,959	3,408	4,380	4,064	3,686	4,246	4,491
Subtotal	9,333	16,131	16,467	13,573	16,714	14,472	12,482	14,610	14,726
Total	40,293	46,547	69,305	35,590	42,806	46,269	42,393	49,805	47,695
NOTES:									
No use data are available for Mendota WMA and Kesterson NWR.									
(1) Use is reported in number of 5-hour visitor days.									
(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 data for 1985 through 1990.									
SOURCES:									
Cortese, pers. comm., and Miller, pers. comms.									

Use at the refuges includes both consumptive and nonconsumptive activities. Nonconsumptive uses are primarily wildlife observation; consumptive uses are hunting and fishing. Between 1985 and 1990, nonconsumptive uses accounted for approximately 69 percent of total use, hunting accounted for approximately 22 percent, and fishing accounted for the remaining 9 percent.

TULARE LAKE REGION

Historical Trends, 1940-1982

Wildlife refuges in the Tulare Lake Region include Kern and Pixley NWRs. Kern NWR was established in 1961 and provides both consumptive and nonconsumptive recreation opportunities. Consumptive activities at Kern NWR include fishing and waterfowl hunting. Wildlife observation is the most important nonconsumptive activity occurring at the refuge. Pixley NWR is not normally open to the public because it is managed to provide endangered species habitat. Comprehensive use data for Kern and Pixley NWRs are not available for the historical period.

Recent Trends, 1983-1990

Between 1983 and 1990, recreation use at Kern NWR totaled approximately 13,730 visits, with nonconsumptive activities accounting for approximately 23 percent of total use. Use has averaged approximately 1,700 visits per year from 1983 to 1990. Use data for Pixley NWR between 1983 and 1990 are not available.

PACIFIC COAST REGION**Historical Trends, 1940-1982**

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 percent of the salmon landed within the subregion (Leet et al., 1992), with commercial fishing accounting for 86 percent.

Sport fishing from party boats has played an important role in the history of ocean sport fishery, accounting for an estimated 65 percent of the total sport harvest of salmon in the region (Leet et al., 1992). Most of these party boats originated from the San Francisco Bay area; relatively few of them were smaller private vessels because of the strong currents near the Golden Gate Bridge (Leet et al., 1992).

Salmon landings data for 1940-1982 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 Pacific Coast Region, accounting for 79 percent of the total salmon sport catch. San Francisco has been the most important subregion, yielding 67 percent of total sport landings between 1979 and 1982. (Pacific Fishery Management Council, 1993b.)

Recent Trends, 1983-1990

An estimated 1.7 million sport fishing trips were made for salmon in the Pacific Coast Region between 1983 and 1990 (Pacific Fishery Management Council, 1993b), an average of 450,700 trips per year. Approximately 1.4 million chinook and coho salmon were harvested during this period, for an average annual catch of 177,400 fish. Chinook salmon accounted for approximately 81 percent of the total salmon sport fishing harvest in the region.

Between 1983 and 1990, the annual sport harvest of chinook and coho salmon in the region ranged from a low of 91,000 fish in 1983 to a high of 239,800 fish in 1987 (Table II-9). The average annual catch was 177,400. The sport catch generally increased between 1983 and 1987 and then decreased substantially between 1987 and 1990. The San Francisco Subregion had the highest annual average catch of the Pacific Coast Region.

TABLE II-9

ANNUAL SPORT CATCH OF CHINOOK AND COHO SALMON IN THE PACIFIC COAST REGION

Subregion/Species	Catch (thousands of fish)									Percentage of Total	Average Annual Catch
	1983	1984	1985	1986	1987	1988	1989	1990	Total		
North Coast (1)											
Chinook	10.9	9.1	49.4	26.9	39.7	40.9	55.7	27.2	259.8	18.3	32.5
Coho	26.6	18.3	15.5	18.3	47.2	34.2	48.6	44.6	253.3	17.9	31.7
Subtotal	37.5	27.4	64.9	45.2	86.9	75.1	104.3	71.8	513.1	36.2	64.2
San Francisco (2)											
Chinook	49.7	73.2	112.5	86.3	119.5	114.5	93.7	77.6	727.0	51.2	90.9
Coho	0.5	0.5	0.3	0.4	0.1	0.3	0.9	5.8	8.8	0.6	1.1
Subtotal	50.2	73.7	112.8	86.7	119.6	114.8	94.6	83.4	735.8	51.8	92.0
Central Coast (3)											
Chinook	3.2	5.4	9.3	28.6	33.3	15.9	37.2	35.1	168.0	11.8	21.0
Coho	0.1	0.2	0.0	0.0	0.0	0.0	0.2	1.2	1.7	0.1	0.2
Subtotal	3.3	5.6	9.3	28.6	33.3	15.9	37.4	36.3	169.7	11.9	21.2
Total											
Chinook	63.8	87.7	171.2	141.8	192.5	171.3	186.6	139.9	1,154.8	81.4	144.4
Coho	27.2	19.0	15.8	18.7	47.3	34.5	49.7	51.6	263.8	18.6	33.0
Total	91.0	106.7	187.0	160.5	239.8	205.8	236.3	191.5	1,418.6	100.0	177.4
NOTES:											
(1) North Coast Subregion includes Crescent City, Eureka, and Fort Bragg.											
(2) San Francisco Subregion includes Bodega Bay, San Francisco, and Half Moon Bay.											
(3) Central Coast Subregion includes Santa Cruz and Monterey.											
SOURCES:											
Pacific Fishery Management Council, 1993a; 1993b.											

Sport fishing activity ranged from a low of 122,800 trips in 1983 to a high of 268,400 trips in 1987 (Table II-10). The San Francisco Subregion accounted for 43 percent of the trips originating from the Pacific Coast Region and also accounted for the largest share of trips made aboard charter vessels.

SAN FRANCISCO BAY REGION

Most lakes and reservoirs in the San Francisco Bay Region have played an important role in providing both water-enhanced and water-dependent recreation activities to residents of the San Francisco Bay area. Access to lakes and reservoirs operated by the SFWD has historically been limited because of water quality considerations. Because many are located within regional parks, it is difficult to determine their relative contribution to recreation opportunities. Most have become important components of the overall recreation opportunities provided at these parks.

RECENT CONDITIONS

INTRODUCTION

The following discussion of recent conditions at recreation sites in the study area focuses on facilities and activities, recreation use and visitor characteristics, and recreation quality conditions. Key recreation facilities are described in greater detail than other potentially affected recreation facilities.

This description is based on 1992 data when available. In instances in which data for that year were not available, the most current available data were reported and are assumed to be representative of recent conditions.

SACRAMENTO RIVER REGION

Major recreation sites in the Sacramento River Region are the key lakes and reservoirs (Shasta Lake, Whiskeytown Lake, Lake Oroville Complex, Folsom Lake, New Bullards Bar Reservoir, and Englebright Lake), key rivers and streams (the Sacramento, Feather, American, and Yuba rivers and Clear Creek), and key NWRs and 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 the CVPIA are Keswick Reservoir, Lake Red Bluff, Camp Far West Reservoir, and the Bear River below Camp Far West Reservoir.

The recreation characteristics of these sites and the use and activities at each are listed in Tables II-11 and II-12, respectively, and discussed in the remainder of this section.

TABLE II-10

ANNUAL SPORT FISHING ACTIVITY FOR SALMON IN THE PACIFIC COAST REGION

Subregion/Mode	Fishing Trips (thousands) (1)									Percentage of Total	Average Annual Trips	
	1983	1984	1985	1986	1987	1988	1989	1990	Total			
North Coast (2)												
Charter	3.5	2.8	7.4	6.7	9.9	9.0	10.5	6.7	56.5	3.4	7.1	
Private	49.5	45.8	73.5	61.0	102.4	85.5	83.7	89.2	590.6	35.7	73.8	
Subtotal	53.0	48.6	80.9	67.7	112.3	94.5	94.2	95.9	647.1	39.1	80.9	
San Francisco (3)												
Charter	50.9	56.8	74.6	69.6	82.9	81.1	83.5	54.3	553.6	33.4	69.2	
Private	9.5	8.2	18.7	22.1	25.5	27.0	11.5	35.4	157.9	9.5	19.7	
Subtotal	60.3	65.0	93.3	91.7	108.4	108.1	95.0	89.7	711.5	43.0	88.9	
Central Coast (4)												
Charter	2.7	1.9	3.2	10.1	12.3	11.7	14.0	17.4	73.3	4.4	9.2	
Private	6.8	11.4	14.6	36.1	35.4	28.2	41.7	49.0	223.2	13.5	27.9	
Subtotal	9.5	13.3	17.8	46.2	47.7	39.9	55.7	66.4	296.5	17.9	37.1	
Total												
Charter	57.0	61.5	85.2	86.4	105.1	101.8	108.0	78.4	683.4	41.3	85.4	
Private	65.8	65.4	106.8	119.2	163.3	140.7	136.9	173.6	971.7	58.7	121.5	
Total	122.8	126.9	192.0	205.6	268.4	242.5	244.9	252.0	1,655.1	100.0	206.9	
NOTES:												
(1) Fishing trips average approximately six hours in length.												
(2) North Coast Subregion includes Crescent City, Eureka, and Fort Bragg.												
(3) San Francisco Subregion includes Bodega Bay, San Francisco, and Half Moon Bay.												
(4) Central Coast Subregion includes Santa Cruz and Monterey.												
SOURCES:												
Pacific Fishery Management Council 1993a, 1993b.												

TABLE II-11

**RECREATION CHARACTERISTICS OF KEY AND OTHER POTENTIALLY
AFFECTED RECREATION AREAS IN THE SACRAMENTO RIVER REGION**

Recreation Areas	Surface Area or Length (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								
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

TABLE II-11. CONTINUED

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: USFS, 1990; Reclamation, 1992a.
- Keswick: Reclamation, 1986, 1992a.
- Whiskeytown: Reclamation, 1992a.
- Red Bluff: Reclamation, 1992b.
- Oroville: DPR, 1988.
- Folsom: COE, 1991; DPR, 1989a.
- New Bullards Bar: YCWA, 1993.
- Englebright: COE, 1992a.
- Camp Far West: YCWA, 1993, Melton, pers. comm.

Rivers:

- Sacramento: Reclamation, 1990; DWR, 1982; Wixom, pers. comm.
- Feather: Wixom, pers. comm.
- American: COE, 1991; BLM, 1990.
- Yuba: DFG, 1991a.
- Clear Creek: DWR, 1986.
- Bear: Melton, pers. comm.
- Wildlife refuges: Reclamation, 1993a; Service, 1992a.
- Private hunting clubs: DFG, 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 II-12

**RECREATION USE AND ACTIVITIES AT KEY AND OTHER POTENTIALLY
AFFECTED RECREATION AREAS IN THE SACRAMENTO RIVER REGION**

Recreation Areas	Use (1,000) (1)	Water-Dependent Activities (percent)					Water-Enhanced Activities (percent)					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	NA	NA	100	NA	NA	NA	NA	NA	NA	NA	100
Middle Reach	42	NA	NA	100	NA	NA	NA	NA	NA	NA	NA	100
Lower Reach	84	NA	NA	100	NA	NA	NA	NA	NA	NA	NA	100
Feather	69	NA	NA	100	NA	NA	NA	NA	NA	NA	NA	100
American	27	NA	NA	100	NA	NA	NA	NA	NA	NA	NA	100
Yuba	2	NA	NA	100	NA	NA	NA	NA	NA	NA	NA	100
Clear Creek	1	NA	NA	100	NA	NA	NA	NA	NA	NA	NA	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	72	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0
Rivers												
Bear	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	

Recreation

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Affected Environment

TABLE II-12. CONTINUED

NOTES:

- (1) Use at all reservoirs is reported in 12-hour RVDs, at rivers is reported in 6-hour RVDs, at wildlife refuges is reported in 5-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 (Reclamation, 1992b), activity (USFS, 1993b).
- Whiskeytown: use (Reclamation, 1992b), activity (Reclamation, 1981).
- Oroville: use (Goswick, pers. comm.).
- Folsom: use (Erba, pers. comm.), activity (DPR, 1989a).
- New Bullards Bar: use (Reclamation, 1992b), activity (YCWA, 1993).
- Englebright: use (COE, 1992a), activity (COE, 1992a).
- Keswick: use (Reclamation, 1992b), activity (Reclamation, 1981).
- Red Bluff: use (Reclamation, 1992b), activity (Reclamation, 1979).
- Camp Far West: use (Higley, pers. comm.), activity (YCWA, 1993).

Rivers:

- Sacramento: use (Wixom, pers. comm.)
- Feather: use (Wixom, pers. comm.)
- American: use (Wixom, pers. comm.)
- Yuba: use (Wixom, pers. comm.)
- Clear Creek: use and activity (DWR, 1986).
- Bear: use and activity (Melton, pers. comm.)
- Wildlife refuges: use (DFG, n.d., Forrest, pers. comm., Reclamation, 1993a), activity (Forrest, pers. comm.)
- Private hunting clubs: Use (DFG, 1992).

LEGEND:

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

Shasta Lake

Facilities and Activities. Shasta Lake, approximately 10 miles north of Redding, is a unit of the Whiskeytown-Shasta-Trinity NRA. Recreation facilities and activities are administered by USFS. When full, the lake has a surface area of approximately 30,000 acres, 370 miles of shoreline, and a surface elevation of 1,067 feet above mean sea level (msl) (Reclamation, 1986, 1992a). The lake has four main arms: Sacramento River, McCloud River, Pit River, and Squaw Creek.

Shasta Lake accommodates a wide variety of water-dependent and water-enhanced recreation activities. Water-dependent activities are power boating, house boating, waterskiing, and fishing. Water-enhanced activities include camping and sightseeing.

Boating activities at the lake are supported by 6 public boat ramps and 13 private marinas. Some private marinas also provide boat launch facilities. The main body of the lake and all the major arms except Squaw Creek arm have at least one boat ramp. The marinas are clustered at the northern end of the Sacramento River arm, along the western shore of the McCloud River arm, and at the Jones Valley area on the Pit River arm. In 1991, these marinas provided an estimated 2,890 mooring spaces (Reclamation, 1992a). Most marinas provide boat storage, houseboat rental, boat repair, and boating and camping supply sales.

The lake has no designated swimming areas (Turner, pers. comm.). Because of limited shore access and steep slopes, most of the swimming activity occurs from boats or near campgrounds. One designated fishing area/picnic area is adjacent to Shasta Dam, and two picnic areas are located on the McCloud River arm (USFS, 1990).

Camping facilities are provided at 22 public campgrounds, most of which are located on the upper reaches of the Sacramento River arm, near Jones Valley on the Pit River arm, and along the western shore of the McCloud River arm. In addition, four campgrounds on the Sacramento, Pit, and McCloud river arms are accessible by boat only (USFS, 1990).

Almost the entire surface area of the lake is accessible by boat. High-speed boating activities such as waterskiing and cruising are allowed on most of the lake except for the ends of the arms and some coves where speeds are restricted for safety reasons (USFS, 1990).

Fishing at Shasta Lake occurs from boats and along the lakeshore. The most frequently caught species are rainbow trout, smallmouth bass, and crappie. Although the entire lake offers fishing opportunities from boats, the most popular fishing area is in the Jones Valley, which also provides easy access to the Pit River and Squaw Creek arms. Because much of the shoreline is accessible by boat only, fishing from shore is concentrated at access points near Shasta Dam and along the arms of the lake. Shore fishing access points are found along the northern end of the McCloud River arm, at Jones Valley on the Pit River arm, at the northern end of the Sacramento River arm, and adjacent to Shasta Lake (Reclamation, 1986). Because of the lack of cover, the best fishing sites for warm-water fish at the lake are under or near structures such as docks or bridges (Reclamation, 1986). Shore fishing is also popular at the ends of the major arms where rivers enter the lake (USFS, 1990).

Use and Visitor Characteristics. During 1992, use at Shasta Lake totaled approximately 2.4 million 12-hour RVDs. Of this total, approximately 1.3 million 12-hour RVDs involved water-dependent activities (USFS, 1993b).

The most popular recreation activities at Shasta Lake are boating and visiting resorts. Power boating is the most popular water-dependent activity, accounting for approximately 55 percent of total water-dependent use, followed by fishing (22 percent); waterskiing (17 percent); other boating such as sailing, jet skiing, and canoeing (6 percent); and swimming and water play (2 percent) (USFS, 1993b). Shore fishing accounts for approximately 18 percent of total fishing activity on the lake (USFS, 1993c).

An estimated 75 percent of the recreation use at Shasta Lake occurs between May and September (Reclamation, 1988). The remaining 25 percent of use is evenly distributed between October and April.

User surveys conducted in 1992 indicate that the largest number of visitors participating in the most popular activities at the lake (fishing, boating, and camping) come from the Sacramento Valley (43 percent), followed by the San Francisco Bay area (19 percent), Southern California (9 percent), and the San Joaquin Valley (2 percent). The remaining visitors come from other California counties or out of state. (USFS, 1993c.)

Recreation Quality Conditions. Public boat ramps on the lake begin to cease operation as the lake level falls 75 feet from full to a surface elevation of 992 feet above msl. The last public boat ramp on the main area of the lake ceases operation when the lake level falls 223 feet to a surface elevation of 844 feet above msl; on the Sacramento River arm, when the lake falls 117 feet to a surface elevation of 950 feet above msl; on the Pit River arm, when the lake falls 125 feet to a surface elevation of 942 feet above msl; and on the McCloud River arm, when the lake falls 115 feet to a surface elevation of 952 feet above msl (Turner, pers. comm.). When the last ramp ceases operation, launching boats from trailers becomes difficult because of steep slopes and muddy shore conditions.

Most marinas remain in operation as the lake level falls. Marinas on the main portion of the lake, the Pit River arm, McCloud River arm, and the lower portion of the Sacramento River arm move in response to lower lake levels (Stevens, pers. comm.). Marinas at the end of the Sacramento River arm are not as flexible as other marinas because of the long, narrow channel and relatively shallow water in this area. Most marinas are first forced to move when the lake recedes 80 feet to a surface elevation of 987 feet above msl (Reclamation, 1988). Marinas at the end of the Sacramento River arm are first forced to move as the lake drops 60 feet to a surface elevation of 1,007 above msl (Stevens, pers. comm.). These marinas are typically forced out of operation as the lake falls 130 feet to a surface elevation of 937 feet above msl.

Camping becomes less popular as the lake level drops because of the increased distance between the campgrounds and the lakeshore, which affects boaters attempting to reach the campground and campers attempting to reach the lake. As the lake level falls, campgrounds located along the relatively shallow upper reaches of the arms of the lake become less popular than those near deeper waters.

Because Shasta Lake is so large, most water-dependent activities continue as the lake level falls, as long as access is maintained. However, boating activities become more constrained as hazards such as submerged islands, rocks, and snags appear. Generally, these hazards appear within the shoreline zone as the lake level drops 240 feet to a surface elevation of 827 feet above msl (USFS, 1990).

Whiskeytown Lake

Facilities and Activities. Whiskeytown Lake is approximately 8 miles west of Redding on the eastern slope of the Coast Range. A unit of the Whiskeytown-Shasta-Trinity NRA, the lake is administered by NPS. When full, the lake has a surface area of 3,250 acres, 36 miles of shoreline, and a surface elevation of 1,210 feet above msl (Reclamation, 1986, 1992a).

Whiskeytown Lake accommodates a variety of recreation activities, such as boating, fishing, swimming and beach use, and camping. Power boating, waterskiing, and sailing are popular boating activities. Fishing occurs from boats and along the shoreline. Swimming and beach use occur at designated areas and in dispersed areas along the lakeshore.

One marina and three boat ramps support boating activities at Whiskeytown Lake. The marina is along the northwestern shore of the lake and is easily accessible from State Route (SR) 299. Two of the boat ramps are on the northwestern side of the lake at Oak Bottom and on the Whiskey Creek arm; the third is at Brandy Creek on the south shore of the lake. The boat ramps at Oak Bottom and Whiskey Creek are easily accessible from SR 299. High-speed boating activities are allowed on most of the lake except for the Clear Creek arm between the Judge Francis Carr Powerhouse and Oak Bottom.

Fishing occurs both from boats and along the lakeshore. The most frequently caught species are rainbow trout and kokanee salmon. The most popular shore fishing area is near the Judge Francis Carr Powerhouse because the water released from the powerhouse attracts planted fish (Reclamation, 1986).

Swimming and beach use are concentrated at the designated areas at the mouth of Brandy Creek on the south side of the lake and Oak Bottom on the northwestern shore. Most of the lakeshore is open to the public, with the most popular informal swimming and beach areas along the eastern shore of the lake near the park headquarters and along SR 299. Swimming and beach use at informal sites along the lakeshore are constrained when the lake is full because of limited access.

Camping areas are located at Brandy Creek, Oak Bottom, and Dry Creek and provide a total of 187 camping spaces (Reclamation, 1992a). Brandy Creek is a dispersed camping area, Oak Bottom provides tent and recreation vehicle (RV) spaces, and Dry Creek is a group camping area (Foust, pers. comm.).

Use and Visitor Characteristics. In 1992, recreation use at Whiskeytown Lake totaled approximately 279,000 12-hour RVDs.

The most popular water-dependent activities at the lake are swimming and beach use, boating, and fishing. Motorboating is the most popular boating activity, accounting for an estimated 37

percent of RVDs (USFS, 1993d). Camping and sightseeing are the most popular water-enhanced activities.

Visitation at Whiskeytown Lake peaks during June through August, accounting for an estimated 50 percent of total annual use (Foust, pers. comm.). November through March is the least popular visiting period, accounting for 20 percent of total recreation use at the lake, with remaining use evenly distributed between spring and fall.

User surveys conducted in 1992 indicate that the largest number of Whiskeytown Lake visitors originate from the Sacramento Valley (54 percent), followed by the San Francisco Bay area (21 percent), Southern California (5 percent), and the San Joaquin Valley (2 percent) (USFS, 1993d). The remaining 18 percent of visitors come from other areas of California or out of state.

Recreation Quality Conditions. Whiskeytown Lake is normally maintained at a relatively stable water level by Reclamation (Reclamation, 1986). Historically, the lake is kept full during spring and summer when visitation is highest (Foust, pers. comm.). The lake typically has an off-season drawdown of approximately 11 feet because water is not diverted from Lewiston Lake (Foust, pers. comm.). Recreation activities can become constrained as the lake level declines because facilities have been designed for use at higher levels. Lake levels of 1,209 feet above msl during summer and 1,198 feet above msl during winter are ideal for typical recreation activities during these seasons (Foust, pers. comm.).

Boat access becomes constrained at Whiskey Creek and Oak Bottom ramps when the lake level drops 13 feet from full to a surface elevation of 1,197 feet above msl (Reclamation, 1986). Both ramps cease operation when the lake drops 15 feet to a surface elevation of 1,195 feet above msl (Reclamation, 1986). The Brandy Creek ramp ceases operation at a surface elevation of 1,190 feet above msl, or 20 feet below full (Foust, pers. comm.). Boats with fixed keels, such as sailboats, cannot be launched when the lake level drops below 1,190 feet above msl (Foust, pers. comm.).

Operation of the marina at Oak Bottom becomes constrained as the lake level drops to 1,204 feet above msl, or 6 feet from full. At this lake elevation, the marina operator must begin to reposition slips. At a lake level of 1,198 feet above msl, or 12 feet from full, the marina cannot be used (Foust, pers. comm.).

Shoreline activities outside the designated swimming areas are enhanced as the lake level falls to an elevation of approximately 1,206 feet above msl, or 6 feet from full (Foust, pers. comm.). Because of steep slopes and dense vegetation, exposing shoreline around the lake enhances access. Below 1,206 feet above msl, the visual character of the lake is affected by a wide band of unvegetated shoreline around the edge of the lake (Foust, pers. comm.).

Swimming and beach use at the Brandy Creek and Oak Bottom swimming areas become constrained as the lake level falls to approximately 1,206 feet above msl, or 4 feet from full, because the lake level drops below the sandy beach area (Foust, pers. comm.).

Because the lake has historically been full during peak visitation periods, it is not clear how water-dependent activities are affected by lowered lake levels. Shore fishing can be enhanced by

improved shore access as the lake level falls. The most popular fishing area on the lake, immediately below the Judge Francis Carr Powerhouse, is not affected by lowered lake levels because it depends more on flows from the powerhouse (Reclamation, 1986). Fishing at this site becomes less popular during winter because water is not diverted from Lewiston Lake (Foust, pers. comm.).

Lake Oroville Complex

Facilities and Activities. The Lake Oroville Complex, managed by DPR as part of the Lake Oroville SRA, is on the Feather River in Butte County. The complex includes Lake Oroville and Thermalito Forebay and Afterbay. When full, Lake Oroville has a surface area of 15,800 acres, 167 miles of shoreline, and a surface elevation of 900 feet above msl.

Most of Lake Oroville SRA's formal recreation facilities are at the lake. The facilities accommodate boating, waterskiing, sailing, fishing, swimming, boat-in camping, and overnight camping. Unrestricted boat access to the shoreline is allowed for camping uses. Boating access is provided at three paved ramps in the southern reservoir area near Lake Oroville and on the West Fork Feather River. Car-top boat launching is allowed on all but the Middle Fork Feather River.

Day and overnight use areas at Lake Oroville are located along the main reservoir and tributary shorelines. Bidwell Canyon and Loafer Creek on the southern shoreline and Lime Saddle on the West Fork Feather River are the major use areas. A visitor center on Kelly Ridge overlooks the dam and lake. Camping is allowed along the shoreline and at boat-in camping areas at Craig Saddle, Foreman Creek, Bloomer Primitive Camp, and Potter Ravine. The Bidwell Canyon marina provides covered berthing slips, a store and snack bar, a fuel dock, boat rental, and open mooring.

Swimming is allowed along the shoreline. Designated swimming facilities are provided at the Loafer Creek unit only, at the southern end of the lake.

Fishing occurs throughout the lake from boats and the shoreline. Game fish are planted in the lake annually; rainbow trout and largemouth and smallmouth bass are the most frequently caught species.

Recreation activities in the 600-acre Thermalito Forebay are accommodated by day-use facilities that feature a turf picnic area, 200-yard-long swimming beach, and two-lane boat ramp. The forebay is reserved for sailboats, canoes, and other non-motorized boating. Facilities at Thermalito Afterbay consist of a parking lot, a four-lane boat ramp, and chemical toilets. Fishing and motorized boating are the main recreation activities at the afterbay. Shore and boat fishing at the forebay and afterbay are primarily for rainbow trout, catfish, and largemouth and smallmouth bass. (DPR, 1988.)

Use and Visitor Characteristics. Visitation at the Lake Oroville Complex totaled approximately 418,000 12-hour RVDs in 1992. Day use and overnight camping account for most of the recreation use.

Use levels by activity at Lake Oroville are not recorded or estimated by DPR. The popularity of water-dependent activities is probably similar to that at other major Sierra Nevada foothill reservoirs, with boating, waterskiing, beach use, and fishing being the most popular activities.

Approximately 81 percent of the annual recreation visitation occurs between April and September, based on an average of 1989-1991 monthly attendance data (Erba, pers. comm.). The average monthly percentage of annual attendance for this period ranges from a high of 20 percent in July to a low of 3 percent during January, February, October, November, and December. Although origin estimates have not been made, it can be assumed that Lake Oroville is similar to other major lakes and reservoirs in California, with most recreationists originating from the local area.

Recreation Quality Conditions. When the lake is full, recreation facilities are available and boating and water sports are optimized. In general, most water-oriented use is substantially reduced at or below an elevation of 750 feet above msl (150 feet below full), and obstacles are buoyed for safety reasons (Walter, pers. comm.). When the lake level falls to an elevation of 775 feet above msl, boat ramps at Loafer Creek cease operation, followed by Lime Saddle at 750 feet above msl, Spillway at 730 feet above msl, and Bidwell Canyon at 710 feet above msl.

Car-top boat launching areas at the Enterprise and Stringtown access points cannot be used at lake elevations of 835 feet and 866 feet above msl, respectively. The designated swimming beach at Loafer Creek begins to be affected at a surface elevation of 860 feet above msl because the lake level falls below the designated beach areas.

Recreation activities at Thermalito Forebay and Afterbay are not directly affected by water level fluctuations because surface water elevations at these control reservoirs are generally maintained at constant levels (Walter, pers. comm.).

Folsom Lake

Facilities and Activities. Folsom Lake SRA, managed by DPR, is located on the American River east of Sacramento. The SRA includes both Folsom Lake and Lake Natoma. When full, Folsom Lake has a surface area of 11,450 acres, 75 miles of shoreline, and a surface elevation of 466 feet above msl. Lake Natoma, a potentially affected recreation area, is included in this description because DPR does not report use of the two lakes separately.

Folsom Lake SRA facilities accommodate a variety of water-oriented recreational activities, including boating, fishing, swimming, jet skiing, windsurfing, and sailing. Camping, picnicking, and trail facilities are also provided in the lake watershed. Boat launches along the 75-mile shoreline provide boat access. Major use areas are Beals Point, Granite Bay, and Rattlesnake Bar on the western shoreline; Dike 8, Mormon Island, and Brown's Ravine Marina on the southern and eastern shorelines; and the Peninsula Campground between the north and south forks of the American River. Brown's Ravine Marina provides 670 berthing slips for year-round mooring and small craft rentals.

Fishing occurs from boats throughout the lake and especially in the upper arms that are designated slow-boating zones. Fishing is mainly for rainbow trout and warm-water species.

Swimming and sunbathing areas are provided at the designated Beals Point and Granite Bay beaches and at numerous nondesignated areas along the reservoir shoreline. Boating, sailing, waterskiing, and other watercraft uses are popular activities throughout the main reservoir area.

Lake Natoma covers 500 acres, approximately 6 miles downstream of Folsom Lake. Lake Natoma has approximately 10 miles of shoreline, a maximum pool of 126 feet, and a maximum daily drawdown of approximately 7 feet (DPR, 1989a). Picnic and camping areas and a boat ramp are located at Negro Bar, environmental camping at Mississippi Bar, and boat launch facilities near Nimbus Dam and Willow Creek. The western shoreline also features an 8.4-mile portion of the popular American River bicycle trail. Recreation activities include fishing, nonmotorized boating, and windsurfing. Lake Natoma is less heavily used for swimming and wading than Folsom Lake because of its cooler water temperature (COE, 1991).

Use and Visitor Characteristics. In 1992, which was a drier year, visitation to the entire Folsom Lake SRA was estimated at 548,000 12-hour RVDs. Of this total, approximately 25 percent (137,000 12-hour RVDs) occurred at Lake Natoma. The SRA is one of the most heavily used units in the California state park system, primarily because of its proximity to the Sacramento metropolitan area, the arid summer climate, and high regional interest in recreation (COE, 1991).

Water-dependent activities dominate Folsom Lake recreation use, accounting for more than 80 percent of the annual recreation use. Boating, the most popular activity at the lake, includes launch and non-launch boating, windsurfing, and jet skiing (DPR, 1989a.)

Approximately 85 percent of Folsom Lake's annual recreation visitation occurs between April and September (DPR, 1989a). December is the lowest visitation month, accounting for only 1 percent of annual visitation, and the period of October through February accounts for approximately 10 percent of annual visitation.

Approximately 95 percent of day-use recreationists and roughly 33 percent of overnight recreationists originate from the Sacramento Valley (DPR, 1989a). The remainder of the overnight users come from the San Francisco Bay area and elsewhere.

Recreation Quality Conditions. The optimal lake elevation for recreation use is 436 feet above msl, or a surface area of 9,600 acres (DPR, 1989a), because all facilities can be used at this elevation. Beaches can accommodate high use levels, and boat ramp and parking facility use is maximized. Lake elevations higher than 436 feet above msl reduce the recreation capacity of the lake because some boat ramps and parking spaces are inundated. When the lake level falls to an elevation of 426 feet above msl, Brown's Ravine Marina ceases operation. At elevation 420 feet above msl (8,500 surface acres), most of the boat ramps cannot be used, and at elevation 405 feet above msl (7,300 surface acres), only one boat ramp can be used (COE, 1991). At 401 feet above msl, all boat ramps are out of service (DPR, 1989a).

Lake surface elevations have the greatest effect on recreation between April and August because visitation is greatest during these months. Although fluctuating elevations in winter can substantially affect recreation activities, only a small proportion of the total annual users are affected (DPR, 1989a).

Boat ramps and recreation use areas at Lake Natoma are not substantially affected by lake drawdown because water levels are kept stable during the primary recreation season (DPR, 1989a).

New Bullards Bar Reservoir

Facilities and Activities. New Bullards Bar Reservoir is located on the Yuba River in Yuba County. YCWA owns the lake, and USFS provides recreation facilities and management. The lake has a surface area of approximately 4,800 acres.

The reservoir accommodates water-oriented recreation uses, including boating, waterskiing, fishing, and swimming. Picnicking, camping, and trail uses are also accommodated. Boat access is provided at the Cottage Creek boat ramp on the southwestern shore of the reservoir and at the Dark Day boat ramp 4 miles north of the dam on the eastern shoreline. The Emerald Cove Marina located at the Cottage Creek boat ramp provides a store, snack bar, 31 berthing slips for small crafts, mooring areas, and houseboat and fishing boat rentals. Currently, 42 houseboats are moored year-round at the reservoir.

The major use areas near the reservoir are the Burnt Bridge Campground and Dark Day Campground and picnic area, both on the west side of the lake. Boat access camping is provided at the Garden Point, Frenchy Point, and Madrone Cove campgrounds.

Waterskiing is allowed throughout the reservoir at 200 feet from the shoreline. Boat and shore fishing opportunities are available for cold- and warm-water species. DFG manages the reservoir primarily for kokanee salmon and releases 220,000 to 250,000 fingerlings annually.

The reservoir shoreline has no designated swimming areas.

Use and Visitor Characteristics. Visitation to New Bullards Bar Reservoir was estimated at approximately 52,000 12-hour RVDs in 1992.

Water-oriented activities dominate annual recreation use at the reservoir. According to a recent YCWA survey, boating activities (e.g., waterskiing, boat fishing, and pleasure boating) accounted for approximately 70 percent of the recreation recorded during the 1991 survey period (YCWA, 1993). The percentage of activity participation was also shown to vary substantially between weekends and weekdays. On weekdays, boat fishing accounted for 46 percent of total use, followed by waterskiing at 25 percent, and pleasure boating at 14 percent. On weekends, waterskiing was the most popular activity (42 percent), followed by boat fishing (28 percent) and pleasure boating (11 percent) (YCWA, 1993).

Approximately 71 percent of visitors to the reservoir originate from the Sacramento Valley, followed by the San Francisco Bay area at 23 percent (Higley, pers. comm.).

Reservoir use patterns indicate high use of overnight camping and boat ramp facilities and low use of picnic areas. The reservoir shoreline areas most heavily used for day and overnight uses are the Little Oregon Creek area, the Garden Valley Road area, and the Bridger Creek and Brandy Creek shoreline areas in the extreme northeastern reservoir arm.

Recreation Quality Conditions. New Bullards Bar Reservoir accommodates high use levels at overnight and boat ramp facilities and low use at picnic areas. Picnic facilities at the Dark Day picnic area and Sunset Vista Point are adequate. Occupancy rates at the two boat ramp parking lots consistently exceed 100 percent on weekends, with the heaviest use at the Cottage Creek boat ramp. High occupancy rates at boat ramps suggest that demand exists for additional boat ramp parking (YCWA, 1993). The maximum water surface elevation is 1,956 feet above msl. The Cottage Creek boat ramp ceases operation at 1,832 feet above msl, and the Dark Day boat ramp cannot be used at 1,798 feet above msl (Wilson, pers. comm.). The Emerald Cove Marina is operational at all lake levels (Wilson, pers. comm.).

Englebright Lake

Facilities and Activities. Englebright Lake, owned and operated by the COE, is on the Yuba River downstream of New Bullards Bar Reservoir. The COE also provides recreation facilities and management. When full, the lake has a surface area of approximately 760 acres and an elevation of 534 feet above msl (COE, 1992a).

Englebright Lake facilities accommodate water-dependent recreation activities, such as boating, waterskiing, fishing, and boat-in camping. Boat access is available at the Narrows and Joe Miller Ravine boat ramps (four lanes total). The Narrows and Joe Miller Ravine recreation areas provide nearly all the day-use facilities; overnight camping and houseboat mooring areas are spread out over approximately 9 miles of the lake. Skippers Cove Marina at the Joe Miller Ravine recreation area provides 223 berthing slips and mooring areas (COE, 1992a).

Waterskiing is allowed on approximately half the lake, with a no-ski zone enforced on the upper reach. Fishing occurs primarily in the northern half of the lake during the summer recreation season. Englebright Lake fisheries consist primarily of planted rainbow trout, kokanee salmon, and warm-water species. DFG stocks the lake with approximately 22,000 catchable-sized trout per year.

Use and Visitor Characteristics. Visitation to Englebright Lake was estimated to total 92,000 12-hour RVDs in 1992. Visitation has increased substantially in recent drought years because of the relatively stable and full water levels.

Water-dependent activities dominate Englebright Lake recreation use. Boating, waterskiing, fishing, and swimming are popular activities. More than 80 percent of the lake's visitation is day use. (COE, 1992a.)

Approximately 74 percent of the annual recreation visitation takes place between April and September, based on an average of 1988-1992 monthly attendance data. Approximately 52 percent of total annual use occurs on weekends. Approximately 80 percent of the visitors are reported to originate from the Sacramento Valley within a 75-mile radius of the lake (COE, 1992a).

Recreation Quality Conditions. Surface water levels at Englebright Lake are stable as a result of operations of New Bullards Bar Reservoir upstream. At elevation 510 feet above msl

(15 feet below full), the Joe Miller Ravine boat ramp cannot be used. When levels fall below 500 feet above msl (25 feet below full), the Narrows recreation area boat ramp cannot be used.

During recent drought years, Englebright Lake was at full pool through the peak summer months. Fall drawdown is approximately 15 feet to provide flood storage (COE, 1992a).

Lake Red Bluff

Facilities and Activities. Lake Red Bluff is located on the Sacramento River at the City of Red Bluff. The lake was first formed in 1964 when the dam began operation. When the dam is operating, the lake has a surface area of approximately 530 acres. Currently, the lake gates are raised from November through April to provide unimpeded upstream and downstream passage for winter-run chinook salmon (Reclamation, 1993b). During this period, the Sacramento River is reestablished through the area. The area becomes inundated when the gates of the dam are lowered.

Activities at the lake include fishing, boating, waterskiing, swimming, camping, and picnicking (Reclamation, 1993b). An important special event at the lake is the annual boat drag races held during the Memorial Day weekend. This event is attended by approximately 7,500 visitors (Yingling, pers. comm.). Flatwater recreation activities are eliminated when the gates of the dam are raised; however, this does not substantially affect recreation use because most use occurs during summer (Reclamation, 1992b). When the gates of the dam are opened, fishing is the primary recreation activity in the area that would normally be inundated.

Recreation areas include Lake Red Bluff Recreation Area along the eastern shore; Red Bluff River Park along the western shore; and Dog Island and Samuel Ayer Parks, both at the northern end of the lake. Most of the water-related facilities are located at the Red Bluff Recreation Area along the eastern shoreline and include a boat ramp, campground, picnic area, and dispersed recreation use area (Reclamation, 1992b). The lake has a water-ski course. Most camping occurring at the lake is associated with fishing on the Sacramento River (Guthrie, pers. comm.).

Use and Visitor Characteristics. Most of the recreation use at Lake Red Bluff occurs between May and September (Reclamation, 1992b), which coincides with the period when the gates of the diversion dam are closed and the lake is formed. In 1992, recreation use at the lake totaled approximately 86,000 12-hour RVDs. Camping and sightseeing are the most popular activities at the lake, followed by fishing and waterskiing.

Recreation Quality Conditions. When in operation, Lake Red Bluff is maintained at a constant pool elevation to allow for diversion of water to the Tehama-Colusa Canal. Because of this operating characteristic, the lake does not fluctuate substantially during the period when the gates are closed. When the gates are opened and the lake is drained, all flatwater recreation opportunities are eliminated.

Keswick Reservoir

Facilities and Activities. Keswick Reservoir is located in a steep canyon on the Sacramento River, approximately one-half mile downstream from Shasta Dam. The reservoir is

approximately 9 miles long, with a surface area of 640 acres and 19 miles of shoreline (Reclamation, 1992a).

Facilities at Keswick Reservoir are limited to a boat launch ramp, parking lot, and pit toilets, located just upstream of Keswick Reservoir (Reclamation, 1986). An unpaved access road along a portion of the west bank of the lake provides additional lake access. Fishing, boating, and sightseeing are the primary recreation activities (Reclamation, 1992a). Fishing is the most popular of these activities, with rainbow trout, bass, and crappie the most frequently caught species. Water-contact activities at the lake are unsafe because of the coldness of the water released from Shasta and Whiskeytown lakes (Reclamation, 1976).

Use and Visitor Characteristics. In 1992, recreation use at Keswick Reservoir totaled 500 12-hour RVDs. Fishing is the most popular activity at the reservoir; other activities include hunting and off-road vehicle use (Reclamation, 1981). Local residents accounted for more than 80 percent of total visitation to the reservoir (Reclamation, 1981).

Recreation Quality Conditions. Keswick Reservoir regulates releases from Shasta Lake and diversions from Whiskeytown Lake. The reservoir can fluctuate daily as it regulates releases to the Sacramento River. The primary recreation activities are not sensitive to fluctuations in water level.

Camp Far West Reservoir

Facilities and Activities. Constructed in 1963, Camp Far West Reservoir is located on the Bear River at the junction of the Nevada, Placer, and Yuba county lines. When full, the reservoir has a surface area of 2,680 acres, 32 miles of shoreline, and a surface elevation of 300 feet above msl.

Camp Far West Reservoir accommodates water-dependent recreation, including boating, waterskiing, jet skiing, fishing, and swimming. Recreation facilities are located at two main use areas: Recreation Area No. 1 on the northern shoreline and Recreation Area No. 2 on the southern shoreline. Facilities at both recreation areas include boat ramps, swimming areas, day-use/picnic areas, and overnight camping/recreational vehicle areas. Boat rentals, fuel, and supplies are available at a marina near Recreation Area No. 1. All types of boating activities are permitted on the reservoir, except operation of houseboats (YCWA, 1993).

Use and Visitor Characteristics. Approximately 72,000 12-hour RVDs were recorded at Camp Far West Reservoir in 1992, most of them during the peak recreation season between April and September. Fishing, waterskiing, and swimming are popular water-dependent activities. About 75 percent of weekend boat traffic is from water skiers. Jet skiing is allowed in specific areas and is becoming increasingly popular (YCWA, 1993). The amount and types of use at the reservoir vary with reservoir surface water levels.

Recreation Quality Conditions. Maximum pool elevation at Camp Far West Reservoir is approximately 300 feet above msl. Minimum pool elevation for the reservoir is approximately 175 feet above msl, with a normal or average pool elevation of 275 feet above msl. The northern and southern recreation area boat ramps are operational at minimum reservoir pool elevation.

Recreation use declines dramatically when lake levels drop 15 to 20 feet below normal pool elevation because of the distance created between swimming areas and the lakeshore and the relatively small remaining surface area (Melton, pers. comm.).

Sacramento River

To facilitate the discussion of recreation, the 300-mile stretch of the Sacramento River between Keswick Reservoir and the Delta (Courtland) was divided into three reaches: Keswick Reservoir to Lake Red Bluff (upper reach), Lake Red Bluff to the Feather River confluence (middle reach), and Feather River confluence to Courtland (lower reach).

Upper Reach Facilities and Activities. The upper reach of the Sacramento River is approximately 60 miles long and flows through the foothill area of the northern Sacramento Valley (DWR, 1982). This reach is characterized by relatively rapid flows and scenic views (DWR, 1982). The river flows through developed areas in Redding and Anderson and then passes through unpopulated foothills before reaching Red Bluff.

Although most of the upper reach flows through private lands, public access is more readily available along this reach than along the middle and lower reaches. Public access points are provided by Redding and Anderson, Tehama County, the State of California, and BLM. BLM, Redding, and Anderson provide the most public access points along this reach of the river, including a 1-mile segment between Keswick Reservoir and Lake Redding Park (owned by BLM and managed by the City of Redding), and Lake Redding Park and Turtle Bay Recreation Area (also managed by the City of Redding). Other popular access areas are Anderson River Park, managed by the City of Anderson, and a 7-mile segment below Jelly's Ferry, managed by BLM (Reclamation, 1990).

Fishing is the most popular water-dependent activity on this reach. Water-contact activities, such as swimming and tubing, are not popular because the water is cold and flows swiftly (DWR, 1982). Popular water-enhanced activities include picnicking and sightseeing (Reclamation, 1990).

Middle Reach Facilities and Activities. The middle reach of the Sacramento River, between Lake Red Bluff and the Feather River confluence, is a 160-mile segment of the river characterized by slower moving water and a meandering river channel lined with riparian thickets and orchards (DWR, 1982). Although most land along this reach is privately owned, some public access is provided by counties through which the river passes and by DPR.

DPR and Tehama, Glenn, Colusa, and Sutter counties provide public access points along the middle reach. Private facilities, primarily fishing access points, marinas, and resorts, are located along the entire reach. This reach of the river also includes the Woodson Bridge SRA.

Water-dependent activities in this reach include boat and shore fishing, swimming, and beach use. Water-contact activities, such as swimming and tubing, are popular in this reach because the water is relatively warm compared to that in the upper reach. Water-enhanced activities include camping and relaxing.

Lower Reach Facilities and Activities. The lower reach of the Sacramento River, between its confluence with the Feather River and Courtland, is an 80-mile segment of the river. The upper 20 miles are characterized by slow-moving water and a meandering river channel (DWR, 1982). Near Sacramento, the character of the river changes because of urban influences, such as levees and commercial development along the river. Between Sacramento and Courtland, the river passes through agricultural areas.

The City and County of Sacramento and DPR provide public access points along the lower reach. Private facilities, primarily marinas, are located along the entire reach. This reach of the river includes Discovery Park at its confluence with the American River.

Fishing and boating are popular water-dependent activities on this reach. Water-contact activities, such as swimming and beach use, are also popular. Water-enhanced activities include picnicking and relaxing. (DWR, 1982.)

Upper Reach Use and Visitor Characteristics. Recent angler surveys conducted for the Service indicate that salmon, steelhead, and trout were the most frequently caught fish species on the upper reach. From July 1, 1992, to June 1, 1993, fishing effort in this reach totaled approximately 34,600 6-hour RVDs. Fishing for trout accounted for the largest percentage of fishing effort (55 percent), followed by salmon (41 percent) and steelhead (1 percent) (Wixom, pers. comm.).

Total estimated recreation use on the upper reach of the river in 1980 was 350,000 visitor days. Boat fishing was the most popular water-dependent activity, followed by swimming and beach use. Important water-enhanced activities include camping, picnicking, and sightseeing.

The origin of visitors to the Sacramento River has been estimated for all river uses and anglers. Most visitors originate from Shasta, Tehama, Glenn, Butte, Colusa, Sutter, Yolo, and Sacramento counties (77 percent), followed by the San Francisco Bay area (9 percent), Southern California (5 percent), the San Joaquin Valley (1.5 percent), other California counties (3.5 percent), and out of state (4 percent) (DWR, 1982). Data on the origin of anglers show an even greater local visitation rate, with most visitors coming from the river counties (84 percent), followed by the San Francisco Bay area (7.5 percent), Southern California (2.5 percent), San Joaquin Valley (2 percent), and other California counties and out of state (4 percent) (DWR, 1982).

Detailed seasonal activity data are not available for river recreation activities. Although water-contact activities are rare in winter because of cool air and water temperatures, fishing is popular year-round (DWR, 1982). DFG estimates of angler use indicate that most of the fishing activity in the upper reach occurs in September and October (70 percent), followed by November (11 percent) and August (8 percent) (Reclamation, 1990). These estimates suggest that fishing activity on this reach of the river is greatest during the fall salmon run. Fishing activity is evenly distributed over the remaining months (Reclamation, 1990).

Middle Reach Use and Visitor Characteristics. Angling surveys conducted for the Service on the middle reach indicate that this segment supports the widest variety of game fish. Salmon, steelhead, trout, American shad, striped bass, sturgeon, and catfish are typically caught on this reach. From July 1, 1992, to June 1, 1993, fishing effort in the middle reach totaled

approximately 42,000 6-hour RVDs. Fishing for striped bass accounted for approximately 30 percent of this effort, followed by American shad (27 percent), salmon (24 percent), sturgeon (5 percent), catfish (3 percent), trout (3 percent), and steelhead (2 percent) (Wixom, pers. comm.).

Recreation use on the middle reach of the river was estimated to total 325,000 visitor days in 1980. Fishing was the most popular water-dependent activity. Water-enhanced activities include camping, picnicking and sightseeing.

The origin of visitors and seasonal use of the river are discussed earlier in the section Upper Reach Use and Visitor Characteristics.

Lower Reach Use and Visitor Characteristics. Surveys indicate that salmon, steelhead, American shad, striped bass, sturgeon, and catfish are caught on this reach as on the middle reach. From July 1, 1992, to June 1, 1993, fishing in the lower reach totaled approximately 84,000 6-hour RVDs. Fishing for striped bass accounted for approximately 39 percent of the total, followed by sturgeon (18 percent), salmon (17 percent), catfish (15 percent), American shad (1 percent), and steelhead (0.3 percent). (Wixom, pers. comm.)

Recreation use on the lower reach of the river in 1980 totaled an estimated 525,000 visitor days. Fishing and boating are the most popular water-dependent activities; water-enhanced activities include sightseeing, picnicking, and camping.

The origin of visitors and seasonal use of the river are discussed in the section Upper Reach Use and Visitor Characteristics.

Recreation Quality Conditions. Water-contact activities are affected by air and water temperature and fishing occurs when fish are present in the river. Changes in flows do not normally affect recreation activities except when those changes also affect water temperature. Water-dependent activities may occasionally be directly affected by lower flows as boating hazards, such as snags, are exposed.

Feather River

Facilities and Activities. The lower Feather River flows approximately 40 miles from Oroville Dam to its confluence with the Sacramento River, largely through private lands. Major recreation areas along the river are the Oroville Wildlife areas south of Lake Oroville, Riverfront Park in Marysville, and Lake of the Woods Wildlife Area near the Bear River confluence. Boat access between Oroville and Marysville is provided at Marysville Riverfront Park and near the communities of Live Oak, Gridley, and Biggs. Undeveloped access points downstream of Marysville are located along Garden Highway, which generally borders the river to Verona.

Water-dependent recreation on the river consists of boat and shore fishing, pleasure boating, and swimming. Water-enhanced recreation activities include sightseeing, picnicking, and camping.

Use and Visitor Characteristics. Recreation use on the Feather River is not well documented because boat and shore use is dispersed at access points in Butte, Yuba, and Sutter counties. Fishing is probably the most popular activity on the river, with American shad, salmon,

striped bass, and steelhead the most frequently caught species. From July 1992 to June 1993, DFG reported that approximately 69,000 6-hour RVDs were recorded on the river (Wixom, pers. comm.). Fishing effort for American shad accounted for approximately 32 percent of total angler effort, followed by salmon (25 percent), striped bass (16 percent), and steelhead (7 percent). Other species caught in the river include catfish and trout.

Visitor origin data for the Feather River are not available; however, a recreation survey conducted on the Sacramento River indicates that approximately 77 percent of visitors originate from counties crossed by the river (DWR, 1982). Because of the geographic and resource similarities between both rivers, this percentage can also be assumed for origin of visitors to the Feather River.

Recreation Quality Conditions. The quality of fishing on the river is sensitive to river flow and water temperature. Changes in flows may affect the quality of boating by exposing or creating navigation hazards. Flows and water temperature have also been found to substantially influence the presence of salmon, striped bass, and American shad populations in the river (DFG, 1975). Changes in game fish populations affect the amount and type of fishing activity.

American River

Facilities and Activities. The American River Parkway, a 23-mile-long river corridor, crosses the Sacramento metropolitan area between Nimbus Dam and the lower American River confluence with the Sacramento River at Discovery Park. The parkway, managed by the Sacramento County Parks and Recreation Department, is recognized as one of the nation's premier urban parkways (COE, 1991).

The river corridor, an approximately 6,000-acre open space area, consists of a broad river channel with dense riparian vegetation. It features 28 automobile access points and 68 access points for pedestrians, equestrians, and bicyclists (BLM, 1990). The Jedediah Smith National Recreation Trail provides bicycle, pedestrian, and equestrian trails from Discovery Park to the Folsom Lake SRA (COE, 1991). The parkway includes a series of 14 parks distributed on publicly owned lands.

Water-dependent recreation activities on the lower American River include rafting, boating, fishing, swimming, and wading. Water-enhanced activities include picnicking, hiking, bicycling, and equestrian recreation.

Use and Visitor Characteristics. The American River supports a substantial anadromous fishery, including salmon and steelhead runs. From July 1, 1992, to June 30, 1993, the Service recorded approximately 27,000 6-hour RVDs. Of this total, salmon fishing accounted for approximately 46 percent of angler effort and steelhead fishing accounted for approximately 12 percent (Wixom, pers. comm.). Trout and striped bass fishing each accounted for 7 percent of angler effort, and shad fishing accounted for 6 percent.

Estimated use of the American River and its parkway totaled approximately 5.5 million visitor days in 1988 (COE, 1991). Approximately 75 percent of parkway use occurs between March and September (BLM, 1990).

Swimming, boating, and fishing are the leading water-dependent recreation activities. Water-enhanced activities include jogging, nature study, hiking, and picnicking. Recreation along the river remains popular throughout the year.

Recreation Quality Conditions. Because the American River flows through a major urban area, recreation use remains high regardless of flows; however, water-dependent activities, such as rafting and fishing, are affected by the river's flow and temperature.

Seasonal American River temperatures and river flows affect commercial rafting. Rafting declines when air temperatures are cool, even during the peak recreation season. On the lower American River, a minimum streamflow of 2,000 cfs is needed to support rafting, kayaking, and canoeing. Approximately 1,500 cfs will support wading and swimming activities (Watson, pers. comm.). Fishing success depends on the temperatures and flows of the river.

Yuba River

Facilities and Activities. The lower Yuba River flows from Englebright Lake and meets the Feather River at Marysville, a distance of approximately 20 miles. Most of this section of the river flows through private lands, restricting public access. No public recreation facilities exist along the river. Limited public access is available at the SR 20 crossing 5 miles downstream from Englebright Lake, at the end of Hallwood Boulevard about 8 miles upstream of the confluence with the Feather River, and through Riverfront Park in Marysville (DFG, 1991a). Power boat access to the river is possible from launches on the Feather River near its confluence with the Yuba River. Boats traveling up the river are constrained by flows and cannot pass Daguerre Point Dam approximately 10 miles upstream from the confluence with the Feather River (DFG, 1991a).

Fishing is the primary recreation activity on the river. Important game fish include chinook salmon, steelhead, and American shad (DFG, 1991a). Striped bass are also caught, although incidentally compared to other fish. Fishing occurs from the shore at access points available to the public and on the river from boats that travel upstream from the Feather River and from drift boats launched near the SR 20 crossing.

Use and Visitor Characteristics. Complete data for recreation use on the lower Yuba River are not available. The river provides an important anadromous fishery. Fishing is probably the most important recreation activity on the river because of the lack of facilities that would support other water-dependent or water-enhanced activities, such as boating and camping. Recent angler surveys conducted by the Service indicate that use totaled an estimated 2,000 6-hour RVDs between July 1, 1992 and June 30, 1993 (Wixom, pers. comm.). This total does not include the important fall run of chinook salmon. Information on the sport catch is not available for the Yuba River; however, it has been estimated that the river contributes approximately 15 percent to the total stock of Sacramento River Region salmon (DFG, 1991a).

Most recreation use along the river probably occurs during fall, winter, and spring, when the most popular game fish are present. Fishing activity is greatest from September through December for fall-run chinook salmon, March through July for spring-run chinook salmon, October through February for steelhead, and May through July for American shad.

Visitor origin data for the Yuba River are not available; however, a recreation survey conducted on the Sacramento River indicates that approximately 77 percent of visitors originate from counties that are crossed by the river (DWR, 1982). Because of the geographic similarities of the two rivers, this percentage can be assumed to be the same or higher for the Yuba River.

Recreation Quality Conditions. The quality of fishing in the river is affected by the number of fish present, which is influenced by flows, temperatures, and seasons. Other water-dependent and water-enhanced activities are not popular on the river.

Clear Creek

Facilities and Activities. Clear Creek flows approximately 17 miles from Whiskeytown Lake to its confluence with the Sacramento River just south of Redding. The upper 4 miles of the creek flow through the Whiskeytown Unit of the Whiskeytown-Shasta-Trinity NRA. Most of the remaining 13 miles flow through private land. The upper half of the creek passes through steep terrain with many falls and cascades, whereas the lower portion has a flatter gradient with few cascades or falls (DWR, 1986).

No formal recreation facilities are found along the creek. The National Environmental Education Camp, administered by NPS, is approximately 1.5 miles below Whiskeytown Dam and is used primarily by surrounding school districts (Reclamation, 1976). Public access is allowed along the portion of the creek that flows through the Whiskeytown-Shasta-Trinity NRA and at the mouth of the creek over a City of Redding easement. However, access is difficult because of steep terrain. Popular recreation sites include the Redding Bar and Saeltzer Dam areas, both located on private lands on the lower portion of the creek (DWR, 1986).

Recreation activities along the creek comprise swimming, beach use, relaxing, fishing, camping, picnicking, hiking, and tubing (DWR, 1986).

Use and Visitor Characteristics. In 1980, total annual recreation use along the creek was estimated at 43,000 visitor days, mostly between May and September. Sport fishing accounted for an estimated 1,000 visitor days. Use has probably increased with the increase in the population of the surrounding area. Because of the limited public access along the creek, most of the use occurs in the Whiskeytown-Shasta-Trinity NRA and at Redding Bar, Saeltzer Bar, and the mouth of the creek. (DWR, 1986.)

Relaxing is the most popular activity along the creek, accounting for 42 percent of total use, followed by beach use (26 percent) and swimming (23 percent). Camping, fishing, picnicking, hiking, and tubing make up for an estimated 7 percent of total use. Local residents account for an estimated 85 percent of recreation use along the creek. (DWR, 1986.)

Recreation Quality Conditions. Most of the recreation use along the creek occurs in summer. During summer, streamflows (measured at Saeltzer Dam) stabilize, ranging from 53 to 65 cfs (DWR, 1986). This stabilization is a result of the operation of Whiskeytown Lake. Because of the stability of these flows during peak use periods, the impact of fluctuating streamflows on recreation use is not known.

Bear River

Facilities and Activities. Bear River below Camp Far West Reservoir is a 20-mile-long reach that crosses private agricultural land in Placer, Yuba, and Sutter counties on a westerly route to its confluence with the Feather River north of the town of Nicolaus. Below Camp Far West Reservoir, the river is dry for most of the summer (Melton, pers. comm.).

No public recreation facilities or public access sites are provided along this portion of the river. Informal access is available at the Forty-Mile Road crossing and McCourtney Road crossing near Camp Far West Reservoir. Recreation activities include warm-water fishing, sightseeing, and informal picnicking during winter and spring. Fishing activity is mainly for bass, catfish, and other warm-water species that move upstream from the Feather River or escape from Camp Far West Reservoir when flows are released to the river.

Use and Visitor Characteristics. Recreation use on the Bear River below Camp Far West Reservoir is not well documented because activities are dispersed, no formal recreation facilities are provided, and the river is dry for most of the summer (Melton, pers. comm.). Most recreation apparently occurs during winter and spring when water is released from Camp Far West Reservoir and fish are present (Melton, pers. comm.).

Recreation Quality Conditions. The quality of recreation on the lower Bear River is currently poor because the river is dry during the peak summer recreation season. The minimum reservoir release to the river from April to July is 25 cfs; from July to the end of the year, minimum releases are 10 cfs. The quality of recreation conditions on this portion of the river depends mainly on surface water flows and the presence of fish.

Wildlife Refuges

Recreation activities at the NWRs and WMAs in the Sacramento River Region could be affected by the CVPIA. NWRs in the Sacramento River Region include Sacramento, Delevan, Sutter, and Colusa refuges managed as the Sacramento NWR Complex. Gray Lodge WMA is a state WMA managed by DFG.

Facilities and Activities. Recreation facilities on the refuges in the Sacramento River Region are primarily designed to enhance wildlife observation opportunities. Facilities include a visitor center at the Sacramento NWR and interpretive trails, viewing platforms, and self-guided driving tours (Reclamation, 1993a).

Most recreation activities on the refuges are also associated with the presence of waterfowl. These activities include nonconsumptive uses (e.g., wildlife observation and hiking) and consumptive uses (e.g., hunting). Hunting of ducks, geese, coots, snipes, and pheasants is permitted between October and January on portions of all refuges in the Sacramento NWR Complex (Service, 1992a). Fishing for catfish and largemouth bass is permitted on the Delevan NWR from February to October but not during the waterfowl hunting season (Service, 1992a). Fishing does not occur on any other refuge in the complex. Certain activities, such as hiking and driving tours, can be restricted when birds are present on the refuges. Hunting and fishing are also allowed at Gray Lodge WMA.

Use and Visitor Characteristics. In 1992, combined recreation use at the Sacramento NWR Complex and Gray Lodge WMA totaled approximately 103,400 5-hour RVDs. During this period, Gray Lodge WMA accounted for 47 percent of total visitation, followed by Sacramento NWR (39 percent), Delevan and Colusa NWRs (each 6 percent), and Sutter NWR (2 percent).

Use records indicate that nonconsumptive recreation uses, primarily activities associated with wildlife observation, account for most of the use at the refuges. Hunting is the most popular consumptive use.

Most visitation to the wildlife refuges occurs when waterfowl are present. Use estimates from the Sacramento NWR Complex show that approximately 75 percent of total use occurs between October and January (Murczek, pers. comm.). Summer use (June through August) accounts for only 4 percent of total use. All hunting occurs between October and January, with approximately 80 percent between November and January. Approximately 50 percent of total fishing activity occurs from March through May.

According to data from visitor registers at the Sacramento NWR Complex, most refuge visitors originate from the Sacramento Valley (49 percent), followed by the Bay-Delta Region (17 percent) (Service, 1990).

Recreation Quality Conditions. Because recreation activities are associated with the presence of wildlife (primarily waterfowl), visitation at the refuges for consumptive and nonconsumptive uses peaks in the winter, when waterfowl are present.

The primary goal of the NWRs is to provide habitat for waterfowl and other wildlife; therefore, recreation activities that would disturb wildlife are not promoted (Uhland, pers. comm.). Management regulations to control disturbance to wildlife may affect recreation at the refuges by preventing access to certain areas at certain periods or by not providing facilities that would enhance visitation.

Private Hunting Clubs

The 516 private waterfowl hunting clubs in the Sacramento River Region total approximately 227,000 acres. Approximately 96,700 acres are flooded annually. In addition to providing opportunities for hunting ducks and geese, many clubs provide snipe, coot, and pheasant hunting. Waterfowl hunting activity was estimated to total 935,000 hunter days in 1992.

SAN FRANCISCO BAY/SACRAMENTO-SAN JOAQUIN DELTA REGION

Many water-dependent and water-enhanced activities occur in the Bay-Delta Region. DWR recently estimated annual recreation use at 7 million visitor days (Wade et al., 1987). Fishing, one of the most popular activities in the region, accounts for an estimated 15 percent of total recreation visits (DWR, 1990). The most important activity in the region is boating (not including fishing), accounting for an estimated 17 percent of all visits, followed by fishing, relaxing (12 percent), sightseeing (11 percent), and camping (8 percent). An estimated 77 percent of recreationists in the Bay-Delta Region originate from the local area (DWR, 1990).

Sport fishing and waterfowl hunting in the Bay-Delta Region could be enhanced by improved water quality and by habitat enhancement in the Sacramento River and San Joaquin River regions. Other recreation activities are not addressed in detail because they are not expected to be substantially affected by the CVPIA.

Sport Fishing

Sport fishing activity in the Bay-Delta Region is associated with fish abundance and migration patterns and fishing regulations. Striped bass, white sturgeon, chinook salmon, and American shad are important sport fish. Steelhead, although an anadromous fish that will benefit from enhanced streamflows and habitat restoration, does not contribute to the sport fishery. 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 (Boydstrom, pers. comm.). Although the exact number of CPFVs operating in the Bay-Delta 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.). Fishing from private vessels in the Bay-Delta 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 and probably in the Delta (San Francisco Estuary Project, 1992). Fishing for striped bass occurs aboard private vessels and CPFVs, or from shore. An estimated 65 percent of total catch is made aboard private vessels, 21 percent from shore, and 14 percent 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 percent), San Pablo Bay and Carquinez Strait (21 percent), Suisun Bay (6 percent), and the Sacramento-San Joaquin River Delta (20 percent) (DFG, 1989). An estimated 15 percent of total catch occurs in the Sacramento River upstream from Courtland, the remaining 3 percent in the ocean just outside the Golden Gate Bridge and in the San Joaquin River.

Recent DFG surveys show that an estimated 185,326 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 II-13). Striped bass was the most popular fish caught during this period, accounting for approximately 697,000 angler hours.

TABLE II-13

**CATCH OF SELECTED FISH SPECIES
IN THE BAY-DELTA REGION**

Species (1)	Catch (2, 3)	Effort	
		Angler Hours	Percent
Striped bass	185,326	696,723	57
Sturgeon	22,082	412,437	34
Salmon	2,730	79,541	6
American shad	<u>27,152</u>	<u>38,297</u>	<u>3</u>
Total	237,290	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.
 (3) Catch consists of fish released and fish kept.

SOURCE:
 Wixom, pers. comm.

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 (DFG, 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 percent of all white sturgeon are landed aboard CPFVs (Leet et al., 1992; DWR, 1990). The remaining 92 percent 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, an estimated 22,082 sturgeon were caught from July 1, 1992, to June 30, 1993, between Carquinez Bridge and Sacramento (Table II-13). Of this total, an estimated 91 percent 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 river flows into the Delta. As described in the Fisheries Technical Appendix, 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 Bay-Delta Region is small (San Francisco Estuary Project, 1992). 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 landed aboard each of these vessels is not available.

Recent DFG surveys show that an estimated 2,730 salmon were caught from July 1, 1992, to June 30, 1993, between Carquinez Bridge and Sacramento (Table II-13). Total angling effort for salmon during this period, excluding landings made at Bay-Delta Region ports included in the discussion of ocean fisheries, accounted for approximately 79,500 angler hours.

The fall run of salmon typically moves through the Bay-Delta Region in August, September, and October; the late fall run moves through the region in December, January, and February (San Francisco Estuary Project, 1992). Adult salmon spend brief periods in the Bay-Delta Region during their upstream migration (San Francisco Estuary Project, 1992). The abundance of salmon, and thus the success of the sport fishery in the region, is probably affected by several factors, including reproduction success of salmon in previous years and fishing success of the ocean stocks.

American Shad. Sport fishing for American shad in the Bay-Delta Region occurs primarily in the lower reaches of the Sacramento and Mokelumne rivers near Clarksburg, Courtland, and Walnut Grove. The most common fishing method for American shad in the region is bump-netting (DFG, 1981), which is used typically at night (DWR, 1990). A hook-and-line sport fishery for American shad is not substantial in the Bay-Delta Region.

Recent DFG surveys indicate that an estimated 27,152 American shad were caught from July 1, 1992, to June 30, 1993, in the Bay-Delta Region (Table II-13). Total angling effort for American shad during this period accounted for approximately 38,300 angler hours.

American shad are oceanic as adults except for the period in which they move into freshwater to spawn (San Francisco Estuary Project, 1992). Spawning migrations typically begin in March and peak in May (San Francisco Estuary Project, 1992). Most American shad pass through the Delta in April and May (DWR, 1985); coinciding with the bump-net fishery, which normally begins in April and continues through June (DFG, 1981). The abundance of American shad in the Delta is associated with spawning and reproduction success in previous years.

Private Hunting Clubs

There are 189 private waterfowl hunting clubs in the Bay-Delta Region, totaling approximately 110,900 acres. Approximately 39,100 acres are flooded annually. Waterfowl hunting activity was estimated to total 315,000 hunter days in 1992. (DFG, 1992.)

SAN JOAQUIN RIVER REGION

Key recreation areas in the San Joaquin River Region are Millerton Lake, San Luis Reservoir, New Melones Reservoir, Lake McClure, and New Don Pedro Reservoir; and the San Joaquin, Merced, Tuolumne, and Stanislaus rivers. Key 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 are Bethany Reservoir, O'Neill Forebay, New Hogan Lake, and Camanche Reservoir; 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 II-14 and II-15, respectively, and discussed in the remaining paragraphs of this section.

San Luis Reservoir

Facilities and Activities. The San Luis Reservoir SRA, operated by DPR, covers approximately 12,700 surface acres when full.

Major components of the San Luis Reservoir SRA are the recreation facilities that accommodate boating, waterskiing, fishing, picnicking, camping, hunting, and trail use activities. Boat access is provided in the southeastern portion of the reservoir at the Basalt area, a two-lane concrete boat ramp and boarding dock, and at the northwestern Dinosaur Point use area, which features a four-lane concrete boat ramp and boarding dock. Wind conditions on the reservoir can create hazardous boating conditions. Warning lights at the DWR-operated Romero Overlook visitor center and DPR Quien Sabe Point facility indicate when wind conditions on the reservoir are hazardous (DPR, 1985).

San Luis Reservoir has no designated swimming or lakeside beach areas. Waterskiing is allowed in designated areas around the 65-mile reservoir shoreline.

Boat and shore fishing occur throughout San Luis Reservoir. Striped bass is the primary game fish in the reservoir. Fishing is usually of high quality from late February through summer, with striped bass fishing being the best during winter and spring (DPR, 1985).

Migratory waterfowl hunting is permitted on most of the reservoir at approximately 300 feet from established reservoir and recreation facilities. Hunting for deer and wild pig is also allowed in the San Luis Reservoir SRA on the northwestern reservoir shoreline.

TABLE II-14

RECREATION CHARACTERISTICS OF KEY AND OTHER 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

TABLE II-14. CONTINUED

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: DWR, 1989.
 Millerton: DPR, 1989a.
 New Melones: Butterbaugh, pers. comm.
 McClure: Merced Irrigation District, 1993.
 New Don Pedro: Don Pedro Recreation Agency, n.d.
 Bethany: DWR, 1989.
 O'Neill Forebay: DWR, 1989.
 New Hogan: COE, 1992b.
 Camanche: YCWA, 1993; BioSystems Analysis, 1992.

Rivers, Aqueducts, and Canals
 San Joaquin: DPR, 1990; Jones & Stokes Associates, 1976.
 Merced: Rodriguez, pers. comm.
 Tuolumne: DPR, 1990.
 Stanislaus: Jones & Stokes Associates, 1976.
 Mokelumne: Moranton, pers. comm.; DFG, 1991b.
 Calaveras: Jones & Stokes Associates, 1988.
 California Aqueduct: DFG, 1984.
 Delta-Mendota Canal: Reclamation, 1993a.
 Wildlife refuges: Service, 1983; 1991; 1992b; Kie, pers. comm.
 Private hunting clubs: DFG, 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 |
| CS = chinook salmon | STB = striped bass |

TABLE II-15

**RECREATION USE AND ACTIVITIES AT KEY AND OTHER POTENTIALLY
AFFECTED RECREATION AREAS IN THE SAN JOAQUIN RIVER REGION**

Recreation Areas	Use (1, 2) (1,000)	Water-Dependent Activities (percent)					Water-Enhanced Activities (percent)					Total
		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	50	NA	50	NA	NA	NA	NA	NA	NA	NA	100
Merced (6)	109	NA	12	42	NA	13	NA	NA	NA	NA	33	100
Tuolumne (7)	150	NA	NA	9	NA	65	NA	NA	NA	NA	26	100
Stanislaus	122	NA	26	14	NA	32	NA	NA	NA	NA	28	100
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

TABLE II-15. CONTINUED

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 percent of use.
- (4) Reported use is for boating, fishing, swimming, and wildlife viewing activities only.
- (5) San Joaquin River use estimates are based on use from Fremont Ford SRA, Las Palmas Fishing Access Site, Mossdale Landing County Park, and Dos 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, Mendota 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 (Reclamation, 1992a), activity (DWR, 1987).
 Millerton: use (Reclamation, 1992a), activity (Reclamation, 1986).
 New Melones: use (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 (Reclamation, 1992a), activity (DWR, 1987).
 New Hogan: use and activity (Lykins, pers. comm.).
 Camanche: use and activity (Hill, pers. comm.).

Rivers and Canals

- San Joaquin: use (Irion, pers. comm.; Brody pers. comm.).
 Merced: use (DPR, 1990; Rodriguez pers. comm.).
 Tuolumne: use (Planning and Conservation League, 1983).
 Stanislaus: use (DPR, 1990; Holmberg pers. comm.).
 Mokelumne: use (Moranton, pers. comm.).
 California Aqueduct: use (Higley, pers. comm.), activity (DWR, 1989).
 Delta-Mendota Canal: use (Reclamation, 1992a), activity (Reclamation, 1993b).
 Wildlife Refuges: use (Murczek, pers. comm., DFG, n.d.), activities (Service, 1990).
 Private Hunting Clubs: (DFG, 1992).

LEGEND:

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

Use and Visitor Characteristics. An estimated 210,000 12-hour RVDs were reported in 1992. Recreation facilities at O'Neill Forebay, immediately east of the reservoir, were developed to accommodate recreation use that may be lost at the main reservoir during drawdown periods.

Water-enhanced activities account for the largest proportion of reservoir use. Relaxing and camping are the most popular water-enhanced activities.

Recreation activities and numbers of participating recreationists vary with the season, with approximately 77 percent of annual use between April and September (Erba, pers. comm.). Most visitors came from the Bay-Delta Region (38 percent), followed by the San Joaquin Valley (29 percent) (DWR, 1987).

Recreation Quality Conditions. Recreation use at San Luis Reservoir is optimized at a maximum reservoir pool elevation of 544 feet above msl. Use of the Basalt area boat ramp becomes inconvenient at approximately 340 feet above msl, but the ramp can be used on a limited basis. The four-lane boat ramp at Dinosaur Point can be used at the minimum reservoir pool but is difficult to access below 360 feet above msl. Swimming activities are not affected by reservoir surface water fluctuations because the reservoir has no designated swimming facilities (Kolb, pers. comm.).

Millerton Lake

Facilities and Activities. Recreation facilities at Millerton Lake are operated by DPR as part of the Millerton Lake SRA. When full, the lake has a surface area of 4,920 acres, 51 miles of shoreline, and a surface elevation of 580 feet above msl.

Recreation opportunities at Millerton Lake include fishing, swimming, boating, waterskiing, picnicking, camping, and trail use. Boat access is provided on the south and north shores of the lake. Major use areas are the La Playa, Grange Grove, Blue Oak, and South Bay picnic areas; McKenzie Point boat ramp and swimming area; and Winchell Bay Marina and South Finegold picnic area on the south shore. Five boat ramps located along the south shore provide 33 launching lanes. The north shore features camping facilities at Dumna Cove and a two-lane boat ramp at the Meadow Campground. The Winchell Bay Marina provides up to 450 berthing slips (DPR, 1989b).

Swimming and sunbathing are popular at the La Playa and South Bay picnic areas from May through September. Boating and waterskiing are popular throughout the main southern reservoir areas. Northwest of Finegold Bay, the 16-mile San Joaquin River Canyon portion of the reservoir is designated as a no-skiing area with a 35-mile-per-hour (mph) boat speed limit. A 5-mph boat speed limit is enforced at the Temperance Flat boat and environmental camps.

Fishing occurs from boats and the shore throughout the reservoir. The Millerton Lake fishery consists mainly of trout and warm-water species.

Use and Visitor Characteristics. Millerton Lake is a popular recreation destination for Fresno, Madera, and Merced county residents and regularly experiences heavy use during the

peak summer season (Reclamation, 1986). In 1992, use at the Millerton Lake SRA totaled approximately 316,000 12-hour RVDs.

Sightseeing and picnicking are the most popular activities at the lake. Estimates of recreation visitation indicate that swimming accounts for approximately 27 percent of water-dependent activities, waterskiing 30 percent, boating 33 percent, and fishing 10 percent (Reclamation, 1986).

Approximately 75 percent of the annual recreation visitation occurs between April and September (Erba, pers. comm.) and visitation typically peaks in June and July. An estimated 70 percent of the visitors to the lake originate from local counties in the San Joaquin Valley (Reclamation, 1980).

Recreation Quality Conditions. Despite the availability of usable boat ramps year-round, Millerton Lake recreation use decreases substantially when the reservoir drops to an elevation of 468 feet above msl (Johnson, pers. comm.). Boat Ramps Nos. 1 (La Playa) and 6 (Meadow Camp) can be used at all surface water elevations. Ramp No. 2 can be used between elevations 537 and 520 feet above msl, Ramp No. 3 at elevations between 578 and 537 feet above msl, Ramp No. 4 at elevations of 520 to 500 feet above msl, and Ramp No. 5 at elevations of 500 to 468 feet above msl.

Winchell Bay Marina operations are affected by surface water elevation changes of approximately 3 feet. Although the marina must be moved frequently when the lake fluctuates, it is operable at all surface water elevations (Johnson, pers. comm.).

The south shore swimming areas are also affected by changes in reservoir water elevations. The La Playa swimming area is generally used at high water elevations, and the McKenzie Point swimming area is generally used at low water elevations (Johnson, pers. comm.). Camping at most of the lake units is not affected by water elevations, but the Temperance Flat camping unit cannot be used below 520 feet above msl (Johnson, pers. comm.).

New Melones Reservoir

Facilities and Activities. Recreation facilities at New Melones Reservoir have operated since 1979 when initial recreation development was completed. When full, the reservoir has a surface area of approximately 3,600 acres, 105 miles of shoreline, and a surface elevation of 1,088 feet above msl.

Recreation facilities at the reservoir accommodate swimming, boating, waterskiing, fishing, picnicking, and camping. Boat access is provided on the north and east shores of the reservoir. Developed use areas are the Glory Hole recreation area in the northwestern portion of the reservoir and the Tutletown recreation area on the eastern shore. The Mark Twain, Parrot's Ferry, Camp Nine, and Old Town recreation areas are undeveloped and offer minimal facilities (Butterbaugh, pers. comm.).

The Glory Hole recreation area is the most intensively used facility on the reservoir and features three seven-lane boat ramps used for high, medium, and low reservoir levels; a concession-

operated marina with berthing slips; three courtesy docks; picnic sites; and camping facilities. A developed beach area provides swimming opportunities.

The Tuttle town recreation area features three seven-lane boat ramps used for variable reservoir levels, three courtesy docks, a fish-cleaning station, picnic sites, and camping facilities.

The designated swimming area and beach at Angels Arm recreation area is closed. Boating and waterskiing are popular throughout the main reservoir area, and fishing is popular from boats and the shoreline (Davis, pers. comm.).

Use and Visitor Characteristics. Approximately 498,000 12-hour RVDs at New Melones Reservoir were recorded in 1992. Water-dependent recreation activities, which account for the largest portion of annual visitation, include waterskiing, pleasure boating, and fishing. Camping is the most popular water-enhanced activity.

Annual recreation visitation at New Melones Reservoir occurs largely from April to late September (Davis, pers. comm.). An estimated 95 percent of the recreationists visiting New Melones Reservoir originate from local counties in the San Joaquin Valley (Reclamation, 1980).

Recreation Quality Conditions. The optimal reservoir level for recreation use is at an elevation of approximately 950 to 980 feet above msl. All boat ramps except one at Glory Hole cease operation as the lake reaches a surface elevation of 950 feet above msl. The Glory Hole boat ramp is a 2-lane facility constructed by volunteers to provide boat access at a reservoir elevation as low as 860 feet above msl. The Glory Hole Marina must be moved with changing water levels. At an approximate elevation of 900 to 950 feet above msl, use is substantially reduced by loss of all but the Glory Hole boat ramp. At an elevation of 880 feet above msl, which was reached during the recent drought, the marina closes. Other ramps in the Mark Twain, Parrot's Ferry, and Old Town undeveloped recreation areas are old roads that can be used on a limited basis to an elevation of approximately 850 feet above msl (Davis, pers. comm.).

Lake McClure

Facilities and Activities. Lake McClure is owned and operated by the Merced Irrigation District. When full, the lake has a surface area of 7,100 acres, 80 miles of shoreline, and an elevation of 867 feet above msl.

Recreation facilities at Lake McClure accommodate a wide variety of water-dependent and water-enhanced activities. Boat access is provided at ramps located around the shoreline. The four major use areas are McClure Point and Barrett Cove recreation areas on the western shoreline, Horseshoe Bend recreation area on the northern shoreline, and Bagby recreation area at the SR 49 crossing on the eastern reservoir arm.

McClure Point facilities include 3 boat launch lanes, a swimming lagoon, a marina with a store and houseboat mooring, picnic areas, comfort stations, and 100 camping units. Barrett Cove features 2 boat ramps with a total of 5 lanes, a swimming lagoon, a marina, comfort stations, picnic areas, and 275 camping units. The Horseshoe Bend recreation area features a 2-lane boat ramp, a swimming lagoon, picnic areas, and 110 camping units. The Bagby recreation area

provides a 1-lane boat ramp, marina, picnic area, and 25 camping units. Each use area has a concession store. (Merced Irrigation District, 1993.)

Recreation activities include boating, waterskiing, fishing, swimming, sailing, jet skiing, hang gliding, picnicking, and camping. Boating and waterskiing occur throughout the reservoir. Rainbow trout fishing opportunities from boat and the shoreline are enhanced by year-round planting. Bass fishing has improved since the Florida largemouth bass was introduced.

Swimming areas are provided at three developed lagoons that feature beach and picnic areas.

Use and Visitor Characteristics. Approximately 606,000 12-hour RVDs were recorded at Lake McClure in 1992 (Merced Irrigation District, 1993). Day-use activities accounted for most of the visitor days.

Annual recreation use at the lake occurs largely between May and September (Ardohain, pers. comm.). Most of the visitors originate from the following counties in order of greatest to least attendance: Santa Clara, Stanislaus, San Joaquin, Merced, Mariposa, Sacramento, Fresno, Madera, Tuolumne, and Calaveras (Ardohain, pers. comm.).

Recreation Quality Conditions. The Lake McClure boat ramps cease operation between 590 and 793 feet above msl. The Bagby ramp is the first to cease operation at 793 feet above msl, followed by Horseshoe Bend at 758 feet above msl; McClure Point at 650 feet above msl; southern Barrett Cove ramp at 630 feet above msl; and northern Barrett Cove and Piney Creek, both at 590 feet above msl. The Horseshoe Bend and Bagby ramps were the only facilities affected during the peak summer recreation season under drought conditions in 1992. (Ardohain, pers. comm.)

The swimming beaches and marinas have not been substantially affected by fluctuating levels between April and September (Ardohain, pers. comm.).

New Don Pedro Reservoir

Facilities and Activities. New Don Pedro Reservoir is owned and operated by the Turlock and Modesto irrigation districts. The recreation facilities are operated by the Don Pedro Recreation Agency. When full, the reservoir has a surface area of 13,000 acres, 160 miles of shoreline, and a maximum water surface elevation of 830 feet above msl (Don Pedro Recreation Agency, n.d.).

Recreation facilities at the reservoir accommodate water-dependent and water-enhanced activities. The developed use areas are Fleming Meadows recreation area on the southern shoreline, Blue Oaks recreation area on the southwestern shoreline, and Moccasin Point recreation area on the northeastern arm of Moccasin Bay, all with boat launch facilities. Two full-service marinas featuring docks, boat slips, mooring areas, and provisions are provided at Fleming Meadows and Moccasin Point recreation areas (Don Pedro Recreation Agency, n.d.). A 2-acre swimming lagoon at Fleming Meadows is separated from the main reservoir body and includes a swimming area with a maximum depth of 6 feet, picnic facilities, and a sandy beach area.

Camping facilities consist of 550 sites for the 3 recreation areas. Primitive boat-in camping is allowed throughout the 160-mile shoreline (Don Pedro Recreation Agency, n.d.).

Recreation activities include boating, swimming, waterskiing, jet skiing, windsurfing, sailing, houseboating, fishing, camping, boat-in camping, picnicking, and sightseeing. Boating and waterskiing occur throughout the reservoir. Swimming occurs mainly at the Fleming Meadows swimming lagoon. Shore and boat fishing are mainly for bass, trout, salmon, crappie, bluegill, and catfish.

Use and Visitor Characteristics. Use at New Don Pedro Reservoir totaled approximately 280,000 12-hour RVDs in 1992 (Cornell, pers. comm.). Water-dependent recreation, such as boating, waterskiing, fishing, and camping, account for most of the annual visitation.

Approximately 84 percent of the annual recreation visitation occurs between May and September (Cornell, pers. comm.). Recreation use from November to February generally accounts for only about 4 percent of annual visitation.

Approximately 27 percent of New Don Pedro Reservoir visitors originate locally from Stanislaus and Tuolumne counties. A large proportion of the visitors (38 percent) travel from Santa Clara, Alameda, and San Joaquin counties. Other surrounding counties individually account for less than 5 percent of the reservoir's visitors.

Recreation Quality Conditions. The full pool elevation for New Don Pedro Reservoir is 830 feet above msl. Generally, use of the reservoir declines moderately when the elevation reaches 790 feet above msl and considerably at 750 feet above msl (Cornell, pers. comm.). The Fleming Meadows boat ramp is out of operation at elevation 600 feet above msl (minimum pool). Between 710 feet and 600 feet, five ramps are lost. The Moccasin Point boat ramp cannot be used at an elevation of 722 feet above msl, and the Blue Oaks boat ramp cannot be used at 726 feet above msl (Cornell, pers. comm.). The Fleming Meadows and Moccasin Point marina operations are limited at 600 and 630 feet above msl, respectively. The swimming lagoon is used at all reservoir surface water elevations because it is separated from the main reservoir and water levels are maintained by water being pumped from the reservoir to the lagoon (Cornell, pers. comm.).

New Hogan Lake

Facilities and Activities. New Hogan Lake is located on the Calaveras River and is operated by the COE. When full, the lake has a surface area of approximately 4,400 acres, 50 miles of shoreline, and a surface elevation of 713 feet above msl.

Recreation facilities at New Hogan Lake provide opportunities for a wide variety of water-dependent activities, such as boating, waterskiing, fishing, swimming, and boat-in camping.

Boat access is available at Fiddleneck day-use area and Acorn East Campground. Major day-and overnight-use areas along the shoreline are primarily concentrated on the western and northern shoreline and include the Monte Vista picnic and trail use area, Wrinkle Cove picnic and swimming area, Acorn West and East campgrounds, Coyote Point Campground, and Fiddleneck

day-use area. The Deer Flat boat-in camp is located on the southeastern shore. Shoreline fishing access is provided at the Bear Creek and Whiskey Creek access points on the southern shoreline and at major use areas on the western and northern shore. The New Hogan Marina at the south end of the Fiddleneck day-use area offers boating and fishing supplies, 80 to 90 berthing slips, and boat storage facilities (Lykins, pers. comm.).

Boating and waterskiing are popular lake activities during summer. Jet skiing is becoming increasingly popular at the lake, particularly during optimal water level periods. Boating speeds are restricted to 5 mph in most of the southern and western shoreline coves. (Lykins, pers. comm.). Wrinkle Cove provides a popular swimming area where boats are prohibited.

Fishing occurs from boats and the shore throughout the lake. According to a DFG creel census, naturally reproducing striped bass are plentiful in New Hogan Lake, although recent creel census data show a decline in fishing conditions during the 1988-1992 drought (Lykins, pers. comm.). Black bass, crappie, sunfish/bluegill, and catfish are caught regularly.

Use and Visitor Characteristics. In 1992, use at the lake totaled approximately 185,000 12-hour RVDs. Water-dependent recreation activities (e.g., boating, waterskiing, swimming, and fishing) accounted for a large proportion of this use.

Approximately 74 percent of the annual recreation visitation at New Hogan Lake occurs between April and September (Lykins, pers. comm.).

Based on the COE's estimate of percentage of visitors by origin, more than 63 percent of the annual visitors originate from the Sacramento and San Joaquin valleys and approximately 37 percent originate from the Bay-Delta and other regions (Lykins, pers. comm.).

Recreation Quality Conditions. Average reservoir pool elevation at the beginning of the recreation season is 680 feet above msl. The reservoir pool elevation for the average recreation season (April-September) is 665 feet above msl.

Recreation at New Hogan Lake is adversely affected by lake levels that fall below normal or average levels. Although extreme high water inundates some day-use and camping facilities, the quality of recreation is not substantially affected (Lykins, pers. comm.). When lake levels are at or above normal levels, hazards and visually unappealing shorelines are not exposed. Recreation use is high during this period because a large amount of water surface is available and the shoreline is safely accessible (Lykins, pers. comm.).

Boat Ramps Nos. 1, 2, and 3 at the Fiddleneck day-use area cannot be used at or below elevations 575, 650, and 673 feet above msl, respectively. The Acorn East Campground ramp cannot be used at or below an elevation of 662 feet above msl. The New Hogan Marina must move facilities frequently during the summer recreation season. Low water levels greatly affect marina operation and business. Use of picnic facilities is usually not substantially affected by water levels, but campground use is greatly affected by low water levels in all of the New Hogan Lake facilities because access to lakeside camping facilities is reduced. (Lykins, pers. comm.)

Camanche Reservoir

Facilities and Activities. Camanche Reservoir, a 7,700-acre reservoir with 53 miles of shoreline, is owned and operated by EBMUD. Recreation facilities include 15,000 acres of recreation lands, 2 main recreation areas with tent and RV camp sites, 2 marinas, 4 boat ramps with a total of 17 lanes, cottages, tennis courts, riding stables, conference rooms, a general store, a coffee shop, and an amphitheater. The north and south shore marinas are full-service facilities featuring boat slips, boat rentals, and bait and tackle (YCWA, 1993).

Water-dependent recreation activities are swimming, waterskiing, jet skiing, windsurfing and fishing year-round. Waterskiing is restricted in the upper reservoir arms. Fishing occurs for cold- and warm-water species, such as rainbow and brown trout, channel and white catfish, sunfish, crappie, largemouth and smallmouth bass, spotted black bass, and white sturgeon (BioSystems Analysis, 1992).

Use and Visitor Characteristics. Approximately 258,000 12-hour RVDs were recorded at Camanche Reservoir's north and south shore recreation areas in 1992. Water-dependent recreation activities dominate reservoir use. In 1992, overnight use was greater than day use (Hill, pers. comm.).

Approximately 71 percent of the 1992 annual recreation visitation at the north shore recreation area occurred between April and September, and 66 percent of the recreation visitation at the south shore recreation area occurred during this peak summer period (Hill, pers. comm.).

More than 90 percent of the north shore visitors originate from San Joaquin, Sacramento, Amador, Stanislaus, Placer/El Dorado, Calaveras, Contra Costa, Alameda, Santa Clara, and Solano counties, most from San Joaquin (25.6 percent), Sacramento (19.9 percent), and Amador (16.2 percent) counties. All the other counties each contributed less than 10 percent. Approximately 92 percent of the south shore visitors originate from San Joaquin, Sacramento, Stanislaus, Amador, Calaveras, Contra Costa, Alameda, Santa Clara, San Francisco, San Mateo, and Solano counties. Most of the south shore visitors travel from San Joaquin (30.4 percent), Sacramento (14.6 percent), Calaveras (10.8 percent), Alameda (8.9 percent), and Stanislaus (6.5 percent) counties (Hill, pers. comm.).

Recreation Quality Conditions. At full pool, the Camanche Reservoir surface water elevation is 235 feet above msl. One of the south shore boat ramps is operational between 180 feet above msl and full pool. The second south shore boat ramp is operational between 180 and 170 feet above msl. One of the north shore boat ramps is operational between 205 and 195 feet above msl. The second north shore boat ramp is operational between 195 and 160 feet above msl (Hill, pers. comm.; Kantwell, pers. comm.).

Bethany Reservoir

Facilities and Activities. The 160-acre Bethany Reservoir is located on the California Aqueduct just south of the Delta pumping plants in Alameda County. DPR operates the recreation facilities at the reservoir. The reservoir functions as a forebay for the South Bay

Pumping Plant and a balancing pool for discharge from the Harvey O. Banks Pumping Plant. (DWR, 1974.)

Recreation facilities provide opportunities for fishing, boating, windsurfing, picnicking, hiking, and bicycling. Boat access is provided at a two-lane boat ramp on the northern shoreline near the main reservoir access point. Picnic areas are provided on the northern and southern shorelines; a bicycle path along the northern shoreline connects the picnic areas. (DWR, 1989.)

Fishing is the most popular activity at Bethany Reservoir, and striped bass and catfish are the species most often caught.

Boating is allowed on Bethany Reservoir. Boat sizes are not limited; however, a maximum speed of 15 mph is allowed in open water and 5 mph is allowed within 200 feet of the shore. Strong winds at the reservoir provide windsurfing opportunities.

Use and Visitor Characteristics. Approximately 30,000 12-hour RVDs were recorded at Bethany Reservoir in 1991. Detailed data on use by activity are not available. Approximately 58 percent of the annual recreation visitation occurs between April and September, with use peaking in July, August, and September (Erba, pers. comm.).

Visitor origin data are not available for Bethany Reservoir. Most visitors are believed to originate from the San Francisco Bay area and northern San Joaquin County (Kolb, pers. comm.).

Recreation Quality Conditions. Because Bethany Reservoir functions as a forebay and regulating reservoir on the California Aqueduct, its water surface elevation does not fluctuate substantially (Kolb, pers. comm.).

O'Neill Forebay

Facilities and Activities. Recreation facilities at the 2,700-acre O'Neill Forebay supplement recreation opportunities provided on San Luis Reservoir. Recreation facilities feature the Medeiros recreation area, which provides picnicking, camping, and boat ramp access, and the San Luis Creek day-use area, which provides picnicking, swimming, and boat ramp access. Facilities accommodate boating, fishing, swimming and wading, camping, and sightseeing activities.

Use and Visitor Characteristics. Approximately 417,000 12-hour RVDs at O'Neill Forebay were estimated for 1992. Recreation facilities provide more diverse recreation opportunities at the forebay than at San Luis Reservoir. Swimming, wading, and relaxing are the most popular activities at the forebay.

Monthly visitation trends for O'Neill Forebay are similar to those for the overall San Luis Reservoir SRA, with most of the recreation use occurring between April and September.

In 1986, recreational visitors to O'Neill Forebay originated from the following counties: Santa Clara (25 percent), Merced (18 percent), Stanislaus (10 percent), Monterey (9 percent), San Benito (7 percent), Santa Cruz (5 percent), and Fresno (5 percent) (DWR, 1987).

Recreation Quality Conditions. Recreation use at O'Neill Forebay generally is not affected by water level fluctuations because surface water elevations at these control reservoirs are usually maintained at constant levels (Kolb, pers. comm.). If water levels were to fluctuate greatly, beach use would probably be adversely affected because a minor drop in surface elevation would expose a relatively large amount of the forebay shoreline (Kolb, pers. comm.).

San Joaquin River

Facilities and Activities. The San Joaquin River is approximately 100 miles long from Millerton Lake to the Sacramento-San Joaquin Delta. The Merced, Tuolumne, Stanislaus, and Calaveras rivers drain to the San Joaquin River in the San Joaquin River Region. The river borders the Madera/Fresno county line from Millerton Lake to the Merced County line near the SR 152 crossing. Although no major public recreation features are available along this reach, public access is available at several road and state highway crossings. The river borders the San Luis NWR and crosses the Fremont Ford SRA in Merced County. Stanislaus County recreation facilities include the Las Palmas fishing access site, Laird County Park, and numerous public access points. Recreation facilities on the river in San Joaquin County are Durham Ferry SRA, Mossdale Landing County Park, Dos Reis County Park, and numerous public road crossings. The City of Stockton has three recreation facilities on the Stockton deepwater channel. The Buckley Cove Marina is located on the San Joaquin River east of Stockton.

Use and Visitor Characteristics. Recreation use estimates for the entire lower San Joaquin River are not available from a single source because recreation is dispersed across 100 miles and five counties. Based on information provided by recreation sites on the river (Fremont Ford SRA and various county parks), boating and fishing activities on the river are estimated to total 157,000 six-hour RVDs (DPR, 1990; Irion, pers. comm.; Brody, pers. comm.). Most of the San Joaquin River visitors are assumed to originate from local counties.

Recreation Quality Conditions. Recreation use on the San Joaquin River has been substantially affected by operation of Millerton Lake and diversions from the Merced Canal and the Chowchilla Canal east of the Mendota Pool. The San Joaquin River is intermittent downstream of the Mendota Pool to the Merced River confluence, with flows fed mainly by irrigation return flows. Flow reduction has eliminated salmon runs in the San Joaquin River (Jones & Stokes Associates, 1976). No estimates of the effect of the reduced flows on annual river recreation use have been located.

Merced River

Facilities and Activities. The Merced River below McSwain Dam is a 50-mile-long reach that crosses private agricultural and grazing land in Merced County en route to its confluence with the San Joaquin River at the Merced/Stanislaus county line. Major public recreation facilities on the river are Henderson County Park on Merced Falls Road east of Snelling, McConnell SRA northeast of Livingston on SR 99, Hagaman County Park at the SR 165 river crossing, and George J. Hatfield SRA on Kelley Road near the San Joaquin River confluence. County parks provide primarily day-use facilities, and state recreation areas provide day-use facilities and camping units.

The two county parks offer group picnic areas and softball fields. No swimming or other water-contact activities are allowed at either park because lifeguards are not provided (Rodriguez, pers. comm.). No boat ramps are provided at county parks, and boating use is generally low because the river is shallow and much of the flow is diverted upstream (Rodriguez, pers. comm.). Some canoeing and rafting occur on the river.

Use and Visitor Characteristics. Recreation use estimates for the entire lower Merced River are not available from a single source. Based on information provided by recreation sites on the river (McConnell SRA, George J. Hatfield SRA, Hagaman County Park, and Henderson County Park), water-related recreation activity on the river is estimated to total 73,000 6-hour RVDs (DPR, 1989b and 1990; Rodriguez, pers. comm.). Most of the use at developed parks along the river consists of passive, water-enhanced recreation. Most recreationists are assumed to be local (Rodriguez, pers. comm.).

Recreation Quality Conditions. Because recreation is dispersed along the 50-mile-long Merced River reach and no formal recreation surveys have been conducted, the extent to which fluctuating flows affect existing recreation is unknown.

Tuolumne River

Facilities and Activities. The Tuolumne River below New Don Pedro Reservoir extends approximately 50 miles to its confluence with the San Joaquin River, traversing mainly private open space and grazing lands, property within the City of Modesto, and several public parks. Major recreation facilities are the La Grange County Regional Park on Yosemite Boulevard near La Grange, Turlock Lake SRA located on Lake Road between Turlock Lake and the river, Fox Grove Regional County Park at the Geer Road/Albers Road crossing, two golf courses adjacent to the river near the SR 99 crossing, and the Shiloh fishing access site at the Shiloh Road crossing upstream of the San Joaquin River/Tuolumne River confluence.

Recreation use on the lower Tuolumne River consists primarily of water-dependent activities, such as fishing, swimming, and rafting and water-enhanced activities at picnic areas and campgrounds.

Use and Visitor Characteristics. In 1992, water-related recreation activities and wildlife viewing accounted for an estimated 150,000 6-hour RVDs (Planning and Conservation League, 1983). Most recreation visits to the river are assumed to originate from Stanislaus County.

Recreation Quality Conditions. Existing flow diversions associated with New Don Pedro Reservoir have substantially reduced Tuolumne River flows compared to pre-project conditions (Jones & Stokes Associates, 1976). The reduced flows have also substantially affected the river coldwater sport fishery, including reductions in salmon runs. No conclusive information on the effect of reduced flows on nonconsumptive recreation uses has been located. It is assumed that when flows decrease, water-dependent and water-enhanced activities decline.

Stanislaus River

Facilities and Activities. The reach of the Stanislaus River between New Melones Reservoir and its confluence with the San Joaquin River is 60 miles long. The river traverses primarily private agricultural and grazing land in Tuolumne, Stanislaus, and San Joaquin counties. It borders the Stanislaus/San Joaquin county line approximately 4 miles downstream from Oakdale. Approximately 10 developed public parks and 6 undeveloped parks are provided on the Stanislaus River. Caswell Memorial State Park is approximately 3 miles upstream of the Sacramento/San Joaquin river confluence; this public facility features day-use facilities and a campground. Public access to the river is dispersed at numerous road crossings. Access for a whitewater rafting run is provided just below Goodwin Dam. The 4-mile-long whitewater run between Goodwin Dam and Knights Ferry is rated Class II-VI (advanced) with several difficult portages (Martin, 1974). Other river activities include fishing, swimming, picnicking, and camping.

Use and Visitor Characteristics. In 1992, the COE estimated boating, swimming, fishing, and wildlife viewing use of the lower Stanislaus River below Goodwin Dam at 122,000 6-hour RVDs. Use at recreation facilities on or near the Stanislaus River has increased substantially since 1980 because of increased park development along the river (Holmberg, pers. comm.). Most of the riverside parks are believed to serve local county residents; however, Caswell Memorial State Park is considered a regional park capable of attracting nonlocal visitation.

Recreation Quality Conditions. The quality of recreation on the Stanislaus River is affected by its flows. Whitewater rafting below Goodwin Dam occurs when major flows are not diverted for irrigation (Martin, 1974). Use at developed parks along the river is also believed to be affected by flows (Holmberg, pers. comm.).

Mokelumne River

Facilities and Activities. The lower Mokelumne River is a 40-mile-long segment of the river between Camanche Reservoir and the Sacramento/San Joaquin Delta. Most of the lower Mokelumne River traverses private rural lands. Major public recreation facilities on the river are EBMUD's Mokelumne River Day Use Area located on McIntire Road near Camanche Reservoir, Stillman McGee County Park on Mackville Road near the town of Clementes, and Lake Lodi near the community of Woodbridge. Public access to the Mokelumne River is available at numerous road crossings in and around Lodi.

Recreation facilities at the Mokelumne River Day Use Area consist of parking, picnic areas, portable toilets, and river access. No boat launch facilities are provided in this recreation area. Popular recreation activities include fishing, wading, swimming, canoeing, kayaking, tubing, and picnicking (Moranton, pers. comm.). Important game fish are American shad and chinook salmon.

Use and Visitor Characteristics. No comprehensive estimate of recreation visitation at the lower Mokelumne River is available because recreation activities are generally dispersed along the length of the river, and no single recreation entity administers all the recreation and access facilities. In 1992, EBMUD estimated day use at the Mokelumne River Day Use Area to be approximately 18,000 6-hour RVDs.

No visitor origin or recreation participation information is available for the Mokelumne River. Most recreationists are probably from the local area because major recreation facilities on the river are not considered regional destination points. Most recreationists participate in water-dependent or water-enhanced recreation activities primarily during the peak summer recreation season.

Recreation Quality Conditions. Use of the lower Mokelumne River is influenced by flows and temperatures. Generally, use increases when flows are normal or above normal and decreases when flows are below normal (Moranton, pers. comm.). Underwater obstacles in several areas of the river could affect boating use during low-flow periods.

Calaveras River

Facilities and Activities. The Calaveras River below New Hogan Lake is 45 miles long and crosses primarily private land in Calaveras and San Joaquin counties en route to its confluence with the San Joaquin River at the Stockton Deep Water Channel. In Stockton, the river crosses several roads that provide public access. The only public recreation facilities immediately adjacent to the river are the Stockton Golf and Country Club and the Brookside Community Golf Course; both are located near the confluence with the San Joaquin River. The Buckley Cove Marina is immediately downstream of the confluence. The marina consists of approximately 47 acres devoted to boat launching, parking, and marina uses and 5 acres for picnicking, a tot-lot play area, and shore fishing access. Activities include some small-craft boating, fishing, swimming, and wading.

Use and Visitor Characteristics. Recreation use data for the Calaveras River are not well documented because access to the river is dispersed and few public recreation facilities are located along the river. Downstream recreation use is substantially affected by upstream diversions in Mormon Slough for irrigation and domestic consumption. Use of the river corridor is believed to be low during a substantial portion of the year because much of the river is diverted upstream (Jones & Stokes Associates, 1988).

Recreation Quality Conditions. Direct water-dependent use of the Calaveras River in Stockton is low because flows are substantially affected by upstream diversions. When flows are diverted, recreation use decreases substantially.

California Aqueduct

Facilities and Activities. Fishing access is provided along 343 miles of the 444-mile-long California Aqueduct, stretching from Bethany Reservoir west of Tracy to Perris Lake in Southern California (DFG, 1984). Most of the portion of the aqueduct that passes through the San Joaquin River Region (approximately 279 miles) is accessible for fishing (DWR, 1989). In addition, the 12 fishing access sites provide parking areas and toilet facilities (DWR, 1989).

Fish species caught in the aqueduct include striped bass, largemouth bass, catfish, crappie, green sunfish, bluegill, and starry flounder.

Use and Visitor Characteristics. An estimated 61,000 visitor days were reported at the aqueduct for fishing purposes in 1991. Most of the fishing activity occurs along the access roads that run along the side of the canal, away from designated fishing sites. No water-dependent uses other than fishing are allowed.

Recreation Quality Conditions. Fluctuation in the level or flow in the aqueduct does not affect fishing.

Delta-Mendota Canal

Facilities and Activities. Fishing access to the Delta-Mendota Canal is provided at Delta-Mendota Canal Site 2A in Stanislaus County and Delta-Mendota Canal Site 5 in Fresno County. Canal Site 2A, covering 87 acres, includes a parking area and restrooms (Reclamation, 1992a). Canal Site 5, covering 570 acres, also includes parking areas and restrooms (Reclamation, 1992a). Neither site provides picnicking or camping facilities. Fishing access to the Delta-Mendota Canal is limited to the developed access points (Reclamation, 1993b).

Fishing is the primary activity at both access sites. Fish species most frequently caught at the access sites are striped bass and catfish.

Use and Visitor Characteristics. An estimated 23,000 visitor days were recorded for the two fishing access sites in 1992. Canal Site 5, the most popular of the two sites, accounted for more than approximately 99 percent of total use in 1991.

An estimated 85 percent of the visitors to the canal fishing sites originate in the local area (Reclamation, 1981).

Recreation Quality Conditions. Because no water-contact activities are allowed on the canal, fluctuations in the level or flow do not affect recreation activities.

Wildlife Refuges

Recreation activities at the NWRs and WMAs in the San Joaquin River Region could be affected by the CVPIA. Wildlife refuges in this region are the San Luis, Kesterson, Mendota, and Merced NWRs and the Volta and Los Banos WMAs.

Facilities and Activities. Recreation facilities on the NWRs and WMAs in the San Joaquin River Region are primarily designed to enhance wildlife observation opportunities. Recreation facilities are limited at San Luis and Merced NWRs; however, both refuges provide self-guided driving tours (Service, 1992b). Camping is permitted at staging areas on the NWRs during hunting season only (Service, 1991, 1992b). Camping is not allowed on the Volta or Los Banos WMAs (Kie, pers. comm.).

Most recreation activities on the refuges are considered wildlife dependent. They include nonconsumptive uses (e.g., wildlife observation) and consumptive uses (e.g., hunting). Waterfowl hunting is permitted at the WMAs and the NWRs. Fishing is permitted on the San Luis NWR only (Service, 1992b).

Use and Visitor Characteristics. In 1992, combined recreation use at the refuges totaled approximately 56,000 5-hour RVDs.

Use records show that nonconsumptive recreation uses, primarily activities associated with wildlife observation, are the most popular activities at the refuges.

Most visitation to the wildlife refuges occurs during winter, when waterfowl are present. According to use estimates from the San Luis NWR complex, approximately 45 percent of total use occurs between October and January (Service, 1992b). Use from June through August accounts for approximately 20 percent of total use. All hunting occurs between October and January, with approximately 80 percent in November and January. Fishing activity is constant year-round. An estimated 15 percent of visitors to the refuges originate from the local area (Miller, pers. comm.).

Recreation Quality Conditions. Recreation activities at the refuges are associated with the presence of wildlife, primarily waterfowl. As described above, visitation at the refuges for consumptive and nonconsumptive uses peaks in winter, when waterfowl are present.

Because the primary goal of the refuges is to provide habitat for waterfowl and other wildlife, recreation activities that would disturb this wildlife are not promoted (Umland, pers. comm.). Management regulations designed to minimize wildlife disturbance at the refuges include limiting public access to certain time periods and not providing facilities that would enhance recreation.

Private Hunting Clubs

The 176 private waterfowl hunting clubs in the San Joaquin River Region cover approximately 96,800 acres. Approximately 33,900 acres are flooded annually. Waterfowl hunting activity was estimated at 241,000 hunter days in 1992.

TULARE LAKE REGION

The Tulare Lake Region contains NWRs and private hunting clubs. Other recreation activities are not described because they are not expected to be affected by the CVPIA.

Wildlife Refuges

Wildlife refuges located in the Tulare Lake Region include the Kern and Pixley NWRs. Pixley NWR is managed to provide suitable habitat for two endangered species and is open to the public by special arrangement only (Service, 1983). Because public access is not normally allowed at Pixley NWR, recreation use at the refuge is not discussed.

Facilities and Activities. Recreation facilities at Kern NWR are primarily designed to enhance wildlife observation opportunities. Although the refuge does not have formal recreation facilities, public access is allowed along roads and dikes throughout the refuge (Service, 1983, 1991). Camping is permitted at staging areas on the refuge during hunting season (Service, 1991, 1992b).

Most recreation activities are considered wildlife dependent. These activities are both nonconsumptive uses (e.g., wildlife observation) and consumptive uses (e.g., hunting). Fishing is not permitted on the Kern NWR (Service, 1992b).

Use and Visitor Characteristics. In 1992, recreation use at the Kern NWR totaled approximately 2,700 5-hour RVDs (Murczek, pers. comm.). Waterfowl hunting accounted for an estimated 1,500 5-hour RVDs, or approximately 55 percent of total use. Wildlife observation accounted for an estimated 1,200 5-hour RVDs. Most visitation to the refuge occurs during the winter, when waterfowl are present. Wildlife observation generally occurs from early October through late April; all hunting use occurs between October and January.

Recreation Quality Conditions. Recreation activities at the refuge are associated with the presence of waterfowl. Because the primary goal is to provide habitat for waterfowl and other wildlife, recreation activities that would disturb the wildlife are not promoted (Uhland, pers. comm.). Wildlife disturbance is minimized by limiting public access to certain time periods or not providing facilities that would enhance recreation.

Private Hunting Clubs

The Tulare Lake Region has approximately 40 private hunting clubs with a total acreage of approximately 15,670 acres. These clubs flood approximately 4,700 acres annually. Waterfowl hunting was estimated to total approximately 58,000 hunter days in 1992. (DFG, 1992.)

PACIFIC COAST REGION

The Pacific Coast Region includes approximately two-thirds of the California coast, extending from the Oregon-California border to Monterey (Figure II-4). As described above, for this technical appendix, the state's coastal areas were divided into three subregions: the North Coast, San Francisco, and Central Coast. Table II-16 shows sport fishing activity and the catch of salmon in these three subregions in 1992.

Approximately 126,400 sport fishing trips for chinook and coho salmon originated from the Pacific Coast Region in 1992, most of them (approximately 49 percent) from the San Francisco Subregion.

Private fishing vessels accounted for 63 percent of total sport fishing trips in the region. In the North and Central Coast subregions, sport fishing trips for salmon more frequently involved private vessels, accounting for 93 percent and 79 percent, respectively, of the total trips taken within each area. Conversely, approximately 61 percent of total trips originating from the San Francisco Subregion were aboard charter vessels.

In 1992, approximately 83,400 chinook and coho salmon were caught in the Pacific Coast Region. Salmon landings within the San Francisco Subregion accounted for approximately 58 percent of the total sport landings of salmon, followed by the North Coast Subregion at 20 percent. Chinook salmon was the most frequently landed species, representing approximately 86 percent of the total sport catch of salmon landed at California ports. Within the North Coast Subregion, coho salmon were more frequently landed than chinook salmon, representing approximately 84 percent of all coho salmon landed in the region.

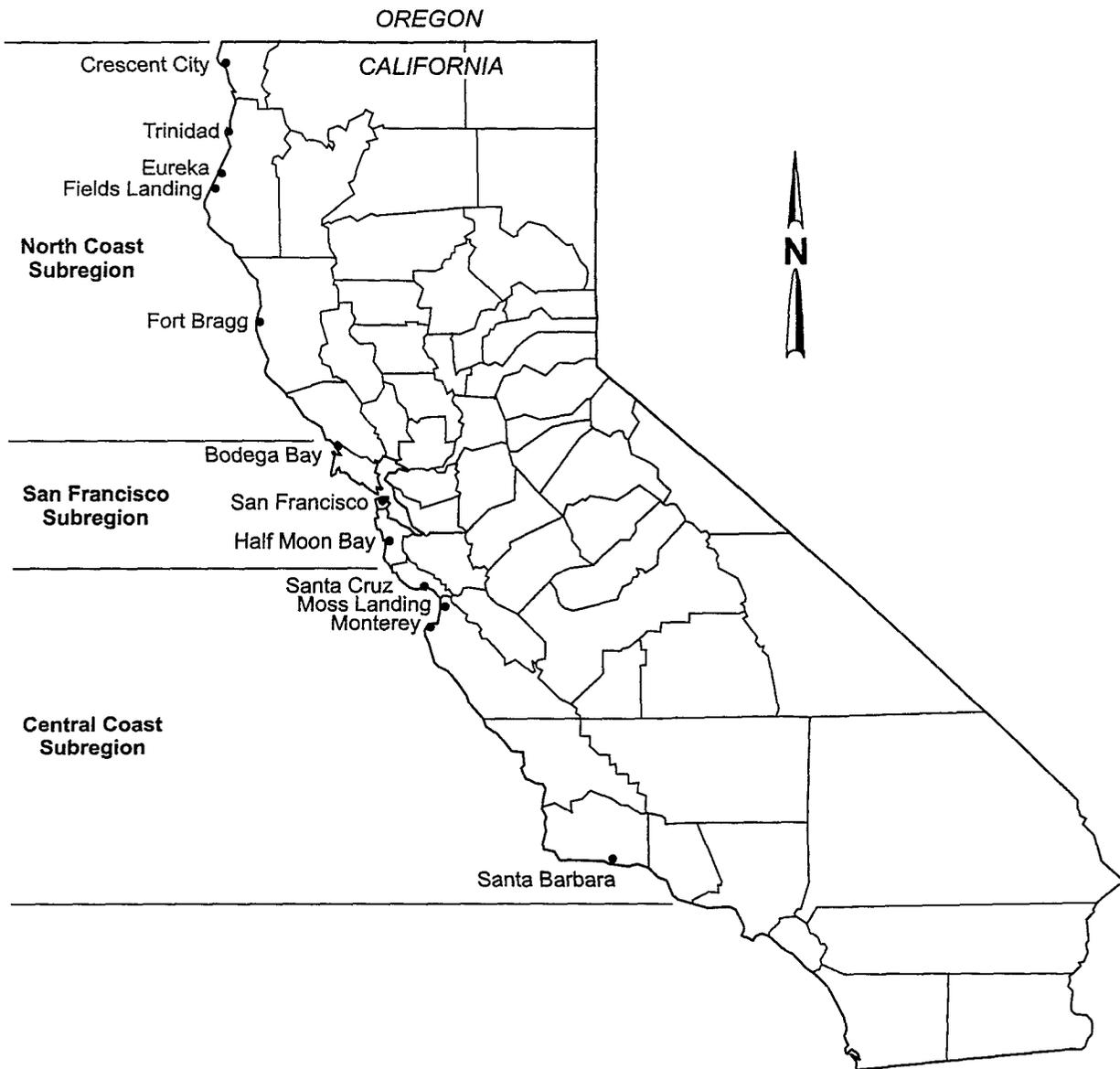


FIGURE II-4
LOCATION OF SUBREGIONS AND MAJOR PORTS
IN THE PACIFIC COAST REGION

TABLE II-16
SPORT FISHING ACTIVITY AND CATCH FOR SALMON
IN THE PACIFIC COAST REGION IN 1992

Activity			Catch		
Subregion/Mode	Trips (1,000)	Percentage of Total	Subregion/Species	Catch (1,000)	Percentage of Total
North Coast (1)			North Coast (1)		
Charter	2.1	1.7	Chinook	6.7	8.0
Private	27.6	21.8	Coho	9.7	11.6
Subtotal	29.7	23.5	Subtotal	16.4	19.6
San Francisco (2)			San Francisco (2)		
Charter	37.4	29.6	Chinook	46.6	55.9
Private	24.3	19.2	Coho	1.6	1.9
Subtotal	61.7	48.8	Subtotal	48.2	57.8
Central Coast (3)			Central Coast (3)		
Charter	7.3	5.8	Chinook	18.6	22.3
Private	27.7	21.9	Coho	0.2	0.2
Subtotal	35.0	27.7	Subtotal	18.8	22.5
Total			Total		
Charter	46.8	37.0	Chinook	71.9	86.2
Private	79.6	63.0	Coho	11.5	13.8
Total	126.4	100.0	Total	83.4	100.0
NOTES:					
(1) North Coast Subregion includes Crescent City, Eureka, and Fort Bragg.					
(2) San Francisco Subregion includes Bodega Bay, San Francisco, and Half Moon Bay.					
(3) Central Coast Subregion includes Santa Cruz and Monterey.					
SOURCES:					
Pacific Fishery Management Council, 1993a, 1993b.					

SAN FRANCISCO BAY REGION

The San Francisco Bay Region includes lakes and reservoirs operated by SFWD, EBMUD, MMWD, and SCVWD. Lakes and reservoirs operated by SFWD are San Andreas Lake, Crystal Springs Reservoir, San Antonio Reservoir, and Calaveras Reservoir. San Pablo Reservoir, Briones Reservoir, San Leandro Reservoir, and Lake Chabot are operated by EBMUD. Nicaso Reservoir is operated by MMWD. SCVWD owns Anderson Reservoir, but Santa Clara County Park and Recreation Department manages the recreation activities at the reservoir.

Facilities and Activities

Because these lakes and reservoirs are used as storage facilities for municipal water supply, access and activities are restricted. Water-contact activities are restricted at most of them and, in some cases, public access is not allowed. San Pablo, Briones, and San Leandro reservoirs and Lake Chabot are all located within regional parks operated by the East Bay Regional Parks District. These lakes and reservoirs enhance recreation activities in the parks. Typical activities include fishing, hiking, and picnicking (Jones & Stokes Associates, 1990). Recreation activities are restricted at Nicaso Reservoir operated by MMWD. Typical recreation activities at Anderson reservoir include boating, water skiing, jet skiing, and picnicking during the peak season. Off-season activities include fishing. Swimming and camping are not allowed at Anderson Reservoir. Reservoir facilities include a single boat ramp, which requires reservations for weekend use.

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.

CHAPTER III
ENVIRONMENTAL CONSEQUENCES

Chapter III

ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter presents the results of the assessment of recreation impacts that would occur with implementation of the CVPIA. It includes the following:

- a brief description of the method used to determine impacts;
- a discussion of the impacts expected under each of the four action alternatives compared to conditions under the No-Action Alternative;
- a comparison of impacts between action alternatives; and
- a discussion of changes in recreation use on rivers in the Sacramento River Region, the San Francisco Bay/Sacramento-San Joaquin Delta Region, and the Pacific Coast Region that would be expected under three scenarios representing a range of possible increases in anadromous fishery populations.

The impact discussion under each alternative has been divided into five study regions: Sacramento River, San Francisco Bay/Sacramento-San Joaquin Delta, San Joaquin River, Tulare Lake, and Pacific Coast. Within each region, the impact assessment has been organized by recreation sites or activity type. In the Sacramento River and San Joaquin River regions, the impact assessment has been organized by reservoirs, rivers, and wildlife refuges. The impact assessment for the San Francisco Bay/ Sacramento-San Joaquin Delta and Pacific Coast regions is focused on describing changes in sport fishing. The Tulare Lake Region impact assessment is focused on describing changes in recreation use at wildlife refuges because no rivers or reservoirs in that region would be affected by changes in operation of the CVP.

IMPACT ASSESSMENT METHODOLOGY

This section briefly describes the methodology used in assessing impacts on recreation opportunities and use at recreation sites that could be affected by implementation of the CVPIA. The Recreation Methodology/Modeling Technical Appendix provides a more detailed description of the methodology used to assess recreation impacts.

Two types of changes related to recreation are assessed in this section: recreation opportunities and recreation use. The assessment of recreation opportunities analyzes how changes in reservoir elevations, river flows, and wildlife refuge water deliveries would affect the opportunities for water-related activities at key recreation facilities during both the peak and off seasons. The assessment of recreation use analyzes how these same types of changes may affect overall recreation use at these facilities. Impacts are described for the changes in recreation opportunities, but because the changes in recreation use are intended principally to contribute to

the recreation economics analysis, changes in recreation use are described but no impacts are provided. The economic effects of changes in recreation use are described in the Fish, Wildlife, and Recreation Economics Technical Appendix.

RESERVOIRS

Impacts based on changes in recreation opportunities are assessed for major and secondary CVP and SWP reservoirs, and reservoirs operated by other agencies that could be affected by implementation of the CVPIA. The major CVP reservoirs are Shasta Lake, Whiskeytown Lake, Folsom Lake, San Luis Reservoir (joint CVP and SWP facility), Millerton Lake, and New Melones Reservoir. Secondary CVP reservoirs are Keswick Reservoir, Lake Red Bluff, and Lake Natoma.

The major SWP reservoir is Lake Oroville. Secondary SWP reservoirs are Thermalito Forebay and Afterbay and Bethany Reservoir. Major reservoirs operated by other agencies include Camanche Reservoir, New Don Pedro Reservoir, New Hogan Lake, and Lake McClure. Secondary reservoirs operated by other agencies include New Bullards Bar Reservoir, Englebright Lake, and Camp Far West Reservoir. The quantitative analysis presented in this technical appendix is based on numerical results from surface water modeling. The models were developed primarily to meet streamflow target goals. The CVP and SWP reservoirs were reoperated within the model (to the extent possible with a monthly model) to meet downstream flow targets. Modified operating rules were developed for the CVP and SWP reservoirs under Alternatives 1 through 4. The projected monthly changes in reservoir storage reflect these estimated modifications in reservoir operations and can be used to compare the alternatives with the No-Action Alternative.

The hydrologic modeling conducted for this analysis has not included reoperation of non-CVP and non-SWP reservoirs. The operational scenarios for these reservoirs are based on their historical operations. No attempt has been made to optimize operations, and actual operations could differ from these assumptions. Therefore, the analysis of these reservoirs and the rivers they control is presented at a more general level of detail than the analysis of the CVP and SWP facilities. Further, should water be purchased from these reservoirs, the price of water would be required to include mitigation for adverse impacts that could not be overcome through reoperation; therefore, effects rather than impacts are described for these facilities.

Major Reservoirs

Recreation Opportunities. Recreation opportunity thresholds have been developed for each major reservoir that could be affected by implementation of the CVPIA and for which PROSIM or SANJASM hydrologic modeling data are available. Because of the nature of hydrologic input data and because average monthly operations data are used, the surface water model results may be accurate to within 10 to 20 percent, depending on the watershed. Therefore, the values obtained from the surface water models and all dependent analysis are used only for comparison of alternatives.

Changes in recreation opportunities are assessed for the full 69-year hydrologic period (1922-1990 hydrologic conditions) as well as for a dry period (1928-1934 hydrologic conditions)

and a wet period (1967-1971 hydrologic conditions). Thresholds have been developed based on information provided by operators of each of the major reservoirs. The thresholds indicate when, in response to changes in reservoir surface elevations, recreation activities begin to significantly decline or cease. This is especially true because many boats are transported to the water only for day use. Therefore, water elevations at marinas are extremely important. The frequency with which the surface elevation of a reservoir drops below these thresholds is used to determine changes in recreation opportunities under each of the project alternatives.

Impact thresholds have been developed for important recreation activities during both peak and off seasons. Typical peak-season activities assessed included boating, beach use, camping, and picnicking. Assessment of off-season activities is limited to boating.

Recreation Use. Changes in annual recreation use are estimated for each of the major CVP reservoirs and major reservoirs operated by other agencies. Changes in annual use at each reservoir under each alternative are estimated for the entire 69-year hydrologic period and for the selected dry and wet hydrologic periods. A detailed description of how use is estimated for each reservoir is provided in the Recreation Methodology/Modeling Technical Appendix.

Secondary Reservoirs

Changes in recreation opportunities and use at secondary reservoirs are qualitatively assessed. In most cases, operation of these facilities was assumed to be the same under each of the alternatives.

RIVERS

Impacts based on changes in recreation opportunities and use are assessed for rivers below major CVP and SWP reservoirs, and reservoirs operated by other agencies that could be affected by implementation of the CVPIA. The major rivers are the Sacramento, Feather, Yuba, American, San Joaquin, Stanislaus, Tuolumne, Calaveras, Merced, and Mokelumne.

Recreation Opportunities

Impact thresholds are developed for important recreation activities on major rivers. Changes in recreation opportunities are assessed for the full 69-year hydrologic period as well as for a dry period (1928-1934 hydrologic conditions) and a wet period (1967-1971 hydrologic conditions). The thresholds are developed based on information provided by operators of recreation facilities along the rivers. These thresholds indicate when recreation activities begin to significantly decline or cease in response to changes in river flows. The frequency with which river flows drop below or rise above these thresholds is used to determine changes in recreation opportunities under each of the project alternatives.

Impact thresholds are developed for important peak-season recreation activities, including boating and swimming. Impacts are not assessed for the off season because most boating and swimming activities do not occur during this period on rivers.

Changes in recreation opportunities are not assessed for the Feather, Yuba, and lower Sacramento rivers because recreation activities on these rivers can be accommodated within a wide range of river flows.

Recreation Use

Changes in annual recreation use on major rivers in the Sacramento River Region (Sacramento, Feather, Yuba, and American rivers) are estimated based on changes in anadromous fish populations. Because estimates of fish populations associated with each alternative were not developed, an analysis of changes in use associated with three scenarios (doubling populations of anadromous fish and two intermediate steps to doubling) are provided in Attachment A. The three scenarios employed here are intended only to display a range of results and have no direct relationship to the alternatives presented elsewhere in this technical appendix.

Changes in annual recreation use on major rivers in the San Joaquin River Region under each alternative are estimated for the full 69-year hydrologic period, as well as for the selected dry and wet hydrologic periods. Recreation uses include nonconsumptive activities (e.g., boating, swimming) and consumptive activities (e.g., fishing). A detailed description of how use was estimated for each river is provided in the Recreation Methodology/Modeling Technical Appendix.

WILDLIFE REFUGES

Impacts on recreation are assessed for national wildlife refuges (NWRs) and state wildlife management areas (WMAs) in the Sacramento River Region, San Joaquin River Region, and Tulare Lake Region. No assessment of impacts on refuges in the Sacramento-San Joaquin Delta Region are made because Grizzly Island WMA is the only refuge in the Delta and it does not receive CVP water supplies. Changes in recreation use are estimated based on four levels of water deliveries to the refuges. Level 2 and Level 2 critical period deliveries are assessed under Alternative 1. Level 4 and Level 4 critical period deliveries are assessed under Alternatives 2, 3, and 4. Changes in annual recreation use at each refuge are estimated for wildlife observation, waterfowl hunting, and fishing. A more detailed discussion of Level 2 and Level 4 water deliveries is provided in the Vegetation and Wildlife Technical Appendix.

BAY-DELTA AND PACIFIC COAST REGIONS

Estimates of changes in annual recreation use in the Bay-Delta and Pacific Coast regions based on changes associated with the assumed doubling of populations of anadromous fish are discussed in Attachment A.

OTHER RECREATION SITES

Other recreation sites included in the impact assessment are the Delta-Mendota Canal and California Aqueduct. These facilities provide limited sport-fishing opportunities. Impacts on sport fishing are qualitatively assessed.

NO-ACTION ALTERNATIVE

The results presented in this section provide an estimate of the conditions against which the results of the action alternatives will be compared. Because of the uncertainties related to projecting conditions 25 years in the future, the numbers presented in this technical appendix can only be used to compare the results of the alternatives than as absolute values.

SACRAMENTO RIVER REGION - RESERVOIRS**Shasta Lake**

69-Year Hydrologic Period. The estimated end-of-month lake level exceedence frequencies for the 69-year hydrologic period are shown in Table III-1 for important recreation opportunities on the portion of Shasta Lake between Shasta Dam and the Pit River Bridge (main area) and the McCloud River, Pit River, and Sacramento River arms under the No-Action Alternative.

On the main area, the reservoir surface elevation would be below the level at which boating becomes constrained in 5 percent of the months during the peak season and 6 percent of the months during the off season. Marinas would be required to relocate facilities once during each of 13 peak-season periods. The reservoir would not fall below the level at which boat ramps are unusable.

Boat ramps on the McCloud River Arm would be unusable in 6 percent of the months during both the peak and off seasons. Usable surface area for boating would become constrained in 10 percent of the months during both the peak and off seasons. Marinas would be required to move facilities once during 13 peak-season periods. The reservoir would be below the level at which campground use declines in 8 percent of the months.

Boat ramps on the Pit River Arm would be unusable in 5 percent of the months during both the peak and off seasons. Usable surface area for boating would be constrained in 24 percent of the months during the peak season and 23 percent of the months during the off season. Marinas would be required to move facilities once during each of 13 peak-season periods. The reservoir would be below the level at which campground use declines during less than 1 percent of the months.

Boat ramps on the Sacramento River Arm would be unusable in 6 percent of the months during both the peak and off seasons. Usable surface area for boating would be constrained in 34 percent of the months during the peak season and 40 percent of the months during the off season. Marinas would be required to move facilities once during each of 21 peak-season periods. The reservoir would be below the level at which campground use declines during 10 percent of the months.

Annual use based on the 69-year hydrologic period is estimated to total 5,740,000 12-hour RVDs (Table III-2).

TABLE III-1

RESULTS OF RECREATION IMPACT ASSESSMENT FOR SHASTA LAKE

Main Area Peak Season (May - Sept.)		Frequency with which Reservoirs are at or Below Elevation Thresholds (Months [% of Months])	
Water Year Type/Alternative	Number of Months	844 ft (1)	947 ft (2)
69-Year Average			
No-Action Alternative	345	0 (0%)	18 (5%)
Alternative 1		0 (0%)	19 (6%)
Alternative 2		0 (0%)	19 (6%)
Alternative 3		0 (0%)	19 (6%)
Alternative 4		0 (0%)	19 (6%)
Dry-Year Period			
No-Action Alternative	35	0 (0%)	11 (31%)
Alternative 1		0 (0%)	12 (34%)
Alternative 2		0 (0%)	12 (34%)
Alternative 3		0 (0%)	13 (37%)
Alternative 4		0 (0%)	11 (31%)
Wet-Year Period			
No-Action Alternative	25	0 (0%)	0 (0%)
Alternative 1		0 (0%)	0 (0%)
Alternative 2		0 (0%)	0 (0%)
Alternative 3		0 (0%)	0 (0%)
Alternative 4		0 (0%)	0 (0%)
Main Area Off Season (Oct. - April)		Frequency with which Reservoirs are at or Below Elevation Thresholds (Months [% of Months])	
Water Year Type/Alternative	Number of Months	844 ft (1)	947 ft (2)
69-Year Average			
No-Action Alternative	483	0 (0%)	30 (6%)
Alternative 1		0 (0%)	28 (6%)
Alternative 2		0 (0%)	28 (6%)
Alternative 3		0 (0%)	28 (6%)
Alternative 4		0 (0%)	27 (6%)
Dry-Year Period			
No-Action Alternative	49	0 (0%)	16 (33%)
Alternative 1		0 (0%)	16 (33%)
Alternative 2		0 (0%)	16 (33%)
Alternative 3		0 (0%)	16 (33%)
Alternative 4		0 (0%)	16 (33%)
Wet-Year Period			
No-Action Alternative	35	0 (0%)	0 (0%)
Alternative 1		0 (0%)	0 (0%)
Alternative 2		0 (0%)	0 (0%)
Alternative 3		0 (0%)	0 (0%)
Alternative 4		0 (0%)	0 (0%)
NOTES:			
(1) Last boat ramp out of operation.			
(2) Limited lake surface area (boating constrained).			
LEGEND:			
Thresholds are shown in feet (ft) above mean sea level.			

TABLE III-1. CONTINUED

McCloud River Arm Peak Season (May - Sept.)		Frequency with which Reservoirs are at or Below Elevation Thresholds (Months [%] of Months)			
Water Year Type/Alternative	Number of Months	952 ft (1)	960 ft (3)	967 ft (2)	
69-Year Average	345				
No-Action Alternative		21 (6%)	27 (8%)	34 (10%)	
Alternative 1		23 (7%)	32 (9%)	41 (12%)	
Alternative 2		22 (6%)	33 (10%)	38 (11%)	
Alternative 3		24 (7%)	31 (9%)	39 (11%)	
Alternative 4		22 (6%)	33 (10%)	41 (12%)	
Dry-Year Period	35				
No-Action Alternative		12 (34%)	16 (46%)	19 (54%)	
Alternative 1		14 (40%)	17 (49%)	19 (54%)	
Alternative 2		14 (40%)	17 (49%)	18 (51%)	
Alternative 3		14 (40%)	16 (46%)	19 (54%)	
Alternative 4		13 (37%)	16 (46%)	19 (54%)	
Wet-Year Period	25				
No-Action Alternative		0 (0%)	0 (0%)	0 (0%)	
Alternative 1		0 (0%)	0 (0%)	0 (0%)	
Alternative 2		0 (0%)	0 (0%)	0 (0%)	
Alternative 3		0 (0%)	0 (0%)	0 (0%)	
Alternative 4		0 (0%)	0 (0%)	0 (0%)	
McCloud River Arm Off Season (Oct. - April)		Frequency with which Reservoirs are at or Below Elevation Thresholds (Months [%] of Months)			
Water Year Type/Alternative	Number of Months	952 ft (1)		967 ft (2)	
69-Year Average	483				
No-Action Alternative		30 (6%)		46 (10%)	
Alternative 1		29 (6%)		48 (10%)	
Alternative 2		30 (6%)		46 (10%)	
Alternative 3		32 (7%)		47 (10%)	
Alternative 4		32 (7%)		47 (10%)	
Dry-Year Period	49				
No-Action Alternative		16 (33%)		20 (41%)	
Alternative 1		17 (35%)		21 (43%)	
Alternative 2		17 (35%)		20 (41%)	
Alternative 3		17 (35%)		21 (43%)	
Alternative 4		17 (35%)		21 (43%)	
Wet-Year Period	35				
No-Action Alternative		0 (0%)		0 (0%)	
Alternative 1		0 (0%)		0 (0%)	
Alternative 2		0 (0%)		0 (0%)	
Alternative 3		0 (0%)		0 (0%)	
Alternative 4		0 (0%)		0 (0%)	
NOTES:					
(1) Last boat ramp out of operation.					
(2) Limited lake surface area (boating constrained).					
(3) Decline in campground use.					
LEGEND:					
Thresholds are shown in feet (ft) above mean sea level.					

TABLE III-1. CONTINUED

Pit River Arm Peak Season (May - Sept.)		Frequency with which Reservoirs are at or Below Elevation Thresholds (Months [%] of Months)		
Water Year Type/Alternative	Number of Months	907 ft (3)	942 ft (1)	1,007 ft (2)
69-Year Average		345		
No-Action Alternative		2 (0.6%)	17 (5%)	84 (24%)
Alternative 1		3 (0.9%)	19 (6%)	99 (29%)
Alternative 2		3 (0.9%)	19 (6%)	97 (28%)
Alternative 3		1 (0.3%)	17 (5%)	97 (28%)
Alternative 4		2 (0.6%)	17 (5%)	99 (29%)
Dry-Year Period		35		
No-Action Alternative		2 (6%)	10 (29%)	30 (86%)
Alternative 1		1 (3%)	12 (34%)	30 (86%)
Alternative 2		1 (3%)	12 (34%)	30 (86%)
Alternative 3		1 (3%)	11 (31%)	30 (86%)
Alternative 4		0 (0%)	12 (34%)	30 (86%)
Wet-Year Period		25		
No-Action Alternative		0 (0%)	0 (0%)	1 (4%)
Alternative 1		0 (0%)	0 (0%)	2 (8%)
Alternative 2		0 (0%)	0 (0%)	2 (8%)
Alternative 3		0 (0%)	0 (0%)	2 (8%)
Alternative 4		0 (0%)	0 (0%)	2 (8%)
Pit River Arm Off Season (Oct. - April)		Frequency with which Reservoirs are at or Below Elevation Thresholds (Months [%] of Months)		
Water Year Type/Alternative	Number of Months	942 ft (1)	1,007 ft (2)	
69-Year Average		483		
No-Action Alternative		25 (5%)	111 (23%)	
Alternative 1		27 (6%)	143 (30%)	
Alternative 2		27 (6%)	142 (29%)	
Alternative 3		26 (5%)	143 (30%)	
Alternative 4		24 (5%)	147 (30%)	
Dry-Year Period		49		
No-Action Alternative		13 (27%)	39 (80%)	
Alternative 1		16 (33%)	40 (82%)	
Alternative 2		16 (33%)	40 (82%)	
Alternative 3		16 (33%)	40 (82%)	
Alternative 4		14 (29%)	40 (82%)	
Wet-Year Period		35		
No-Action Alternative		0 (0%)	3 (9%)	
Alternative 1		0 (0%)	1 (3%)	
Alternative 2		0 (0%)	1 (3%)	
Alternative 3		0 (0%)	1 (3%)	
Alternative 4		0 (0%)	1 (3%)	
NOTES:				
(1) Last boat ramp out of operation.				
(2) Limited lake surface area (boating constrained).				
(3) Decline in campground use.				
LEGEND:				
Thresholds are shown in feet (ft) above mean sea level.				

TABLE III-1. CONTINUED

Sacramento River Arm Peak Season (May - Sept.)		Frequency with which Reservoirs are at or Below Elevation Thresholds (Months [%] of Months)				
Water Year Type/Alternative	Number of Months	937 ft (5)	950 ft (1)	967 ft (4)	1,007 ft (3)	1,017 ft (2)
69-Year Average						
No-Action Alternative	345	14 (4%)	19 (6%)	34 (10%)	84 (24%)	116 (34%)
Alternative 1		15 (4%)	20 (6%)	41 (12%)	99 (29%)	120 (35%)
Alternative 2		14 (4%)	21 (6%)	38 (11%)	97 (28%)	118 (34%)
Alternative 3		14 (4%)	23 (7%)	39 (11%)	97 (28%)	118 (34%)
Alternative 4		15 (4%)	21 (6%)	41 (12%)	99 (29%)	122 (35%)
Dry-Year Period						
No-Action Alternative	35	8 (23%)	12 (34%)	19 (54%)	30 (86%)	30 (86%)
Alternative 1		8 (23%)	13 (37%)	19 (54%)	30 (86%)	30 (86%)
Alternative 2		8 (23%)	13 (37%)	18 (51%)	30 (86%)	30 (86%)
Alternative 3		8 (23%)	14 (40%)	19 (54%)	30 (86%)	31 (89%)
Alternative 4		8 (23%)	13 (37%)	19 (54%)	30 (86%)	30 (86%)
Wet-Year Period						
No-Action Alternative	25	0 (0%)	0 (0%)	0 (0%)	1 (4%)	4 (16%)
Alternative 1		0 (0%)	0 (0%)	0 (0%)	2 (8%)	2 (8%)
Alternative 2		0 (0%)	0 (0%)	0 (0%)	2 (8%)	2 (8%)
Alternative 3		0 (0%)	0 (0%)	0 (0%)	2 (8%)	2 (8%)
Alternative 4		0 (0%)	0 (0%)	0 (0%)	2 (8%)	2 (8%)
Sacramento River Arm Off Season (Oct. - April)		Frequency with which Reservoirs are at or Below Elevation Thresholds (Months [%] of Months)				
Water Year Type/Alternative	Number of Months	950 ft (1)		1,017 ft (2)		
69-Year Average						
No-Action Alternative	483	30 (6%)		191 (40%)		
Alternative 1		28 (6%)		224 (46%)		
Alternative 2		28 (6%)		223 (46%)		
Alternative 3		30 (6%)		226 (47%)		
Alternative 4		28 (6%)		225 (47%)		
Dry-Year Period						
No-Action Alternative	49	16 (33%)		41 (84%)		
Alternative 1		16 (33%)		41 (84%)		
Alternative 2		16 (33%)		41 (84%)		
Alternative 3		17 (35%)		41 (84%)		
Alternative 4		16 (33%)		41 (84%)		
Wet-Year Period						
No-Action Alternative	35	0 (0%)		11 (31%)		
Alternative 1		0 (0%)		10 (29%)		
Alternative 2		0 (0%)		10 (29%)		
Alternative 3		0 (0%)		10 (29%)		
Alternative 4		0 (0%)		10 (29%)		
NOTES:						
(1) Last boat ramp out of operation.						
(2) Limited lake surface area (boating constrained).						
(3) Lake level requiring marina movement.						
(4) Decline in campground use.						
(5) Marina closes.						
LEGEND:						
Thresholds are shown in feet (ft) above mean sea level.						

TABLE III-2

**ANNUAL VISITOR USE FOR RESERVOIRS
IN THE SACRAMENTO RIVER REGION**

Water Year/Alternative	Annual Visitor Use (1)		
	Shasta Lake	Lake Oroville	Folsom Lake
69-Year Average			
No-Action Alternative	5,740,000	1,250,000	910,000
Alternative 1	5,650,000	1,260,000	930,000
Alternative 2	5,670,000	1,260,000	930,000
Alternative 3	5,670,000	1,270,000	930,000
Alternative 4	5,650,000	1,260,000	930,000
Dry-Year Period			
No-Action Alternative	4,080,000	1,030,000	820,000
Alternative 1	4,060,000	1,040,000	840,000
Alternative 2	4,070,000	1,040,000	840,000
Alternative 3	4,050,000	1,050,000	830,000
Alternative 4	4,140,000	1,040,000	840,000
Wet-Year Period			
No-Action Alternative	6,320,000	1,330,000	980,000
Alternative 1	6,270,000	1,330,000	990,000
Alternative 2	6,280,000	1,330,000	990,000
Alternative 3	6,320,000	1,340,000	990,000
Alternative 4	6,260,000	1,330,000	990,000
NOTE:			
(1) Annual visitor use is reported in 12-hour RVDs and is reported to the nearest 10,000 visitor days.			

Dry Hydrologic Period. On the main area of the reservoir, usable surface area for boating would be constrained in 31 percent of the months during the peak season and 33 percent of the months during the off season (Table III-1). Marinas would be required to move facilities once during each of three peak-season periods. Availability of boat ramps would not be affected.

Boat ramps on the McCloud River Arm would be unusable in 34 percent of the months during the peak season and 33 percent of the months during the off season. Usable surface area for boating would be constrained in 54 percent of the months during the peak season and 41 percent of the months during the off season. Marinas would be required to move facilities once during each of three peak-season periods. The reservoir would be below the level at which campground use declines in 46 percent of the months.

Boat ramps on the Pit River Arm would be unusable in 29 percent of the months during the peak season and 27 percent of the months during the off season. Usable surface area for boating would be constrained in 86 percent of the months during the peak season and 80 percent of the months during the off season. Marinas would be required to move facilities once during each of three peak-season periods. The reservoir would be below the level at which campground use declines in 6 percent of the months.

Boat ramps on the Sacramento River Arm would be unusable in 34 percent of the months during the peak season and 33 percent of the months during the off season. Usable surface area for boating would be constrained in 86 percent of the months during the peak season and 84 percent of the months during the off season. Marinas would be required to move once during each of two peak-season periods. The reservoir would be below the level at which campground use declines in 54 percent of the months.

Annual use during the dry hydrologic period is estimated to total 4,080,000 12-hour RVDs (Table III-2).

Wet Hydrologic Period. On the main area and the McCloud River Arm, reservoir elevations would remain above important recreation opportunity thresholds (Table III-1).

On the Pit River Arm, boating would be constrained in 4 percent of the months during the peak season and 9 percent of the months during the off season. The surface elevation of the reservoir would remain above thresholds for other important recreation opportunities.

On the Sacramento River Arm, boating would be constrained in 16 percent of the months during the peak season and 31 percent of the months during the off season. The surface elevation of the reservoir would remain above thresholds for other important recreation opportunities.

Annual use during the wet hydrologic period is estimated to total 6,320,000 12-hour RVDs (Table III-2).

Lake Oroville

69-Year Hydrologic Period. The end-of-month lake level exceedence frequencies for important recreation opportunities at Lake Oroville under the No-Action Alternative are shown

in Table III-3. Boat ramp availability would be limited in 7 percent of the months during the peak season and 10 percent of the months during the off season. Usable surface area for boating would be constrained in 15 percent of the months during the peak season and 23 percent of the months during the off season. Marinas would be required to move facilities once during each of 11 peak-season periods.

The reservoir would be below the level at which beach use declines in 47 percent of the months during the peak season and below the level at which camping and picnicking typically decline in 6 percent of the months.

Annual use based on the 69-year hydrologic period is estimated to total 1,250,000 12-hour RVDs (Table III-2).

Dry Hydrologic Period. Boat ramp availability would be limited in 33 percent of the months during the peak season and 45 percent of the months during the off season (Table III-3). Usable surface area for boating would be constrained in 62 percent of the months during the peak season and 64 percent of the months during the off season. Marinas would be required to move facilities once during each of five peak-season periods.

The reservoir would be below the level at which beach use declines in 86 percent of the months during the peak season and below the level at which beach areas close in 83 percent of the months. The reservoir would be below the level at which camping and picnicking typically decline in 26 percent of the months.

Annual use during the dry period is estimated to total 1,030,000 12-hour RVDs (Table III-2).

Wet Hydrologic Period. Usable surface area for boating would be constrained in 7 percent of the months during the peak season and 10 percent of the months during the off season (Table III-3). Operation of marinas and boat ramps would not be affected.

The reservoir would be below the level at which beach use declines in 23 percent of the months during the peak season and below the level at which beach areas close in 20 percent of the months. The reservoir would not fall below the level at which camping and picnicking decline.

Annual use during the wet hydrologic period is estimated to total 1,330,000 12-hour RVDs (Table III-2).

Folsom Lake

69-Year Hydrologic Period. The end-of-month lake level exceedence frequencies for boating, swimming, and shoreline activities at Folsom Lake under the No-Action Alternative are shown in Table III-4. All boat ramps would be unusable in 1 percent of the months during the peak season and 3 percent of the months during the off season. Usable surface area for boating would be constrained in 14 percent of the months during the peak season and 25 percent of the months during the off season. The marina would be forced to close in 20 percent of the months during the peak season.

**TABLE III-3
RESULTS OF RECREATION IMPACT ASSESSMENT FOR LAKE OROVILLE**

Peak Season (April - Sept.)	Number of Months	Frequency with Which Reservoirs Are at or below Elevation Thresholds (Months [% of Months])				
Water Year Type/Alternative		700 ft (1)	710 ft (2)	750 ft (3)	819 ft (4)	840 ft (5)
69-Year Average	414					
No-Action Alternative		23 (6%)	28 (7%)	62 (15%)	162 (39%)	196 (47%)
Alternative 1		18 (4%)	24 (6%)	55 (13%)	160 (39%)	198 (48%)
Alternative 2		19 (5%)	22 (5%)	54 (13%)	158 (38%)	197 (48%)
Alternative 3		14 (3%)	20 (5%)	55 (13%)	154 (37%)	179 (43%)
Alternative 4		19 (5%)	23 (6%)	62 (15%)	162 (39%)	196 (47%)
Dry-Year Period	42					
No-Action Alternative		11 (26%)	14 (33%)	26 (62%)	35 (83%)	36 (86%)
Alternative 1		8 (19%)	11 (26%)	24 (57%)	36 (86%)	37 (88%)
Alternative 2		8 (19%)	9 (21%)	23 (55%)	36 (86%)	37 (88%)
Alternative 3		8 (19%)	10 (24%)	25 (60%)	36 (86%)	36 (86%)
Alternative 4		9 (21%)	11 (26%)	25 (60%)	36 (86%)	36 (86%)
Wet-Year Period	30					
No-Action Alternative		0 (0%)	0 (0%)	2 (7%)	6 (20%)	7 (23%)
Alternative 1		0 (0%)	0 (0%)	2 (7%)	5 (17%)	6 (20%)
Alternative 2		0 (0%)	0 (0%)	2 (7%)	5 (17%)	6 (20%)
Alternative 3		0 (0%)	0 (0%)	1 (3%)	5 (17%)	6 (20%)
Alternative 4		0 (0%)	0 (0%)	1 (3%)	5 (17%)	7 (23%)
Off Season (Oct. - March)	Number of Months	Frequency with which Reservoirs are at or below Elevation Thresholds (Months [% of Months])				
Water Year Type/Alternative		710 ft (2)				750 ft (3)
69-Year Average	414					
No-Action Alternative		43 (10%)				96 (23%)
Alternative 1		35 (8%)				86 (21%)
Alternative 2		33 (8%)				83 (20%)
Alternative 3		40 (10%)				86 (21%)
Alternative 4		39 (9%)				99 (24%)
Dry-Year Period	42					
No-Action Alternative		19 (45%)				27 (64%)
Alternative 1		16 (38%)				31 (74%)
Alternative 2		15 (36%)				31 (74%)
Alternative 3		10 (24%)				31 (74%)
Alternative 4		20 (48%)				32 (76%)
Wet-Year Period	30					
No-Action Alternative		0 (0%)				3 (10%)
Alternative 1		0 (0%)				4 (13%)
Alternative 2		0 (0%)				3 (10%)
Alternative 3		0 (0%)				3 (10%)
Alternative 4		0 (0%)				4 (13%)
NOTES:						
(1) Decline in campground/picnicking use.						
(2) Limited boat ramp availability, relocation of the marina.						
(3) Limited lake surface area (boating constrained).						
(4) Beach area closed.						
(5) Decline in beach use.						
LEGEND:						
Thresholds are shown in feet (ft) above mean sea level.						

TABLE III-4

RESULTS OF RECREATION IMPACT ASSESSMENT FOR FOLSOM LAKE

Peak Season (April - Sept.)	Number of Months	Frequency with which Reservoirs are at or Below Elevation Thresholds (Months [% of Months])									
Water Year Type/Alternative		360 ft (1)	400 ft (2)	405 ft (3)	430 ft (4)	450 ft (5)	360 ft (1)	400 ft (2)	405 ft (3)	430 ft (4)	450 ft (5)
69-Year Average	414	6 (1%)	60 (14%)	83 (20%)	175 (42%)	95 (23%)	6 (1%)	60 (14%)	83 (20%)	175 (42%)	95 (23%)
No-Action Alternative		6 (1%)	60 (14%)	83 (20%)	175 (42%)	95 (23%)	6 (1%)	60 (14%)	83 (20%)	175 (42%)	95 (23%)
Alternative 1		8 (2%)	50 (12%)	54 (13%)	147 (36%)	92 (22%)	8 (2%)	50 (12%)	54 (13%)	147 (36%)	92 (22%)
Alternative 2		8 (2%)	49 (12%)	52 (13%)	146 (35%)	90 (22%)	8 (2%)	49 (12%)	52 (13%)	146 (35%)	90 (22%)
Alternative 3		8 (2%)	49 (12%)	52 (13%)	144 (35%)	97 (23%)	8 (2%)	49 (12%)	52 (13%)	144 (35%)	97 (23%)
Alternative 4		8 (2%)	51 (12%)	54 (13%)	152 (37%)	92 (22%)	8 (2%)	51 (12%)	54 (13%)	152 (37%)	92 (22%)
Dry-Year Period	42	0 (0%)	14 (33%)	17 (40%)	33 (79%)	3 (7%)	0 (0%)	14 (33%)	17 (40%)	33 (79%)	3 (7%)
No-Action Alternative		0 (0%)	14 (33%)	17 (40%)	33 (79%)	3 (7%)	0 (0%)	14 (33%)	17 (40%)	33 (79%)	3 (7%)
Alternative 1		0 (0%)	12 (29%)	13 (31%)	30 (71%)	3 (7%)	0 (0%)	12 (29%)	13 (31%)	30 (71%)	3 (7%)
Alternative 2		0 (0%)	12 (29%)	13 (31%)	30 (71%)	3 (7%)	0 (0%)	12 (29%)	13 (31%)	30 (71%)	3 (7%)
Alternative 3		0 (0%)	12 (29%)	13 (31%)	30 (71%)	3 (7%)	0 (0%)	12 (29%)	13 (31%)	30 (71%)	3 (7%)
Alternative 4		0 (0%)	12 (29%)	13 (31%)	30 (71%)	3 (7%)	0 (0%)	12 (29%)	13 (31%)	30 (71%)	3 (7%)
Wet-Year Period	30	0 (0%)	1 (3%)	3 (10%)	7 (23%)	10 (33%)	0 (0%)	1 (3%)	3 (10%)	7 (23%)	10 (33%)
No-Action Alternative		0 (0%)	1 (3%)	3 (10%)	7 (23%)	10 (33%)	0 (0%)	1 (3%)	3 (10%)	7 (23%)	10 (33%)
Alternative 1		0 (0%)	0 (0%)	0 (0%)	5 (17%)	9 (30%)	0 (0%)	0 (0%)	0 (0%)	5 (17%)	9 (30%)
Alternative 2		0 (0%)	0 (0%)	0 (0%)	5 (17%)	9 (30%)	0 (0%)	0 (0%)	0 (0%)	5 (17%)	9 (30%)
Alternative 3		0 (0%)	0 (0%)	0 (0%)	5 (17%)	9 (30%)	0 (0%)	0 (0%)	0 (0%)	5 (17%)	9 (30%)
Alternative 4		0 (0%)	0 (0%)	0 (0%)	5 (17%)	9 (30%)	0 (0%)	0 (0%)	0 (0%)	5 (17%)	9 (30%)
Off Season (Oct - March)	Number of Months	Frequency with which Reservoirs are at or Below Elevation Thresholds (Months [% of Months])									
Water Year Type/Alternative		360 ft (1)					400 ft (2)				
69-Year Average	414	11 (3%)					105 (25%)				
No-Action Alternative		11 (3%)					105 (25%)				
Alternative 1		5 (1%)					89 (21%)				
Alternative 2		5 (1%)					88 (21%)				
Alternative 3		5 (1%)					89 (21%)				
Alternative 4		5 (1%)					87 (21%)				
Dry-Year Period	42	0 (0%)					19 (45%)				
No-Action Alternative		0 (0%)					19 (45%)				
Alternative 1		0 (0%)					19 (45%)				
Alternative 2		0 (0%)					19 (45%)				
Alternative 3		0 (0%)					20 (48%)				
Alternative 4		0 (0%)					19 (45%)				
Wet-Year Period	30	0 (0%)					4 (13%)				
No-Action Alternative		0 (0%)					4 (13%)				
Alternative 1		0 (0%)					0 (0%)				
Alternative 2		0 (0%)					0 (0%)				
Alternative 3		0 (0%)					0 (0%)				
Alternative 4		0 (0%)					0 (0%)				

NOTES:
 (1) Limited boat ramp availability.
 (2) Limited lake surface area (constrains boating).
 (3) Marinas close.
 (4) Decline in campground/picnicking use.
 (5) Beach area inundated.

LEGEND:
 Thresholds are shown in feet above mean sea level.

Beach areas would be inundated in 23 percent of the months during the peak season. The reservoir would be below the level at which camping and picnicking typically decline in 42 percent of the months during the peak season. Annual use based on the 69-year hydrologic period is estimated to total 910,000 12-hour RVDs (Table III-2).

Dry Hydrologic Period. Usable surface area for boating would be constrained in 33 percent of the months during the peak season and 45 percent of the months during the off season (Table III-4). The marinas would be forced to close in 40 percent of the months during the peak season.

Beach areas would be inundated in 7 percent of the months during the peak season. The reservoir would be below the level at which camping and picnicking decline in 79 percent of the months. Annual use during the dry period is estimated to total 820,000 12-hour RVDs (Table III-2).

Wet Hydrologic Period. Usable surface area for boating would be constrained in 3 percent of the months during the peak season and 13 percent of the months during the off season (Table III-4). The marinas would be forced to close in 10 percent of the months during the peak season.

Beach areas would be inundated in 33 percent of the months during the peak season. The reservoir would fall below the level at which camping and picnicking typically decline in 23 percent of the months.

Annual use during the wet hydrologic period is estimated to total 980,000 12-hour RVDs (Table III-2).

Lake Red Bluff

Under the No-Action Alternative, the operation of Lake Red Bluff would continue as described in the Affected Environment chapter, with the gates of the dam being raised from November through April. Recreation facilities and types of recreation activities at the lake are expected to be the same as described under Affected Environment except for the addition of the annual squawfish derby, which began after 1992. Annual use at the lake is estimated to total 99,000 12-hour RVDs.

The potential impacts on recreation that are expected with the gates of the dam being raised permanently are discussed under Supplemental Analysis 1i following Alternative 1. The potential impacts on recreation associated with the gates of the dam continuing to be raised from November through April are discussed qualitatively under Alternatives 1, 2, 3, and 4.

Other Reservoirs

Hydrologic modeling data for Whiskeytown Lake indicate that reservoir surface elevations under Alternatives 1 through 4 would be similar to those under the No-Action Alternative. Because there would be no change in lake level between the alternatives, no impacts on recreation opportunities and use are anticipated.

Hydrologic modeling data were not available and impacts could not be quantitatively ascertained for several other reservoirs in the Sacramento River Region. The recreation impacts at Keswick Reservoir, Thermalito Forebay and Afterbay, Lake Natoma, New Bullards Bar Reservoir, Englebright Lake, and Camp Far West Reservoir are discussed qualitatively in the alternatives analysis.

SACRAMENTO RIVER REGION - RIVERS

Sacramento River

The upper reach of the Sacramento River encompasses the portion of the river from Keswick Dam downstream to Lake Red Bluff. The river flow exceedence frequencies for important recreation opportunities on the upper reach under the No-Action Alternative are shown in Table III-5. For the 69-year hydrologic period, river flows would fall within a range that accommodates many important boating activities in 66 percent of the months during the peak season. These activities include power boating, drift boating, rafting, canoeing, and kayaking. During the dry and wet hydrologic periods, river flows would accommodate these activities in 91 percent and 40 percent of the months, respectively.

The lower reach of the Sacramento River encompasses the portion of the river from Lake Red Bluff downstream to the Sacramento-San Joaquin Delta. The quality of recreation on this reach is sensitive to water and air temperatures and the abundance of sport fish and less sensitive to normal fluctuations in river flows.

During the 69-year, wet, and dry hydrologic periods, river bank recreation opportunities such as fishing, picnicking, and camping are expected to be similar to conditions described in Chapter II.

Recreation use associated with abundance of anadromous fish in the upper and lower Sacramento River is discussed in Attachment A.

Feather River

The quality of recreation on the Feather River is sensitive to water and air temperatures and the abundance of sport fish and less sensitive to normal fluctuations in river flows. River-related recreation opportunities associated with flows occur over a broad range of flows. These opportunities are expected to be similar to conditions described in Chapter II. Recreation use associated with the abundance of anadromous fish is discussed in Attachment A.

American River

69-Year Hydrologic Period. For the 69-year hydrologic period, the river flow exceedence frequencies for important recreation activities on the American River under the No-Action Alternative are shown in Table III-5. River flows fall within the optimal range for all boating activities in 30 percent of the months during the peak season and below the minimum level in 22 percent of the months during the same period. River flows fall below the optimal level for swimming in 19 percent of the months during the peak season.

TABLE III-5

RESULTS OF RECREATION IMPACT ASSESSMENT FOR RIVERS
IN THE SACRAMENTO RIVER REGION

Upper Sacramento River Peak Season (May - Sept.)		Frequency with which Rivers are Between Flow Thresholds (Months [% of Months])					
Water Year Type/Alternative	Number of Months	Between 2,500 and 12,000 cfs. (1)					
69-Year Average	345	228		(66%)			
No-Action Alternative		259		(75%)			
Alternative 1		258		(75%)			
Alternative 2		259		(75%)			
Alternative 3		255		(74%)			
Dry-Year Period	35	32		(91%)			
No-Action Alternative		32		(91%)			
Alternative 1		32		(91%)			
Alternative 2		32		(91%)			
Alternative 3		32		(91%)			
Wet-Year Period	25	10		(40%)			
No-Action Alternative		12		(48%)			
Alternative 1		12		(48%)			
Alternative 2		12		(48%)			
Alternative 3		12		(48%)			
Alternative 4	12		(48%)				
American River Peak Season (May - Sept.)		Frequency with which Rivers are Between or Below Flow Thresholds (Months [% of Months])					
Water Year Type/Alternative	Number of Months	Between 1,750 and 3,000 cfs. (1)		Below 1,750 cfs. (2)		Below 1,500 cfs. (3)	
69-Year Average	345	103	(30%)	75	(22%)	64	(19%)
No-Action Alternative		125	(36%)	97	(28%)	94	(27%)
Alternative 1		129	(37%)	95	(28%)	93	(27%)
Alternative 2		128	(37%)	97	(28%)	93	(27%)
Alternative 3		129	(37%)	98	(28%)	93	(27%)
Dry-Year Period	35	13	(37%)	16	(46%)	15	(43%)
No-Action Alternative		12	(34%)	20	(57%)	20	(57%)
Alternative 1		12	(34%)	20	(57%)	20	(57%)
Alternative 2		12	(34%)	20	(57%)	20	(57%)
Alternative 3		12	(34%)	20	(57%)	20	(57%)
Wet-Year Period	25	5	(20%)	3	(12%)	2	(8%)
No-Action Alternative		7	(28%)	4	(16%)	4	(16%)
Alternative 1		7	(28%)	4	(16%)	4	(16%)
Alternative 2		7	(28%)	4	(16%)	4	(16%)
Alternative 3		7	(28%)	4	(16%)	4	(16%)
Alternative 4	7	(28%)	4	(16%)	4	(16%)	

NOTES:
 (1) Optimal flow range for all boating.
 (2) Below minimum river flows for boating.
 (3) Below optimal flow for swimming.

LEGEND:
 cfs = cubic feet per second of flow.

SOURCES:
 American River: COE, 1991.
 Sacramento River: Matzat, pers. comm.

Recreation use associated with the abundance of anadromous fish is discussed in Attachment A.

Dry Hydrologic Period. For the dry hydrologic period, river flows for all types of boating would fall within the optimal range in 37 percent of the months during the peak season and below the minimum level in 46 percent of the months during the same period (Table III-5). River flows would be below the optimal level for swimming in 43 percent of the months during the peak season.

Wet Hydrologic Period. During the wet hydrologic period, river flows for all boating activities would fall within the optimal range in 20 percent of the months during the peak season and below the minimum level for boating in 12 percent of the months during the same period (Table III-5). River flows would fall below the optimal level for swimming in 8 percent of the months during the peak season.

Yuba River

River-related recreation opportunities on the Yuba River are expected to be similar to conditions described in Chapter II. Recreation use associated with the abundance of anadromous fish is discussed in Attachment A.

Clear Creek

Recreation opportunities on Clear Creek under the No-Action Alternative are expected to be similar to conditions described in Chapter II.

SACRAMENTO RIVER REGION - WILDLIFE REFUGES AND PRIVATE HUNTING LANDS

Wildlife Refuges

Wildlife refuges in the Sacramento River Region include the Sacramento, Delevan, Sutter, and Colusa NWRs and Gray Lodge WMA. For the No-Action Alternative, annual recreation use at the refuges has been estimated for two types of water deliveries: Level 2 water deliveries with conveyance losses and critical period water deliveries. Critical period water deliveries to the Sacramento River Region wildlife refuges are the deliveries that would be made during critical dry years; they are equal to 75 percent of Level 2 deliveries with conveyance losses.

Level 2 Deliveries with Conveyance Losses. Under the No-Action Alternative, Level 2 deliveries to the Sacramento River Region wildlife refuges would provide water to support approximately 19,100 acres of wetlands, including permanent ponds, seasonal wetlands, and water grass.

Annual visitation to the wildlife refuges is estimated to total 101,200 5-hour RVDs (Table III-6). Nonconsumptive activities such as wildlife viewing would account for approximately 49,700 5-hour RVDs, followed by waterfowl hunting at 45,000 5-hour RVDs, and fishing at 6,500 5-hour RVDs. Gray Lodge WMA would account for approximately 36 percent of the waterfowl

hunting on the refuges, followed by Sacramento NWR (29 percent), Sutter NWR (19 percent), Colusa NWR (9 percent), and Delevan NWR (7 percent).

**TABLE III-6
ANNUAL VISITOR USE FOR WILDLIFE REFUGES
IN THE SACRAMENTO RIVER REGION**

Water Year Type/Alternative	Annual Visitor Use (1)			
	Hunting	Non-Consumptive	Fishing	Total
69-Year Average				
No-Action Alternative	45,000	49,700	6,500	101,200
Alternative 1 (Level 2)	59,400	58,600	7,700	125,700
Alternatives 2, 3, and 4 (Level 4)	86,100	69,300	9,100	164,500
Critical Period				
No-Action Alternative	45,000	37,400	4,800	87,200
Alternative 1 (Level 2)	52,100	44,000	5,700	101,800
Alternatives 2, 3, and 4 (Level 4)	69,000	52,000	6,800	127,800
NOTES:				
(1) Annual use is reported in 5-hour RVDs.				
(2) Critical period = critical dry years when refuges will receive a 25 percent reduction in deliveries.				

Critical Period Deliveries. During the critical period deliveries, total annual visitation to the wildlife refuges is estimated to total 87,200 5-hour RVDs (Table III-6). Waterfowl hunting would account for approximately 45,000 5-hour RVDs, followed by wildlife viewing at 37,400 5-hour RVDs, and fishing at 4,800 5-hour RVDs. Gray Lodge WMA would account for approximately 36 percent of waterfowl hunting on the refuges, followed by Sacramento NWR (29 percent), Sutter NWR (19 percent), Colusa NWR (9 percent), and Delevan NWR (7 percent).

Private Hunting Lands

Under the No-Action Alternative, approximately 96,700 acres would be flooded annually. Waterfowl hunting on private hunting lands is estimated to total 935,000 hunter days annually.

SAN FRANCISCO BAY/SACRAMENTO-SAN JOAQUIN DELTA REGION

Recreation opportunities associated with water levels or the availability of recreation facilities in the region are expected to be similar to conditions described in Chapter II.

Recreation use associated with the abundance of anadromous fish is discussed in Attachment A.

SAN JOAQUIN RIVER REGION - RESERVOIRS**San Luis Reservoir**

69-Year Hydrologic Period. The lake level exceedence frequencies for important recreation opportunities at San Luis Reservoir under the No-Action Alternative are shown in Table III-7. Boat ramps would be unusable in less than 1 percent of the months during the peak season and would not be affected during the off season. Usable surface area for boating would be constrained in 4 percent of the months during the peak season and 4 percent of the months during the off season.

The reservoir would be below the level at which camping and picnicking decline in 4 percent of the months during the peak season.

Annual use at San Luis Reservoir based on the 69-year hydrologic period is estimated to total 184,000 12-hour RVDs (Table III-8).

Dry Hydrologic Period. Boat ramp availability would not be affected during the peak and off seasons. Usable surface area for boating would be constrained in 14 percent of the months during the peak season and 10 percent of the months during the off season. The reservoir would be below the level at which camping and picnicking decline in 14 percent of the months.

Annual use during the dry period is estimated to total 176,000 12-hour RVDs (Table III-8).

Wet Hydrologic Period. Boating and camping opportunities would not be affected during the peak or off season.

Annual use during the wet hydrologic period is estimated to total 192,000 12-hour RVDs (Table III-8).

Millerton Lake

69-Year Hydrologic Period. At Millerton Lake, boat ramps would be unusable in 4 percent of the months during the peak season and 1 percent of the months during the off season under the No-Action Alternative. Usable surface area for boating would be constrained in 6 percent of the months during the peak season and 1 percent of the months during the off season. The reservoir would be below the level at which beach use declines in 6 percent of the months.

Annual use based on the 69-year hydrologic period is estimated to total 663,000 12-hour RVDs (Table III-8).

Dry Hydrologic Period. Boat ramps would be unusable in 14 percent of the months during the peak season and 2 percent of the months during the off season. Usable surface area for boating would be constrained in 17 percent of the months during the peak season and 5 percent of the months during the off season. The reservoir would be below the level at which beach use declines in 17 percent of the months.

TABLE III-7

RESULTS OF RECREATION IMPACT ASSESSMENT FOR SAN LUIS RESERVOIR

Peak Season (May - Sept.)		Frequency with which Reservoirs are at or Below Elevation Thresholds (Months [% of Months])			
Water Year Type/Alternative	Number of Months	340 ft (1)		360 ft (2)	
69-Year Average	414				
No-Action Alternative		1	(0.2%)	18	(4%)
Alternative 1		0	(0%)	17	(4%)
Alternative 2		0	(0%)	17	(4%)
Alternative 3		2	(0.5%)	33	(8%)
Alternative 4		0	(0%)	25	(6%)
Dry-Year Period	42				
No-Action Alternative		0	(0%)	6	(14%)
Alternative 1		0	(0%)	6	(14%)
Alternative 2		0	(0%)	6	(14%)
Alternative 3		0	(0%)	4	(10%)
Alternative 4		0	(0%)	7	(17%)
Wet-Year Period	30				
No-Action Alternative		0	(0%)	0	(0%)
Alternative 1		0	(0%)	0	(0%)
Alternative 2		0	(0%)	0	(0%)
Alternative 3		0	(0%)	0	(0%)
Alternative 4		0	(0%)	0	(0%)
Off Season (Oct. - April)		Frequency with which Reservoirs are at or Below Elevation Thresholds (Months [% of Months])			
Water Year Type/Alternative	Number of Months	340 ft (1)		360 ft (2)	
69-Year Average	414				
No-Action Alternative		0	(0%)	17	(4%)
Alternative 1		0	(0%)	7	(2%)
Alternative 2		0	(0%)	7	(2%)
Alternative 3		0	(0%)	11	(3%)
Alternative 4		0	(0%)	13	(3%)
Dry-Year Period	42				
No-Action Alternative		0	(0%)	4	(10%)
Alternative 1		0	(0%)	2	(5%)
Alternative 2		0	(0%)	2	(5%)
Alternative 3		0	(0%)	1	(2%)
Alternative 4		0	(0%)	4	(10%)
Wet-Year Period	30				
No-Action Alternative		0	(0%)	0	(0%)
Alternative 1		0	(0%)	0	(0%)
Alternative 2		0	(0%)	0	(0%)
Alternative 3		0	(0%)	0	(0%)
Alternative 4		0	(0%)	0	(0%)
NOTES:					
(1) Limited boat ramp availability.					
(2) Constraints on boating, decline in campground/picnicking use.					
LEGEND:					
Thresholds are shown in feet (ft) above mean sea level.					

TABLE III-8
ANNUAL VISITOR USE AT RESERVOIRS
IN THE SAN JOAQUIN RIVER REGION

Water Year Type/Alternative	Annual Visitor Use (1)			
	San Luis Reservoir	Millerton Lake	New Melones Reservoir	Non-CVP/SWP Reservoirs (2)
69-Year Average				
No-Action Alternative	184,000	663,000	800,000	1,799,000
Alternative 1	184,000	663,000	788,000	1,799,000
Alternative 2	184,000	663,000	788,000	1,797,000
Alternative 3	184,000	663,000	785,000	1,807,000
Alternative 4	182,000	663,000	785,000	1,807,000
Dry-Year Period				
No-Action Alternative	176,000	674,000	752,000	1,699,000
Alternative 1	176,000	674,000	710,000	1,698,000
Alternative 2	176,000	674,000	712,000	1,700,000
Alternative 3	176,000	674,000	703,000	1,712,000
Alternative 4	174,000	674,000	703,000	1,712,000
Wet-Year Period				
No-Action Alternative	192,000	618,000	819,000	1,846,000
Alternative 1	190,000	618,000	817,000	1,847,000
Alternative 2	190,000	618,000	816,000	1,842,000
Alternative 3	192,000	618,000	815,000	1,855,000
Alternative 4	189,000	618,000	815,000	1,855,000
NOTES:				
(1) Annual use is reported in 12-hour RVDs and is reported to the nearest 1,000 visitor days.				
(2) Non-CVP/SWP reservoirs are Camanche Reservoir, New Don Pedro Reservoir, New Hogan Lake, and Lake McClure.				

Annual use based on the dry hydrologic period is estimated to total 674,000 12-hour RVDs (Table III-8).

Wet Hydrologic Period. Usable surface area for boating would be constrained in 3 percent of the months during the peak season and would not be affected during the off season. Boat ramp availability would not be impaired under the No-Action Alternative. The reservoir would be below the level at which beach use declines in 3 percent of the months during the peak season.

Annual use based on the wet hydrologic period is estimated to total 618,000 12-hour RVDs (Table III-8).

New Melones Reservoir

69-Year Hydrologic Period. The lake level exceedence frequencies for important recreation opportunities at New Melones Reservoir under the No-Action Alternative are shown in Table III-9. For the 69-year hydrologic period, boat ramps would be unusable in less than 1 percent of the months during both the peak and off seasons. Usable surface area for boating would be constrained in less than 1 percent of the months during the peak season and 1 percent of the months during the off season. Marinas would close in 1 percent of the months during the peak season.

The reservoir would be below the level at which beach use declines in 3 percent of the months during the peak season and below the level at which camping and picnicking typically decline in less than 1 percent of the months.

Annual use based on the 69-year hydrologic period is estimated to total 800,000 12-hour RVDs (Table III-8).

Dry Hydrologic Period. During the dry hydrologic period, boat ramps would be unusable in 2 percent of the months during the peak season and would not be affected during the off season (Table III-9). Usable surface area for boating would be constrained in 5 percent of the months during the peak season and would not be affected during the off season. Marinas would close in 7 percent of the months during the peak season.

The reservoir would be below the level at which beach use declines in 14 percent of the months during the peak season and below the level at which camping and picnicking decline in 5 percent of the months during the peak season.

Annual use during the dry hydrologic period is estimated to total 752,000 RVDs (Table III-8).

Wet Hydrologic Period. During the wet hydrologic period, the surface elevation of the reservoir would not fall below important recreation opportunity thresholds.

Annual use during the wet hydrologic period is estimated to total 819,000 RVDs (Table III-8).

TABLE III-9

RESULTS OF RECREATION IMPACT ASSESSMENT
FOR NEW MELONES RESERVOIR

Peak Season (April - Sept.)	Number of Months	Frequency with which Reservoirs are at or Below Elevation Thresholds (Months [% of Months])			
Water Year Type/Alternative		850 ft (1)	860ft (2)	880 ft (3)	900ft (4)
69-Year Average	414				
No-Action Alternative		1 (0.2%)	2 (0.5%)	4 (1%)	13 (3%)
Alternative 1		12 (3%)	15 (4%)	20 (5%)	36 (9%)
Alternative 2		10 (2%)	15 (4%)	19 (5%)	34 (8%)
Alternative 3		13 (2%)	16 (4%)	22 (5%)	35 (8%)
Alternative 4		13 (3%)	16 (4%)	22 (5%)	35 (8%)
Dry-Year Period	42				
No-Action Alternative		1 (2%)	2 (5%)	3 (7%)	6 (14%)
Alternative 1		9 (21%)	10 (24%)	13 (31%)	20 (48%)
Alternative 2		7 (17%)	10 (24%)	12 (29%)	18 (43%)
Alternative 3		8 (19%)	10 (24%)	16 (38%)	20 (48%)
Alternative 4		8 (19%)	10 (24%)	16 (38%)	20 (48%)
Wet-Year Period	30				
No-Action Alternative		0 (0%)	0 (0%)	0 (0%)	0 (0%)
Alternative 1		0 (0%)	0 (0%)	0 (0%)	0 (0%)
Alternative 2		0 (0%)	0 (0%)	0 (0%)	0 (0%)
Alternative 3		0 (0%)	0 (0%)	0 (0%)	0 (0%)
Alternative 4		0 (0%)	0 (0%)	0 (0%)	0 (0%)
Off Season (Oct - March)	Number of Months	Frequency with which Reservoirs are at or Below Elevation Thresholds (Months [% of Months])			
Water Year Type/Alternative		850 ft (1)			860 ft (2)
69-Year Average	414				
No-Action Alternative			4 (1%)		5 (1%)
Alternative 1			17 (4%)		19 (5%)
Alternative 2			16 (4%)		18 (4%)
Alternative 3			17 (4%)		19 (5%)
Alternative 4			17 (4%)		19 (5%)
Dry-Year Period	42				
No-Action Alternative			0 (0%)		0 (0%)
Alternative 1			7 (17%)		9 (21%)
Alternative 2			6 (14%)		8 (21%)
Alternative 3			7 (17%)		9 (21%)
Alternative 4			7 (17%)		9 (21%)
Wet-Year Period	30				
No-Action Alternative			0 (0%)		0 (0%)
Alternative 1			0 (0%)		0 (0%)
Alternative 2			0 (0%)		0 (0%)
Alternative 3			0 (0%)		0 (0%)
Alternative 4			0 (0%)		0 (0%)

NOTES:
 (1) Limited boat ramp availability.
 (2) Limited lake surface area, decline in campground/picnicking use.
 (3) Marinas close.
 (4) Decline in beach use.

LEGEND:
 Thresholds are shown in feet (ft) above mean sea level.

Non-CVP and SWP Reservoirs

Non-CVP and SWP reservoirs in the San Joaquin River Region include Camanche Reservoir, New Don Pedro Reservoir, New Hogan Lake, and Lake McClure.

During the 69-year hydrologic period, boat ramps would be unusable during 4 percent of the peak-season months at Camanche Reservoir and would always be usable at the other three reservoirs. Usable surface area for boating would be constrained for approximately 10 percent of the peak-season months at Camanche Reservoir and New Hogan Lake and 4 percent of the peak-season months at New Don Pedro Reservoir. Constraints on boating would not occur at Lake McClure. Beach use would be limited in 10 percent of the peak-season months at Camanche Reservoir and 26 percent of the peak-season months at New Don Pedro Reservoir.

Lake levels would be below the level at which camping and picnicking declines during 7 percent of the peak-season months at Camanche Reservoir and 4 percent of the peak-season months at New Don Pedro Reservoir. Camping and picnicking opportunities would not be affected at New Hogan Lake and Lake McClure.

During the dry hydrologic period, boat ramps would be unusable during 12 percent of the peak-season months at Camanche Reservoir and would always be usable at the other three reservoirs. Usable surface area for boating would be constrained for approximately 33 percent of the peak-season months at Camanche Reservoir, 14 percent of peak-season months at New Hogan Lake, and 9 percent of the peak-season months at New Don Pedro Reservoir. Surface area constraints on boating would not occur at Lake McClure. Beach use would be limited in 10 percent of the peak-season months at Camanche Reservoir and 57 percent of the peak-season months at New Don Pedro Reservoir, and 76 percent of the peak-season months at New Hogan Reservoir. Lake levels would be below the level at which camping and picnicking declines during 24 percent of the peak-season months at Camanche Reservoir, 9 percent of the peak-season months at New Don Pedro Reservoir, and 2 percent of the months at New Hogan Reservoir. Camping and picnicking opportunities would not be affected at Lake McClure.

During the wet hydrologic period, the surface elevations of the four reservoirs would remain above the levels at which boating activities are affected. Shoreline activities would not be affected, except for 8 percent of the peak-season months at New Don Pedro Reservoir. Boating during the off season would not be affected at the four reservoirs.

Annual recreation use at the four reservoirs is estimated to total 1,799,000 12-hour RVDs during the 69-year hydrologic period, 1,699,000 12-hour RVDs during the dry hydrologic period, and 1,846,000 12-hour RVDs during the wet hydrologic period (Table III-8).

Other Reservoirs

During the 69-year, dry, and wet hydrologic periods, recreation opportunities at Bethany Reservoir and O'Neill Forebay are expected to be similar to conditions described in Chapter II.

SAN JOAQUIN RIVER REGION - RIVERS**San Joaquin River**

Because of its length, the San Joaquin River has been divided into upper and lower reaches for this analysis. The upper reach extends from Millerton Lake to the confluence with the Merced River. The lower reach extends from the confluence with the Merced River to the Bay-Delta. Recreation opportunities on the upper reach are not addressed because operation of Millerton Lake would not change from existing conditions. Recreation opportunities on the lower reach could be affected because of changes in flows attributable to operation of reservoirs located on tributaries to the river.

69-Year Hydrologic Period. On the lower reach, river flows would fall within the optimal range for canoeing in 5 percent of the months during the peak season (Table III-10). All other boating activities would have optimal river flows in 70 percent of the months during the peak season. River flows would fall below the optimal swimming level in 6 percent of the months during the peak season.

Annual use during the 69-year hydrologic period is estimated to total 520,000 6-hour RVDs (Table III-11).

Dry Hydrologic Period. On the lower reach, river flows would fall within the optimal range for canoeing in 20 percent of the months during the peak season (Table III-10). All other boating activities would have optimal river flows in 80 percent of the months during the peak season. River flows would fall below the optimal swimming level in 20 percent of the months during the peak season.

Annual use during the dry period is estimated to total 532,000 6-hour RVDs (Table III-11).

Wet Hydrologic Period. On the lower reach, river flows would not be within the optimal range for canoeing during the peak season. Optimal flows for all other boating activities would occur in 68 percent of the months during the peak season. River flows would not fall below the optimal level for swimming during the entire peak season (Table III-10).

Annual use during the wet hydrologic period is estimated to total 517,000 6-hour RVDs (Table III-11).

Stanislaus River

Because of its length, the Stanislaus River has been divided into upper and lower reaches for this discussion. The upper reach extends from New Melones Reservoir to the City of Oakdale. The lower reach extends from the City of Oakdale to the confluence with the San Joaquin River.

69-Year Hydrologic Period. For the upper reach, river flows for all types of boating would fall within the optimal range in 34 percent of the months during the peak season (Table III-10). On the lower reach, river flows would fall within the optimal range for all boating activities in 7

TABLE III-10

**RESULTS OF RECREATION IMPACT ASSESSMENT FOR RIVERS
IN THE SAN JOAQUIN RIVER REGION**

San Joaquin River - Lower Reach Peak Season (May - Sept.)	Number of Months	Frequency with which Rivers are Between or Below Flow Thresholds (Months [%])		
		Between 300 and 500 cfs (1)	Between 200 and 300 cfs (2)	Below 300 cfs (3)
Water Year Type/Alternative				
69-Year Average	345			
No-Action Alternative		243 (70%)	18 (5%)	18 (5%)
Alternative 1		255 (74%)	26 (8%)	27 (8%)
Alternative 2		253 (73%)	28 (8%)	28 (8%)
Alternative 3		256 (74%)	25 (7%)	26 (8%)
Alternative 4		255 (74%)	25 (7%)	26 (8%)
Dry-Year Period	35			
No-Action Alternative		28 (80%)	7 (20%)	7 (20%)
Alternative 1		27 (77%)	8 (23%)	8 (23%)
Alternative 2		27 (77%)	8 (23%)	8 (23%)
Alternative 3		29 (83%)	8 (23%)	8 (23%)
Alternative 4		27 (77%)	8 (23%)	8 (23%)
Wet-Year Period	25			
No-Action Alternative		17 (68%)	0 (0%)	0 (0%)
Alternative 1		19 (76%)	0 (0%)	0 (0%)
Alternative 2		19 (76%)	0 (0%)	0 (0%)
Alternative 3		19 (76%)	0 (0%)	0 (0%)
Alternative 4		19 (76%)	0 (0%)	0 (0%)
NOTES:				
(1) Optimal flow range for all boating activities.				
(2) Optimal range of canoeing flows.				
(3) Below optimal flows for swimming.				
(4) Below minimum flows for all boating activities.				
SOURCES:				
San Joaquin River: Koehler and Reep, pers. comms.				
Stanislaus River: Foust, pers. comm.				
LEGEND:				
cfs = cubic feet per second of flow				

TABLE III-10. CONTINUED

Stanislaus River - Upper Reach		Frequency with which Rivers are Between or below Flow Thresholds(Months [%])	
Peak Season (May - Sept.)			
Water Year Type/Alternative	Number of Months	Between 700 and 2,000 cfs (1)	Below 700 cfs (4)
69-Year Average	345		
No-Action Alternative		116 (34%)	0 (0%)
Alternative 1		109 (32%)	0 (0%)
Alternative 2		118 (34%)	0 (0%)
Alternative 3		208 (60%)	0 (0%)
Alternative 4		208 (60%)	0 (0%)
Dry-Year Period	35		
No-Action Alternative		21 (60%)	0 (0%)
Alternative 1		20 (57%)	0 (0%)
Alternative 2		20 (57%)	0 (0%)
Alternative 3		32 (91%)	0 (0%)
Alternative 4		32 (91%)	0 (0%)
Wet-Year Period	25		
No-Action Alternative		4 (16%)	0 (0%)
Alternative 1		5 (20%)	0 (0%)
Alternative 2		6 (24%)	0 (0%)
Alternative 3		11 (44%)	0 (0%)
Alternative 4		11 (44%)	0 (0%)
Stanislaus River - Lower Reach		Frequency with which Rivers are Between or below Flow Thresholds (Months [%])	
Peak Season (May - Sept.)			
Water Year Type/Alternative	Number of Months	Between 700 and 800 cfs (1)	Below 300 cfs (4)
69-Year Average	345		
No-Action Alternative		23 (7%)	127 (37%)
Alternative 1		42 (12%)	69 (20%)
Alternative 2		37 (11%)	35 (10%)
Alternative 3		18 (5%)	5 (1%)
Alternative 4		18 (5%)	5 (1%)
Dry-Year Period	35		
No-Action Alternative		2 (6%)	14 (40%)
Alternative 1		1 (3%)	12 (34%)
Alternative 2		6 (17%)	5 (14%)
Alternative 3		1 (3%)	1 (3%)
Alternative 4		1 (3%)	1 (3%)
Wet-Year Period	25		
No-Action Alternative		1 (4%)	5 (20%)
Alternative 1		4 (16%)	4 (16%)
Alternative 2		0 (0%)	2 (8%)
Alternative 3		0 (0%)	0 (0%)
Alternative 4		0 (0%)	0 (0%)
NOTES:			
(1) Optimal flow range for all boating activities.			
(2) Optimal range of canoeing flows.			
(3) Below optimal flows for swimming.			
(4) Below minimum flows for all boating activities.			
SOURCES:			
San Joaquin River: Koehler and Reep, pers. comms.			
Stanislaus River: Faust, pers. comm.			
LEGEND:			
cfs = cubic feet per second of flow			

TABLE III-11

**ANNUAL VISITOR USE AT RIVERS
IN THE SAN JOAQUIN RIVER REGION**

San Joaquin River	Annual Visitor Use (Visitor Days) (1)		
Water Year Type/Alternative	Fishing	Nonconsumptive	Total
69-Year Average			
No-Action Alternative	150,000	370,000	520,000
Alternative 1	150,000	370,000	520,000
Alternative 2	150,000	370,000	520,000
Alternative 3	149,000	369,000	518,000
Alternative 4	149,000	369,000	518,000
Dry-Year Period			
No-Action Alternative	154,000	378,000	532,000
Alternative 1	152,000	375,000	527,000
Alternative 2	152,000	374,000	526,000
Alternative 3	148,000	367,000	515,000
Alternative 4	148,000	367,000	515,000
Wet-Year Period			
No-Action Alternative	149,000	368,000	517,000
Alternative 1	149,000	368,000	517,000
Alternative 2	149,000	368,000	517,000
Alternative 3	148,000	366,000	514,000
Alternative 4	148,000	366,000	514,000
Stanislaus River	Annual Visitor Use (Visitor Days) (1)		
Water Year Type/Alternative	Fishing	Nonconsumptive	Total
69-Year Average			
No-Action Alternative	82,000	201,000	283,000
Alternative 1	83,000	202,000	285,000
Alternative 2	84,000	205,000	289,000
Alternative 3	88,000	214,000	302,000
Alternative 4	88,000	214,000	302,000
Dry-Year Period			
No-Action Alternative	90,000	216,000	306,000
Alternative 1	93,000	222,000	315,000
Alternative 2	97,000	231,000	328,000
Alternative 3	104,000	246,000	350,000
Alternative 4	104,000	246,000	350,000
Wet-Year Period			
No-Action Alternative	85,000	207,000	292,000
Alternative 1	84,000	205,000	289,000
Alternative 2	86,000	209,000	295,000
Alternative 3	92,000	220,000	312,000
Alternative 4	92,000	220,000	312,000
NOTES:			
(1) Annual visitor use is reported in 6-hour RVDs and is reported to the nearest 1,000 visitor days			

TABLE III-11. CONTINUED

Non-CVP/SWP Rivers (2)	Annual Visitor Use (1)		
Water Year Type/Alternative	Fishing	Nonconsumptive	Total
69-Year Average			
No-Action Alternative	112,000	278,000	390,000
Alternative 1	111,000	277,000	388,000
Alternative 2	112,000	281,000	393,000
Alternative 3	116,000	289,000	405,000
Alternative 4	116,000	289,000	405,000
Dry-Year Period			
No-Action Alternative	100,000	255,000	355,000
Alternative 1	99,000	253,000	352,000
Alternative 2	104,000	264,000	368,000
Alternative 3	119,000	300,000	419,000
Alternative 4	119,000	300,000	419,000
Wet-Year Period			
No-Action Alternative	109,000	274,000	383,000
Alternative 1	109,000	274,000	383,000
Alternative 2	111,000	277,000	388,000
Alternative 3	114,000	286,000	400,000
Alternative 4	114,000	286,000	400,000
<p>NOTES:</p> <p>(1) Annual visitor use is reported in 6-hour RVDs and is reported to the nearest 1,000 visitor days.</p> <p>(2) Non-CVP and non-SWP rivers include only the Tuolumne and Merced. Use on the Calaveras and Mokelumne rivers was not estimated.</p>			

percent of the months during the peak season; however, they would be below the minimum flow in 37 percent of the months.

Annual use for the entire Stanislaus River during the 69-year hydrologic period is estimated to total 283,000 6-hour RVDs (Table III-11).

Dry Hydrologic Period. On the upper reach, river flows for all types of boating activities would fall within the optimal range in 60 percent of the months during the peak season (Table III-10). On the lower reach, river flows would fall within the optimal range for all boating activities in 6 percent of the months during the peak season and below the minimum necessary for these activities in 40 percent of the months.

Annual use for the entire Stanislaus River during the dry hydrologic period is estimated to total 306,000 6-hour RVDs (Table III-11).

Wet Hydrologic Period. On the upper reach, river flows for all types of boating activities would fall within the optimal range in 16 percent of the months during the peak season (Table III-10). On the lower reach, river flows would fall within the optimal range for all boating activities in 4 percent of the months during the peak season and below the minimum level in 20 percent of the months.

Annual use for the entire Stanislaus River during the wet hydrologic period is estimated to total 292,000 6-hour RVDs (Table III-11).

Non-CVP and SWP Rivers

Non-CVP and SWP rivers in the San Joaquin River Region include the Tuolumne, Calaveras, Merced, and Mokelumne. The Mokelumne River has been divided into upper and lower reaches.

During the 69-year hydrologic period, optimal flows for all boating activities would occur in approximately 4 percent of the peak-season months on the Tuolumne River and 28 percent of the peak-season months on the upper reach of the Mokelumne River. On the Tuolumne River, flows would be below the minimum level for power boating in 77 percent of the peak-season months and for canoeing in 67 percent of the peak-season months. River flows would be below the minimum level for all boating activities in 84 percent of the peak-season months on the Merced River, 65 percent of the peak-season months on the lower Mokelumne River, and 4 percent of the peak-season months on the upper Mokelumne River. River flows would be within the optimal range for swimming in 22 percent of the peak-season months on the Merced River, and 6 percent of the peak-season months on the Tuolumne River. River flows would be below the minimum level for swimming for 52 percent of the peak-season months on the Tuolumne River, 63 percent of the peak-season months on the lower Mokelumne River, and 3 percent of the peak-season months on the upper Mokelumne River.

During the dry hydrologic period, optimal flows for all boating activities would occur in approximately 3 percent of the peak-season months on the Tuolumne River and 17 percent of the peak-season months on the upper reach of the Mokelumne River. On the Tuolumne River, flows would be below the minimum level for power boating in all peak-season months and for

canoeing 97 percent of the peak-season months. River flows would be below the minimum level for all boating activities during all peak-season months on the Merced River, 86 percent of the peak-season months on the lower Mokelumne River, and 11 percent of the peak-season months on the upper Mokelumne River. River flows would be within the optimal range for swimming in 20 percent of the peak-season months on the Merced River and in 3 percent of the peak-season months on the Tuolumne River. River flows would be below the minimum level for swimming for 83 percent of the peak-season months on the Tuolumne River and 86 percent of the peak-season months on the lower Mokelumne River.

During the wet hydrologic period, optimal flows for all boating activities would occur in approximately 4 percent of the peak-season months on the Tuolumne River and 36 percent of the peak-season months on the upper reach of the Mokelumne River. On the Tuolumne River, flows would be below the minimum level for power boating and canoeing in 60 percent of the peak-season months. River flows would be below the minimum level for all boating activities during 64 percent of the peak-season months on the Merced River, and 48 percent of the peak-season months on the lower Mokelumne River. River flows would be within the optimal range for swimming in 4 percent of the peak-season months on the Merced and Tuolumne rivers. River flows would be below the minimum level for swimming for 40 percent of the peak-season months on the Tuolumne River and 44 percent of the peak-season months on the lower Mokelumne River.

Under the No-Action Alternative, recreation opportunities on the Calaveras River are expected to be similar to conditions described in Chapter II. These opportunities are limited because of upstream water diversions and lack of public access facilities.

Combined annual recreation use on the Tuolumne and Merced rivers is estimated to total 390,000 8-hour RVDs during the 69-year hydrologic period, 355,000 8-hour RVDs during the dry hydrologic period, and 383,000 8-hour RVDs during the wet hydrologic period (Table III-11). Annual recreation use on the Calaveras and Mokelumne rivers was not estimated due to a lack of historical data.

California Aqueduct and Delta-Mendota Canal

Recreation opportunities provided by the California Aqueduct and Delta-Mendota Canal are expected to be similar to conditions described in Chapter II because water levels in the canals are held at constant levels.

SAN JOAQUIN RIVER REGION - WILDLIFE REFUGES AND PRIVATE HUNTING LANDS

Wildlife Refuges

Wildlife refuges in the San Joaquin River Region include San Luis, Mendota, and Merced NWRs and Volta and Los Banos WMAs. For the No-Action Alternative, annual recreation use at the refuges has been estimated for two types of water deliveries: Level 2 water deliveries minus conveyance losses and critical period water deliveries. Critical period water deliveries to San

Joaquin River Region wildlife refuges would occur during critical dry years and are equal to 75 percent of Level 2 deliveries.

Level 2 Deliveries with Conveyance Losses. Under the No-Action Alternative, Level 2 deliveries to the San Joaquin River Region refuges would provide water to support approximately 40,300 acres of wetlands, including permanent ponds, seasonal wetlands, and water grass. Annual visitation to the wildlife refuges is estimated to total 72,900 5-hour RVDs (Table III-12). Wildlife viewing would account for approximately 35,800 5-hour RVDs, followed by waterfowl hunting at 32,500 5-hour RVDs, and fishing at 4,600 5-hour RVDs.

Critical Period Deliveries. During the critical period deliveries, total annual visitation to the wildlife refuges is estimated to total 50,100 5-hour RVDs (Table III-12). Wildlife viewing would account for approximately 27,200 5-hour RVDs, followed by waterfowl hunting at 19,500 5-hour RVDs, and fishing at 3,400 5-hour RVDs.

**TABLE III-12
ANNUAL VISITOR USE FOR WILDLIFE REFUGES
IN THE SAN JOAQUIN RIVER REGION**

Water Year Type/Alternative	Annual Visitor Use (1)			
	Hunting	Non-Consumptive	Fishing	Total
69-Year Average				
No-Action Alternative	32,500	35,800	4,600	72,900
Alternative 1 (Level 2)	48,800	39,300	5,100	93,200
Alternatives 2, 3, and 4 (Level 4)	70,100	45,000	5,900	121,000
Critical Period (2)				
No-Action Alternative	19,500	27,200	3,400	50,100
Alternative 1 (Level 2)	25,300	29,600	3,800	58,700
Alternatives 2, 3, and 4 (Level 4)	33,000	33,800	4,400	71,200
NOTES:				
(1) Annual use is reported in 5-hour RVDs.				
(2) Critical period = critical dry years when refuges will receive a 25 percent reduction in deliveries.				

Private Hunting Lands

Under the No-Action Alternative, approximately 33,900 acres would be flooded annually. Waterfowl hunting on private hunting lands is estimated to total 935,000 hunter days annually.

TULARE LAKE REGION - WILDLIFE REFUGES AND PRIVATE HUNTING LANDS

Wildlife refuges in the Tulare Lake Region include the Kern and Pixley NWRs. Annual recreation use at the refuges has been estimated for two types of water deliveries: full Level 2

water deliveries and critical period water deliveries. Critical period water deliveries to the Tulare Lake Region wildlife refuges would occur during critical dry years and are equal to 75 percent of Level 2 deliveries.

Wildlife Refuges

Level 2 Deliveries with Conveyance Losses. Under the No-Action Alternative, Level 2 deliveries to the Tulare Lake Region wildlife refuges would provide water to support approximately 3,557 acres of wetlands, including permanent ponds, seasonal wetlands, and water grass. Annual visitation to the wildlife refuges is estimated to total 4,400 5-hour RVDs (Table III-13). Wildlife viewing would account for approximately 3,900 5-hour RVDs followed by fishing at 500 5-hour RVDs.

Critical Period Deliveries. During the critical period deliveries, total annual visitation to the wildlife refuges is estimated to total 3,100 5-hour RVDs (Table III-13). Wildlife viewing would account for approximately 2,700 5-hour RVDs, followed by fishing at 400 5-hour RVDs.

TABLE III-13

ANNUAL VISITOR USE FOR WILDLIFE REFUGES IN THE TULARE LAKE REGION

Water Year Type/Alternative	Annual Visitor Use (1)		
	Non-Consumptive	Fishing	Total
69-Year Average			
No-Action Alternative	3,900	500	4,400
Alternative 1 (Level 2)	3,900	500	4,400
Alternatives 2, 3, and 4 (Level 4)	9,700	1,300	11,000
Critical Period (2)			
No-Action Alternative	2,700	400	3,100
Alternative 1 (Level 2)	2,900	400	3,300
Alternatives 2, 3, and 4 (Level 4)	7,300	900	8,200
NOTES:			
(1) Annual use is reported in 5-hour RVDs.			
(2) Critical period = critical dry years when refuges will receive a 25 percent reduction in deliveries.			

Private Hunting Lands

Under the No-Action Alternative, approximately 15,670 acres would be flooded annually, providing waterfowl hunting opportunities estimated at 58,000 hunter days.

PACIFIC COAST REGION

The Pacific Coast Region includes approximately two-thirds of the California Coast. Recreation use associated with the abundance of anadromous fish is discussed in Attachment A.

SAN FRANCISCO BAY REGION

Under the No-Action Alternative, CVP water deliveries to water districts in the San Francisco Bay Region would be similar to deliveries under existing conditions. Because these deliveries would be similar, recreation opportunities at reservoirs operated by these districts are also expected to be similar to existing conditions.

ALTERNATIVE 1

This section describes changes in recreation opportunities and use at important recreation sites under Alternative 1 compared to the No-Action Alternative.

SACRAMENTO RIVER REGION - RESERVOIRS

Shasta Lake

The lake level exceedence frequencies during the 69-year, dry, and wet hydrologic periods for important recreation activities at Shasta Lake under Alternative 1 are shown in Table III-1.

During the 69-year hydrologic period, peak-season boat ramp availability on the main area of the lake and the three major arms would be nearly the same as under the No-Action Alternative. Usable surface area for boating would be constrained for 15 more peak-season months and 32 more off-season months on the Pit River Arm and 33 more off-season months on the Sacramento River Arm. Usable surface area for boating on the main area of the lake and the McCloud Arm would be nearly the same as under the No-Action Alternative. Peak-season marina operations would be nearly the same as under the No-Action Alternative. Peak-season camping opportunities around the lake would be nearly the same as under the No-Action Alternative (Figures III-1, III-2, and III-3).

During the dry and wet hydrologic periods, boating and camping opportunities on the main area of the lake and the three major arms would be nearly the same as under the No-Action Alternative.

Annual use is estimated to decrease by approximately 2 percent during the 69-year hydrologic period and decrease by less than 1 percent during the dry and wet hydrologic periods (Table III-2).

In summary, the surface elevation of Shasta Lake would fall below the levels at which boating becomes constrained on the Pit River and Sacramento River arms more frequently under Alternative 1 than under the No-Action Alternative. This potential impact would occur during off-season months.

Lake Oroville

The lake level exceedence frequencies during the 69-year, dry, and wet hydrologic periods for important recreation activities at Lake Oroville under Alternative 1 are shown in Table III-3.

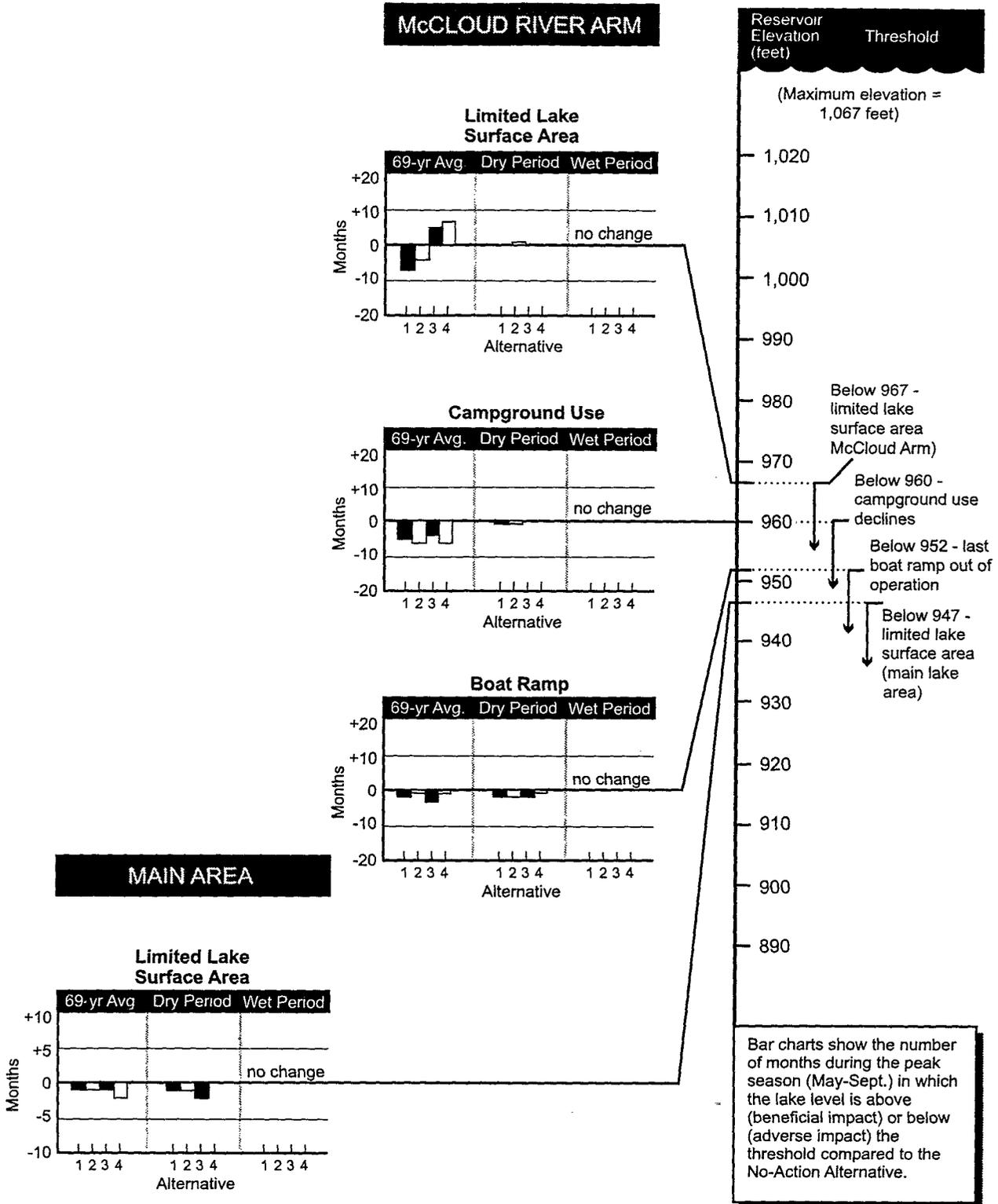


FIGURE III-1

RECREATION OPPORTUNITY THRESHOLDS (PEAK SEASON)
AT SHASTA LAKE, MAIN AREA AND McCLOUD RIVER ARM

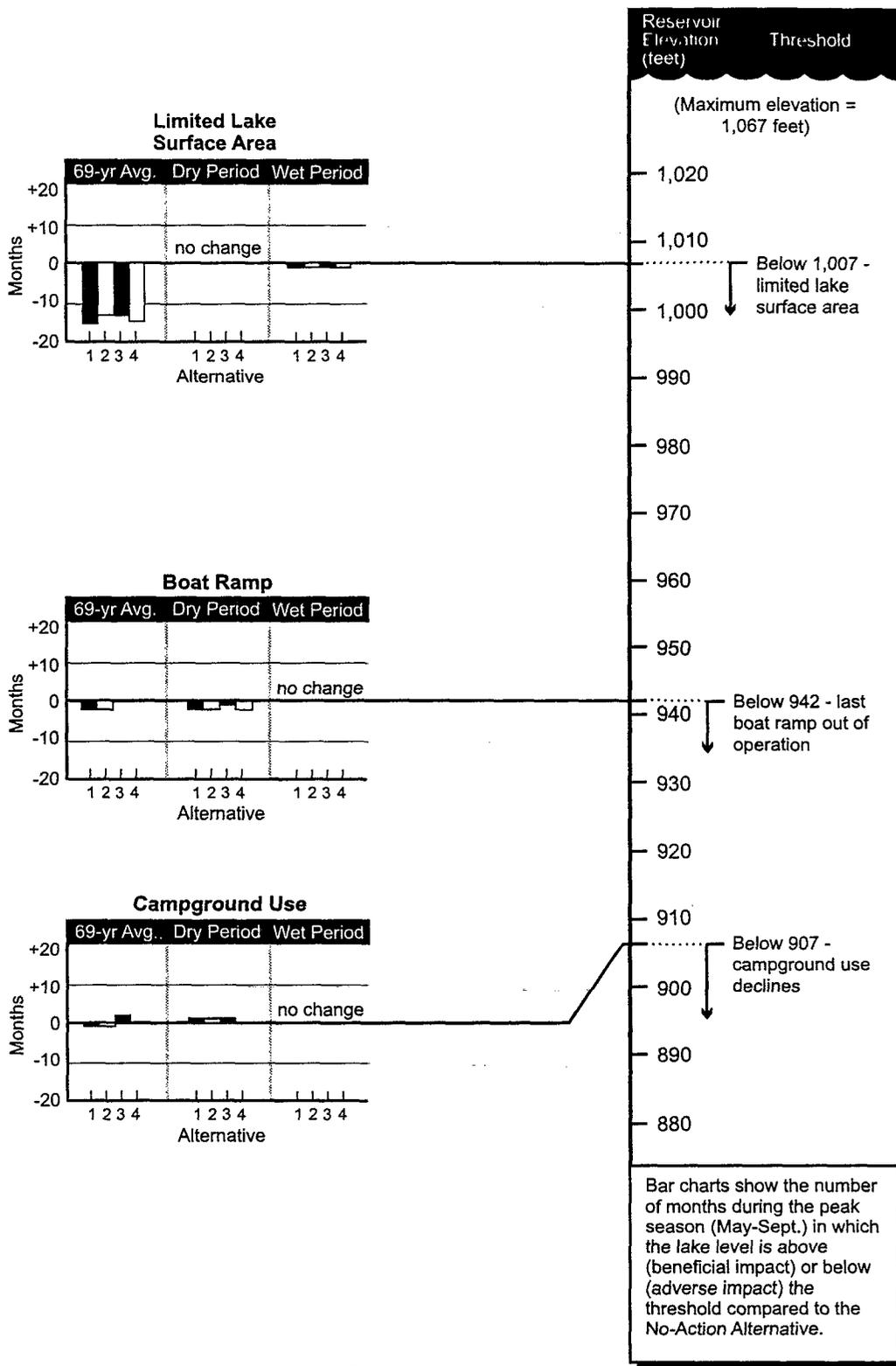


FIGURE III-2

RECREATION OPPORTUNITY THRESHOLDS (PEAK SEASON)
AT SHASTA LAKE, PIT RIVER ARM

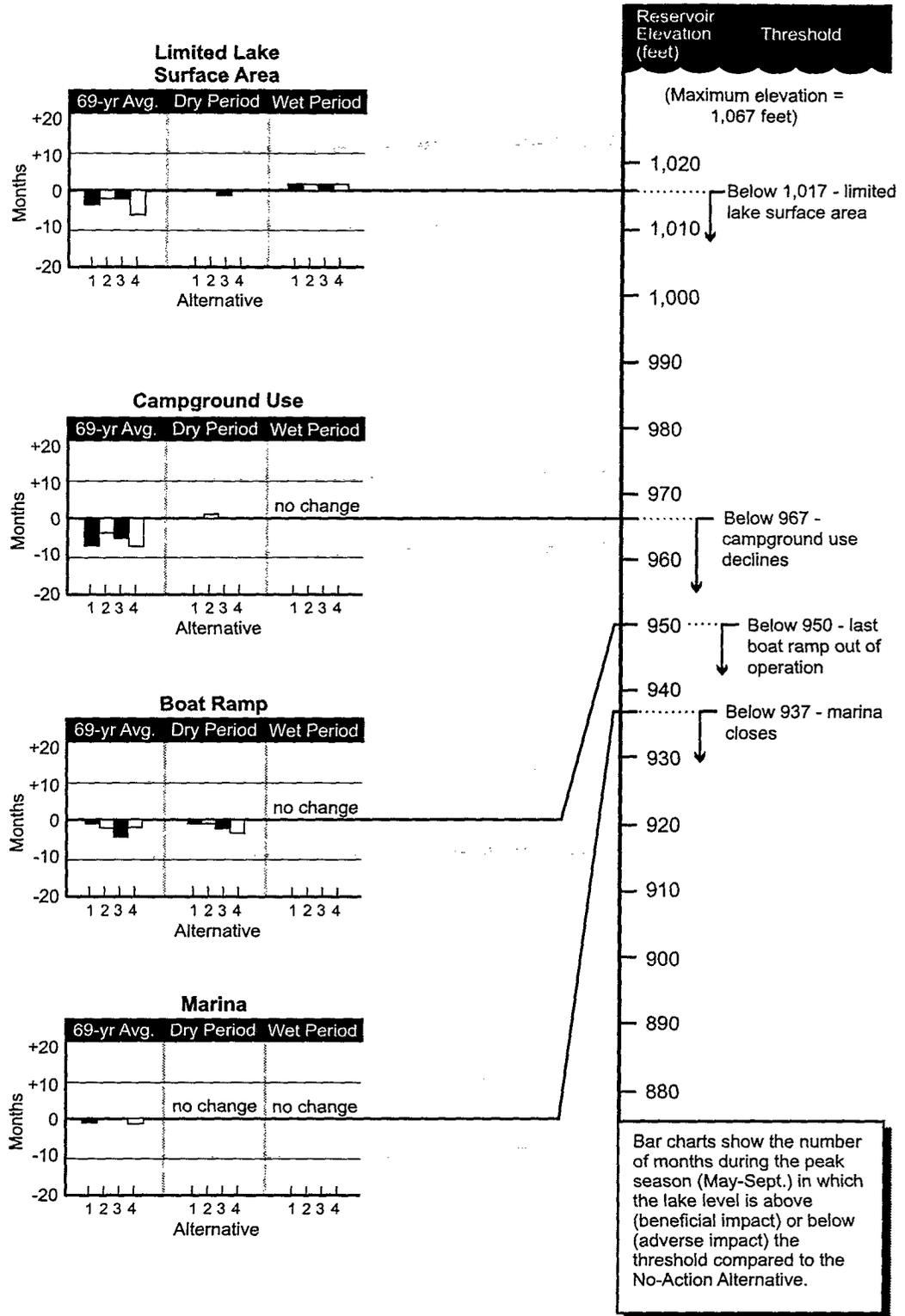


FIGURE III-3

RECREATION OPPORTUNITY THRESHOLDS (PEAK SEASON)
AT SHASTA LAKE, SACRAMENTO RIVER ARM

During the 69-year hydrologic period, boat ramps would be usable for four more peak-season months and eight more off-season months (Figure III-4). Usable surface area for boating would be constrained for 7 fewer peak-season months and 10 fewer off-season months. Marinas would be required to move facilities three fewer times during the peak season. The reservoir would remain below the level at which boating is constrained for three fewer peak-season periods and three fewer off-season periods. The reservoir would fall below the level at which camping and picnicking typically decline for five fewer months.

During the dry hydrologic period, boat ramps would be usable for three more months during both the peak and off seasons (Table III-3 and Figure III-4). Usable surface area for boating would be constrained for two fewer peak-season months and four more off-season months. The reservoir would be below the level at which beach use declines and beach areas close for one more peak-season month and below the level at which camping and picnicking decline for three fewer peak-season months.

During the wet hydrologic period, usable surface area for boating would be constrained for one more off-season month (Table III-3). The reservoir would be below the level at which beach use declines and beach areas close for one less peak-season month.

Annual use during the 69-year, dry, and wet hydrologic periods under Alternative 1 is estimated to increase by less than 1 percent from annual use estimated for the No-Action Alternative (Table III-2).

In summary, the surface elevation of Lake Oroville would generally be maintained at higher levels during peak- and off-season periods under Alternative 1 than under the No-Action Alternative. Higher surface elevations would potentially benefit recreation opportunities by increasing the availability of boat access and maintaining the lake level above the level at which boating becomes constrained and shoreline activities decrease. Although lake levels would fall below some recreation opportunity thresholds more frequently under Alternative 1 than under the No-Action Alternative, these small changes would be outweighed by the larger beneficial effects.

Folsom Lake

The reservoir level exceedence frequencies during the 69-year, dry, and wet hydrologic periods for important recreation opportunities at Folsom Lake are shown in Table III-4.

During the 69-year hydrologic period, boat ramps would be unusable for two more peak-season months and six fewer off-season months (Figure III-5). Usable surface area for boating would be constrained for 10 fewer peak-season months and 16 fewer off-season months. The marina would be forced to close for 29 fewer peak-season months. Usable surface area for boating would be constrained for two more peak-season periods and three fewer off-season periods. The reservoir would be below the level at which camping and picnicking decline for 28 fewer peak-season months.

During the dry and wet hydrologic periods, boating and beach use opportunities would be nearly the same as under the No-Action Alternative (Table III-4 and Figure III-6).

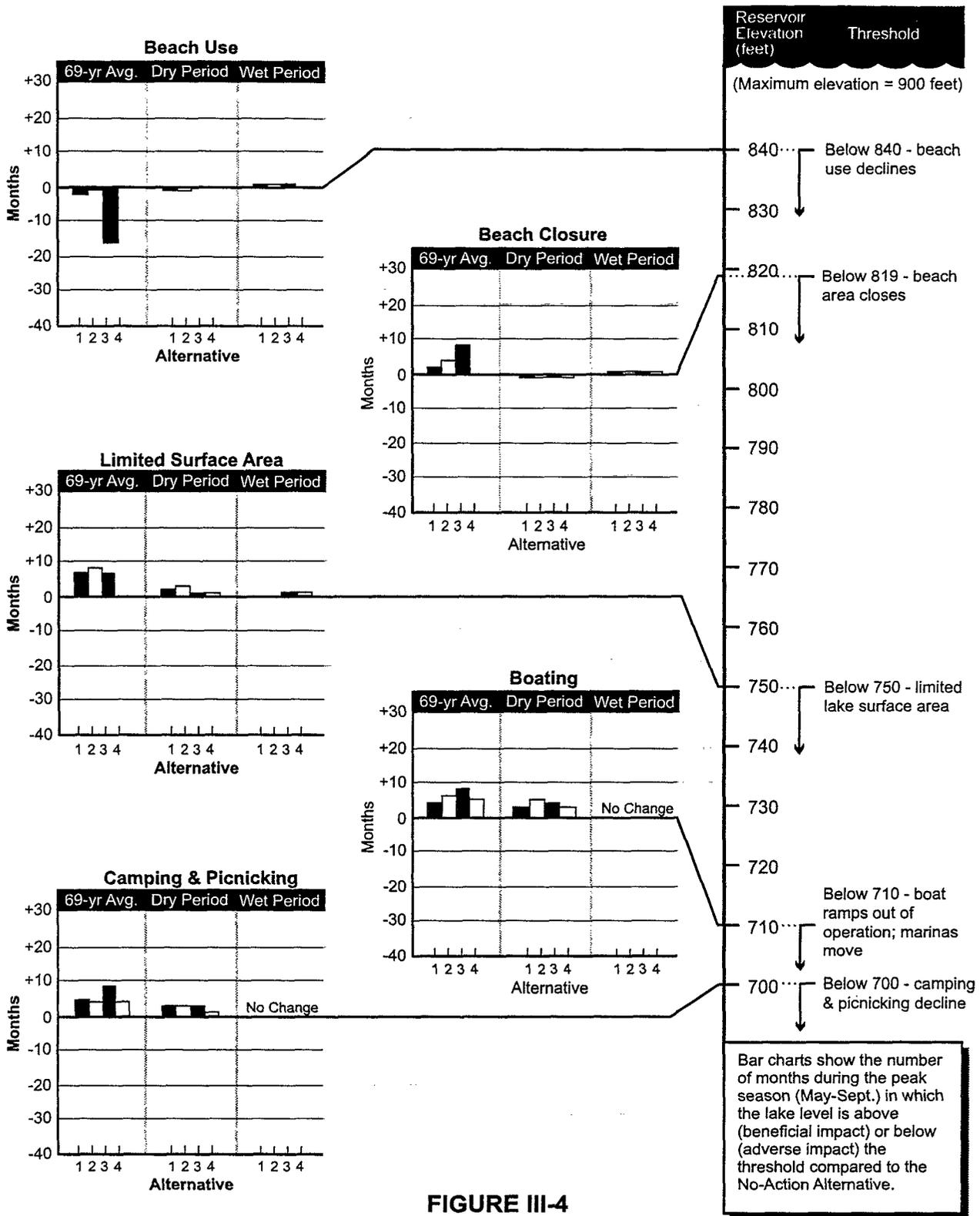


FIGURE III-4

RECREATION OPPORTUNITY THRESHOLDS (PEAK SEASON)
AT LAKE OROVILLE

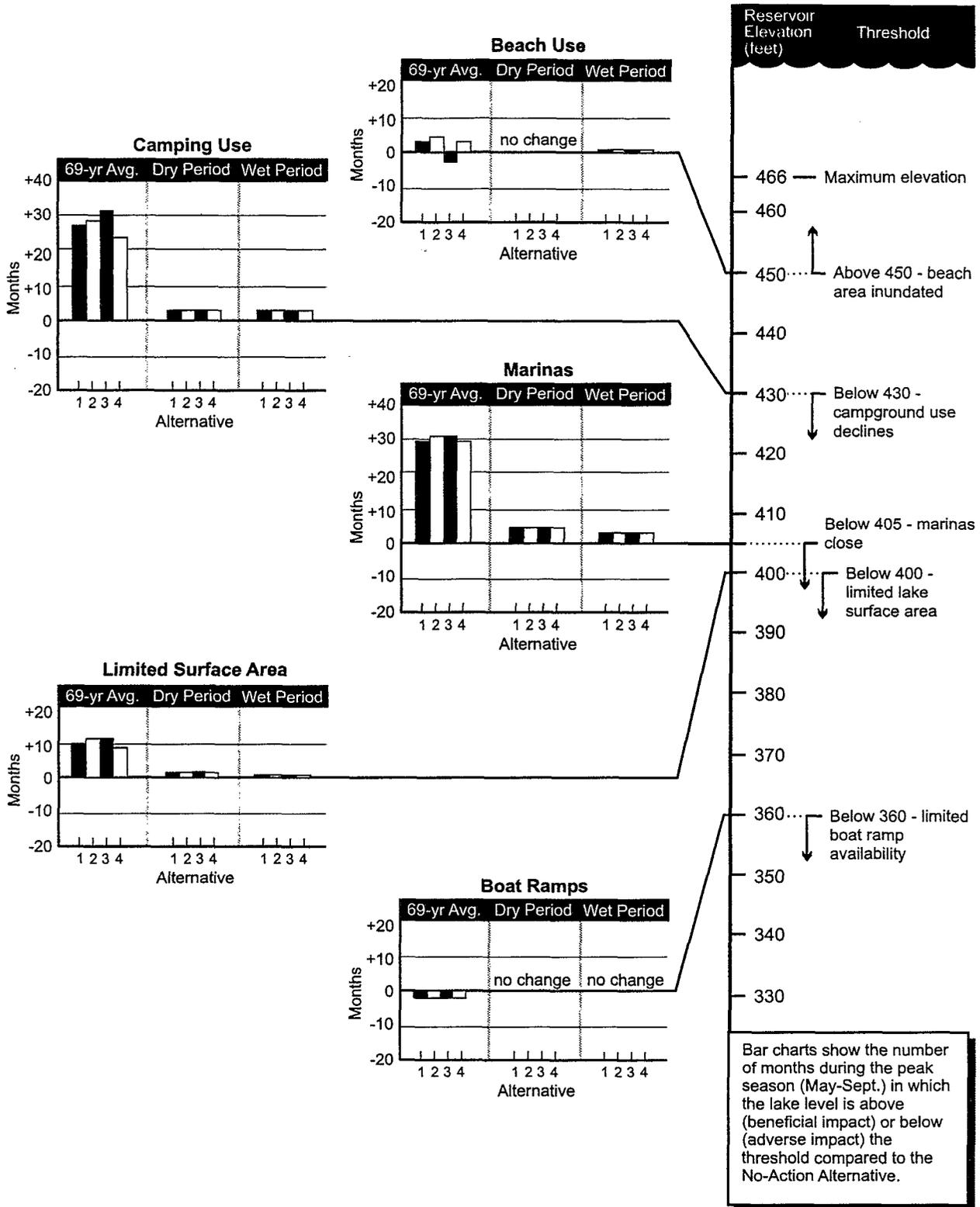


FIGURE III-5

RECREATION OPPORTUNITY THRESHOLDS (PEAK SEASON)
AT FOLSOM LAKE

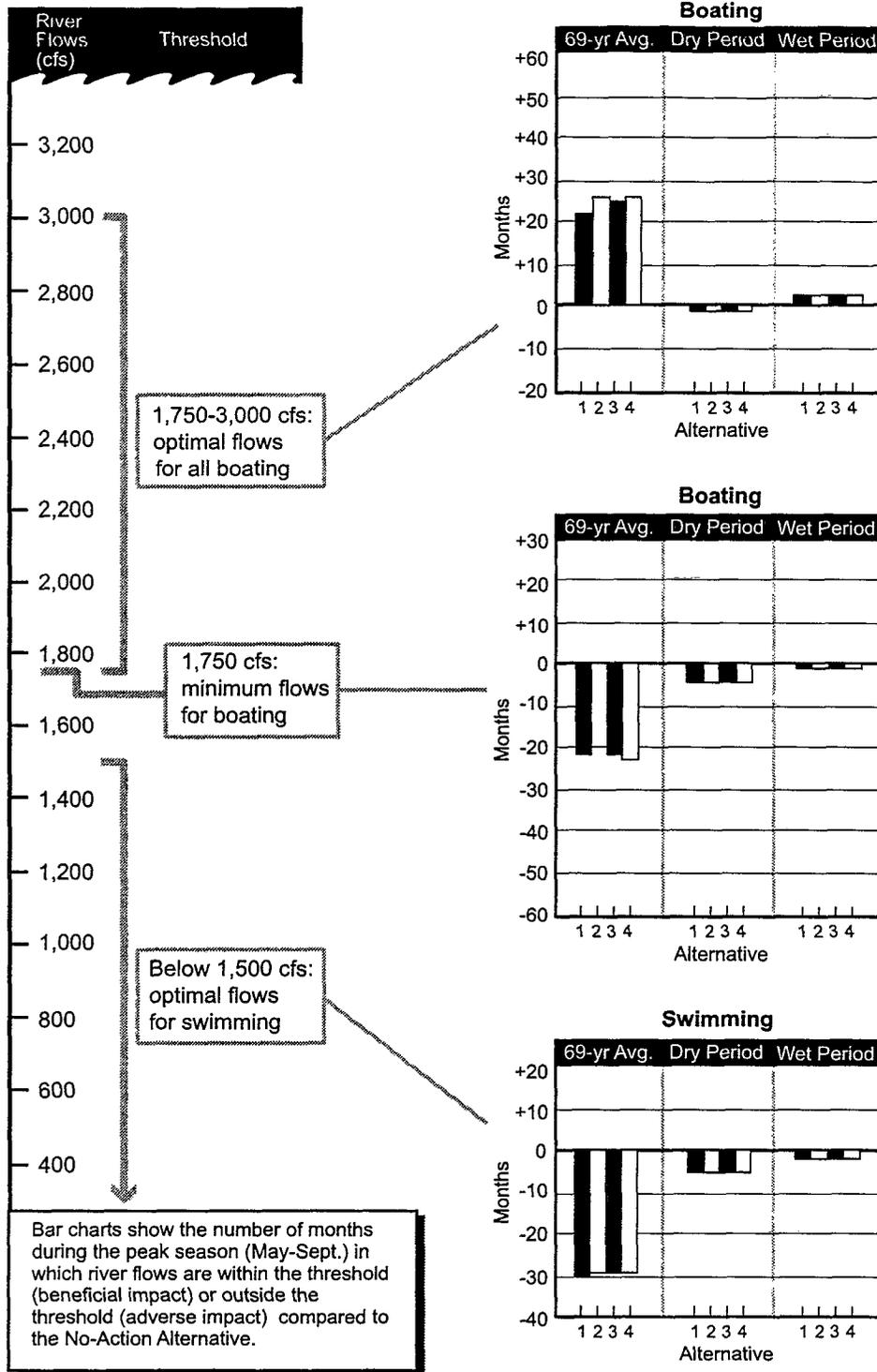


FIGURE III-6

RECREATION OPPORTUNITY THRESHOLDS (PEAK SEASON)
ON THE AMERICAN RIVER

Annual use during the 69-year, dry, and wet hydrologic periods is estimated to increase by less than 2 percent from annual use estimated for the No-Action Alternative (Table III-2 and Figure III-5).

In summary, the surface elevation of Folsom Lake would generally be maintained at higher levels during peak- and off-season periods under Alternative 1 than under the No-Action Alternative. Higher surface elevations would result in a potential beneficial impact on recreation opportunities by increasing the availability of boat access and maintaining the reservoir's surface elevation above the level at which boating becomes constrained and shoreline activities decrease. Although lake levels would fall below some recreation opportunity thresholds more frequently under Alternative 1 than under the No-Action Alternative, these small changes would be outweighed by the larger beneficial effects.

Other Reservoirs

The operations of Whiskeytown Lake, Keswick Reservoir, Lake Red Bluff, New Bullards Bar Reservoir, Englebright Lake, Camp Far West Reservoir, Lake Natoma, and Thermalito Forebay and Afterbay under Alternative 1 are not expected to change relative to the No-Action Alternative. Because operations of these reservoirs would not change, recreation opportunities and visitation are expected to be the same as under the No-Action Alternative.

SACRAMENTO RIVER REGION - RIVERS

Sacramento River

The river flow exceedence frequencies for boating activities on the upper reach of the Sacramento River are shown in Table III-5. On the upper reach, all boating activities would have optimal flows for 31 more peak-season months during the 69-year hydrologic period (Figure III-7). During the wet and dry hydrologic periods, conditions would be nearly the same as described under the No-Action Alternative.

On the lower reach, recreation opportunities are not expected to change because they are less sensitive to changes in river flows, and these flows would be similar to those under the No-Action Alternative.

In summary, the number of months when upper Sacramento River flows would be within the optimal range for all boating activities during the peak season would be greater under Alternative 1 than under the No-Action Alternative. These flows would result in a potential beneficial impact on boating during the peak season. Changes in recreation associated with increased abundance of anadromous fish are discussed in Attachment A.

Feather River

No changes in recreation opportunities associated with river flows are expected under Alternative 1 because recreation is accommodated by a wide range of river flows and these flows would be similar to those under the No-Action Alternative. No impacts on recreation

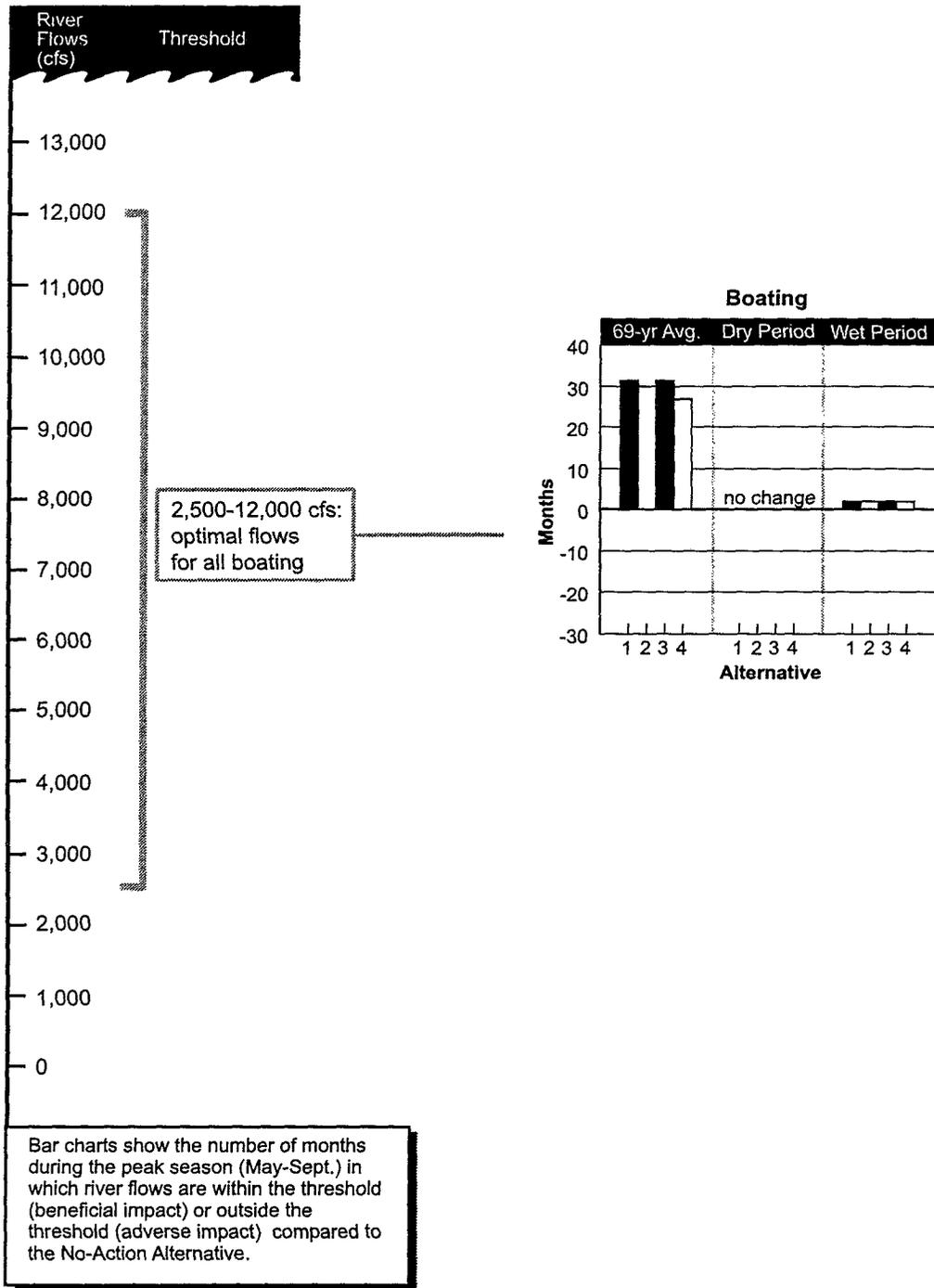


FIGURE III-7

RECREATION OPPORTUNITY THRESHOLDS (PEAK SEASON)
ON THE UPPER SACRAMENTO RIVER

opportunities are expected on the Feather River. Changes in recreation use associated with increased abundance of anadromous fish are discussed in Attachment A.

American River

During the 69-year hydrologic period, river flows would fall within the optimal range for all boating opportunities for 22 more peak-season months and below the minimum level for 22 more peak-season months (Table III-5 and Figure III-6). Although river flows would be below the minimum level for all boating activities more frequently under Alternative 1 than under the No-Action Alternative, this change would be offset by an increase in the frequency with which flows are within the optimal range. As a result of these offsetting changes, boating opportunities on the American River are not expected to change substantially under Alternative 1. River flows would fall below the optimal swimming level for 30 more peak-season months.

During the dry and wet hydrologic periods, boating and swimming opportunities would be nearly the same as under the No-Action Alternative (Table III-5 and Figure III-6).

In summary, the number of months when American River flows would be below the optimal level for swimming during the peak season would be greater under Alternative 1 than under the No-Action Alternative. These lower flows would occur over the entire 69-year hydrologic period and during the dry hydrologic period.

Yuba River

Recreation opportunities on the Yuba River associated with river flows are not expected to change because flows would be similar to those under the No-Action Alternative. Changes in recreation use associated with increased abundance of anadromous fish are discussed in Attachment A.

Clear Creek

Flows during the peak season in Clear Creek under Alternative 1 are expected to be higher than under the No-Action Alternative. These higher flows could slightly enhance rafting and tubing on the lower portion of the creek. Other recreation opportunities are expected to be similar to conditions under the No-Action Alternative.

SACRAMENTO RIVER REGION - WILDLIFE REFUGES AND PRIVATE HUNTING LANDS

Wildlife Refuges

Under Alternative 1, changes in use at NWRs and state WMAs in the Sacramento River Region have been estimated for full Level 2 and critical period water delivery scenarios (Level 2 deliveries reduced by 25 percent).

With full Level 2 deliveries under Alternative 1, Sacramento River Region wildlife refuges would support an additional 3,300 acres of wetlands. Annual visitation to the wildlife refuges is estimated to increase by 24 percent from annual use estimated for the No-Action Alternative

(Table III-6). Waterfowl hunting would increase by 32 percent, followed by fishing and wildlife observation (both increasing by 18 percent).

With critical period deliveries under Alternative 1, total annual visitation to the wildlife refuges is estimated to increase by 17 percent from annual use estimated for the No-Action Alternative (Table III-6). Fishing would increase by 19 percent, followed by wildlife observation (18 percent) and waterfowl hunting (16 percent).

In summary, water deliveries under the full Level 2 and critical period scenarios would result in potential beneficial impacts on recreation opportunities and use at Sacramento River Region wildlife refuges. Under both scenarios, wildlife observation, hunting, and fishing opportunities would benefit as a result of enhanced water deliveries and increased area of wetlands. Potential benefits are expected to be greater with full Level 2 deliveries than with reduced critical period deliveries. This is reflected in higher annual visitation under the full Level 2 delivery scenario than the critical period delivery scenario.

Private Hunting Lands

Waterfowl hunting opportunities on private lands under Alternative 1 are not expected to change from conditions under the No-Action Alternative because water deliveries from the CVP or other water sources to duck clubs and other private hunting lands in the Sacramento Valley would not be affected.

SAN FRANCISCO BAY/SACRAMENTO-SAN JOAQUIN DELTA REGION

Recreation opportunities in the Bay-Delta Region associated with flows and surface elevation are not expected to change under Alternative 1 because the hydrologic characteristics of the Bay-Delta Region are expected to be the same as under the No-Action Alternative. Changes in recreation use associated with increased abundance of anadromous fish are discussed in Attachment A.

SAN JOAQUIN RIVER REGION - RESERVOIRS

San Luis Reservoir

The lake level exceedence frequencies for important recreation activities at San Luis Reservoir under Alternative 1 are shown in Table III-7. Usable surface area for boating would be constrained for 1 less peak-season month and 10 fewer off-season months over the 69-year hydrologic period and 2 fewer off-season months during the dry hydrologic period (Figure III-8). During the wet hydrologic period, recreation opportunities would not change from conditions under the No-Action Alternative.

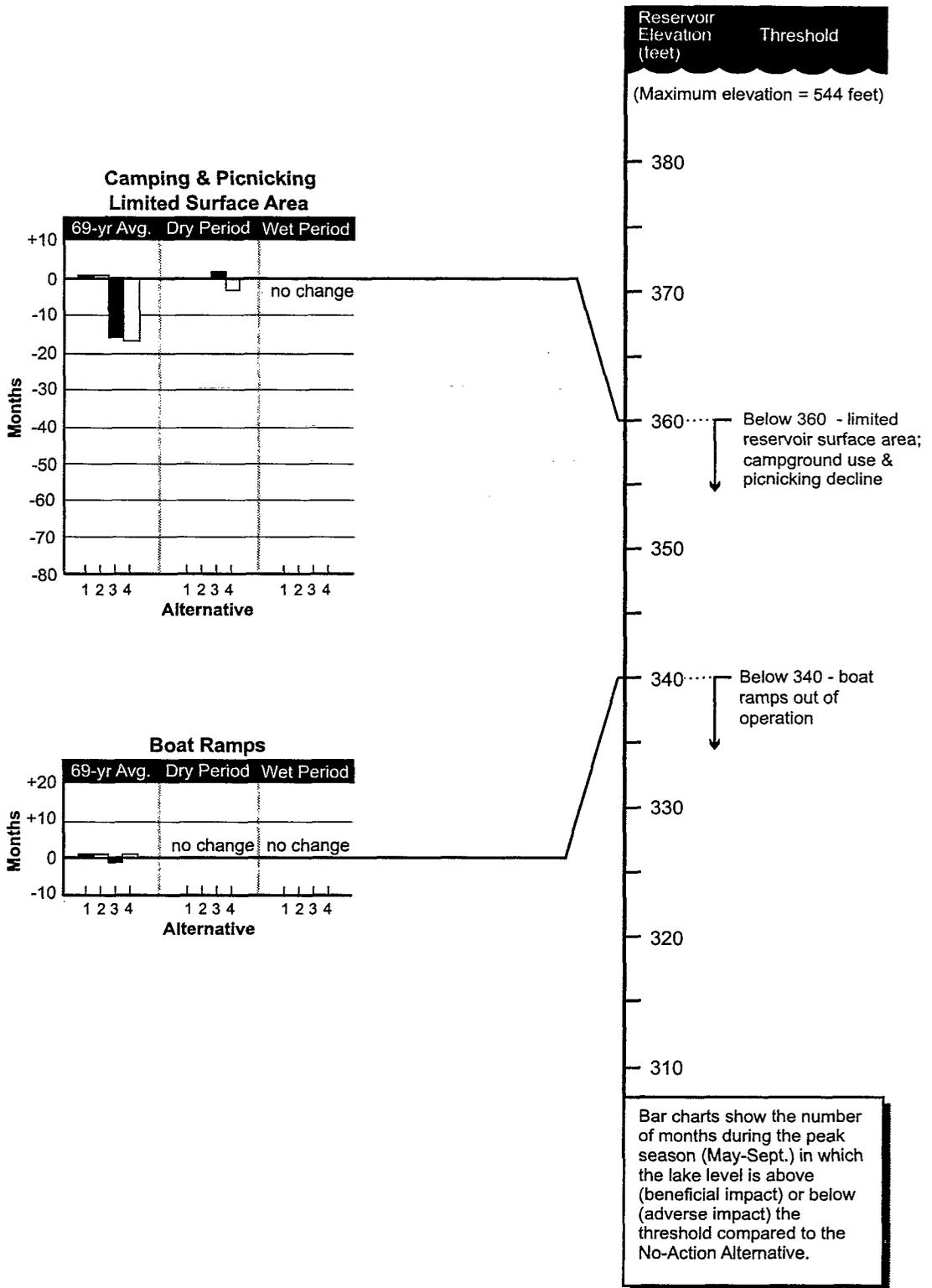


FIGURE III-8

RECREATION OPPORTUNITY THRESHOLDS (PEAK SEASON)
AT SAN LUIS RESERVOIR

Annual use is estimated to increase by less than 1 percent during the 69-year, dry, and wet hydrologic periods compared to the No-Action Alternative (Table III-8).

No potential impacts on recreation at San Luis Reservoir during the 69-year and dry hydrologic periods are expected under Alternative 1 because recreation opportunities would change only very slightly from conditions under the No-Action Alternative.

Millerton Lake

The frequencies with which the reservoir would fall below the levels at which recreation opportunities become constrained during the 69-year, dry, and wet hydrologic periods are the same as under the No-Action Alternative. Annual use during the 69-year, dry, and wet hydrologic periods would not change from use estimated for the No-Action Alternative (Table III-8).

No impacts on recreation at Millerton Lake during the 69-year, dry, and wet hydrologic periods are expected under Alternative 1 because recreation opportunities would not change from conditions under the No-Action Alternative.

New Melones Reservoir

During the 69-year hydrologic period, boat ramps would be unusable for 11 more peak-season months and 13 more off-season months (Table III-10 and Figure III-9). Usable surface area for boating would be constrained for 13 more peak-season months. Marinas would close for 16 more peak-season months. Beach use would decline for 23 more peak-season months. The lake level would be below the level at which camping and picnicking decline for 13 more peak-season months.

The surface elevation of New Melones Reservoir would remain below the elevation at which boating becomes constrained for two more entire peak-season periods and one more entire off-season period. Boat ramps would be unusable for one more entire peak-season period and one more entire off-season period.

During the dry hydrologic period, boat ramps would be unusable for eight more peak-season months and seven more off-season months (Table III-10 and Figure III-10). Usable surface area for boating would be constrained for eight more peak-season months and nine more off-season months. Marinas would close for 10 more peak-season months. The reservoir surface elevation would be below the level at which beach use declines for 14 more peak-season months and below the level at which camping and picnicking decline for 8 more peak-season months. The surface elevation of New Melones Reservoir would remain below the elevation at which boating becomes constrained for one fewer entire peak-season period and below the elevation at which boat ramps are unusable for one more entire peak-season period.

During the wet hydrologic period, the frequency of reservoir levels falling below those at which recreation opportunities become constrained would not change from conditions under the No-Action Alternative.

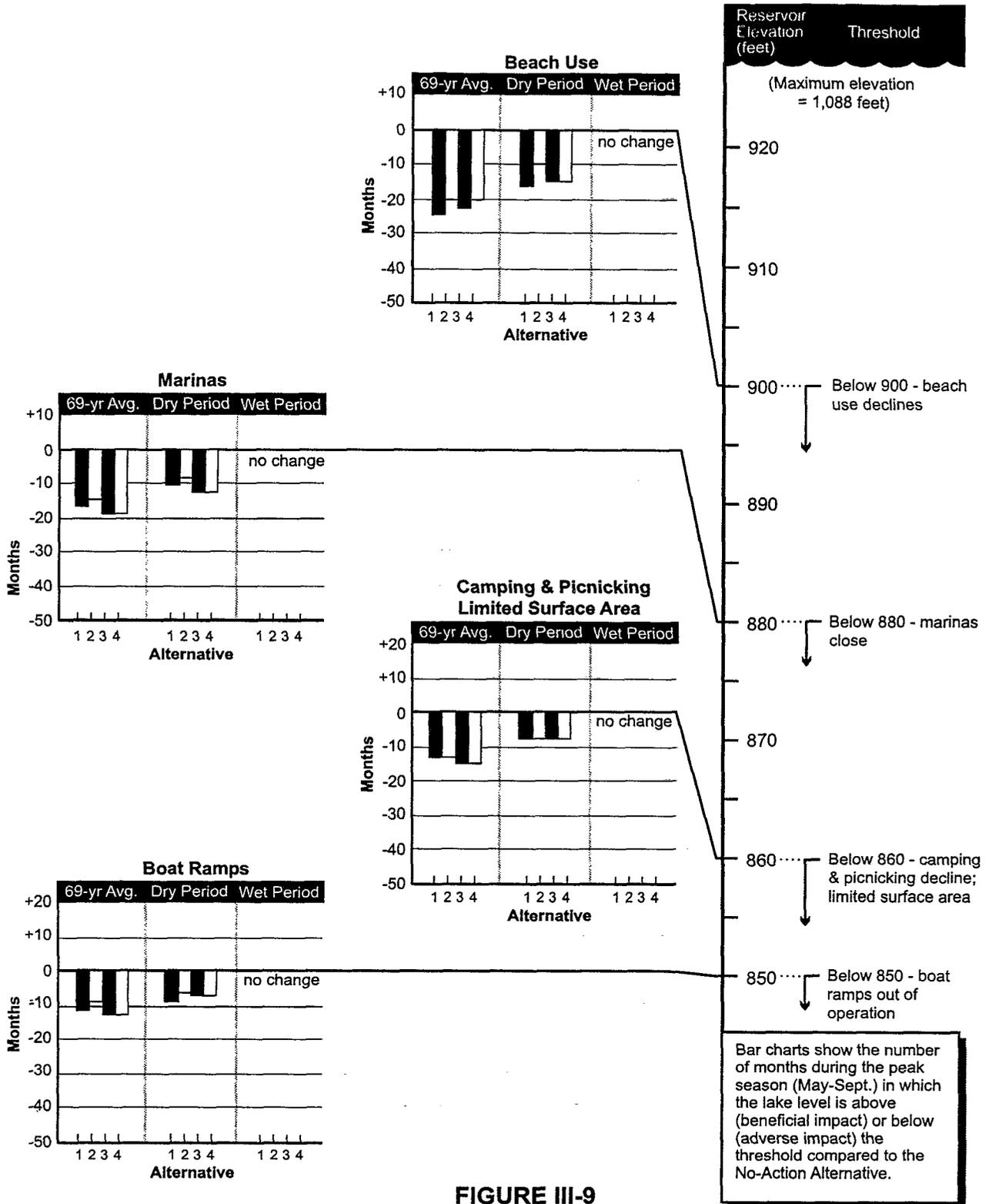


FIGURE III-9

RECREATION OPPORTUNITY THRESHOLDS (PEAK SEASON)
AT NEW MELONES RESERVOIR

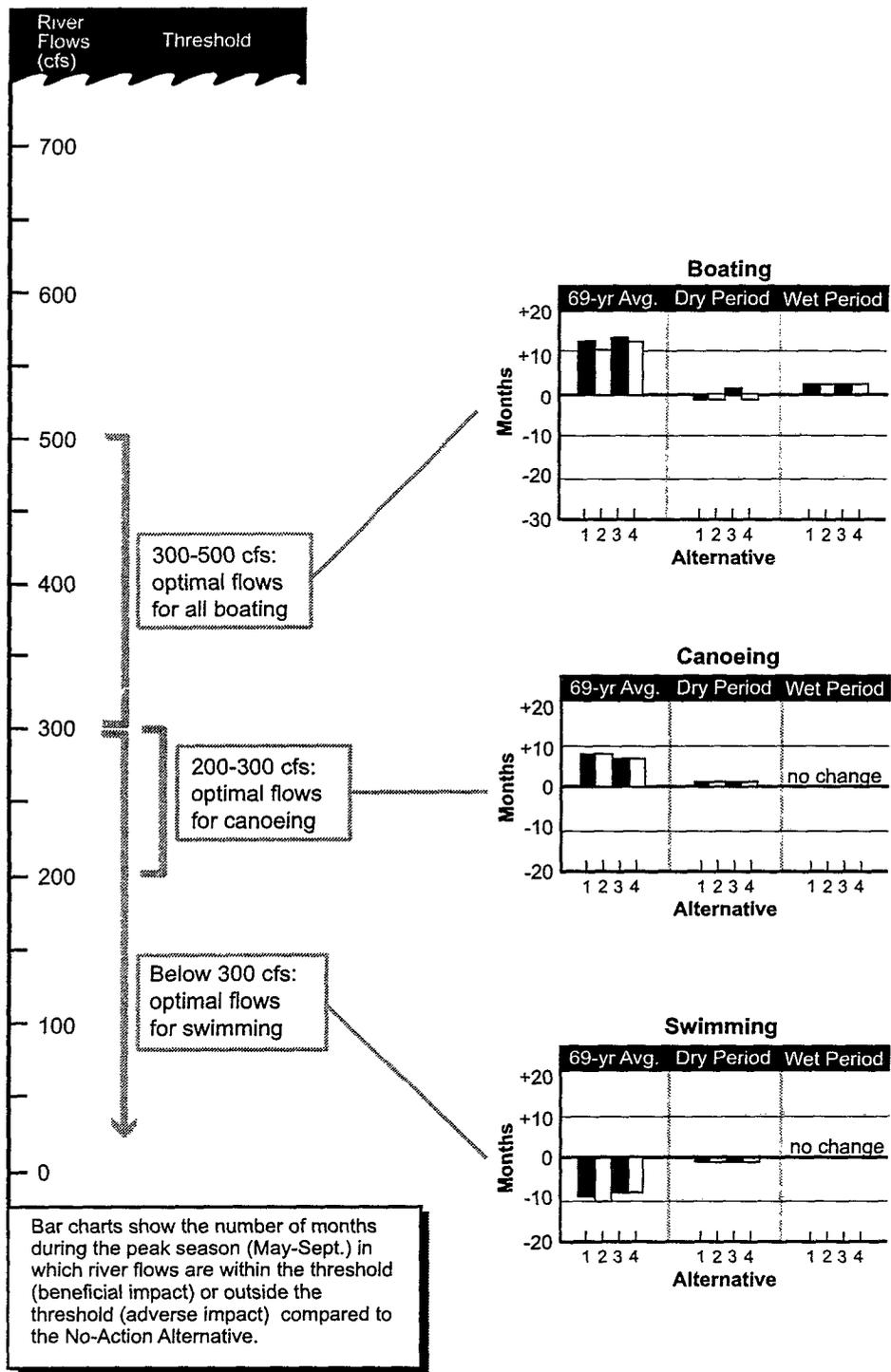


FIGURE III-10

RECREATION OPPORTUNITY THRESHOLDS (PEAK SEASON)
ON THE LOWER SAN JOAQUIN RIVER

Annual use at New Melones Reservoir is estimated to decrease by approximately 1 percent during the 69-year hydrologic period, decrease by approximately 6 percent during the dry hydrologic period, and decrease by less than 1 percent during the wet hydrologic period.

In summary, the surface elevation of New Melones Reservoir would fall below the levels at which boating becomes constrained and boat ramps become unusable more frequently under Alternative 1 than under the No-Action Alternative. These lower levels would occur throughout the 69-year hydrologic period and during the dry hydrologic period and could result in an impact on boating opportunities at the reservoir.

In addition, the surface elevation of New Melones Reservoir would fall more frequently below levels at which shoreline recreation opportunities decline under Alternative 1 than under the No-Action Alternative. These lower surface elevations would occur throughout the 69-year hydrologic period and during the dry hydrologic period and could result in an impact on shoreline recreation opportunities at the reservoir.

Non-CVP and SWP Reservoirs

Water-dependent and water-enhanced recreation opportunities at Camanche Reservoir, New Don Pedro Reservoir, New Hogan Lake, and Lake McClure during the 69-year hydrologic period under Alternative 1 would be nearly the same as under the No-Action Alternative. Recreation opportunities at the four reservoirs during the dry and wet hydrologic periods would be the same as under the No-Action Alternative.

Compared to the No-Action Alternative, combined recreation use at the four reservoirs is expected to decrease by less than 1 percent during the 69-year and dry hydrologic periods and increase by less than 1 percent during the wet hydrologic period.

No changes in recreation opportunities at Camanche Reservoir, New Don Pedro Reservoir, New Hogan Lake, and Lake McClure during the 69-year hydrologic period are expected under Alternative 1 because lake levels would change only very slightly from conditions under the No-Action Alternative.

Other Reservoirs

Recreation opportunities at Bethany Reservoir and O'Neill Forebay under Alternative 1 are not expected to change because lake levels would be similar to conditions under the No-Action Alternative.

SAN JOAQUIN RIVER REGION - RIVERS

San Joaquin River

The river flow exceedence frequencies during the 69-year, dry, and wet hydrologic periods for important recreation opportunities on the San Joaquin River under Alternative 1 are shown in Table III-10. For the lower reach, river flows would be within the optimal range for canoeing during 7 more peak-season months and within the optimal range for all other boating for 16 more

peak-season months (Figure III-10). River flows would be below the optimal level for swimming for seven more peak-season months.

During the dry and wet hydrologic periods, recreation opportunities would be nearly the same as under the No-Action Alternative.

Annual use would decrease by less than 1 percent during the 69-year hydrologic period, decrease by approximately 1 percent during the dry hydrologic period, and increase by less than 1 percent during the wet hydrologic period (Table III-11).

No impacts on recreation on the San Joaquin River over the 69-year, dry, and wet hydrologic periods are expected under Alternative 1 because recreation opportunities would change only slightly from conditions under the No-Action Alternative.

Stanislaus River

During the 69-year hydrologic period, river flows on the upper reach would fall within the optimal range for all types of boating activities during seven fewer peak-season months (Table III-10 and Figure III-11). For the lower reach, river flows would be within the optimal range for all boating activities 19 more peak-season months. River flows would be above the minimum level for all boating activities 58 more peak-season months.

During the dry hydrologic period, river flows on the upper reach would be outside the optimal range for all boating activities for one more peak-season month (Table III-10). For the lower reach, river flows would be within the optimal range for boating activities for one less peak-season month and would fall below the minimum level for all boating activities for two fewer peak-season months (Figure III-11).

During the wet hydrologic period, river flows would be within the optimal range for all boating activities for one more peak-season month (Table III-10). For the lower reach, river flows would be inside the optimal range for all boating activities for three more peak-season months and would be above the minimum level for boating activities for one more peak-season month.

Annual use for the entire Stanislaus River is estimated to increase by less than 1 percent during the 69-year hydrologic period, increase by approximately 3 percent during the dry hydrologic period, and decrease by less than 1 percent during the wet hydrologic period (Table III-11).

In summary, flows on the lower reach of the river would be maintained at higher levels during the peak use season over the 69-year hydrologic period more frequently under Alternative 1 than under the No-Action Alternative. These higher flows could result in a beneficial impact on recreation opportunities by increasing the frequency of minimum flows necessary for boating.

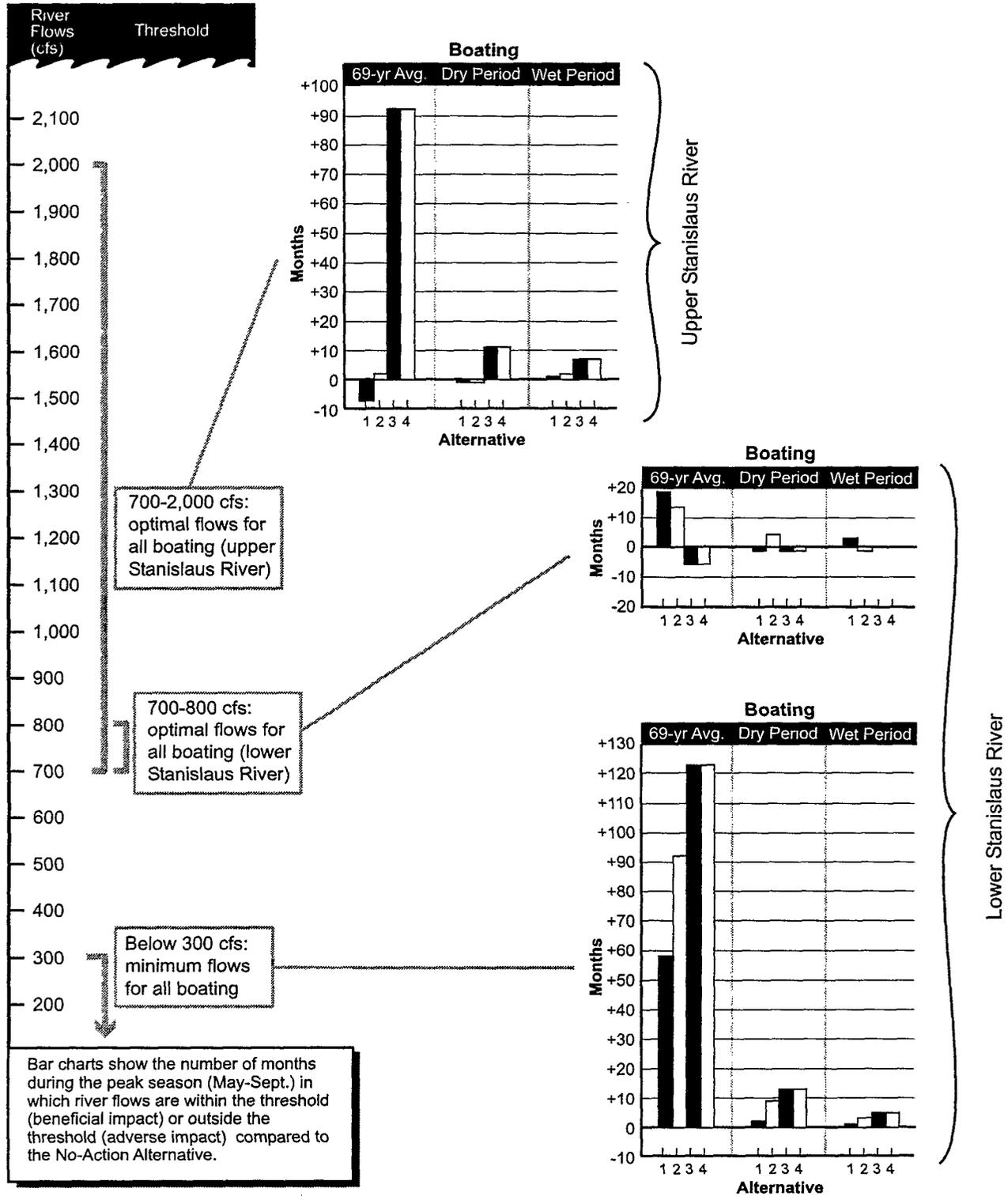


FIGURE III-11

RECREATION OPPORTUNITY THRESHOLDS (PEAK SEASON)
ON THE STANISLAUS RIVER

Non-CVP and SWP Rivers

During the 69-year hydrologic period, boating and swimming opportunities on the Tuolumne and Mokelumne rivers under Alternative 1 would be the same as conditions under the No-Action Alternative. Boating and swimming opportunities on the Merced River under Alternative 1 would increase slightly compared to the No-Action Alternative.

During the dry and wet hydrologic periods, boating and swimming opportunities on the Tuolumne and Mokelumne rivers under Alternative 1 would be the same as conditions under the No-Action Alternative. On the Merced River, boating opportunities are not expected to change and swimming opportunities would increase slightly compared to the No-Action Alternative.

Compared to the No-Action Alternative, combined recreation use on the Tuolumne and Merced rivers would increase by less than 1 percent during the 69-year hydrologic period, and decrease by less than 1 percent during the dry and wet hydrologic periods.

California Aqueduct and Delta-Mendota Canal

Recreation opportunities provided by the California Aqueduct and Delta-Mendota Canal are not expected to change relative to the No-Action Alternative because water levels in the canals would be held at constant levels.

SAN JOAQUIN RIVER REGION - WILDLIFE REFUGES AND PRIVATE HUNTING LANDS

Wildlife Refuges

Under Alternative 1, changes in use at NWRs and state WMAs in the San Joaquin River Region have been estimated for full Level 2 and critical period water delivery scenarios.

With full Level 2 deliveries under Alternative 1, San Joaquin River Region wildlife refuges would support an additional 25,700 acres of wetlands. Annual visitation to the wildlife refuges is estimated to increase by 28 percent (Table III-12). Waterfowl hunting would increase by 50 percent, followed by fishing (11 percent) and wildlife observation (10 percent).

With critical period deliveries under Alternative 1, total annual visitation to the wildlife refuges is estimated to increase by 17 percent (Table III-12). Waterfowl hunting would increase by 29 percent, followed by fishing (12 percent) and wildlife observation (9 percent).

In summary, water deliveries under the full Level 2 and critical period scenarios would result in potential beneficial impacts on recreation opportunities and use at San Joaquin River Region wildlife refuges. Under both water delivery scenarios, wildlife observation, hunting, and fishing opportunities would potentially benefit as a result of enhanced water deliveries and increased wetland acreages. However, changes in use would be greater with full Level 2 deliveries than with critical period delivery. This is reflected in the increase in total recreation use estimated for each scenario.

Private Hunting Lands

Waterfowl hunting opportunities on private clubs are not expected to change from conditions under the No-Action Alternative because duck clubs and other private hunting lands are expected to receive their historical water deliveries.

TULARE LAKE REGION - WILDLIFE REFUGES AND PRIVATE HUNTING LANDS

Wildlife Refuges

Under Alternative 1, changes in use at NWRs and state WMAs in the Tulare Lake Region have been estimated for full Level 2 and critical period water delivery scenarios.

With full Level 2 deliveries, recreation opportunities and visitation to wildlife refuges in the Tulare Lake Region are not expected to change because water deliveries in the refuges would be the same as under the No-Action Alternative (Table III-13).

With critical period deliveries, annual visitation to Tulare Lake Region wildlife refuges is estimated to increase by 7 percent compared to the No-Action Alternative (Table III-13). Wildlife observation is the only activity that would increase.

Compared to the No-Action Alternative, overall changes in recreation opportunities at wildlife refuges in the Tulare Lake Region would improve slightly under Alternative 1.

Private Hunting Lands

Waterfowl hunting opportunities on private hunting lands are not expected to change from conditions under the No-Action Alternative because duck clubs and other private hunting lands should continue to receive historical water deliveries.

PACIFIC COAST REGION

Changes in recreation use associated with increased abundance of anadromous fish in the Pacific Coast Region are discussed in Attachment A.

SAN FRANCISCO BAY REGION

Under Alternative 1, CVP water deliveries to water districts in the San Francisco Bay Region would be slightly less than under the No-Action Alternative. Lower annual deliveries would be made in 9 years to CCWD and in 27 years to the SCVWD. These lower deliveries are not expected to result in a substantial change in recreation opportunities at reservoirs operated by these districts because the change is a small percentage of total annual deliveries.

SUPPLEMENTAL ANALYSIS 1i

Under this supplemental analysis, the gates at Red Bluff Diversion Dam would be raised year-round, which would permanently drain Lake Red Bluff and reestablish a free-flowing Sacramento River during the peak recreation season. This action would potentially affect flatwater recreation opportunities occurring at Lake Red Bluff.

Flatwater recreation opportunities for boating, water skiing, jet skiing, and swimming that normally occur during the summer would be affected. Two boat ramps operated by the City of Red Bluff and a water ski course would become unusable if the gates were permanently raised. Camping near Lake Red Bluff could also be affected, although most camping near the lake is associated with fishing on the Sacramento River (Guthrie, pers. comm.). The annual boat drag races held on Memorial Day weekend would be eliminated and the squawfish derby would be affected by reducing the area available to hold the event. Annual visitation to the lake would be affected.

In summary, the permanent raising of gates at Lake Red Bluff would potentially affect recreation at the lake by eliminating flatwater recreation opportunities and the annual boat drag races held during the Memorial Day weekend and by reducing the area used for the squawfish derby. Reestablishing a free-flowing Sacramento River through the area that is inundated by Lake Red Bluff could potentially benefit recreation by increasing river fishing and off-highway vehicle recreation opportunities.

ALTERNATIVE 2

This section describes changes in recreation opportunities and use at important recreation sites under Alternative 2 compared to the No-Action Alternative.

SACRAMENTO RIVER REGION - RESERVOIRS**Shasta Lake**

The lake level exceedence frequencies for important recreation opportunities on the main area of the reservoir (Shasta Dam to the Pit River Bridge) and the McCloud River, Pit River, and Sacramento River arms are shown in Table III-1. The changes in recreation opportunities under Alternative 2 compared to the No-Action Alternative would be nearly the same as the changes discussed under Alternative 1 (Figures III-1, III-2, and III-3).

Annual use is estimated to decrease by approximately 2 percent during the 69-year hydrologic period and by less than 1 percent during the dry and wet hydrologic periods (Table III-2).

The surface elevations of Shasta Lake would fall below the levels at which boating becomes constrained on the Pit River and Sacramento River arms more frequently under Alternative 2 than under the No-Action Alternative. This potential impact would occur during off-season months.

Lake Oroville

The lake level exceedence frequencies for important recreation opportunities at Lake Oroville under Alternative 2 are shown in Table III-3. The changes in recreation opportunities under Alternative 2 compared to the No-Action Alternative would be nearly the same as the changes discussed under Alternative 1 (Figure III-4).

Annual use is estimated to increase by less than 1 percent during the 69-year, dry, and wet hydrologic periods (Table III-2).

In summary, the surface elevation of Lake Oroville would generally be maintained at higher levels during peak- and off-season periods under Alternative 2 than under the No-Action Alternative. Higher surface elevations would potentially benefit recreation opportunities by increasing the availability of boat access and increasing the frequency with which the reservoir's surface elevation is above the level at which boating becomes constrained and shoreline activities decrease. Although lake levels would fall below some recreation opportunity thresholds more frequently under Alternative 2 than under the No-Action Alternative, these small changes would be outweighed by the larger beneficial effects.

Folsom Lake

The reservoir level exceedence frequencies for important recreation opportunities at Folsom Lake are shown in Table III-4. The changes in recreation opportunities under Alternative 2 compared to the No-Action Alternative would be nearly the same as the changes discussed under Alternative 1.

Annual use is estimated to increase by approximately 2 percent during the 69-year, dry, and wet hydrologic periods (Table III-2).

The surface elevation of Folsom Lake would generally be maintained at higher levels during peak- and off-season periods under Alternative 2 than under the No-Action Alternative. Higher surface elevations would potentially benefit recreation opportunities by increasing the availability of boat access and increasing the frequency with which the reservoir's surface elevation is above the level at which boating becomes constrained and shoreline activities decrease. Although lake levels would fall below some recreation opportunity thresholds more frequently under Alternative 2 than under the No-Action Alternative, these small changes would be outweighed by the larger beneficial effects.

Other Reservoirs

The operations of Whiskeytown Lake, Keswick Reservoir, Lake Red Bluff, New Bullards Bar Reservoir, Englebright Lake, Camp Far West Reservoir, Lake Natoma, and Thermalito Forebay and Afterbay under Alternative 2 are not expected to change relative to the No-Action Alternative. Because the operations of these reservoirs would not change, recreation opportunities and visitation are expected to be the same as under the No-Action Alternative.

SACRAMENTO RIVER REGION - RIVERS**Sacramento River**

The river flow exceedence frequencies for boating on the upper Sacramento River are shown in Table III-5 and Figure III-7. The changes in recreation opportunities under Alternative 2 compared to the No-Action Alternative would be nearly the same as the changes discussed under Alternative 1. Changes in recreation use associated with increased abundance of anadromous fish are discussed in Attachment A.

The number of months when upper Sacramento River flows would be within the optimal range for all boating activities during the peak season would be greater under Alternative 2 than under the No-Action Alternative. These flows would result in a potential beneficial impact on boating during the peak season.

American River

The river flow exceedence frequencies for boating and swimming on the American River under Alternative 2 are shown in Table III-5 and Figure III-6. The changes in recreation opportunities under Alternative 2 compared to the No-Action Alternative would be nearly the same as the changes discussed under Alternative 1. Changes in recreation use associated with increased abundance of anadromous fish are discussed in Attachment A.

The number of months when river flow would be below the optimal level for swimming on the American River during the peak season would be greater under Alternative 2 than under the No-Action Alternative. These lower flows would occur over the entire 69-year hydrologic period and during the dry hydrologic period.

Other Rivers

Recreation opportunities on the Sacramento, Feather, and Yuba rivers and Clear Creek under Alternative 2 would be the same as described under Alternative 1, with no significant changes compared to the No-Action Alternative. Changes in recreation use associated with increased abundance of anadromous fish are discussed in Attachment A.

SACRAMENTO RIVER REGION - WILDLIFE REFUGES AND PRIVATE HUNTING LANDS**Wildlife Refuges**

Under Alternative 2, changes in use at NWRs and state WMAs in the Sacramento River Region have been estimated for Level 4 water deliveries and critical period deliveries.

With Level 4 deliveries under Alternative 2, the Sacramento River Region wildlife refuges would support an additional 5,100 acres of wetlands. Annual visitation to the wildlife refuges is expected to increase by 63 percent (Table III-6). Waterfowl hunting would increase by 91 percent, followed by fishing (40 percent) and wildlife observation (39 percent).

With critical period deliveries under Alternative 2, total annual visitation to wildlife refuges is estimated to increase by 47 percent (Table III-6). Waterfowl hunting would increase by 53 percent, followed by fishing (42 percent) and wildlife observation (39 percent).

Water deliveries under the Level 4 and critical period scenarios would result in potential beneficial impacts on recreation opportunities and use at Sacramento River Region wildlife refuges. Under both water delivery scenarios, wildlife observation, hunting, and fishing opportunities would potentially benefit as a result of enhanced water deliveries and increases in wetland acreages. However, changes in use would be greater with full Level 4 deliveries than with critical period delivery. This is reflected in the increase in total recreation use estimated for each scenario.

Private Hunting Lands

Waterfowl hunting opportunities on private clubs under Alternative 2 are not expected to change from conditions under the No-Action Alternative because water deliveries from the CVP or other water sources to duck clubs and other private hunting lands in the Sacramento Valley would not be affected.

SAN FRANCISCO BAY/SACRAMENTO-SAN JOAQUIN DELTA REGION

Recreation opportunities in the Bay-Delta Region associated with flows and surface elevation are not expected to change under Alternative 2 because the hydrologic characteristics of the Bay-Delta Region are expected to be the same as under the No-Action Alternative. Changes in recreation use associated with increased abundance of anadromous fish are discussed in Attachment A.

SAN JOAQUIN RIVER REGION - RESERVOIRS

San Luis Reservoir

Changes in recreation opportunities at San Luis Reservoir over the 69-year, dry, and wet hydrologic periods under Alternative 2 would be the same as described under Alternative 1 (Table III-7 and Figure III-8). Annual use is estimated to increase by less than 1 percent during the 69-year and dry hydrologic periods and decrease by less than 1 percent during the wet hydrologic period (Table III-8).

No impacts on recreation at San Luis Reservoir during the 69-year and dry hydrologic periods are expected under Alternative 2 because recreation opportunities would change only very slightly from the No-Action Alternative.

Millerton Lake

Reservoir levels are projected to be below important recreation opportunity thresholds during the 69-year, dry, and wet hydrologic periods and would occur with the same frequency as under the No-Action Alternative. Annual use during the 69-year, dry, and wet hydrologic periods would not change from use estimated for the No-Action Alternative (Table III-8).

No impacts on recreation at Millerton Lake during the 69-year hydrologic period are expected under Alternative 2 because recreation opportunities would not change from conditions under the No-Action Alternative.

New Melones Reservoir

The lake level exceedence frequencies for important recreation opportunities at New Melones Reservoir during the 69-year, dry, and wet hydrologic periods are shown in Table III-9. The changes in recreation opportunities under Alternative 2 compared to the No-Action Alternative would be nearly the same as the changes discussed under Alternative 1 (Figure III-9).

Annual use is estimated to decrease by approximately 1 percent during the 69-year hydrologic period, 5 percent during the dry hydrologic period, and less than 1 percent during the wet hydrologic period (Table III-8).

The surface elevations of New Melones Reservoir would fall below the levels at which boating becomes constrained and ramps unusable more frequently under Alternative 2 than under the No-Action Alternative. These lower levels would occur throughout the 69-year hydrologic period and during the dry hydrologic period and could result in an impact on boating opportunities at the reservoir.

The surface elevations of New Melones Reservoir would fall below levels at which shoreline recreation opportunities decline more frequently under Alternative 2 than under the No-Action Alternative. These lower surface elevations would occur throughout the 69-year hydrologic period and during the dry hydrologic period and could result in an impact on shoreline recreation opportunities at the reservoir.

Non-CVP and SWP Reservoirs

The changes in recreation opportunities at Camanche Reservoir, New Don Pedro Reservoir, New Hogan Lake, and Lake McClure under Alternative 2 compared to the No-Action Alternative would be the same as described under Alternative 1. No impacts on recreation opportunities are expected.

Compared to the No-Action Alternative, combined recreation use at the four reservoirs is expected to decrease by less than 1 percent during 69-year and wet hydrologic periods and increase by less than 1 percent during the dry hydrologic period.

Other Reservoirs

Recreation opportunities at Bethany Reservoir and O'Neill Forebay under Alternative 2 are not expected to change because lake levels would be similar to conditions under the No-Action Alternative.

SAN JOAQUIN RIVER REGION - RIVERS**San Joaquin River**

The river flow exceedence frequencies for important recreation activities on the San Joaquin River under Alternative 2 are shown in Table III-10. The changes in recreation opportunities under Alternative 2 compared to the No-Action Alternative would be nearly the same as the changes discussed under Alternative 1 (Figure III-10). No impacts on recreation on the San Joaquin River are expected under Alternative 2 because recreation opportunities would change only slightly from conditions under the No-Action Alternative.

Compared to the No-Action Alternative, annual use under Alternative 2 is estimated to decrease by less than 1 percent during the 69-year, dry, and wet hydrologic periods (Table III-11).

Stanislaus River

The river flow exceedence frequencies for important recreation opportunities on the Stanislaus River under Alternative 2 are shown in Table III-10. On the lower reach, river flows would be within the optimal range for all boating activities 14 more peak-season months and above the minimum level for all boating activities 92 more peak-season months (Figure III-11). During the dry hydrologic period, river flows would be within the optimal range for all boating four more peak-season months and above the minimum level for all boating nine more peak-season months. Changes in other recreation opportunities during the dry and wet hydrologic periods would be the same as described under Alternative 1.

Annual use for the entire Stanislaus River is estimated to increase by approximately 1 percent during the 69-year hydrologic period, increase by approximately 7 percent during the dry hydrologic period, and decrease by less than 1 percent during the wet hydrologic period (Table III-11).

In summary, river flows on the lower reach of the Stanislaus River would be maintained at higher levels during the peak-use season over the 69-year hydrologic period more frequently under Alternative 2 than under the No-Action Alternative. These higher flows could result in a potential beneficial impact on recreation opportunities by increasing the frequency of minimum flows necessary for boating.

Non-CVP and SWP Rivers

During the 69-year hydrologic period, flows on the Tuolumne and Merced rivers would be above the flows necessary to conduct boating activities and within the optimal range for swimming much more frequently under Alternative 2 than under the No-Action Alternative. On the Calaveras and Mokelumne rivers, no changes in recreation opportunities are expected because river flows would be nearly the same as under the No-Action Alternative.

During the dry and wet hydrologic periods, flows on the Tuolumne and Merced rivers would be above the minimum level necessary to conduct boating activities slightly more frequently under Alternative 2 than under the No-Action Alternative. River flows would be above the minimum

level for swimming on the Tuolumne River and within the optimal range for swimming on the Merced River slightly more frequently under Alternative 2 than under the No-Action Alternative. On the Calaveras and Mokelumne rivers, no changes in recreation opportunities are expected during the dry and wet hydrologic periods because river flows would be nearly the same as under the No-Action Alternative.

Compared to the No-Action Alternative, combined recreation use on the Tuolumne and Merced rivers would increase by less than 1 percent during the 69-year and wet hydrologic periods and increase by approximately 4 percent during the dry hydrologic period.

In summary, an increase in boating and swimming opportunities would occur on the Tuolumne and Merced rivers under Alternative 2 compared to the No-Action Alternative. Improved opportunities for boating and swimming would occur because river flows would be maintained more frequently above the minimum flows necessary to conduct these activities.

California Aqueduct and Delta-Mendota Canal

Recreation opportunities provided by the California Aqueduct and the Delta-Mendota Canal under Alternative 2 are not expected to change relative to the No-Action Alternative because water levels in the canals would be held at constant levels.

SAN JOAQUIN RIVER REGION - WILDLIFE REFUGES AND PRIVATE HUNTING LANDS

Wildlife Refuges

Under Alternative 2, changes in use at NWRs and state WMAs in the San Joaquin River Region have been estimated for Level 4 water deliveries and critical period deliveries.

With Level 4 deliveries under Alternative 2, the San Joaquin River Region refuges would support an additional 25,700 acres of wetlands. Annual visitation to the wildlife refuges is expected to increase by 65 percent (Table III-12). Waterfowl hunting would increase by 116 percent, followed by fishing (28 percent) and wildlife observation (26 percent).

With critical period deliveries under Alternative 2, total annual visitation to wildlife refuges is estimated to increase by 42 percent (Table III-12). Waterfowl hunting would increase by 69 percent, followed by fishing (29 percent) and wildlife observation (24 percent).

Water deliveries under the Level 4 and critical period scenarios would potentially benefit recreation opportunities and use at San Joaquin River Region wildlife refuges. Under both water delivery scenarios, wildlife observation, hunting, and fishing opportunities would potentially benefit as a result of enhanced water deliveries and increases in wetland acreages. However, changes in use would be greater with full Level 4 deliveries than with critical period delivery. This is reflected in the increase in total recreation use estimated for each scenario.

Private Hunting Lands

Waterfowl hunting opportunities on private clubs under Alternative 2 are not expected to change from conditions under the No-Action Alternative because duck clubs and private hunting lands are expected to receive their historical water deliveries.

TULARE LAKE REGION - WILDLIFE REFUGES AND PRIVATE HUNTING LANDS

Under Alternative 2, changes in use at federal and state wildlife refuges in the Tulare Lake Region have been estimated for Level 4 water deliveries and critical period deliveries.

Wildlife Refuges

With Level 4 deliveries under Alternative 2, the Tulare Lake Region wildlife refuges would support an additional 12,400 acres of wetlands. Annual visitation to the wildlife refuges is estimated to increase by 150 percent (Table III-13). Wildlife observation would increase by 149 percent and fishing would increase by 160 percent.

With critical period deliveries under Alternative 2, annual visitation to the wildlife refuges is estimated to increase by 165 percent (Table III-13). Wildlife observation would increase by 170 percent and fishing would increase by 125 percent.

In summary, water deliveries under the Level 4 and critical period scenarios would potentially benefit recreation opportunities and use at Tulare Lake Region wildlife refuges. Under both water delivery scenarios, wildlife observation, hunting, and fishing opportunities would potentially benefit as a result of enhanced water deliveries and increased wetland acreages. However, changes in use would be greater with full Level 4 deliveries than with critical period delivery. This is reflected in the increase in total recreation use estimated for each scenario.

Private Hunting Lands

Waterfowl hunting opportunities on private clubs under Alternative 2 are not expected to change from conditions under the No-Action Alternative because duck clubs and other private hunting lands should continue to receive historical water deliveries.

PACIFIC COAST REGION

Changes in recreation use associated with increased abundance of anadromous fish in the Pacific Coast Region are discussed in Attachment A.

SAN FRANCISCO BAY REGION

Changes in recreation opportunities at reservoirs in the San Francisco Bay Region would be similar to the changes discussed under Alternative 1.

ALTERNATIVE 3

This section describes changes in recreation opportunities and use at important recreation sites under Alternative 3 compared to the No-Action Alternative.

SACRAMENTO RIVER REGION - RESERVOIRS

Shasta Lake

The lake level exceedence frequencies for important recreation opportunities on the main area of the reservoir (Shasta Dam to the Pit River Bridge) and the McCloud River, Pit River, and Sacramento River arms are shown in Table III-1. The changes in recreation opportunities under Alternative 3 compared to the No-Action Alternative would be nearly the same as the changes discussed under Alternative 1 (Figures III-1, III-2, and III-3).

Annual use is estimated to decrease by approximately 1 percent during the 69-year and dry hydrologic periods, and would not change from use under the No-Action Alternative during the dry hydrologic period (Table III-2).

In summary, the surface elevation of Shasta Lake would fall below the levels at which boating becomes constrained on the Pit River and Sacramento River arms more frequently under Alternative 3 than under the No-Action Alternative. This potential impact would occur during off-season months.

Lake Oroville

Lake level exceedence frequencies for important recreation opportunities at Lake Oroville under Alternative 3 are shown in Table III-3. The changes in recreation opportunities under Alternative 3 compared to the No-Action Alternative would be nearly the same as the changes discussed under Alternative 1 (Figure III-4).

Annual use is estimated to increase by approximately 1 percent during the 69-year hydrologic period, by approximately 2 percent during the dry hydrologic period, and by less than 1 percent during the wet hydrologic period (Table III-3).

In summary, the surface elevation of Lake Oroville would generally be maintained at higher levels during peak- and off-season periods under Alternative 3 than under the No-Action Alternative. Higher surface elevations would potentially benefit recreation opportunities by increasing the availability of boat access and increasing the frequency when the reservoir's surface elevation is above the level at which boating becomes constrained and shoreline activities decrease. Although lake levels would fall below some recreation opportunity thresholds more frequently under Alternative 3 than under the No-Action Alternative, these small changes would be outweighed by the larger, potentially beneficial effects.

Folsom Lake

Lake level exceedence frequencies for important recreation opportunities at Folsom Lake under Alternative 3 are shown in Table III-4. The changes in recreation opportunities under Alternative 3 compared to the No-Action Alternative would be nearly the same as the changes discussed under Alternative 1 (Figure III-5).

Annual use is estimated to increase by approximately 2 percent during the 69-year and wet hydrologic periods and by approximately 1 percent during the dry hydrologic period (Table III-2).

In summary, the surface elevation of Folsom Lake would generally be maintained at higher levels during peak- and off-season periods under Alternative 3 than under the No-Action Alternative. Higher surface elevations would potentially benefit recreation opportunities by increasing the availability of boat access and increasing the frequency with which the reservoir's surface elevation is above the level at which boating becomes constrained and shoreline activities decrease. Although lake levels would fall below some recreation opportunity thresholds more frequently under Alternative 3 than under the No-Action Alternative, these small changes would be outweighed by the larger, potentially beneficial effects.

Other Reservoirs

The operations of Whiskeytown Lake, Keswick Reservoir, Lake Red Bluff, New Bullards Bar Reservoir, Englebright Lake, Camp Far West Reservoir, Lake Natoma, and Thermalito Forebay and Afterbay under Alternative 3 are not expected to change relative to the No-Action Alternative. Because the operations of these reservoirs would not change, recreation opportunities and visitation are expected to be the same as under the No-Action Alternative.

SACRAMENTO RIVER REGION - RIVERS**Sacramento River**

The river flow exceedence frequencies for boating on the upper Sacramento River are shown in Table III-5 and Figure III-7. The changes in recreation opportunities under Alternative 3 compared to the No-Action Alternative would be nearly the same as the changes discussed under Alternative 1. Changes in recreation use associated with increased abundance of anadromous fish are discussed in Attachment A.

The number of months when upper Sacramento River flows would be within the optimal range for all boating activities during the peak season would be greater under Alternative 3 than under the No-Action Alternative. These flows would result in a potential beneficial impact on boating during the peak season.

American River

The river flow exceedence frequencies for boating and swimming on the American River under Alternative 3 are shown in Table III-5. The changes in recreation opportunities under

Alternative 3 compared to the No-Action Alternative would be nearly the same as the changes discussed under Alternative 1.

Changes in recreation use associated with increased abundance of anadromous fish are discussed in Attachment A.

The number of months when American River flows would be below the optimal level for swimming on the American River during the peak season would increase under Alternative 3 compared to the No-Action Alternative. These lower flows would occur over the entire 69-year hydrologic period and during the dry hydrologic period.

Other Rivers

Recreation opportunities on the Feather and Yuba rivers and Clear Creek under Alternative 3 would be the same as described under Alternative 1. Changes in recreation use associated with increased abundance of anadromous fish are discussed in Attachment A.

SACRAMENTO RIVER REGION - WILDLIFE REFUGES AND PRIVATE HUNTING LANDS

Wildlife Refuges

The changes in recreation at wildlife refuges in the Sacramento River Region under Alternative 3 compared to the No-Action Alternative would be the same as changes discussed under Alternative 2.

Water deliveries under the Level 4 and critical period scenarios would potentially benefit recreation opportunities and use at Sacramento River Region wildlife refuges. Under both water delivery scenarios, wildlife observation, hunting, and fishing opportunities would potentially benefit as a result of enhanced water deliveries and increased wetland acreages. However, changes in use would be greater with Level 4 deliveries than with critical period delivery. This is reflected in the increase in total recreation use estimated for each scenario.

Private Hunting Lands

Waterfowl hunting opportunities on private clubs under Alternative 3 are not expected to change from conditions under the No-Action Alternative because water deliveries from CVP or other water sources to duck clubs and other private hunting lands in the Sacramento Valley would not be affected.

SAN FRANCISCO BAY/SACRAMENTO-SAN JOAQUIN DELTA REGION

Recreation opportunities in the Bay-Delta Region associated with flows and surface elevation are not expected to change under Alternative 3 because the hydrologic characteristics of the Bay-Delta Region are expected to be the same as under the No-Action Alternative. Changes in recreation use associated with increased abundance of anadromous fish are discussed in Attachment A.

SAN JOAQUIN RIVER REGION - RESERVOIRS**San Luis Reservoir**

The reservoir level exceedence frequencies for important recreation opportunities at San Luis Reservoir are shown in Table III-7 and Figure III-8. Usable surface area for boating would be constrained for 15 more peak-season months. Availability of boat ramps during the peak- and off-season periods would be nearly the same as described under the No-Action Alternative. The reservoir would be below the levels at which camping and picnicking decline for 15 more peak-season months.

Annual use is estimated to decrease by less than 1 percent during the 69-year and wet hydrologic periods and increase by less than 1 percent during the dry hydrologic period from use estimated for the No-Action Alternative. (Table III-8).

The surface elevation of San Luis Reservoir would fall below the level at which boating becomes constrained more frequently under Alternative 3 than under the No-Action Alternative. This potential impact would occur during the peak-season months and cannot be avoided, minimized, or fully mitigated without maintaining the surface elevation of San Luis Reservoir at minimum levels during the peak-season period.

Millerton Lake

The frequency with which reservoir levels are below important recreation opportunity thresholds during the 69-year, dry, and wet hydrologic periods would be the same under Alternative 3 as under the No-Action Alternative. Annual use during the 69-year, dry, and wet hydrologic periods would not change from use estimated for the No-Action Alternative (Table III-8).

No impacts on recreation at Millerton Lake during the 69-year hydrologic period are expected under Alternative 3 because recreation opportunities would not change from conditions under the No-Action Alternative.

New Melones Reservoir

The lake level exceedence frequencies for important recreation opportunities at New Melones Reservoir under Alternative 3 are shown in Table III-9. The changes in recreation opportunities under Alternative 3 compared to the No-Action Alternative for the 69-year, dry, and wet hydrologic periods would be nearly the same as the changes discussed under Alternative 1 (Figure III-9).

Annual use is estimated to decrease by approximately 2 percent during the 69-year hydrologic period, approximately 7 percent during the dry hydrologic period, and less than 1 percent during the wet hydrologic period (Table III-8).

The surface elevations of New Melones Reservoir would fall below the levels at which boating becomes constrained and ramps unusable more frequently under Alternative 3 than under the No-Action Alternative. These lower levels would occur throughout the 69-year hydrologic

period and during the dry hydrologic period and could result in a potential impact on boating opportunities at the reservoir.

The surface elevations of New Melones Reservoir would fall below levels at which shoreline recreation opportunities decline more frequently under Alternative 3 than under the No-Action Alternative. These lower surface elevations would occur throughout the 69-year hydrologic period and during the dry hydrologic period.

Non-CVP and SWP Reservoirs

Water-dependent and water-enhanced recreation opportunities at Camanche Reservoir would increase slightly during the 69-year and dry hydrologic periods under Alternative 3. Recreation opportunities during the wet hydrologic period would be the same as under the No-Action Alternative.

Boating opportunities at New Don Pedro Reservoir and New Hogan Lake would decrease slightly during the 69-year and dry hydrologic periods under Alternative 3. Beach use opportunities at the two reservoirs would decrease during the 69-year hydrologic period. Boating and beach use opportunities during the wet hydrologic period would be the same as under the No-Action Alternative.

Recreation opportunities at Lake McClure during the 69-year, dry, and wet hydrologic periods would be nearly the same as described under the No-Action Alternative.

Compared to the No-Action Alternative, combined recreation use at the four reservoirs is expected to increase by less than 1 percent during the 69-year, dry, and wet hydrologic periods.

No effects on recreation opportunities at Camanche Reservoir and Lake McClure are expected under Alternative 3 because lake levels would be the same or change only very slightly from conditions under the No-Action Alternative. No effects on boating opportunities at New Don Pedro Reservoir and New Hogan Lake are expected because the frequency with which the surface elevation of each reservoir drops below the level at which boating opportunities would be affected changes slightly from conditions under the No-Action Alternative. Potential effects on beach use opportunities at New Don Pedro Reservoir and New Hogan Lake during the 69-year period could occur under Alternative 3, because the surface elevation of both reservoirs would be below the level at which beach use declines more frequently than under the No-Action Alternative.

Other Reservoirs

Recreation opportunities at Bethany Reservoir and O'Neill Forebay under Alternative 3 are not expected to change because lake levels would be similar to conditions under the No-Action Alternative.

SAN JOAQUIN RIVER REGION - RIVERS**San Joaquin River**

The river flow exceedence frequencies for important recreation activities on lower reach of the San Joaquin River under Alternative 3 are shown in Table III-10. The changes in recreation opportunities under Alternative 3 compared to the No-Action Alternative would be nearly the same as the changes discussed under Alternative 1 (Figure III-10).

Annual use under Alternative 3 is estimated to decrease by less than 1 percent during the 69-year, dry, and wet hydrologic periods (Table III-11).

No impacts on recreation on the San Joaquin River are expected under Alternative 3 because recreation opportunities would change only slightly from conditions under the No-Action Alternative.

Stanislaus River

The river flow exceedence frequencies for important recreation activities on the Stanislaus River under Alternative 3 are shown in Table III-10. On the upper reach, river flows would be within the optimal range for all boating during 92 more peak-season months over the 69-year hydrologic period, 11 more peak-season months during the dry hydrologic period, and 7 more peak-season months during the wet hydrologic period (Figure III-11). On the lower reach, river flows would be outside the optimal range for boating 5 fewer months and above the minimum flow for 122 more months over the 69-year hydrologic period.

Annual use under Alternative 3 is estimated to increase by approximately 7 percent during the 69-year period, 14 percent during the dry hydrologic period, and 7 percent during the wet hydrologic period (Table III-11).

In summary, river flows on the upper reach of the Stanislaus River would be maintained at higher levels during the peak use season over the 69-year, dry, and wet hydrologic periods more frequently under Alternative 3 than under the No-Action Alternative. These higher flows could result in a potentially beneficial impact on recreation opportunities by providing more frequently the optimal flows for boating than under the No-Action Alternative.

Non-CVP and SWP Rivers

During the 69-year hydrologic period, flows on the Tuolumne, Merced, and lower Mokelumne Rivers would be above the flows necessary to conduct boating activities and within the optimal range for swimming much more frequently under Alternative 3 than under the No-Action Alternative. On the upper Mokelumne River, flows would be outside the optimal range for all boating activities and below the minimum level for swimming more frequently under Alternative 3 than under the No-Action Alternative. On the Calaveras River, no changes in recreation opportunities are expected because river flows would be nearly the same as under the No-Action Alternative.

During the dry and wet hydrologic periods, flows on the Tuolumne and Merced rivers would be above the minimum level necessary to conduct boating activities more frequently under Alternative 3 than under the No-Action Alternative. River flows would be above the minimum level for swimming on the Tuolumne River and within the optimal range for swimming on the Merced River more frequently under Alternative 3 than under the No-Action Alternative. On the upper Mokelumne River, flows would be outside the optimal range for all boating activities more frequently under Alternative 3 than under the No-Action Alternative. On the lower reach of the Mokelumne River, flows would be above the minimum flow for boating and swimming slightly more frequently under Alternative 3 than under the No-Action Alternative. On the Calaveras River, no change in recreation opportunities are expected during the dry and wet hydrologic periods, because river flows would be nearly the same as under the No-Action Alternative.

Compared to the No-Action Alternative, combined recreation use on the Tuolumne and Merced rivers would increase by approximately 4 percent during the 69-year and wet hydrologic periods, and increase by 18 percent during the dry hydrologic period.

In summary, an increase in boating and swimming opportunities would occur on the Tuolumne and Merced rivers under Alternative 3 compared to opportunities under the No-Action Alternative. Boating and swimming opportunities would potentially benefit by river flows being maintained more frequently above the minimum flows necessary to conduct these activities. No potential effects are expected on the Mokelumne and Calaveras rivers because flows would be the same or nearly the same as under the No-Action Alternative.

California Aqueduct and Delta-Mendota Canal

Recreation opportunities provided by the California Aqueduct and Delta-Mendota Canal under Alternative 3 are not expected to change relative to the No-Action Alternative because water levels in the canals would be held at constant levels.

SAN JOAQUIN RIVER REGION - WILDLIFE REFUGES AND PRIVATE HUNTING LANDS

Wildlife Refuges

The changes in recreation use at wildlife refuges in the San Joaquin River Region under Alternative 3 compared to the No-Action Alternative would be the same as changes discussed under Alternative 2.

Water deliveries under the Level 4 and critical period scenarios would potentially benefit recreation opportunities and use at San Joaquin River Region wildlife refuges. Under both water delivery scenarios, wildlife observation, hunting, and fishing opportunities would potentially benefit as a result of enhanced water deliveries and increased wetland acreage. However, changes in use would be greater with full Level 4 deliveries than with critical period delivery. This is reflected in the increase in total recreation use estimated for each scenario.

Private Hunting Lands

Waterfowl hunting opportunities on private clubs under Alternative 3 are not expected to change from conditions under the No-Action Alternative because duck clubs and private hunting lands are expected to receive their historical water deliveries.

TULARE LAKE REGION - WILDLIFE REFUGES AND PRIVATE HUNTING LANDS

Wildlife Refuges

The changes in recreation at wildlife refuges in the Tulare Lake Region under Alternative 3 compared to the No-Action Alternative would be the same as changes discussed under Alternative 2.

Water deliveries under the Level 4 and critical period scenarios would potentially benefit recreation opportunities and use at Tulare Lake Region wildlife refuges. Under both water delivery scenarios, wildlife observation, hunting, and fishing opportunities would potentially benefit as a result of enhanced water deliveries and increased wetland acreages. However, changes in use would be greater with full Level 4 deliveries than with critical period delivery. This is reflected in the increase in total recreation use estimated for each scenario.

Private Hunting Lands

Waterfowl hunting opportunities on private clubs under Alternative 3 are not expected to change from conditions under the No-Action Alternative because duck clubs and private hunting lands are expected to receive their historical water deliveries.

PACIFIC COAST REGION

Changes in recreation use associated with increased abundance of anadromous fish in the Pacific Coast Region are discussed in Attachment A.

SAN FRANCISCO BAY REGION

Changes in recreation opportunities at reservoirs in the San Francisco Bay Region under Alternative 3 would be similar to the changes discussed under Alternative 1.

ALTERNATIVE 4

This section describes changes in recreation opportunities and use at important recreation sites under Alternative 4 compared to the No-Action Alternative.

SACRAMENTO RIVER REGION - RESERVOIRS**Shasta Lake**

The lake level exceedence frequencies for important recreation opportunities on the main area of the reservoir (Shasta Dam to the Pit River Bridge) and the McCloud River, Pit River, and Sacramento River arms are shown in Table III-1. The changes in recreation opportunities under Alternative 4 compared to the No-Action Alternative would be nearly the same as the changes discussed under Alternative 1 (Figures III-1, III-2, and III-3).

Annual use is estimated to decrease by approximately 2 percent during the 69-year hydrologic period, decrease by approximately 1 percent during the wet hydrologic period, and increase by approximately 1 percent during the dry hydrologic period (Table III-3).

In summary, the surface elevation of Shasta Lake would fall below the levels at which boating becomes constrained on the Sacramento River arm more frequently under Alternative 4 than under the No-Action Alternative. This potential impact would occur during the off-season period.

Lake Oroville

The reservoir level exceedence frequencies for important recreation activities at Lake Oroville under Alternative 4 are shown in Table III-3. The changes in recreation opportunities under Alternative 4 compared to the No-Action Alternative would be nearly the same as the changes discussed under Alternative 1 (Figure III-4).

Annual use is estimated to increase by less than 1 percent during the 69-year and wet hydrologic periods and decrease by 2 percent during the dry hydrologic period (Table III-3).

In summary, the surface elevation of Lake Oroville would generally be maintained at higher levels during peak- and off-season periods under Alternative 4 than under the No-Action Alternative. Higher surface elevations would benefit recreation opportunities by increasing the availability of boat access and maintaining the lake level above the level at which boating becomes constrained and shoreline activities decrease. Although lake levels would fall below some recreation opportunity thresholds more frequently under Alternative 4 than under the No-Action Alternative, these small changes would be outweighed by the larger beneficial effects.

Folsom Lake

Lake level exceedence frequencies for important recreation opportunities at Folsom Lake under Alternative 4 are shown in Table III-4. The changes in recreation opportunities under Alternative 4 compared to the No-Action Alternative would be nearly the same as the changes discussed under Alternative 1 (Figure III-5).

Annual use is estimated to increase by approximately 1 percent during the 69-year and dry hydrologic periods and by approximately 2 percent during the wet hydrologic period (Table III-3).

In summary, the surface elevation of Folsom Lake would generally be maintained at higher levels during peak- and off-season periods under Alternative 4 than under the No-Action Alternative. Higher surface elevations would benefit recreation opportunities by increasing the availability of boat access and maintaining the reservoir's surface elevation above the level at which boating becomes constrained and shoreline activities decrease more frequently than under the No-Action Alternative.

Other Reservoirs

Recreation opportunities at Whiskeytown Lake, Keswick Reservoir, Lake Red Bluff, Englebright Lake, Lake Natoma, and Thermalito Forebay and Afterbay under Alternative 4 are not expected to change relative to the No-Action Alternative. Recreation opportunities at New Bullards and Camp Far West reservoirs could change relative to the No-Action Alternative because water would be released for fish flows. These changes are not expected to be substantial because releases would be made during the off season.

SACRAMENTO RIVER REGION - RIVERS

Sacramento River

The river flow exceedence frequencies for boating on the upper Sacramento River are shown in Table III-5 and Figure III-7. The changes in recreation opportunities under Alternative 4 compared to the No-Action Alternative would be nearly the same as the changes discussed under Alternative 1. Changes in recreation use associated with increased abundance of anadromous fish are discussed in Attachment A.

The number of months when upper Sacramento River flows would be within the optimal range for all boating activities during the peak season would be greater under Alternative 4 than under the No-Action Alternative. These flows would result in a potential beneficial impact on boating during the peak season.

American River

The river flow exceedence frequencies for boating and swimming on the American River under Alternative 4 are shown in Table III-5. The changes in recreation opportunities under Alternative 4 compared to the No-Action Alternative would be nearly the same as the changes discussed under Alternative 1 (Figure III-6).

Changes in recreation use associated with increased abundance of anadromous fish are discussed in Attachment A.

The number of months when American River flows would be below the optimal level for swimming during the peak season would be greater under Alternative 4 than under the No-Action Alternative. These lower flows would occur over the entire 69-year hydrologic period and during the dry hydrologic period.

Other Rivers

Recreation opportunities on Clear Creek under Alternative 4 would be the same as described under Alternative 1. Although flows would increase on the Feather and Yuba rivers under Alternative 4, recreation opportunities are not expected to change from conditions under the No-Action Alternative because these opportunities occur within a broad range of river flows. Changes in recreation use associated with increased abundance of anadromous fish are discussed in Attachment A.

SACRAMENTO RIVER REGION - WILDLIFE REFUGES AND PRIVATE HUNTING LANDS**Wildlife Refuges**

The changes in recreation at wildlife refuges in the Sacramento River Region under Alternative 4 compared to the No-Action Alternative would be the same as changes discussed under Alternative 2.

Water deliveries under the Level 4 and critical period scenarios would potentially benefit recreation opportunities and use at Sacramento River Region wildlife refuges. Under both water delivery scenarios, wildlife observation, hunting, and fishing opportunities would potentially benefit as a result of enhanced water deliveries and increased wetland acreages. However, changes in use would be greater with full Level 4 deliveries than with critical period delivery. This is reflected in the increase in total recreation use estimated for each scenario.

Private Hunting Lands

Waterfowl hunting opportunities on private lands under Alternative 4 are not expected to change from conditions under the No-Action Alternative because water deliveries from CVP or other water sources to duck clubs and other private hunting lands in the Sacramento Valley would not be affected.

SAN FRANCISCO BAY/SACRAMENTO-SAN JOAQUIN DELTA REGION

Recreation opportunities in the Bay-Delta Region associated with flows and surface elevation are not expected to change under Alternative 4 because the hydrologic characteristics of the Bay-Delta Region are expected to be the same as under the No-Action Alternative. Changes in recreation use associated with increased abundance of anadromous fish are discussed in Attachment A.

SAN JOAQUIN RIVER REGION - RESERVOIRS**San Luis Reservoir**

Changes in recreation opportunities at San Luis Reservoir over the 69-year, dry, and wet hydrologic periods under Alternative 4 would be nearly the same as described under the No-Action Alternative (Table III-7 and Figure III-8). Annual use is estimated to decrease by

approximately 2 percent during the 69-year and wet hydrologic periods and by less than 1 percent during the wet hydrologic period (Table III-8).

No impacts on recreation at San Luis Reservoir are expected under Alternative 4 because recreation opportunities would change only slightly from conditions under the No-Action Alternative.

Millerton Lake

The frequency with which reservoir levels are below important recreation opportunity thresholds would be the same as under the No-Action Alternative. Annual use during the 69-year, dry, and wet hydrologic periods would not change from use estimated for the No-Action Alternative (Table III-8).

No impacts on recreation at Millerton Lake during the 69-year hydrologic period are expected under Alternative 4 because recreation opportunities would not change from conditions under the No-Action Alternative.

New Melones Reservoir

The lake level exceedence frequencies for important recreation opportunities at New Melones Reservoir under Alternative 4 are shown in Table III-9. The changes in recreation opportunities under Alternative 4 compared to the No-Action Alternative would be the same as the changes discussed under Alternative 3 (Figure III-9).

Annual use is estimated to decrease by approximately 2 percent during the 69-year hydrologic period, approximately 7 percent during the dry hydrologic period, and less than 1 percent during the wet hydrologic period (Table III-8).

In summary, the surface elevations of New Melones Reservoir would fall below the levels at which boating becomes constrained and ramps unusable more frequently under Alternative 4 than under the No-Action Alternative. These lower levels would occur throughout the 69-year hydrologic period and during the dry hydrologic period and could result in an impact on boating opportunities at the reservoir.

The surface elevations of New Melones Reservoir would also fall below levels at which shoreline recreation opportunities decline more frequently under Alternative 4 than under the No-Action Alternative. These lower surface elevations would occur throughout the 69-year hydrologic period and during the dry hydrologic period.

Non-CVP and SWP Reservoirs

The changes in recreation opportunities and use at Camanche Reservoir, New Don Pedro Reservoir, New Hogan Lake, and Lake McClure during the 69-year, dry, and wet hydrologic periods under Alternative 4 compared to the No-Action Alternative would be the same as changes discussed under Alternative 3.

Other Reservoirs

Recreation opportunities at Bethany Reservoir and O'Neill Forebay under Alternative 4 are not expected to change because lake levels would be similar to conditions under the No-Action Alternative.

SAN JOAQUIN RIVER REGION - RIVERS**San Joaquin River**

The river flow exceedence frequencies for important recreation activities on the San Joaquin River under Alternative 4 are shown in Table III-10. The changes in recreation opportunities under Alternative 4 compared to the No-Action Alternative would be nearly the same as the changes discussed under Alternative 1 (Figure III-10).

Annual use under Alternative 4 is estimated to decrease by less than 1 percent during the 69-year and wet hydrologic periods and by approximately 3 percent during the dry hydrologic period (Table III-11).

No impacts on recreation on the San Joaquin River are expected under Alternative 4 because recreation opportunities would change only slightly from conditions under the No-Action Alternative.

Stanislaus River

The river flow exceedence frequencies for important recreation activities on the Stanislaus River under Alternative 4 are shown in Table III-10. The changes in recreation opportunities under Alternative 4 compared to the No-Action Alternative would be the same as the changes discussed under Alternative 3.

Annual use under Alternative 4 is estimated to increase by approximately 7 percent during the 69-year period, 14 percent during the dry hydrologic period, and 7 percent during the wet hydrologic period (Table III-11).

River flows on the lower reach of the Stanislaus River would be maintained at higher levels during the peak use season over the 69-year, dry, and wet hydrologic periods under Alternative 4 than under the No-Action Alternative. These higher flows could result in a potentially beneficial impact on recreation by providing the optimal flows for boating more frequently than the No-Action Alternative.

Non-CVP and SWP Rivers

The changes in recreation opportunities and use on the Tuolumne, Merced, Calaveras, and Mokelumne rivers during the 69-year, dry, and wet hydrologic periods under Alternative 4 compared to the No-Action Alternative would be the same as changes discussed under Alternative 3.

An increase in boating and swimming opportunities would occur on the Tuolumne and Merced rivers under Alternative 4 compared to opportunities under the No-Action Alternative. Boating and swimming opportunities would potentially benefit by river flows being maintained more frequently above the minimum flows necessary to conduct these activities. No potential effects are expected on the Mokelumne and Calaveras rivers because flows would be the same or nearly the same as under the No-Action Alternative.

California Aqueduct and Delta-Mendota Canal

Recreation opportunities provided by the California Aqueduct and Delta-Mendota Canal under Alternative 4 are not expected to change relative to the No-Action Alternative because water levels in the canals would be held at constant levels.

SAN JOAQUIN RIVER REGION - WILDLIFE REFUGES AND PRIVATE HUNTING LANDS

Wildlife Refuges

The changes in recreation use at wildlife refuges in the San Joaquin River Region under Alternative 4 compared to the No-Action Alternative would be the same as changes discussed under Alternative 2.

Water deliveries under the Level 4 and critical period scenarios would benefit recreation opportunities and use at San Joaquin River Region wildlife refuges. Under both water delivery scenarios, wildlife observation, hunting, and fishing opportunities would potentially benefit as a result of enhanced water deliveries and increased wetland acreages. However, changes in use would be greater with full Level 4 deliveries than with critical period delivery. This is reflected in the increase in total recreation use estimated for each scenario.

Private Hunting Lands

Waterfowl hunting opportunities on private clubs under Alternative 4 are not expected to change from the No-Action Alternative because duck clubs and private hunting lands are expected to receive their historical water deliveries.

TULARE LAKE REGION - WILDLIFE REFUGES AND PRIVATE HUNTING LANDS

Wildlife Refuges

The changes in recreation use at wildlife refuges in the Tulare Lake Region under Alternative 4 compared to the No-Action Alternative would be the same as changes discussed under Alternative 2.

Water deliveries under the Level 4 and critical period scenarios would potentially benefit recreation opportunities and use at Tulare Lake Region wildlife refuges. Under both water delivery scenarios, wildlife observation, hunting, and fishing opportunities would potentially benefit as a result of enhanced water deliveries and increased wetland acreages. However,

changes in use would be greater with full Level 4 deliveries than with critical period delivery. This is reflected in the increase in total recreation use estimated for each scenario.

Private Hunting Lands

Waterfowl hunting opportunities on private clubs under Alternative 4 are not expected to change from the No-Action Alternative because duck clubs and private hunting lands are expected to receive their historical water deliveries.

PACIFIC COAST REGION

Changes in recreation use associated with increased abundance of anadromous fish in the Pacific Coast Region are discussed in Attachment A.

SAN FRANCISCO BAY REGION

Changes in recreation opportunities at reservoirs in the San Francisco Bay Region under Alternative 4 would be similar to the changes discussed under Alternative 1.

CHAPTER IV

BIBLIOGRAPHY

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BIBLIOGRAPHY

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ATTACHMENT A

**EFFECTS OF IMPROVEMENTS IN ANADROMOUS
FISHERIES**

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Attachment A

EFFECTS OF IMPROVEMENTS IN ANADROMOUS FISHERIES

This section describes the estimated changes in sport fishing associated with increasing populations of anadromous fish (and two intermediate steps to doubling) in the Sacramento River Region (Sacramento, Feather, Yuba, and American rivers), Bay-Delta Region, and Pacific Coast Region. The impacts of fishery enhancement (as it is related to flows) in the San Joaquin River Region were evaluated as part of the analysis of alternatives. The three scenarios employed here are intended only to display a range of possible results and have no direct relationship to the hydrologic modeling results used elsewhere in this technical appendix.

Table A-1 shows the changes in sport fishing that would be expected if anadromous fish catch were doubled, as well as the changes in recreational fishing that would occur with intermediate increases in anadromous fish catch (33 percent and 66 percent increases). It must be recognized that the doubling of anadromous fish catch cannot be associated with any of the PEIS alternatives. Although Table A-1 shows results for all three enhancement scenarios, this attachment discusses results for the 100 Percent Increase Scenario only.

SACRAMENTO RIVER REGION

Changes in sport fishing in the Sacramento River Region, resulting from doubling the populations of anadromous fish, are shown in Table A-1. On the upper reach of the Sacramento River, annual sport fishing is estimated to total 38,200 visitor days, an increase of 47 percent from use under the No-Action Alternative. On the lower reach, sport fishing is estimated to total 239,600 visitor days, an increase of 23 percent. Sport fishing on the Feather River is estimated to total 125,800 visitor days, an increase of 22 percent from the No-Action Alternative. Sport fishing on the American River is estimated to total 120,300 visitor days, an increase of 21 percent from the No-Action Alternative. On the Yuba River, sport fishing is estimated to total 40,100 visitor days, an increase of 19 percent compared to the No-Action Alternative (Table A-1).

SAN FRANCISCO BAY/SACRAMENTO-SAN JOAQUIN DELTA REGION

Changes in sport fishing in the Bay-Delta Region, resulting from doubling the populations of anadromous fish, are shown in Table A-1. Sport fishing in the Bay-Delta Region is estimated to total 324,100 visitor days, an increase of 24 percent from use estimated under the No-Action Alternative (Table A-1).

PACIFIC COAST REGION

Changes in sport fishing in the Pacific Coast Region, resulting from doubling the populations of anadromous fish, are shown in Table A-1. Sport fishing in the California North Coast Subregion is estimated to total 166,480 visitor days, an increase of 2 percent from use estimated under the

TABLE A-1

ANNUAL SPORT FISHING USE NUMBERS ASSOCIATED WITH ASSUMED
IMPROVEMENTS IN ANADROMOUS FISHERIES

Recreation Area	Annual Visitor Use (Visitor Days)			
	No-Action	33% Increase (1)	66% Increase (1)	100% Increase (1)
Sacramento River Region (2)				
American River	99,400	107,500	114,400	120,300
Feather River	103,400	112,100	119,500	125,800
Upper Sacramento River	26,000	30,600	34,600	38,200
Lower Sacramento River	195,300	212,600	226,900	239,600
Yuba River	33,800	36,300	38,400	40,100
San Francisco Bay/ Sacramento-San Joaquin Delta Region (2)				
	262,000	286,100	306,500	324,100
Pacific Coast Region (3)				
North Coast total	162,650	164,020	165,270	166,480
Charter trips	18,150	18,490	18,800	19,100
Private trips	144,500	145,530	146,470	147,380
San Francisco total	108,220	112,970	117,040	124,080
Charter trips	69,750	73,250	76,260	81,500
Private trips	38,470	39,720	40,780	42,580
Central Coast total	121,960	127,610	132,310	136,320
Charter trips	40,770	43,240	45,320	47,110
Private trips	81,190	84,370	86,990	89,210
NOTES:				
(1) The three scenarios assessed here are intended only to display a range of possible results. There is no relationship between these scenarios and the alternatives analyzed elsewhere in this technical appendix.				
(2) Use numbers reflect visitor days associated with all sport fishing in the recreation areas.				
(3) Use numbers reflect fishing trips associated with salmon sport fishing only.				

No-Action Alternative. In the San Francisco Subregion, sport fishing is estimated to total 124,080 days, an increase of 15 percent from the No-Action Alternative. Sport fishing in the California Central Coast Subregion is estimated to total 136,320 visitor days, an increase of 12 percent from the No-Action Alternative.