XII. MANDATORY FINDINGS UNDER CEQA

A. CUMULATIVE IMPACTS

Cumulative impacts are defined in the CEQA Guidelines as two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts. The individual effects may be changes resulting from a single project or a number of separate projects. The cumulative impact from several projects is the change in the environment that results from the incremental impact of the project when added to other closely related past, present, and reasonably foreseeable probable future projects. Cumulative impacts can result from individually minor but collectively significant impacts (CEQA Guidelines § 15355). In a CEQA evaluation, the proposed action must be considered with the combined effects of the cumulative actions in a single analysis.

In this case, the principal impacts of implementation of the proposed decision can be traced to the changes in the operation of reservoirs in the Sacramento-San Joaquin river system, changes in diversions from those rivers or their tributaries, or changes in water available for export from the region. Therefore, significant cumulative impacts include the impacts of other projects or activities that reduce the water available to areas upstream of the Delta and to export areas, or actions that affect the operation of the SWP and CVP.

The discussion of the cumulative impacts of implementing the 1995 Bay/Delta Plan combined with other actions is divided into the following sections: (1) future actions with potential for cumulative effects; and (2) cumulative impact assessment.

1. Future Actions with Potential for Cumulative Effects

This section describes actions that may occur in the foreseeable future and discusses the effect of those actions. These actions are at various stages of development, and there is no certainty that all of them will be completed. Many of the actions described below could have specific impacts due to construction alone, including: (1) disturbing habitat and special status species, (2) limiting normal recreation and shoreline activities, and (3) reduced aesthetic value in the vicinity of the project. These construction-related impacts are not addressed in the following discussion. Instead, the focus of the descriptions is on the general effects of implementing the action or operating the project.

a. <u>American River Watershed Project</u>. Lead Agency: USCOE.

Project Description: Major features proposed by the study include construction of Auburn Dam, continued reoperation of Folsom Dam to provide a minimum of 400 TAF and a maximum of 670 TAF of storage for flood control, stabilization of levees along the American River downstream of Folsom Dam, and raising 12 miles of levees along the Sacramento River near Sacramento International Airport.

Project Impacts: The Auburn Dam will inundate various plant and animal species upstream of the dam and displace those species capable of re-establishing in other locations after construction is complete. The dam facility will block fish passage for those fish that normally spawn upstream of the proposed dam site. Releases may cause wide variations in daily flows, temperatures, and water levels. The Auburn Dam has the potential to change the timing of flows to the Bay/Delta; it will capture flow that would otherwise run off into the Delta during high-flow periods, and flow releases may increase Delta inflow during low-flow periods.

Reoperation of Folsom Dam has the potential to inundate or strand various species, displace species or habitat, and permanently alter habitat. The reoperation also could lead to wide variations in water levels, temperatures, and flows, and change the quantity and timing of flows to the Bay/Delta Estuary.

Stabilizing and raising levees is likely to have construction-related impacts, but is not expected to affect Bay/Delta watershed hydrology.

b. CALFED. Lead Agencies: State members: Resources Agency, DWR, DFG, California Environmental Protection Agency, and SWRCB. Federal members: U.S. Department of the Interior (USDOI), USBR, USFWS, USEPA, and NMFS.

Project Description: In 1994, State and federal agencies responsible for managing resources in the Bay/Delta signed the Bay/Delta Accord which, among other things, established a joint state and federal long-term solution finding process for Bay/Delta resource management. The participating agencies are referred to as the CALFED agencies.

The CALFED Bay/Delta Program established a three-phase approach to developing and implementing a long-term solution to problems affecting the Delta. During Phase I (June 1995 through August 1996) the Program defined the problems, developed a range of solutions, and identified three preliminary alternatives to be further analyzed in Phase II. In Phase II, the Program refined the preliminary alternatives, conducted a comprehensive programmatic environmental review, and issued a Draft Programmatic EIS/EIR in March 1998. Because a Preferred Program Alternative was subsequently identified, CALFED revised the document with an analysis of the Preferred Program Alternative and reissued the Draft Programmatic EIS/EIR in June 1999.

The Preferred Program Alternative will be implemented in stages during Phase III. This phase will include any necessary studies and site-specific environmental review and permitting. Because of the size and complexity of the program alternatives, implementation is likely to take place over a period of 20-30 years.

Each of the CALFED alternatives includes eight program elements: Ecosystem Restoration, Water Quality, Levee System Integrity, Water Use Efficiency, Water Transfer, Watershed, Storage, and Conveyance. The alternatives are programmatic in nature, defining broad approaches to meet Program purposes, and the descriptions of the Program elements, except for Conveyance, do not vary among the alternatives. The elements are described in the CALFED Revised Phase II Report (December 18, 1998).

The three conveyance approaches are: (1) existing system conveyance where little or no modifications are made to the flow capacity of existing Delta channels; (2) a through-Delta conveyance where a variety of modifications to Delta channels could be made to increase the conveyance efficiency; and (3) dual Delta conveyance using a combination of improved through-Delta conveyance and conveyance isolated from Delta channels.

The Preferred Program Alternative consists of a through-Delta conveyance approach, coupled with ecosystem restoration, water quality improvements, levee system improvements, increased water use efficiency, improved water transfer opportunities, watershed restoration, and a Water Management Strategy that includes an integrated storage program. The Preferred Program Alternative provides for a system of research and monitoring to determine whether modifications or additional actions are needed.

Project Impacts: The Preferred Program Alternative is expected to have potentially significant beneficial and adverse consequences in the Bay/Delta watershed. The most significant potential consequences are related to water supply/water management, water quality, ground water, fisheries and aquatic ecosystems, and vegetation and wildlife. Details of the project impacts are disclosed in the programmatic EIR/EIS.

c. <u>Central Valley Project Improvement Act</u>. Lead Agency: USBR.

Project Description: The Central Valley Project Improvement Act (CVPIA) reauthorizes the USDOI's Central Valley Project under P.L. 102-575. The CVPIA adds fish and wildlife protection, restoration, and mitigation as project purposes having equal priority with irrigation and domestic uses, and fish and wildlife enhancement as a project purpose equal to power generation. The CVPIA includes the following three measures that are likely to affect Bay/Delta watershed hydrology significantly.

- Section 3406(b)(2) of the CVPIA directs the Secretary of the Interior to dedicate and manage annually 800 TAF of CVP yield (referred to as "(b)(2) water)" for the primary purpose of implementing the fish, wildlife, and habitat restoration purposes and measures authorized in the Act. This quantity of water is reduced to 600 TAF in critically dry conditions. The USDOI issued an Administrative Proposal on the Management of Section

3406(b)(2) Water (November 20, 1997) presenting the USDOI's conclusions as to how it intended to comply with the statutory mandate to dedicate and manage the water each year. The Administrative Proposal was returned to the USDOI by a reviewing court for changes in accordance with the court's opinion. The final decision was released on October 5, 1999. On July 15, 1999, the USDOI proposed a new decision to implement section 3406(b)(2).

- The CVPIA requires the Secretary of the Interior to provide, either directly or through contractual agreements with appropriate parties, firm water supplies of suitable quality to maintain and improve wetland habitat areas on: units of the National Wildlife Refuge System in the Central Valley of California; the Gray Lodge, Los Banos, Volta, North Grasslands, and Mendota state wildlife management areas; and the Grasslands Resources Conservation District in the Central Valley of California.

- Section 3406(b)(23) of the CVPIA allocates a minimum of 340,000 acre-feet per year for the purposes of fishery restoration, propagation, and maintenance, and further requires that the Trinity River Flow Evaluation Study be completed in a manner which ensures the development of recommendations for the restoration and maintenance of the Trinity River fishery. The Draft Trinity River Flow Evaluation, released in January 1998, contains daily flow recommendations for the Trinity River which range, depending on water year type, from 300 cfs to 10,564 cfs. If these daily flow recommendations are adopted, releases from Trinity Lake into the Trinity River will range from 368,621 acre feet in a critically dry year to 815,226 acre feet in an extremely wet year, excluding unscheduled releases associated with large storm events.

Project Impacts: The CVPIA is expected to have significant fishery and hydrologic impacts in the Bay/Delta watershed. Alternatives for implementing the CVPIA are the subject of a programmatic draft EIS which was released in October 1997.

d. <u>Conjunctive Use Programs</u>. Lead Agency: DWR.

Project Description: To meet SWP contractors' increasing need for water, the DWR is investigating the potential for entering into programs with various water agencies whereby the DWR would finance facilities in exchange for water that would be made available through conjunctive use. Surface water would be made available from the SWP to the participants for in-lieu groundwater recharge in above-normal and wet years. In dry years, the participants would release a portion of their surface water supplies to the SWP and use stored groundwater instead of surface water. Projects are being considered in several areas in the Central Valley.

Project Impacts: Conjunctive use offers a relatively low-cost method to store water in times of above-average supply for use during dry periods. However, groundwater pumping during extended drought could initiate land subsidence in some locations. Flows into the Delta could decrease in wetter years because of upstream diversions to groundwater storage. Exports from the Delta and flows into the Delta could increase in drier years as stored groundwater is used.

e. Delta Wetlands Project. Lead Agencies: USCOE and SWRCB.

Project Description: Delta Wetlands Properties is the project proponent for the Delta Wetlands project, which includes diversion and storage of water on two Delta islands owned by the company (Bacon Island and Webb Tract, the "reservoir islands") and seasonal diversion of water for creation and enhancement of wetlands and management of wildlife habitat on two islands owned primarily by the company (Bouldin Island and Holland Tract, the "habitat islands"). Delta Wetlands would improve and strengthen levees on all four islands and install two additional intake siphon stations and a new pump station on each of the reservoir islands. The project would divert water onto the reservoir islands during periods of availability to be stored for later sale. The purchased water would be either exported or allowed to flow out of the Delta to meet water quality or flow requirements.

Total maximum initial water storage capacity of the Delta Wetlands reservoir islands as proposed would be 238 TAF. Total physical storage capacity may increase in 50 years to 260 TAF as a result of soil subsidence. Mean annual diversions and discharges are estimated in the draft EIR/EIS for the project to be 222-225 TAF and 188-202 TAF, respectively, based on the historical hydrologic record for 1922-1991 and assuming current Delta standards, facilities, and upstream/export demands for water. Diversion rates onto the reservoir islands would vary with pool elevation and water availability. The maximum rate of diversion onto either Webb Tract or Bacon Island would be 4,500 cfs (9,000 acre feet per day) when diversions begin (when head differential is greatest). The combined daily average diversion rate for all the islands (including diversions to the habitat islands) would be 4,000 cfs. At this average rate, both reservoir islands could be filled in approximately one month.

Water would be discharged from storage on the reservoir islands during periods of demand in any month, subject to Delta regulatory limitations and export pumping capacities, at a combined maximum daily average of 6,000 cfs. The combined monthly average discharge rate of the reservoir islands would not exceed 4,000 cfs. At this average rate, both reservoir islands could be emptied in approximately one month.

Project Impacts: Operation of the project will have a significant effect on Bay/Delta hydrology. A detailed description of the project impacts can be found in the draft EIR for the project (SWRCB and USCOE 1995).

f. **<u>Eastside Reservoir</u>**. Lead Agency: Metropolitan Water District (MWD).

Project Description: The purpose of the project is to secure six months of emergency storage in southern California in the event of a major earthquake and to provide additional water supplies for drought protection and peak summer needs. The Eastside Reservoir site is located in the Domenigoni and Diamond valleys, four miles southwest of the City of Hemet. Storage capacity of the reservoir will be 800 TAF. The reservoir will be 4.5 miles long, more than 2 miles wide, and have a surface area of 4,500 acres. The water source for the project is the Colorado River Aqueduct, delivered through the San Diego Canal into the reservoir forebay. Also, SWP water from Lake Silverwood will flow by gravity into the reservoir through the new 12-foot-diameter, 45-mile-long Inland Feeder, connecting with the new 9-mile-long Eastside Pipeline.

Project Impacts: The new reservoir will inundate habitat and displace species upstream of the site. The project will allow the SWP to increase exports, which will alter Bay/Delta hydrology. Water supply reliability in the MWD service area will be improved. A detailed description of the project impacts can be found in the EIR for the project (MWD 1991).

g. **<u>EBMUD Supplemental Water Supply Program</u>**. Lead Agency: EBMUD.

Project Description: The EBMUD Board of Directors adopted its Water Supply Management Program Action Plan in September 1995. The Action Plan included two alternatives for taking delivery of American River water pursuant to EBMUD's contract with the USBR. EBMUD contracted with the USBR in 1970 for 150,000 AF/year from Folsom Lake, to be delivered via the Folsom South Canal (FSC) to an as-yet-unbuilt connection to the Mokelumne Aqueducts.

The EBMUD and the USBR issued a draft EIR/EIS on the Supplemental Water Supply Project in November 1997, which addresses two primary project alternatives. The first alternative is an EBMUD-only project that involves deliveries from the American River near Nimbus Dam, via the FSC to a new pipeline connection between the FSC in southern Sacramento County and EBMUD's Mokelumne Aqueducts in San Joaquin County. The second alternative is a joint project between EBMUD, the City of Sacramento, and the County of Sacramento. Under this alternative, water would be diverted from the lower American River near the confluence with the Sacramento River and conveyed to the City's water treatment plant. Water for EBMUD would then be conveyed through new pipelines from the treatment plant to the FSC and from the FSC to the Mokelumne Aqueducts.

A key difference between the two alternatives is the location of the diversion points on the American River. The first alternative would provide higher quality water from farther upstream, but would be subject to court-ordered flows that would allow less water to be delivered to EBMUD in dry years. A joint Sacramento project would guarantee water even in the driest years and still provide high-quality water taken from the American River delivery point farther downstream.

In 1997, San Joaquin County interests proposed a groundwater storage project that would allow EBMUD to store surface water from the American River in San Joaquin County aquifers. The project would provide more out-of-service area storage and improved supply reliability during droughts for EBMUD and would also provide significant benefits to San Joaquin County water users. However, a conjunctive use alternative was not included in the 1997 draft EIR/EIS.

Project Impacts: The American River diversion may present risk to fish of impingement and entrainment at diversion facilities. Diversion of American River water will affect the quantity of Bay/Delta inflows, especially for CVP exports; however, water supply reliability will be improved for the EBMUD service areas.

h. Inland Feeder Project. Lead Agency: MWD.

Project Description: The Inland Feeder Project will more than double the water delivery capacity of the east branch of the California Aqueduct from the SWP, providing Southern California with approximately 2 TAF per day of additional delivery capacity. The project begins in the Devil Canyon area north of the City of San Bernardino and ties into the MWD's Colorado River Aqueduct south of Lake Perris, near the City of San Jacinto. The water source is the SWP through the east branch of the California Aqueduct from Lake Silverwood. Estimated project cost is $1.1 billion. One of the purposes of this project is to feed water into the Eastside Reservoir, which is currently under construction.

Project Impacts: The project will allow an increase in Bay/Delta exports, which will alter Delta hydrology. Water supply reliability will be improved for the project area.

i. Interim South Delta Program (ISDP). Lead Agency: DWR.

Project Description: The purpose of the Interim South Delta Program is to (1) improve water levels and circulation in southern Delta channels for local agricultural diversions; and (2) improve southern Delta hydraulic conditions in order to increase diversions into Clifton Court Forebay to maximize the frequency of full pumping capacity at Banks Pumping Plant.

In July 1982, South Delta Water Agency (SDWA) filed a lawsuit against the State of California and the federal government, in part alleging that operations of SWP and CVP pumps violate South Delta Water Agency's rights by lowering water levels, reversing flows, and diminishing the influence of the tides. The DWR, USBR, and SDWA recently agreed to a draft contract that settles the 1982 lawsuit and includes provisions to test and construct barriers in certain southern Delta channels to provide the SDWA with an adequate agricultural water supply.

The DWR, USBR, and USACE are proposing the installation of three permanent flow control structures and one fish control barrier through the ISDP. The program also calls for operating the SWP pumps at full capacity; installing additional forebay intake structures; and limited channel dredging along a 5-mile stretch of Old River. In May 1999 the ISDP was rolled into the CALFED South Delta Improvements Program.

Project Impacts: Operating the pumps at full capacity will enable the SWP to increase exports from the Delta. The increased exports and the operation of the barrier and flow control structures will alter Delta hydrology and water quality. The increase in diversions to Clifton Court Forebay may be unscreened and therefore have an impact on fish residing in or passing through the Delta. Fish salvage at the export pumps may also increase. The project will increase water supply reliability in the SWP service area.

Operation of the barrier and flow control structures will alter habitat. The structures may lead to increased straying, blocked passage, and increased predation if fish are reluctant to pass the structures. Navigation and recreation will be restricted, and aesthetic value may be reduced. For a detailed description of project impacts, see the ISDP Draft EIR/EIS (DWR and USBR 1996).

j. Los Angeles Aqueduct. Lead Agency: Los Angeles Department of Water and Power (LADWP).

Description: The LADWP owns and operates the Los Angeles Aqueduct (LAA) which diverts both surface and groundwater from the Owens Valley and surface water from the Mono Basin. The first pipeline of the LAA was completed in 1913 and began conveying water from the Owens Valley to the City of Los Angeles. The aqueduct was extended north to the Mono Basin where diversion began in 1940. A second pipeline was completed in 1970, bringing the combined capacity of the LAA to about 550 TAF/yr and average annual diversions from the Mono-Owens region to about 400 TAF/yr.

LADWP's diversions from the Owens Valley and Mono Basin resulted in the degradation of the region's environmental resources and have been the subject of extensive litigation. Recent actions by the courts and regulatory agencies have resulted in restrictions on the amount of water that the City of Los Angeles can divert and agreements for environmental restoration. These actions include the 1994 SWRCB Decision 1631 on Mono Lake, the 1997 agreement between Inyo County and the City of Los Angeles for rewatering the lower Owens River, and the 1997 implementation plan adopted by the Great Basin Unified Air Pollution Control District.

The California Supreme Court ruled in 1983 that the SWRCB has authority to reexamine past water allocation decisions and the responsibility to protect public trust resources where feasible. Amendments to LADWP's water right licenses for diversions from the Mono Basin are set forth in D-1631. The order sets instream flow requirements for fish in the four streams from which LADWP diverts water. The order prohibits exports of water from the basin until Mono Lake surface elevation reaches 6,377 feet. Diversions are then restricted to 16 TAF/yr until the lake reaches the 6,391-foot level (estimated to take about 20 years). In order to maintain the 6,391-foot level, long-term diversions will be restricted to about 31 TAF/yr, or one-third of the historical diversions from the Mono Basin.

Inyo County filed suit against the City of Los Angeles in 1972, claiming that increased groundwater pumping was harming the Owens Valley environment. After 25 years of litigation, an agreement was executed in 1997 between Los Angeles and Inyo County which resolved the concerns of several organizations and state agencies over the Lower Owens River Project (LORP) and other provisions of the 1991 environmental impact report for groundwater management in the Owens Valley. The agreement requires LADWP and Inyo County to implement numerous environmental projects and studies. The LORP, which is identified as mitigation for impacts that occurred between 1970 and 1990, includes four significant physical features. These include: (1) provision for year-round flows in the lower Owens River (with a pumpback station just above the Owens River delta to return some of the water to the LAA), (2) provision of flows past the pumpback station to create new wetlands in the Owens River delta, (3) enhancement of off-river lakes and ponds, and (4) development of a new 1,500-acre waterfowl habitat area.

After the City of Los Angeles began diverting water from the Owens Valley, Owens Lake became a dry lakebed. On windy days, airborne particulates from the dry lakebed violate air quality standards. In 1997, the Great Basin Unified Air Pollution Control District ordered the City of Los Angeles to implement specified control measures at Owens Lake to mitigate the dust problem. These measures could reduce the city's potential diversion by up to 50 TAF/yr. Upon appeal, a compromise was reached when LADWP agreed to begin work at Owens Lake by 2001 and to ensure that federal clean air standards would be met by 2006. LADWP's dust control strategy may include treating over 14,000 acres of lakebed through a combination of shallow flooding, vegetation planting, and gravel placement.

Project Impacts: The actions described above are designed to reverse or mitigate for the impacts resulting from the diversion and export of water from the Owens Valley and Mono Basin. They are also designed to protect and enhance fish, wildlife, recreation and other environmental resources in the region. The reduction in Mono Basin exports and the inbasin use of water in the Owens Valley for dust control and the LORP will have a direct effect on water supplies available to the City of Los Angeles. The reduction in water supply from the LAA is likely to be offset through a combination of conservation, reclamation, recycling, and additional supplies from MWD.

k. Los Banos Grandes Reservoir. Lead Agency: DWR.

Project Description: The Los Banos Grandes facilities would consist of an offstream storage reservoir located near the San Luis Dam and Reservoir, with associated pumping and generating plants and conveyance channels. Water would be stored south of the Delta when winter flows are high. These flows would be pumped from the Banks pumping plant in the Delta through the California Aqueduct and then to the Los Banos Grandes reservoir for storage. Operation of the reservoir would be similar to that of the San Luis Reservoir, except that Los Banos Grandes would reserve about two-thirds of its stored water each year to provide supplies during periods of water shortage. The project would improve SWP reliability by increasing the dependable yield of the project by more than 250 TAF, an estimate made prior to the adoption of the 1995 Bay/Delta Plan.

The DWR has investigated other potential south-of-the-Delta storage sites on the west side of the San Joaquin Valley. The list includes ten watersheds with 20 potential dam locations identified. Evaluation of the Los Banos Grandes site included cost estimates, a threatened and endangered species survey, a pilot program to investigate re-establishment of sycamore woodland habitat, and a study to evaluate the effects of canals on the movement of kit fox throughout the study area commissioned by the DWR and conducted by the DFG. DWR is not actively studying this project at this time; however, it is included in CALFED's list of alternatives for offstream storage south of the Delta.

Project Impacts: Increased exports from the Delta will occur, which will alter Bay/Delta hydrology. Water supply reliability should be improved for SWP service areas south of the Delta. A new reservoir will alter and inundate habitat and displace species upstream of the reservoir.

l. **Los Vaqueros Project**. Lead Agency: Contra Costa Water District.

Project Description: The objectives of the project are to improve water quality; minimize seasonal water quality changes of delivered water, especially in late-summer periods when salinity concentrations rise in the Delta; and improve reliability of water supplies during extended emergencies. Facilities included in the project include the Los Vaqueros Dam and Reservoir (a 200-foot high earthen dam and a 100 TAF reservoir); the Old River pumping plant (250 cfs) and pipeline facilities (a 7-mile pipeline); a transfer reservoir and pipeline (a 4-million-gallon reservoir and 5-mile pipeline); the Los Vaqueros Pipeline (9 miles); and relocation of Vasco Road and several utilities.

Project Impacts: The project should result in higher diversions from the Delta in high flow periods and lower diversions in low flow periods. This change in diversion patterns will affect Bay/Delta hydrology. Numerous construction-related impacts will occur. For a detailed description of this project, see the Los Vaqueros Reservoir EIR (CCWD 1992). This project was completed in March 1998.

m. **Mandeville Island Project**. Lead Agency: SWRCB.

Project Description: CCRC Farms and the Tuscany Institute are the proponents for the project, which would involve diversion and storage of water on Mandeville Island in the Delta. The project is very similar to the Delta Wetlands project that is described earlier in this section.

The applicant seeks to divert 330 TAF of water per year at a rate of 2,600 cfs from four separate diversion points, including: Connection Slough, Old River, Middle River, and San Joaquin River. The water would be diverted by 40 siphons and 31 pump stations. The proposed reservoir would have a surface area of 5,280 acres with an average depth of about 24 feet.

Project Impacts: Project impacts would be very similar to the impacts of the Delta Wetlands project.

n. **Montezuma Wetlands Project**. Lead Agency: Solano County/USCOE.

Project Description: Levine-Fricke proposes to deposit dredged materials on a diked bayland site near Collinsville in Solano County, adjacent to the Suisun Marsh, to restore 1,822 acres of tidal wetlands on a 2,394-acre site. The site is currently used as grazing lands and includes approximately 1,620 acres of nontidal, federally-regulated wetlands and 202 acres of uplands. The proposal calls for constructing facilities to receive up to 20 million cubic yards of approved dredge materials from ports and navigation channels in the San Francisco Bay and to distribute the materials over the site. This deposition would return the subsided land surface to an elevation range at which marsh could establish. The top 3 feet of dredged sediment would have contaminant levels that have passed tests for suitability in a tidal wetland environment. After the subsided baylands are filled, the levees would be breached to enable tides to ebb and flow over the constructed foundation of tidal channels and low marsh plains. The marsh design includes high marsh and marsh ponds that would seldom be reached by tides. Project construction is proposed to be in four phases to minimize temporary losses of wetlands during construction and to facilitate engineered placement of dredged materials. Each completed phase would be hydrologically independent with a single connection to Montezuma Slough or the Sacramento River. Phases would range in size from about 240 acres to 600 acres.

Project Impacts: This project is not expected to affect Delta hydrology. The deposit of dredged materials may lead to burial, disturbance, or displacement of various species at the project site.

o. **Pardee Reservoir Enlargement Project**. Lead Agency: EBMUD.

Project Description: The project would raise Pardee Dam by 57 feet, thereby increasing the capacity of the reservoir by 150 TAF. Additional elements of the project include modifying the powerhouse, modifying or replacing the outlet tower, constructing a secondary dam in the Jackson Creek arm, modifying the recreation and shoreline facilities, and constructing a new Highway 49 bridge crossing. No environmental documentation for this project is planned for the near future.

Project Impacts: The increased storage capacity will increase exports from Pardee Dam to the EBMUD service area through the Mokelumne Aqueduct. These exports may decrease overall Delta inflows from the Mokelumne River. However, minimum instream flows for the lower

Mokelumne River would be expected to increase due to the gain-sharing provision of the Mokelumne River Joint Settlement Agreement that was approved by the USFWS, DFG, and EBMUD and subsequently approved by the FERC. Increasing the size of the main dam and reservoir capacity at Pardee Reservoir may inundate various plant and animal species upstream of the dam and displace those species capable of re-establishing in other locations once construction is complete.

p. **Red Bluff Diversion Dam Fish Passage Project**. Lead Agency: USBR.

Project Description: The USBR is evaluating possible long-term solutions to fish passage and water delivery problems at the Red Bluff Diversion Dam on the Sacramento River. The "eight-months gates-up" operation under the NMFS biological opinion has substantially reduced, but not eliminated, fish passage problems at the Dam and has created water delivery problems during planting and harvest seasons. A research pumping facility was installed in 1993 and 1994 to evaluate potential means of pumping water while using existing drum screens. Engineering and biological evaluations are still in progress, and interim measures have been developed to supply water during the "gates-up" period. Field and laboratory studies of fish ladder alternatives are in progress, as is a hydrological study to guide analysis of alternatives.

Project Impacts: This project may improve conditions for migration of anadromous fish. It is not expected to have any impacts on Bay/Delta hydrology.

q. **Reallocation of Colorado River Water**. Lead Agency: USDOI.

Description: During the past decade, the MWD has operated the Colorado River Aqueduct at or near capacity of about 1.2 MAF annually. Currently, however, the DWR estimates that the MWD's contractual supplies and firm rights to Colorado River water amount to only about 724 TAF (DWR 1994d). The excess deliveries came from surplus water when available and from supplies apportioned to, but unused by, Arizona and Nevada. These supplies are either unreliable or unlikely to be available in the future.

Impacts: Reductions in Colorado River supplies will exacerbate the effect in the MWD service area of reductions in Bay/Delta supplies caused by implementation of the Bay/Delta Plan. MWD will also likely seek additional supplies in the Bay/Delta watershed, which will alter Bay/Delta hydrology.

r. **Rice Field Flooding**. Lead Agency: Various water right holders.

Description: Historically, many farmers in the Sacramento Valley flooded their harvested rice fields in order to attract waterfowl for hunting. Due to the air quality restrictions on burning rice straw, additional rice acreage is now being flooded for rice straw decomposition. Most flooding of harvested rice fields begins in mid-October and continues into November. Flooded conditions are usually maintained through March. Fields used for waterfowl hunting have higher water demands than those used for rice straw decomposition alone. Fields used for waterfowl hunting require an additional flow of water through the flooded fields to prevent the potential for waterfowl diseases caused by stagnant water. A study by the DWR to evaluate fall and winter water use in the Sacramento Valley found that the estimated applied water requirement was about 2 AF/acre and that the ETAW was approximately 40 percent of applied water.

As an example of how rice field flooding may affect water use and availability in the Sacramento Valley, the Glenn-Colusa Irrigation District has filed an application for a water right permit for diversion of water from the Sacramento River (A-30838). The application requests a direct diversion of 1,200 cfs, from November 1 to March 31 of every year, for a total of 189 TAF annually. The application lists the purpose of use as rice straw decomposition, wildlife enhancement, recreation, and irrigation. In the project description, GCID estimates that it will require 150 TAF of water to maintain an average of 75,000 acres annually at a depth of 8 inches.

Project Impacts: Rice field flooding has created additional winter habitat used by millions of waterfowl that travel the Pacific Flyway. Water for winter rice field flooding is generally diverted in months when there is excess water in the Delta, but these diversions could be curtailed under Term 91 in very dry conditions. Water demands for flooding to decompose rice straw may decrease in the future if growers are able to find commercial uses for the rice straw or acceptable alternatives for its elimination.

s. **Sacramento Area Water Forum Process**. Lead Agency: The City and County of Sacramento through the City-County Office of Metropolitan Water Planning.

Project Description: The Sacramento Area Water Forum is a diverse group of water managers, business and agricultural leaders, environmentalists, citizen groups, and local governments in Sacramento County which was formed in 1993 to evaluate water resources and future water supply needs in the Sacramento metropolitan region. The group was joined in 1995 by water managers from Placer and El Dorado counties. The Water Forum has formulated a Water Forum Proposal (WFP) for the effective long-term management of the region's water resources. The proposal is incorporated in the Water Forum Action Plan, which was released in January 1999.

The WFP is based on the two coequal objectives of the Water Forum: (1) provide a reliable and safe water supply for the region's economic health and planned development through the year 2030; and (2) preserve the fishery, wildlife, recreational, and aesthetic values of the lower American River. The proposal contains seven elements which together form a package of linked actions designed to make more water available for consumption while protecting the natural resources of the lower American River from environmental damage. The seven elements include:

- increased surface water diversions;
- actions to meet customers' needs while reducing diversion impacts on the lower American River in drier years;

- support for an improved pattern of fishery flow releases from Folsom Reservoir;
- lower American River habitat management;
- water conservation;
- ground water management; and,
- Water Forum successor effort.

Project Impacts: The Water Forum issued a draft EIR for the WFP in January 1999. Element 1 of the WFP provides for increased diversions from the lower American River. The remaining six elements, in one way or another, are intended to reduce the adverse impacts of those increased diversions. The draft EIR identifies potentially significant impacts to certain fisheries, recreational opportunities, and cultural resources in the lower American River and Folsom Reservoir. Potential impacts outside the American River system include impacts to water supply, water quality, and power supply. The project is considered to be growth inducing in the water service study area.

t. **State and Federal ESA**. Lead Agency: State and Federal Resource Agencies.

Description: The State and federal ESAs require consideration of the effects of actions on organisms--plants and animals--listed as threatened or endangered. An endangered species is one in danger of extinction in all or a significant portion of its range; a threatened species is one likely to become endangered.

The acts are designed to protect threatened and endangered species by: (1) listing endangered and threatened species; (2) ensuring State and federal agencies adopt measures to protect the species during the design, construction, and operation of projects; and (3) prohibiting the taking of endangered species. One important aspect of the acts is preserving habitat critical to the survival of the threatened or endangered species. Fish species occurring in the Delta that are listed or proposed for listing under the state and federal endangered species acts are shown in Table III-17.

Requirements of the acts presently affect water resources planning in the Delta. Requirements established for protection of winter-run chinook salmon and delta smelt, referred to as biological opinions, controlled many of the operational decisions of the SWP and the CVP in the Bay/Delta Estuary in the last four years. On December 15, 1994, State and federal agencies signed the Principles for Agreement in which the signatories agreed to accept the requirements in the Bay/Delta Plan for the next three years, after which the requirements may be revised. Accordingly, the biological opinions for delta smelt and winter-run chinook salmon have been redrafted and are largely consistent with the requirements in the plan.

The listing of spring-run chinook under CESA in 1998 may result in additional changes in water resources requirements.

Impacts: The hydrology throughout the Bay/Delta watershed can be affected by the State and federal ESA in the future. If the requirements in the plan do not stabilize populations of endangered species in the Delta, more restrictive ESA requirements may be established. Additional species could also be listed in the future.

u. Water Transfers. Lead Agency: DWR.

Project Description: Prior to 1991, most water transfers in California were negotiated by the DWR on a limited basis. SWP facilities were used to transfer water (1) for SWP long-term contractors and (2) to other agencies in California--most notably to CVP contractors. With the most recent drought, however, California implemented a statewide policy of transferring water.

In 1991 and 1992, California began its first large-scale water transfer program when Governor Wilson established the 1991 Drought Water Bank. Because of the success of this program, increasing interest is being expressed in water transfers as a water management tool for alleviating short-term shortages as well as for augmenting long-term supplies.

Project Impacts: The water transfer capacity through the Delta from July through October is identified in Chapter V of this report. The increase in Delta inflows and exports that could occur due to water transfers will affect Delta hydrology.

v. West Delta Program. Lead Agency: DWR.

Project Description: This program will result in strengthening and reconstruction of levees on several islands in the western Delta. Land on these islands will be converted from farmland to managed wildlife habitat. The habitat that is developed may be used to mitigate for the construction and operation of future SWP facilities.

Many levees in the western Delta are in jeopardy, as indicated by a prolonged history of periodic failure. Consequences of levee failures include seriously degraded water quality for all uses, as well as contributing to potential levee failures on interior Delta islands. From a water supply standpoint, this project will provide more security to existing supplies, rather than develop additional supplies. It will prevent the reduction of existing supplies that would result from future levee failures.

Project Impacts: Taking agricultural land out of production will alter water demands in the Bay/Delta, which will alter Delta hydrology. Habitat values in the converted areas should improve. Although converting farmland to managed wildlife habitat under the proposed project would have positive effects, the project is likely to alter or permanently remove some existing habitat.

2. Cumulative Impact Assessment

The hydrology for the Cumulative Impact Assessment was modeled using DWRSIM. The DWRSIM study assumes full compliance with the 1995 Bay/Delta Plan, and the assumptions described in Chapter IV are still applicable. Additional assumptions include: (1) the ISDP is in place, including SWP Banks Pumping Plant capacity of 10,350 cfs; (2) combined use of points of diversion is allowed for the SWP and the CVP, limited only by the combined physical capacities of the pumping plants; (3) Eastside Reservoir is in operation; (4) Los Vaqueros Reservoir is in operation; and (5) year 2020 level of development is used. As described in section 1 of this chapter, other projects and actions may be relevant to the cumulative impact assessment but they were not included in the modeling because insufficient detail is available.

The following impact analysis compares the modeled hydrologies of the Cumulative Impact Assessment to those of the No Project Alternative and the Bay/Delta Plan Alternative. The No Project Alternative is the base case and is described as Flow Alternative 1 in Chapter II of this report. The Bay/Delta Plan Alternative assumes full compliance with the 1995 Bay/Delta Plan. Both the No Project Alternative and the Bay/Delta Plan Alternative assume a 1995 level of development and operating criteria described in Chapter IV. All three alternatives assign primary responsibility for meeting the objectives to the SWP and the CVP.

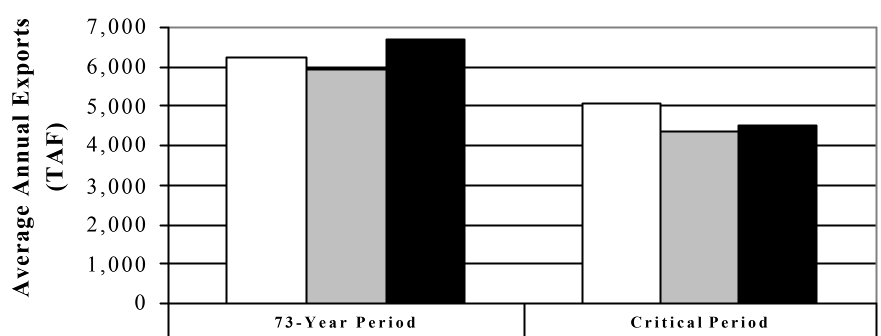
For modeling purposes, both the Cumulative Impact Assessment and the Bay/Delta Plan Alternative require the release of additional water from reservoirs on tributaries to the San Joaquin River in order to fully comply with the objectives. During the 73-year period, this quantity averages 23 TAF for the Bay/Delta Plan Alternative and 26 TAF for the Cumulative Impact Assessment. Because these reservoirs are surrogates for parties who would be assigned responsibility for meeting the objectives if the Day/Delta Plan is implemented, this analysis will not address impacts to those reservoirs.

The analysis of cumulative impacts focuses on the potential changes to: (a) Delta exports, (b) carryover storage, (c) transfer capacity, (d) Delta outflow, (e) fisheries, (f) salinity, and (g) water temperature. The analysis of fishery impacts includes the effects on salmon smolt survival and striped bass populations in the Delta, and the relationship of upstream river flows and reservoir levels to habitat quality. The analysis of salinity impacts includes the changes in X2 (2 ppt isohaline) position and salinity levels throughout the Delta.

a. Delta Exports. The 1995 Bay/Delta Plan limits the rate of Delta export pumping to a percentage of Delta inflow as described in Chapter V. For the purpose of calculating the export/inflow ratio, exports include SWP Banks Pumping Plant exports and CVP Tracy Pumping Plant exports. Other project exports include the Contra Costa Canal, North Bay Aqueduct, and the City of Vallejo; however, these diversions are not included in the export/inflow ratio calculations.

Figure XII-1 shows the average annual exports as modeled under the No Project Alternative, the Bay/Delta Plan Alternative, and the Cumulative Impact Assessment for both the 73-year period and the critical period. The cumulative impact to exports can be illustrated by comparing the Delta exports under the Cumulative Impact Assessment to the exports under the No Project and Bay/Delta Plan alternatives. For the 73-year period, average annual exports are greater under the Cumulative Impact Assessment than under the No Project Alternative or the Bay/Delta Plan Alternative. During the critical period, average annual exports in the Cumulative Impact Assessment are less than in the No Project Alternative, but slightly greater than in the Bay/Delta Plan Alternative. Most of this reduced export capacity can be made up through increased transfers as described below.

Figure XII-1
Average Annual Exports



	73-Year Period	Critical Period
No Project	6,256	5,102
Bay/Delta Plan	5,980	4,378
Cumulative Impact	6,715	4,474

Critical Period is May 1928 through October 1934

b. **<u>Carryover Storage</u>**. Carryover storage is the amount of water retained in a reservoir at the end of September of each year. The purpose of carryover storage is to help meet future demand in the event that the next year is dry. The amount of water dedicated to carryover storage is balanced against the amount needed to meet immediate delivery needs, hydropower generation needs and instream flow requirements of a project, according to operation rules that differ for each reservoir.

To determine the cumulative impacts on carryover storage, average September storage amounts for the SWP and CVP reservoirs included in the Cumulative Impact Assessment were compared to the No Project and Bay/Delta Plan alternatives. Reservoirs in this analysis include Shasta Lake, Lake Oroville, Folsom Lake, and New Melones Reservoir. Other reservoirs are not included because their operation is not affected under the modeling studies used for this analysis. Table XII-1 shows the average annual carryover storage volumes for the 73-year period and the critical period for the reservoirs considered. The table also shows the difference in average annual carryover storage when comparing the Cumulative Impact Assessment to each alternative.

Table XII-1
Carryover Storage in Central Valley Reservoirs

73-Year Average (TAF)

Study	Shasta	Oroville	Folsom	New Melones
No Project	2,910	2,310	481	1,543
Bay/Delta Plan	2,893	2,195	445	1,286
Cumulative Impact	2,849	2,167	464	1,325
Change from:*				
No Project to Cumulative Impact	-61	-143	-17	-218
B/D Plan to Cumulative Impact	-44	-28	19	39

Critical Period Average (TAF)

Study	Shasta	Oroville	Folsom	New Melones
No Project	1,944	1,608	261	1,104
Bay/Delta Plan	1,893	1,469	182	620
Cumulative Impact	1,790	1,591	261	714
Change from*				
No Project to Cumulative Impact	-154	-17	0	-390
B/D Plan to Cumulative Impact	-103	122	79	94

* Negative value indicates a reduction in carryover storage

Generally, there is less carryover storage in the Cumulative Impact Assessment than in the No Project Alternative. This is true for the 73-year period average as well as the critical period average. Folsom shows a small decrease in carryover storage in the 73-year period and no difference in the critical period. The decrease at Lake Oroville is slight in the critical period.

In comparing the Cumulative Impact Assessment to the Bay/Delta Plan Alternative, there is less carryover storage during the 73-year period at Shasta Lake and Lake Oroville, while there is more carryover storage at Folsom and New Melones Reservoirs. There is less carryover storage in the critical period at Shasta Lake, and more carryover storage at Oroville, Folsom and New Melones Reservoirs.

c. Transfer Capacity. The capacity of the projects to accommodate water transfers principally depends on two factors: unused pumping capacity at the Banks and Tracy pumping plants and limits on exports in the 1995 Bay/Delta Plan. The method for determining transfer capacity is described in Chapter V, section D. For this evaluation, July through October is assumed to be the most likely period for water transfers to occur. This assumption is based on historical Delta operations, the objectives in the 1995 Bay/Delta Plan (which are more restrictive of exports from February through June), and the increased possibility of fishery impacts in other periods.

The total transfer capacity for the period July through October, as calculated for the Cumulative Impact Assessment and the No Project and Bay/Delta Plan alternatives, is shown in Figure XII-2. The total transfer capacity for this period is greater in the Cumulative Impact Assessment than in the No Project Alternative or the Bay/Delta Plan Alternative. This is true for the 72-year average (1922-1993) and the critical period average. This is because the Cumulative Impact Assessment allows for both combined use of two points of diversion by the SWP and CVP and full use of SWP pumping capacity. The long-term average does not include 1994 because the analysis uses the calendar period July-October, and October 1994 is part of water year 1995 (which is not included in the simulation studies).

Average monthly transfer capacity for July-October is shown in Table XII-2. For the 72-year average, monthly transfer capacity is greater in July and August in the Cumulative Impact Assessment than in the No Project Alternative or the Bay/Delta Plan Alternative and less in September. Transfer capacity in October is somewhat lower in the Cumulative Impact Assessment than in the No Project Alternative, but virtually the same as the Bay/Delta Plan Alternative.

For the critical period, monthly transfer capacity in the Cumulative Impact Assessment is greater in July and August than in the No Project Alternative or the Bay/Delta Plan Alternative, less in September than in the No Project Alternative, and greater in October than in the Bay/Delta Plan Alternative. There is no significant difference in average monthly transfer capacity between the Cumulative Impact Assessment and the Bay/Delta Plan Alternative in September or the No Project Alternative in October.

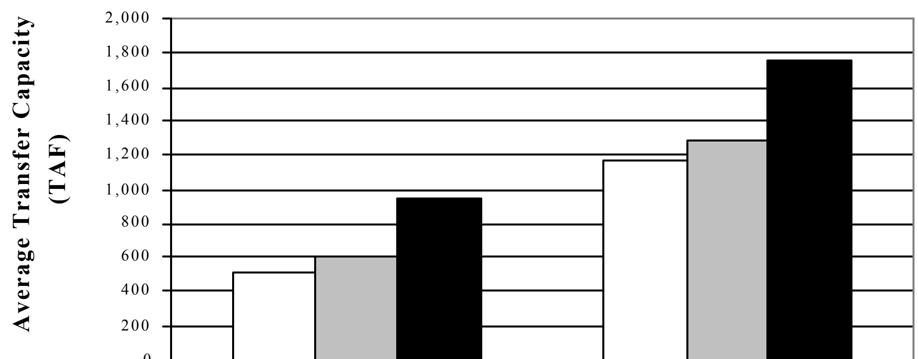
d. Delta Outflow. Delta outflow is one of the flow objectives included in the 1995 Bay/Delta Plan. The principal purpose of the flow objective is for protection of fish and wildlife. Table XII-3 shows the average monthly Delta outflow for the 73-year period and the critical period for each study.

For the 73-year period, Delta outflow in the Cumulative Impact Assessment is 8-10 percent less than the No Project Alternative in the months of June, November, December, and January, and 24 percent less in October; however, outflow is 10 percent higher in April and 6 percent higher in August. Delta outflow in the Cumulative Impact Assessment is 8-14 percent less than the Bay/Delta Plan Alternative between September and January and in June.

For the critical period, Delta outflow in the Cumulative Impact Assessment is significantly higher than the No Project Alternative in September and from February through July, particularly February-March and May-June. Outflow is significantly less than the No Project Alternative in August and from October through January. Delta outflow in the Cumulative Impact Assessment is 7-12 percent less than the Bay/Delta Plan Alternative in October, January, and June; however, outflow is 6 percent higher in August.

Figure XII-2

Transfer Capacity July through October



	72-Year Period	Critical Period
No Project	513	1,171
Bay/Delta Plan	612	1,286
Cumulative Impact	941	1,755

Critical Period is May 1928 through October 1934

Table XII-2

Transfer Capacity*, July - October (TAF)

72-year Average (1922-1993)

Study	Jul	Aug	Sep	Oct	Total
No Project	64	117	167	165	513
Bay/Delta Plan	149	221	118	124	612
Cumulative Impac	276	453	88	123	941

Critical Period (1928-1934)

Study	Jul	Aug	Sep	Oct	Total
No Project	108	341	358	364	1171
Bay/Delta Plan	338	404	270	268	1280
Cumulative Impac	539	591	253	372	1755

* Average monthly excess pumping capacity at Banks and Tracy pumping plants

Table XII-3
Delta Outflow

73-Year Period Average Monthly Flow (TAF)

Study	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
No Project	505	594	1,364	2,379	2,794	2,583	1,453	1,132	767	407	238	247
Bay/Delta Plan	449	628	1,346	2,345	2,846	2,636	1,636	1,142	789	411	249	278
Cumulative Impacts	385	547	1,232	2,150	2,783	2,571	1,603	1,122	706	410	253	242
Change from*												
No Project to Cumulative Impact	-120	-46	-132	-229	-10	-12	150	-10	-61	3	15	-5
B/D Plan to Cumulative Impact	-64	-81	-115	-194	-63	-65	-34	-20	-83	-1	4	-36

Critical Period Average Monthly Flow (TAF)

Study	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
No Project	351	182	369	652	475	499	487	295	252	244	298	158
Bay/Delta Plan	257	286	346	519	650	784	553	514	444	299	239	180
Cumulative Impacts	235	285	335	458	663	771	554	517	413	299	254	180
Change from*												
No Project to Cumulative Impact	-116	103	-34	-194	188	272	67	222	161	54	-44	22
B/D Plan to Cumulative Impact	-22	-1	-11	-61	13	-13	1	2	-31	0	15	0

* Negative value indicates a reduction in Delta outflow

For the critical period, Delta outflow in the Cumulative Impact Assessment is significantly higher than the No Project Alternative in September and from February through July, particularly February-March and May-June. Outflow is significantly less than the No Project Alternative in August and from October through January. Delta outflow in the Cumulative Impact Assessment is 7-12 percent less than the Bay/Delta Plan Alternative in October, January, and June; however, outflow is 6 percent higher in August.

e. **Fisheries**. Cumulative impacts to fisheries were assessed for the Delta and for the upstream rivers and reservoirs. To characterize impacts to Delta fisheries, effects on juvenile chinook salmon, steelhead, and striped bass were evaluated. To characterize impacts to aquatic habitat in upstream areas, the Range of Variability Analysis was used (Richter 1997). To characterize impacts to reservoir fisheries, estimated end-of-month storage was used to predict changes in habitat quality.

Chinook Salmon. The USFWS salmon smolt survival model, described in Chapter IV, was used to estimate juvenile chinook salmon survival through the Delta. Survival indices calculated for the Cumulative Impact Assessment were compared with the Bay/Delta Plan and No Project alternatives. For the Sacramento River, survival indices were predicted for fall-run, late fall-run, and winter-run smolts, and spring-run young-of-the-year and yearlings. For the San Joaquin River, indices were predicted for fall-run smolts, with and without the Old River Barrier operation.

Results of the model for the Sacramento River are shown in Figure XII-3. For all salmon runs, predicted survival indices for the Cumulative Impact Assessment were slightly lower than for the Bay-Delta Plan, but were higher than for the No Project Alternative. Differences between the No

Project and other alternatives result primarily from differences in the operation of the Delta Cross Channel gates. The gates are open more often under the No Project Alternative; smolt survival decreases if smolts are diverted off the mainstream of the river and into the central Delta. Differences between the Bay/Delta Plan and Cumulative Impact Assessment result from changes in flow and exports.

Results of the model for the San Joaquin River are shown in Figure XII-4. Predicted survival indices for all alternatives were lower without the Old River Barrier, but differences among the alternatives were similar with and without the barrier. Survival indices for the Cumulative Impact Assessment were slightly lower than for the Bay/Delta Plan, but were higher than for the No Project Alternative.

Steelhead. Changes in flow, Delta exports, and Delta Cross Channel gate closure have the potential to affect juvenile steelhead during the period of emigration through the Delta. Emigration occurs from December through May, with peak migration occurring from February through April (DWR and USBR 1999). The primary differences among the No Project, Bay/Delta Plan, and Cumulative Impacts Assessment that may affect juvenile steelhead include Delta exports and closure of the Delta Cross Channel gates.

In the February through April period, Delta exports are lower under the Bay/Delta Plan than under the No Project Alternative, but higher in the Cumulative Impacts Assessment than under the Plan. Due to these changes in exports, survival of juvenile steelhead may be higher under the Bay/Delta Plan compared to the No Project Alternative, but may be reduced under the Cumulative Impacts Assessment compared to the Bay/Delta Plan.

The increased closure of the Delta Cross Channel gates in the February through April period under the Bay/Delta Plan and Cumulative Impacts Assessment may improve survival of emigrating juvenile steelhead compared to the No Project Alternative.

Striped Bass. Changes in flow and Delta exports due to cumulative impacts will primarily affect the young-of-the-year striped bass lifestage. The effects of the No Project, Bay/Delta Plan, and Cumulative Impacts alternatives on young-of-the-year striped bass abundance were evaluated using a multiple regression relating total young-of-the-year striped bass abundance at 38 mm. to the mean April – July San Joaquin River flow past Jersey Point, $\log_{10}$ net Delta outflow, and total Delta exports (including CVP, SWP, Contra Costa Canal, and miscellaneous Delta diversions) (Lee Miller, DFG, personal communication). The regression is described in Chapter IV; regression calculations are shown in Volume 2, Appendix 5.

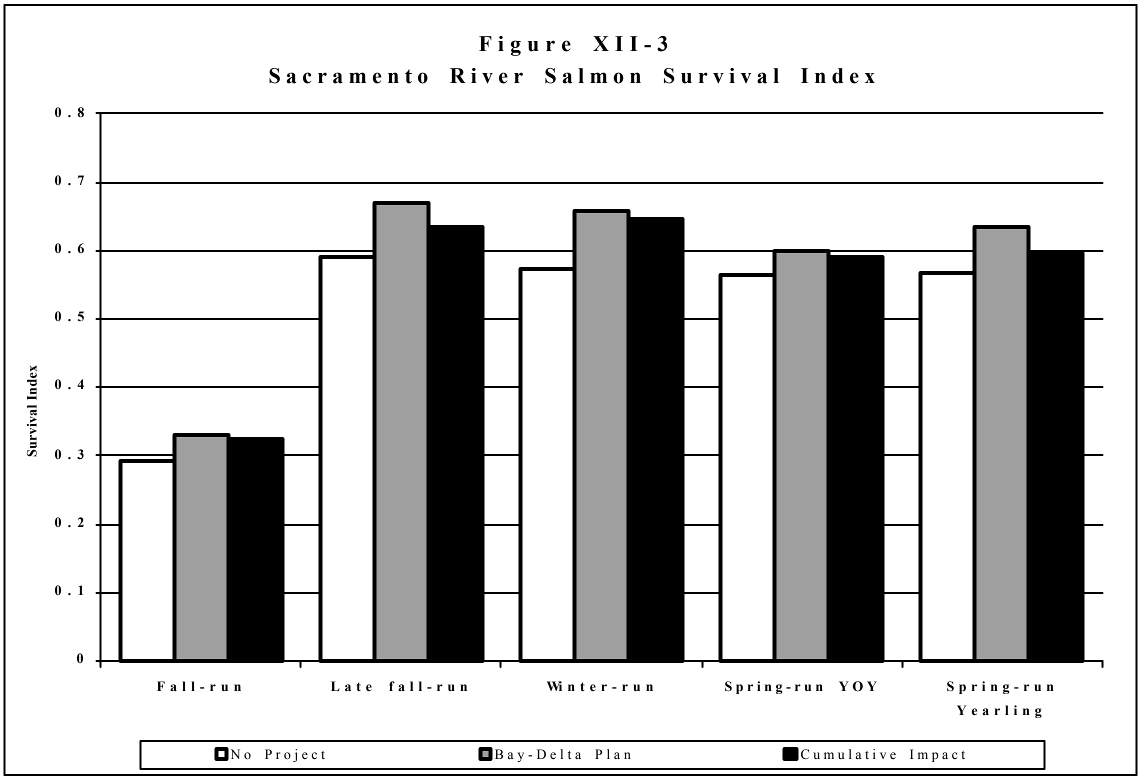


Figure XII-3
Sacramento River Salmon Survival Index
Survival Index
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Fall-run
Late fall-run
Winter-run
Spring-run YOY
Spring-run Yearling
No Project
Bay-Delta Plan
Cumulative Impact

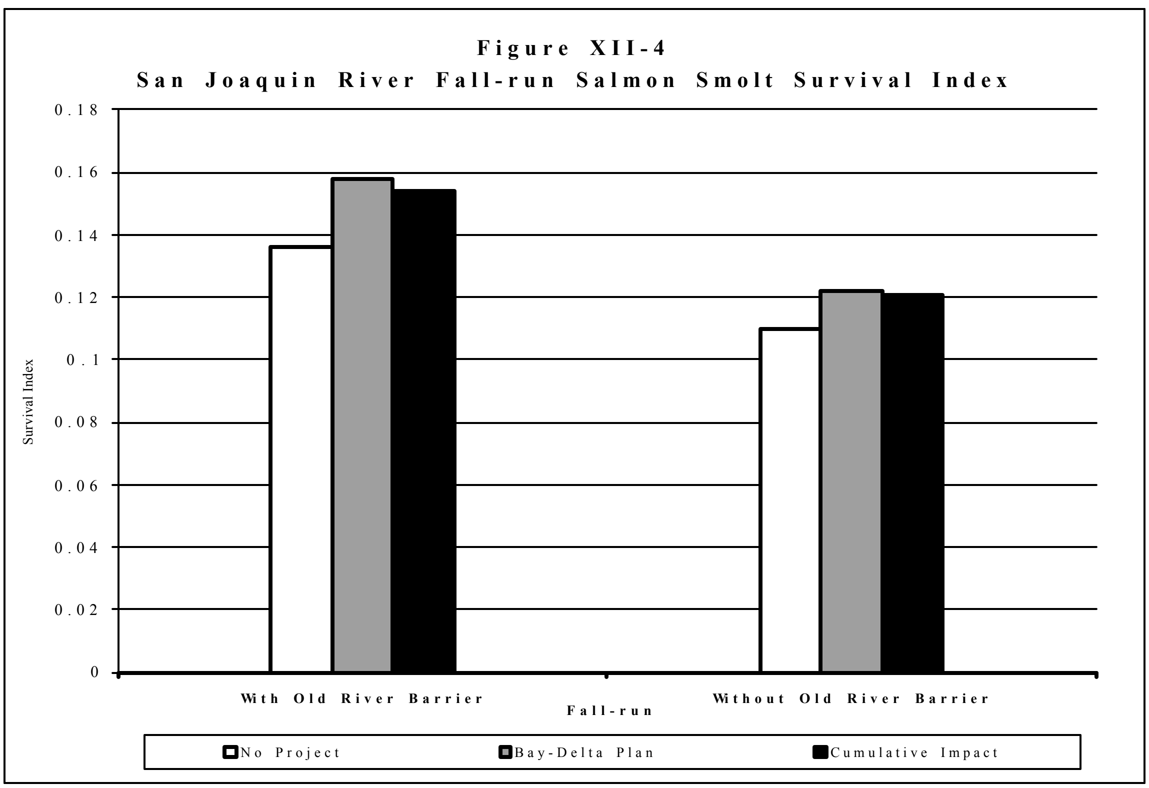
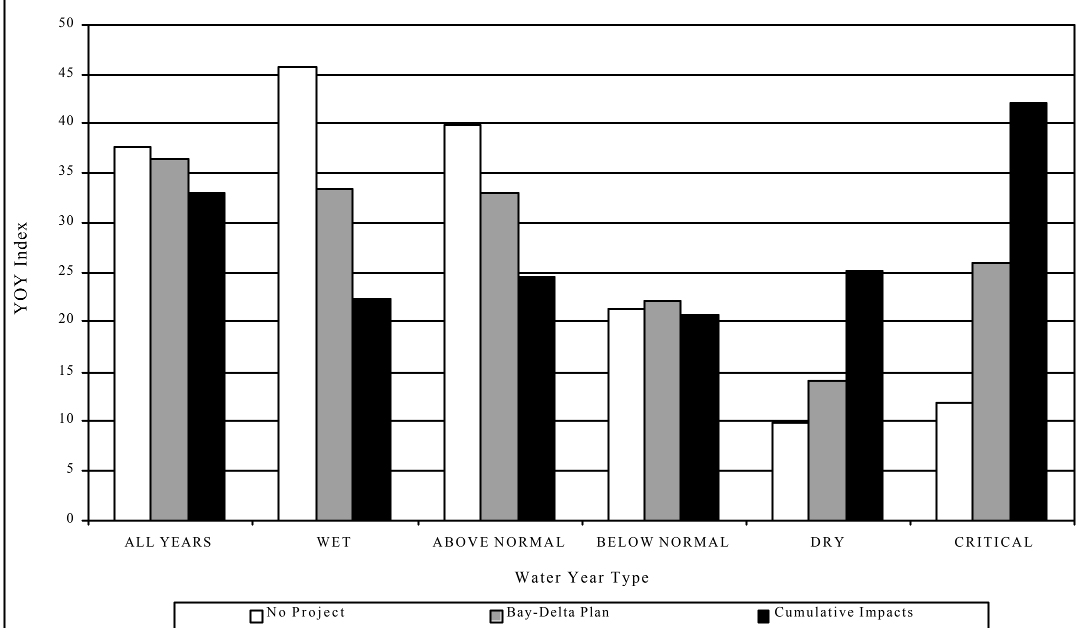


Figure XII-4
San Joaquin River Fall-run Salmon Smolt Survival Index
Survival Index
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
With Old River Barrier
Fall-run
Without Old River Barrier
No Project
Bay-Delta Plan
Cumulative Impact

Figure XII-5 shows the predicted young-of-the-year index for the No Project, Bay/Delta Plan, and Cumulative Impacts alternatives, by water year type and all years combined. In wet and above normal water years, the predicted index was lower for the Bay/Delta Plan than for the No Project base case, and the index for Cumulative Impacts was lower than for the Bay/Delta Plan. In below normal water years, the predicted index for the three conditions were similar. In dry and critical water years, indices were lowest for the No Project condition, intermediate for the Bay/Delta Plan, and highest for the Cumulative Impacts condition. For all years combined, the predicted index for the Bay/Delta Plan was slightly lower than for the base case; the index for Cumulative Impacts was slightly lower than for the Bay/Delta Plan.

FIGURE XII-5
Predicted Striped Bass YOY Index Cumulative Impacts



The observed differences in the abundance indices are primarily due to changes in total Delta exports. Of the flow/export variables included in the regression, mean April – July total Delta exports had a dominant effect on the predicted abundance indices. Mean April – July total Delta exports predicted in DWRSIM for all scenarios were lower in dry and critical years than in other water year types. In these water years, exports in the Cumulative Impacts condition were also lower than for the No Project or Bay/Delta Plan conditions. Lower exports in these conditions resulted in higher predictions of young-of-the-year striped bass abundance.

The predicted changes in young-of-the-year abundance may result in lower recruitment to the adult striped bass population. Striped bass losses due to cumulative impacts could be mitigated through funding of additional stocking. The DFG is considering a stocking program for striped bass, but federal resource agencies have expressed concern regarding the effect of a stocking program on smelt and winter-run chinook salmon. These concerns are currently being addressed under the Section 10 permitting process of the ESA.

Upstream Aquatic Habitat. The Range of Variability Approach (RVA) developed by Richter et al (1997) was used to assess the cumulative impacts to upstream aquatic habitat compared to the No Project and Bay/Delta Plan alternatives. This approach, described in Chapter VI, is based on aquatic ecology theory concerning the critical role of hydrologic variability, and associated characteristics of duration and timing, in sustaining aquatic ecosystems.

The Range of Variability Analysis method was used to assess cumulative impacts at locations where estimates of unimpaired flow data were available on the mainstream Sacramento and San Joaquin rivers:

- Sacramento River near Red Bluff
- San Joaquin River at Vernalis

Since estimated unimpaired flows were available only on a monthly time step, a subset of the 32 hydrologic parameters recommended in the RVA analysis was calculated for the available period of record (1922 – 1993). Hydrologic parameters used in the analysis included the magnitude of monthly flows, the magnitude of annual extreme flow conditions, and the timing of annual extreme flow conditions.

Simulated flows for the period of record (1922 – 1993) for each of the alternatives (DWRSIM analysis) were compared with flow target ranges based on unimpaired flows to evaluate the relative suitability of the alternatives in meeting ecological objectives. For the flow simulations, locations from the DWRSIM analysis were selected that were closest to sites on each river where estimated unimpaired flow data were available. The rate of non-attainment of the flow management targets was calculated for each site and flow parameter.

Table XII-4 summarizes the Range of Variability Analysis for the Cumulative Impact Assessment, Bay/Delta Plan and No Project Alternatives at the two sites. Differences in the rate of non-attainment of the target ranges between these conditions are minor. Results of the Range of Variability Analysis Cumulative Impacts Cases where flow parameters showed a greater than 10 percent deviation in the non-attainment rate between the alternatives are described below.

Table XII-4
Results of the Range of Variability Analysis Cumulative Impacts

San Joaquin River at Vernalis

	Unimpaired Conditions (1922 - 93)						No Project					Bay/Delta Plan									
			Range Limits		RVA Target Range				Range Limits		Rate of Non-			Range Limits		Rate of Non-			Range Limits		Rate of Non-
IHA Group 1	**Mean**	**SD**	**Low**	**High**	**Low**	**High**	**Mean**	**SD**	**Low**	**High**	**Attainment**	**Mean**	**SD**	**Low**	**High**	**Attainment**	**Mean**	**SD**	**Low**	**High**	**Attainment**
Monthly Flow Magnitude (cfs)																					
October	903	990	147	6,940	147	1,893	3,153	2,566	1,457	12,688	44%	3,091	2,270	1,254	12,441	78%	3,108	2,292	1,252	12,445	76%
November	2,389	3,816	219	25,842	219	6,206	2,081	1,718	1,387	13,552	3%	1,993	1,697	1,183	13,552	3%	2,003	1,691	1,186	13,555	3%
December	4,570	6,526	277	35,973	277	11,095	2,947	3,631	1,331	21,495	6%	2,768	3,475	1,124	21,495	4%	2,785	3,471	1,125	21,502	4%
January	6,124	6,659	375	33,464	375	12,783	4,452	5,067	1,288	24,859	8%	4,183	4,877	1,088	24,860	8%	4,206	4,898	1,088	24,863	8%
February	9,234	8,104	433	41,685	1,130	17,338	6,930	7,373	1,404	36,536	8%	6,486	6,946	1,159	36,536	7%	6,492	6,958	1,163	36,538	7%
March	10,519	7,465	1,059	42,098	3,054	17,984	6,240	7,231	1,406	41,110	51%	6,140	7,015	1,202	41,110	49%	6,124	7,029	1,208	41,111	49%
April	15,561	6,986	3,434	43,300	8,575	22,547	5,496	5,043	1,529	27,032	88%	5,852	4,864	1,990	27,030	88%	5,844	4,871	1,990	27,031	88%
May	23,634	11,360	4,334	58,048	12,274	34,993	4,695	5,194	1,217	26,213	90%	5,441	4,900	1,871	26,139	90%	5,432	4,910	1,871	26,214	90%
June	18,505	12,626	1,279	63,838	5,879	31,131	3,756	5,465	1,030	36,445	82%	3,930	5,157	1,253	36,445	82%	3,920	5,204	1,246	36,448	82%
July	6,393	6,344	587	35,044	587	12,737	1,805	1,811	945	13,585	1%	2,029	1,707	1,133	13,585	1%	2,032	1,708	1,122	13,588	1%
August	1,636	1,750	179	11,909	179	3,387	1,363	198	992	1,730	0%	1,638	197	1,163	1,921	0%	1,643	195	1,188	1,923	0%
September	813	1,004	118	5,825	118	1,817	1,879	738	1,356	6,851	44%	1,842	710	1,160	6,498	43%	1,843	710	1,184	6,501	43%
IHA Group 2																					
Mean Annual Extremes (cfs)																					
Annual 30-day minimum	484	518	118	4,394	118	1,003	1,315	205	945	1,730	97%	1,449	232	1,088	1,921	100%	1,453	236	1,088	1,923	100%
Annual 30-day maximum	25,044	12,103	5,034	63,838	12,941	37,148	9,131	8,463	1,698	41,110	78%	8,798	8,185	1,990	41,110	81%	8,816	8,190	1,990	41,111	81%
IHA Group 3																					
Timing of Annual Extremes																					
Month of annual minimum	9	1	8	1	8	10	8	2	1	12	67%	8	4	1	12	85%	7	4	1	12	82%
Month of annual maximum	5	1	12	6	4	6	2	2	10	6	68%	5	3	1	12	54%	5	3	1	12	54%

Sacramento River near Red Bluff

	Unimpaired Conditions (1922 - 93)						No Project					Bay/Delta Plan					Cumulative Impacts				
			Range Limits		RVA Target Range				Range Limits		Rate of Non-			Range Limits		Rate of Non-			Range Limits		Rate of Non-
IHA Group 1	**Mean**	**SD**	**Low**	**High**	**Low**	**High**	**Mean**	**SD**	**Low**	**High**	**Attainment**	**Mean**	**SD**	**Low**	**High**	**Attainment**	**Mean**	**SD**	**Low**	**High**	**Attainment**
Monthly Flow Magnitude (cfs)																					
October	4,966	1,777	2,933	14,630	3,189	6,742	7,285	2,822	3,682	14,636	36%	7,353	2,902	3,682	14,221	36%	7,367	2,789	3,682	14,221	43%
November	7,711	5,372	3,300	35,471	3,300	13,083	8,916	5,602	3,721	41,079	13%	9,105	5,511	4,352	41,303	13%	8,963	5,429	3,754	40,429	13%
December	13,396	10,489	3,649	47,214	3,649	23,885	12,443	9,546	4,261	45,352	17%	12,473	9,717	4,224	45,352	18%	12,394	9,676	3,990	45,352	18%
January	17,837	13,990	3,861	73,900	3,861	31,826	15,381	13,827	4,733	78,039	11%	15,251	13,833	3,903	78,039	11%	15,215	13,802	3,905	78,039	11%
February	22,291	15,087	4,852	79,618	7,204	37,378	18,428	15,133	4,528	67,087	29%	18,501	14,804	4,582	66,086	25%	18,336	14,791	4,582	65,733	28%
March	19,883	11,768	4,659	76,197	8,114	31,651	15,455	13,149	4,037	68,665	44%	15,581	12,966	4,555	68,665	39%	15,355	13,036	4,775	68,665	43%
April	16,423	8,718	4,293	40,438	7,705	25,141	11,542	7,317	5,292	42,993	38%	11,554	7,320	4,880	42,993	35%	11,559	7,316	5,048	42,993	36%
May	10,988	4,487	3,959	24,927	6,500	15,475	10,719	3,256	6,178	20,157	15%	10,533	3,202	6,031	20,157	10%	10,474	3,214	6,031	20,157	10%
June	7,267	2,479	3,603	14,360	3,603	9,745	10,949	1,822	6,788	16,681	82%	12,057	2,246	7,157	17,593	86%	11,059	1,771	7,281	16,681	81%
July	4,873	1,029	3,030	7,739	3,843	5,902	12,794	2,082	6,837	16,145	100%	12,213	1,738	7,544	15,329	100%	12,710	1,931	7,544	16,524	100%
August	4,162	746	2,867	5,898	3,416	4,908	10,551	1,384	6,812	13,406	100%	9,823	1,495	6,227	13,406	100%	10,044	1,659	6,301	13,406	100%
September	4,342	816	2,811	5,993	3,526	5,158	6,269	2,157	4,099	13,905	65%	6,306	2,393	4,057	13,905	57%	7,265	1,849	5,630	13,905	100%
IHA Group 2																					
Mean Annual Extremes (cfs)																					
Annual 30-day minimum	4,029	703	2,811	5,898	3,326	4,732	5,420	1,427	3,682	12,290	75%	5,438	1,589	3,682	12,290	68%	6,061	1,534	3,682	12,290	82%
Annual 30-day maximum	30,007	16,299	5,507	79,618	13,709	46,306	26,230	16,781	9,424	78,039	43%	26,097	16,701	8,859	78,039	33%	25,932	16,703	8,377	78,039	38%
IHA Group 3																					
Timing of Annual Extremes																					
Month of annual minimum	9	1	7	11	8	10	10	1	8	3	19%	9	2	1	12	13%	9	3	1	12	31%
Month of annual maximum	2	1	11	5	1	3	3	3	10	8	42%	4	3	1	12	40%	5	3	1	12	46%

For the Sacramento River, no differences occurred in any of the flow parameters between the Cumulative Impact Assessment, the Bay/Delta Plan, and No Project alternatives, except for the timing of the annual minimum flow. Under the Bay-Delta Plan and No Project alternatives, the timing of the annual minimum flow was more similar to unimpaired conditions than in the Cumulative Impact Assessment.

For the San Joaquin River, no differences occurred in any of the flow parameters between the Cumulative Impact and Bay/Delta Plan alternatives. These alternatives differed slightly from the No Project alternative; in some cases, these alternatives were more similar to unimpaired flow conditions and in some cases, they resulted in a shift away from unimpaired conditions.

In October, monthly flow magnitudes under the Bay/Delta Plan and Cumulative Impacts alternatives resulted in a shift away from unimpaired conditions compared to the No Project alternative. The timing of the annual 30-day minimum flow under the Bay/Delta Plan and Cumulative Impacts alternatives also resulted in a shift away from unimpaired conditions compared to the No Project alternative. The timing of the annual 30-day maximum flow under the Bay/Delta Plan and Cumulative Impacts alternatives resulted in a shift toward unimpaired conditions.

Reservoir Fisheries. To assess the cumulative impacts to upstream reservoir fisheries, DWRSIM modeling of end-of-month surface elevations for four of the SWP and CVP reservoirs was used to calculate the relative potential quality of reservoir fishery habitat. The method of analysis, described in more detail in Chapter VI, provides a basis for comparison of the effects of reservoir operation under the various alternatives being studied.

Survival of fry and juveniles is higher with stable and maximum reservoir pool levels, because they rear primarily in nearshore, shallow areas. Two critical factors influence spawning and rearing habitat conditions: (1) starting elevation, and (2) change in reservoir elevation during the spawning season. In this analysis, each month is scored by: (1) the water surface elevation relative to maximum pool at the beginning of the month; and (2) the change in elevation during that month. These two scores are summed for the months of concern, March through September. The summed scores are then multiplied together to arrive at a reservoir habitat index value. The analysis assumes that the higher the index, the greater the quantity and quality of habitat.

The following CVP and SWP reservoirs were included in this analysis: Shasta Lake, Lake Oroville, Folsom Lake, and New Melones Reservoir. Other reservoirs were unaffected by the modeling. The analysis characterizes reservoir operations under the No Project and Bay/Delta Plan alternatives and the Cumulative Impact Assessment, for the 73-year period and the critical period, and indicates the potential impacts to warmwater aquatic species. The results of the analysis of reservoir habitat conditions are shown in Table XII-5.

Table XII-5
Reservoir Habitat Index

73-Year Average

Study	Shasta	Oroville	Folsom	New Melones
No Project	459	388	438	298
Bay/Delta Plan	460	385	426	258
Cumulative Impact	458	384	428	266

Critical Period Average

Study	Shasta	Oroville	Folsom	New Melones
No Project	202	184	250	219
Bay/Delta Plan	202	191	213	186
Cumulative Impact	197	204	228	190

For the 73-year period, the index values for the Cumulative Impact Assessment are lower at Folsom and New Melones than under the No Project Alternative, with little or no difference at the other reservoirs. The index values for the Cumulative Impact Assessment are slightly higher at New Melones than under the Bay/Delta Plan Alternative, with little or no difference at the other reservoirs.

For the critical period, the index values for the Cumulative Impact Assessment are somewhat lower at Folsom and New Melones than under the No Project Alternative, and less so at Shasta; however, they are higher at Oroville. The index values for the Cumulative Impact Assessment are slightly lower at Shasta than under the Bay/Delta Plan Alternative, but they are somewhat higher at Oroville, Folsom, and New Melones.

Overall, the results indicate that under the cumulative impact conditions, there may be significant effects on some CVP reservoirs, but these effects are caused by implementation of the Bay/Delta Plan alone -- not the additional projects included in the Cumulative Impact Assessment. As described in Chapter VI, these impacts are generally temporary and mitigable. If significant effects on reservoir fish populations are observed, mitigation could include additional fish planting, habitat improvement through planting vegetation, or addition of habitat structures.

f. **Salinity**. Two analysis methods were used to assess the cumulative impacts on salinity in the Bay/Delta Estuary. In each analysis, the results of the Cumulative Impact Assessment are compared to the No Project and Bay/Delta Plan alternatives. In the first analysis, the X2 (2 ppt isohaline) position is compared, and in the second, electrical conductivity (EC) is compared at several stations throughout the Delta.

X2. The 1995 Bay/Delta Plan includes objectives pertaining to the location of X2 within the Bay/Delta Estuary. DWRSIM was used to determine the position of X2 for each of the flow alternatives and for the Cumulative Impact Assessment. For this analysis, the position of X2 as predicted for the Cumulative Impact Assessment is compared to the position under the No Project and Bay/Delta Plan alternatives.

Table XII-6 shows monthly average X2 positions for the 73-year period and the critical period. The table also shows the change in position when comparing the Cumulative Impact Assessment to each alternative. Positive changes indicate westward movement of the X2 line, which is desirable for aquatic species in the Estuary; negative changes indicate a shift toward the Delta.

Table XII-6
Computed Isohaline (X2) Position*

73-Year Period Average Monthly X2 Position (km)

Study	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
No Project	83.0	82.4	77.2	70.4	66.4	66.1	70.8	73.3	76.6	80.9	85.7	88.1
Bay/Delta Plan	83.8	81.3	77.0	70.9	65.3	64.7	67.8	71.4	74.1	79.4	84.7	86.6
Cumulative Impact	84.8	82.6	78.4	72.5	66.0	65.2	68.0	71.5	75.3	79.8	84.7	87.1
Change												
No Project - Cum. Impact	-1.8	-0.2	-1.2	-2.1	0.4	0.9	2.8	1.8	1.3	1.1	1.0	1.0
B/D Plan - Cum. Impact	-1.0	-1.2	-1.4	-1.6	-0.8	-0.5	-0.3	-0.1	-1.2	-0.4	0.0	-0.5

Critical Period Average Monthly X2 Position (km)

Study	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
No Project	85.4	88.8	84.9	79.1	79.8	82.6	81.1	83.5	85.9	87.3	85.9	90.0
Bay/Delta Plan	87.8	86.2	84.7	81.1	77.3	76.0	77.2	78.1	79.6	83.5	86.4	89.1
Cumulative Impact	88.4	86.3	84.8	81.8	77.5	76.1	77.3	78.1	80.1	83.7	85.9	89.0
Change												
No Project - Cum. Impact	-3.0	2.6	0.2	-2.8	2.4	6.5	3.9	5.4	5.8	3.6	-0.1	1.0
B/D Plan - Cum. Impact	-0.6	0.0	-0.1	-0.8	-0.1	-0.2	0.0	0.0	-0.6	-0.2	0.4	0.1

* X2 position is stated as the number of kilometers upstream from the Golden Gate Bridge

For the 73-year period, the X2 position in the Cumulative Impact Assessment is downstream of the No Project Alternative position from February through September, with the greatest change occurring in April (+2.8 km). The X2 position is upstream from October through January, with the greatest change occurring in January (-2.1 km). The X2 position in the Cumulative Impact Assessment is upstream of the Bay/Delta Plan Alternative position in all months but August (no change), with the greatest change occurring in January (-1.6 km).

For the critical period, the X2 position in the Cumulative Impact Assessment is downstream of the No Project Alternative position from February through July and in September, November, and December, with the greatest change occurring in March (+6.5 km). The X2 position is upstream in October, January, and August, with the greatest change occurring in October (-3.0 km). The X2 position in the Cumulative Impact Assessment is slightly upstream of the Bay/Delta Plan Alternative position in all months but August and September, with the greatest change occurring in January (-0.8 km).

The placement of the X2 isohaline for the Cumulative Impact Assessment downstream from the corresponding X2 position for the No Project Alternative in February through June is a positive result.

EC Within the Delta. This analysis compares the salinity or chloride levels at various locations as predicted using DWRDSM (discussed in Chapter IV) for the Cumulative Impact Assessment and the No Project and Bay/Delta Plan alternatives. Figures XII-6 through XII-51 show expected EC or chloride levels at the following locations: Contra Costa Canal at Pumping Plant No. 1/Rock Slough; Sacramento River at Emmaton; San Joaquin River at Jersey Point; San Joaquin River at San Andreas Landing; South Fork of the Mokelumne River at Terminous; San Joaquin River at Prisoners Point; San Joaquin River at Vernalis; San Joaquin River at Brandt Bridge site; Old River near Tracy Road Bridge; and Old River near Middle River. Salinity output are end-of-month values resulting from monthly average flow inputs for water years 1976 through 1991. Chloride levels are reported at the Contra Costa Canal intake; the other locations are reported as EC.

Where possible, water quality objectives for each station have been noted on the figures. EC objectives for the four stations in the southern Delta are the same for all year types, while EC objectives at other stations change based on the year type. The water quality objectives for the western and interior Delta monitoring locations are dependent on Sacramento River water-year classification. The first figure for each station shows the average EC (or chloride concentration) for wet years during the 16-year period, followed by above normal, below normal, dry, and critically dry years. Year types follow the Sacramento Valley “40-30-30” and San Joaquin Valley “60-20-20” hydrologic classification conventions in the 1995 Plan (see Figures II-1 and II-2). Below normal years under the San Joaquin 60-20-20 hydrologic classification do not occur during the model study period (1976 – 1991). Consequently below normal year types are omitted for southern Delta stations.

The results for the western and central Delta are very similar to the results for the salinity modeling described in Chapter VI. Salinity and chloride levels at these locations are generally higher in December and January than for the No Project or Bay/Delta Plan alternatives, and chloride objectives are significantly exceeded at the Contra Costa Pumping Plant. As described in Chapter VI, this is the result of differences in the DWRSIM and DWRDSM models. In real operation, the SWP and the CVP would have to release carriage water, if necessary to avoid violations of the objectives, in order to maintain their operations. Such releases would reduce the chloride and EC levels throughout the western and central Delta. In general, the Cumulative Impact Assessment shows improved or similar chloride and EC levels in other months. Therefore, because of the assumption that carriage water will be released if necessary, there should not be any significant negative impact on EC or chloride levels associated with the cumulative impact conditions.

In the southern Delta, the EC effects observed are due principally to the difference in objectives between the Bay/Delta Plan and the No Project Alternative and to the operation of the barriers in the ISDP. The Bay/Delta Plan has Vernalis EC objectives of 0.7 mmhos/cm from April through August and 1.0 mmhos/cm from September through March; the No Project Alternative has a requirement for New Melones Reservoir to maintain a TDS of 500 ppm at Vernalis. Operation of the ISDP reduces EC levels principally at the Old River locations from April through November. The improved EC conditions in the southern Delta under the cumulative impact conditions during the principal irrigation season provide a benefit to agricultural uses.

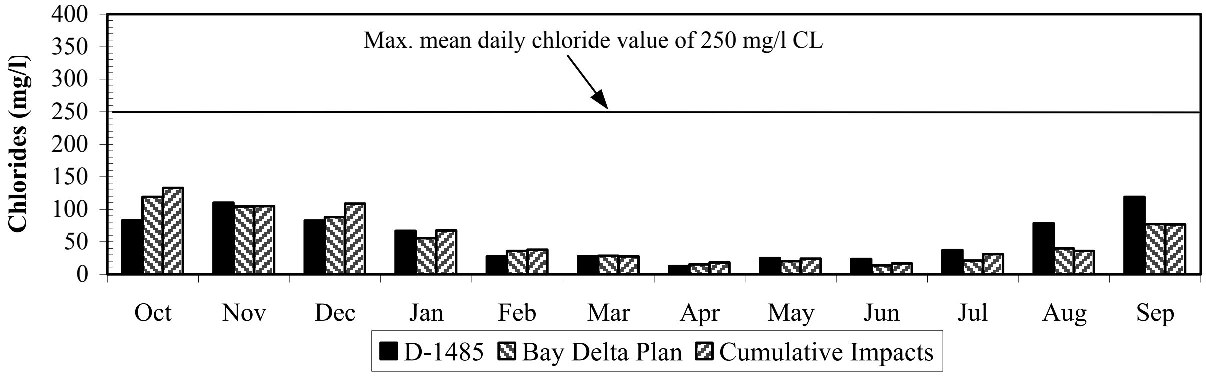
g. Water Temperature. The minor changes in Delta outflow in the Cumulative Impact Assessment are unlikely to result in significant changes in water temperature in the Delta. In upstream areas, the minor differences in streamflow releases under the Cumulative Impact Assessment are also unlikely to result in substantial changes in temperature in these areas.

B. MITIGATION MEASURES

The impacts of implementing the Bay/Delta Plan objectives are discussed in the preceding chapters. Mitigation measures for significant adverse impacts are included in Chapters VI through X. Unless specifically noted otherwise, the mitigation measures identified in these chapters are unlikely to reduce the identified impacts to less than significant levels. The flow objectives contained in the Bay/Delta Plan increase the protection provided to fish and wildlife uses of the Estuary while maintaining existing water quality protection for other uses of water. The higher level of protection for the fish and wildlife beneficial uses of water from the Estuary may result in curtailment of inbasin diversions and will result in decreased water availability in export areas, and changes in reservoir levels and river flows in upstream areas. Consequently, mitigation measures beyond those previously identified likely will focus on actions that encourage the efficient use of available water supplies or provide flexibility in the operation of existing water projects. The following section discusses the general actions that may be taken by water right holders and water users in response to the reductions in water supply. These actions include conservation, ground water management (conjunctive use), water transfers, reclamation, combined use of points of diversion, offstream storage projects, and the ISDP.

The SWRCB is not proposing to initiate any of these measures as a part of implementing the 1995 Bay/Delta Plan. Rather, these measures are among the actions that others might take as a means of offsetting a reduction in water supply that may result from the curtailment of surface water diversions. Some of these measures may have potential to result in significant environmental impacts associated with their implementation. The following discussion does not include an analysis of those impacts.

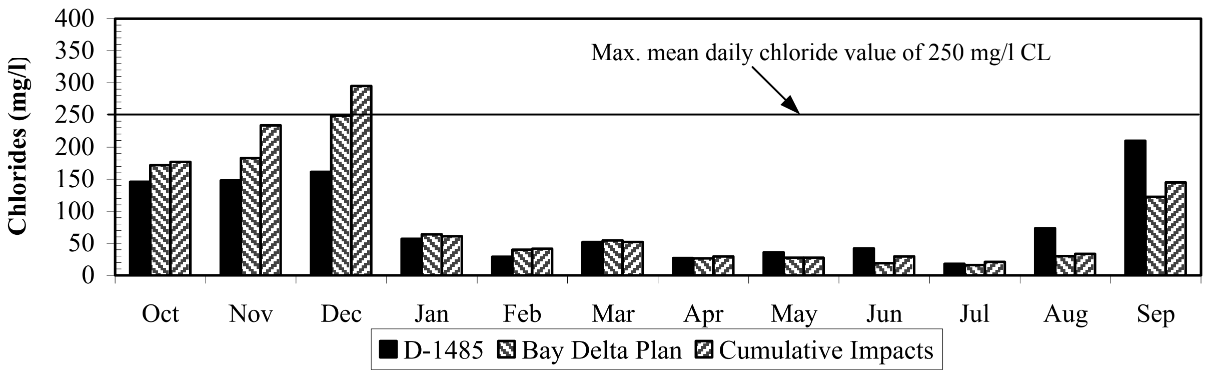
Figure XII-6
Salinity for Contra Costa Canal at Pumping Plant #1
End-of-Month Simulated Values for Wet Years



For a Wet water year; 240 (66%) days <= 150 mg/l CL
Salinity objectives are the same for D-1485 & Bay/Delta Plan

Sacramento "40-30-30" **wet** years averaged (1982, 83, 84 & 86)

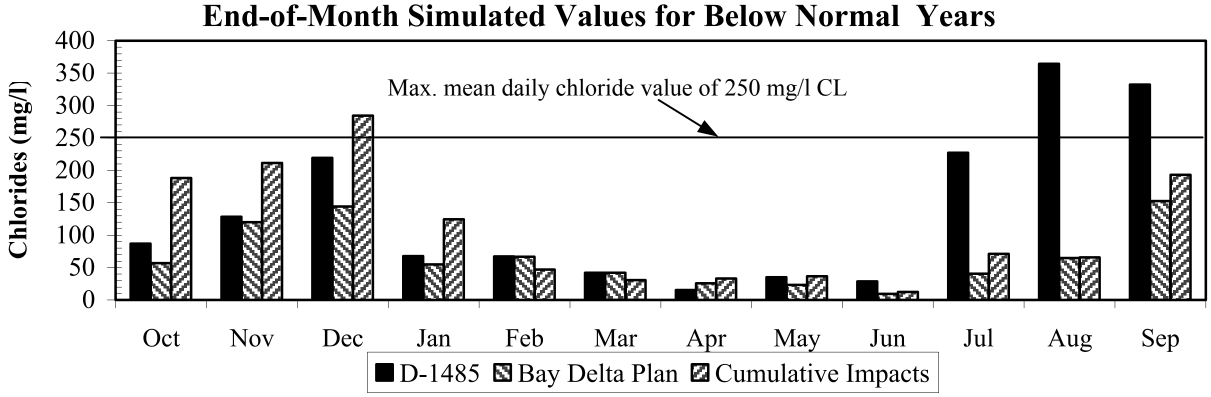
Figure XII-7
Salinity for Contra Costa Canal at Pumping Plant #1
End-of-Month Simulated Values for Above Normal Years



For a Above Normal water year; 190 (52%) days <= 150 mg/l CL
Salinity objectives are the same for D-1485 & Bay/Delta Plan

Sacramento "40-30-30" **above normal** years averaged (1978 & 80)

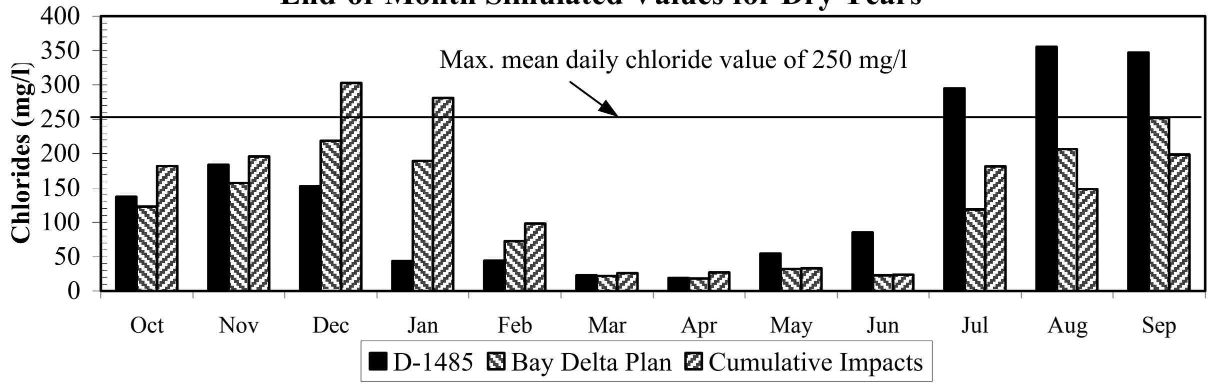
Figure XII-8
Salinity for Contra Costa Canal at Pumping Plant #1
End-of-Month Simulated Values for Below Normal Years



For a Below Normal water year; 175 (48%) days <= 150 mg/l CL
Salinity objectives are the same for D-1485 & Bay/Delta Plan

Sacramento "40-30-30" **below normal** year (1979)

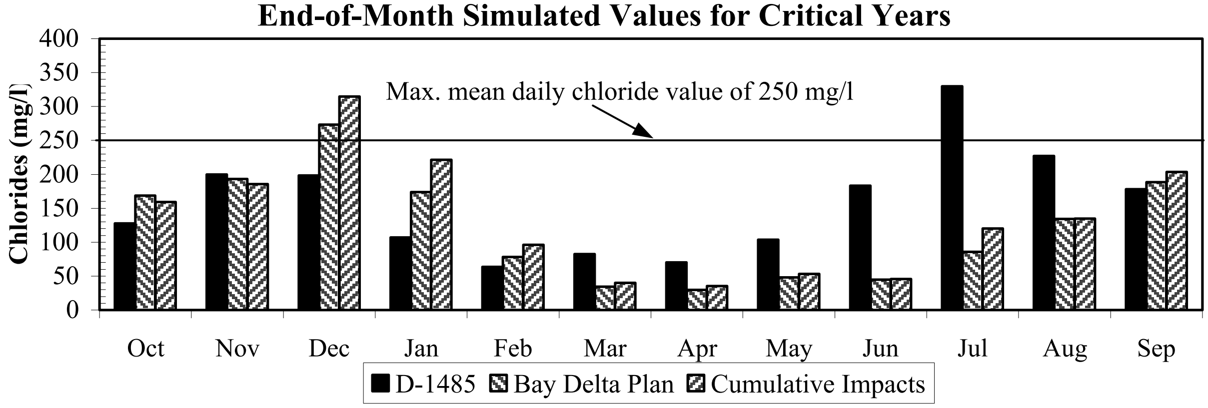
Figure XII-9
Salinity for Contra Costa Canal at Pumping Plant #1
End-of-Month Simulated Values for Dry Years



For a Dry water year; 165 (45%) days <= 150 mg/l CL
Salinity objectives are the same for D-1485 & Bay/Delta Plan

Sacramento "40-30-30" **dry** years averaged (1981, 85, 87 & 89)

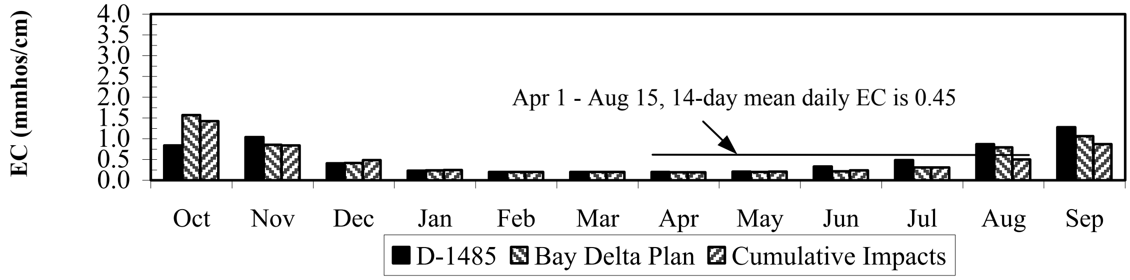
Figure XII-10
Salinity for Contra Costa Canal at Pumping Plant #1
End-of-Month Simulated Values for Critical Years



For a Critical water year; 155 (42%) days <= 150 mg/l
Salinity objectives are the same for D-1485 & Bay/Delta Plan

Sacramento "40-30-30" **critical** years averaged (1976, 77, 88, 90 & 91)

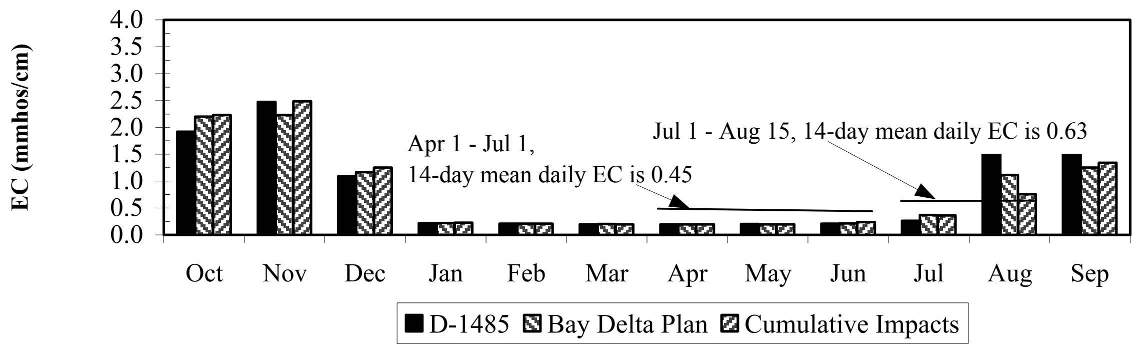
Figure XII-11
Salinity for Sacramento River at Emmaton
End-of-Month Simulated Values for Wet Years



Salinity objectives are the same for D-1485 & Bay/Delta Plan

Sacramento "40-30-30" **wet** years averaged (1982, 83, 84 & 86)

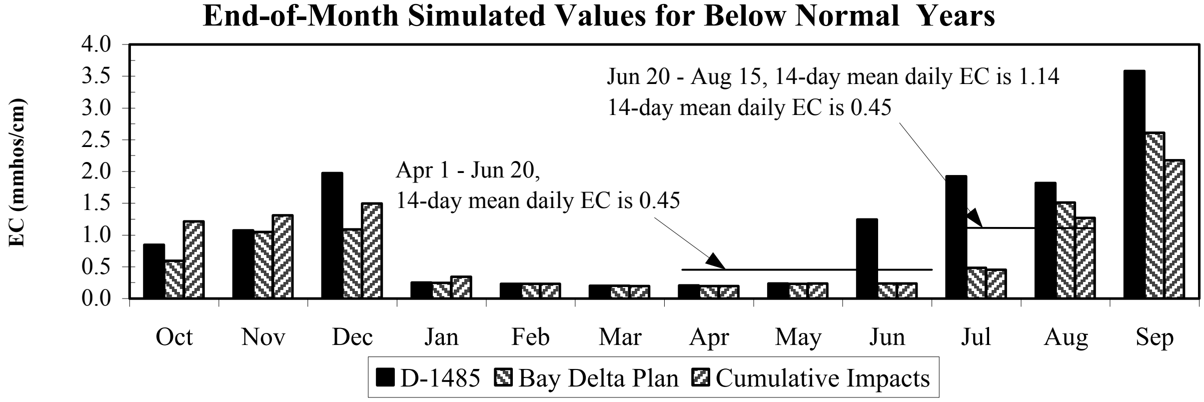
Figure XII-12
Salinity for Sacramento River at Emmaton
End-of-Month Simulated Values for Above Normal Years



Salinity objectives are the same for D-1485 & Bay/Delta Plan

Sacramento "40-30-30" **above normal** years averaged (1978 & 80)

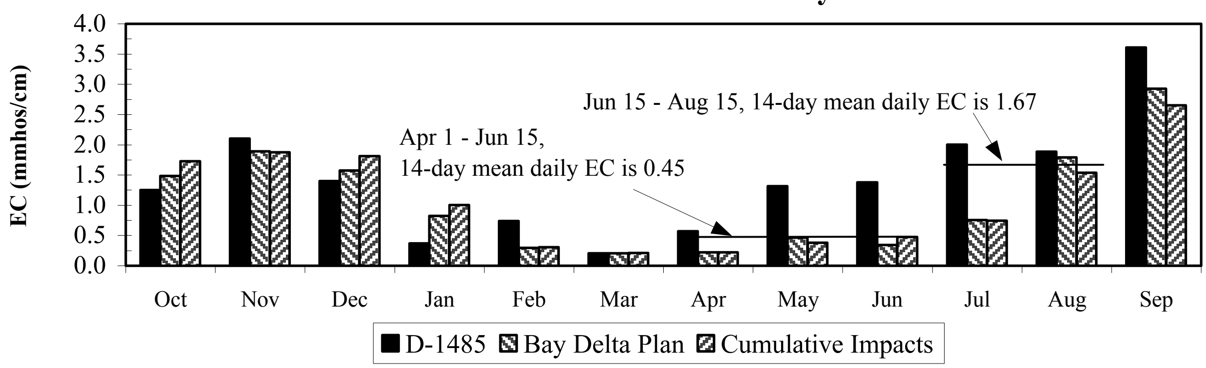
Figure XII-13
Salinity for Sacramento River at Emmaton
End-of-Month Simulated Values for Below Normal Years



Salinity objectives are the same for D-1485 & Bay/Delta Plan

Sacramento "40-30-30" **below normal** year (1979)

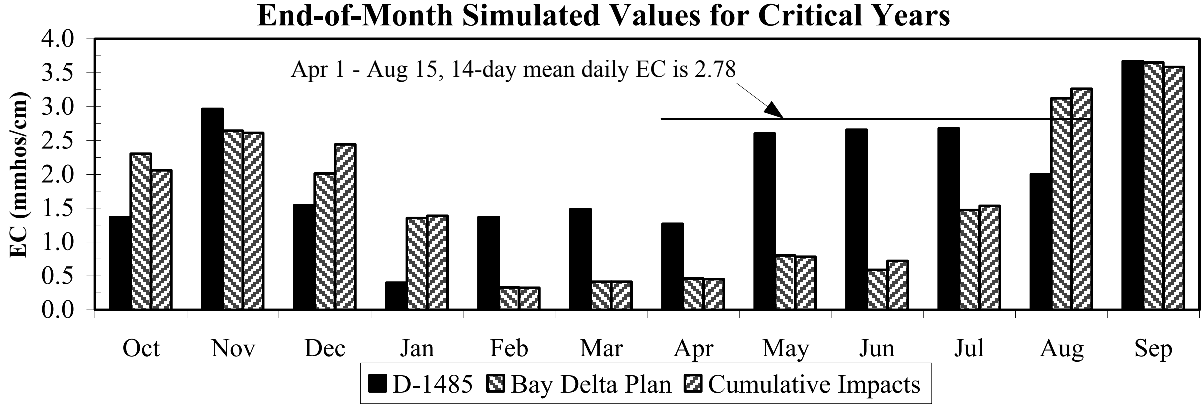
Figure XII-14
Salinity for Sacramento River at Emmaton
End-of-Month Simulated Values for Dry Years



Sacramento "40-30-30" **dry** years averaged (1981, 85, 87 & 89)

Salinity objectives are the same for D-1485 & Bay/Delta Plan

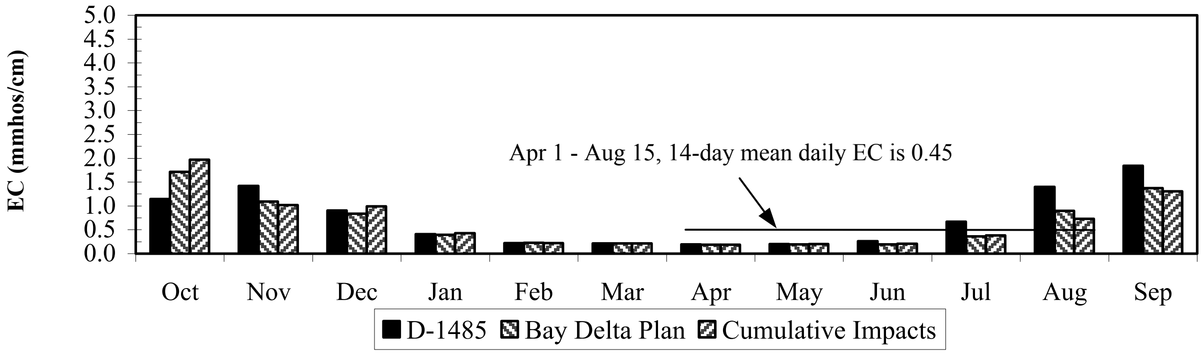
Figure XII-15
Salinity for Sacramento River at Emmaton
End-of-Month Simulated Values for Critical Years



Sacramento "40-30-30" **critical** years averaged (1976, 77, 88, 90 & 91)

Salinity objectives are the same for D-1485 & Bay/Delta Plan

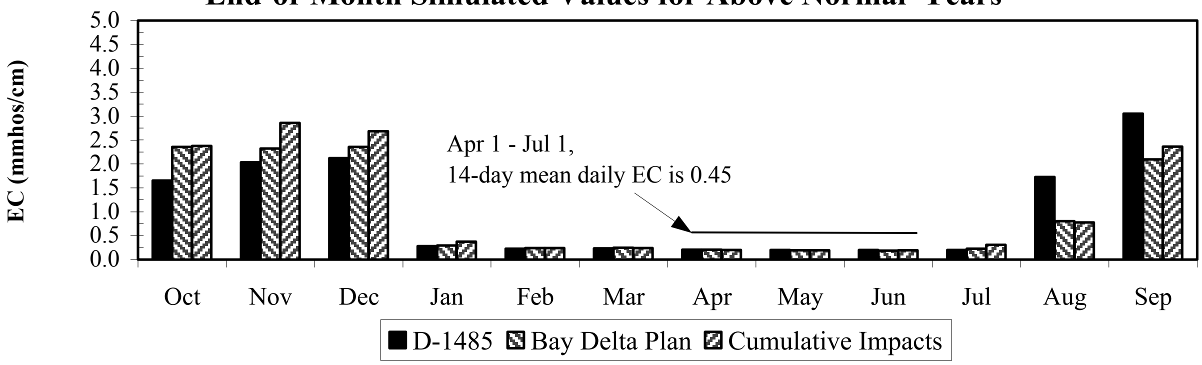
Figure XII-16
Salinity for San Joaquin River at Jersey Point
End-of-Month Simulated Values for Wet Years



The agricultural salinity objectives are the same for D-1485 & Bay/Delta Plan. The fish and wildlife Bay/Delta Plan salinity objective for Apr-May is 0.44 mmhos/cm

Sacramento "40-30-30" **wet** years averaged (1982, 83, 84 & 86)

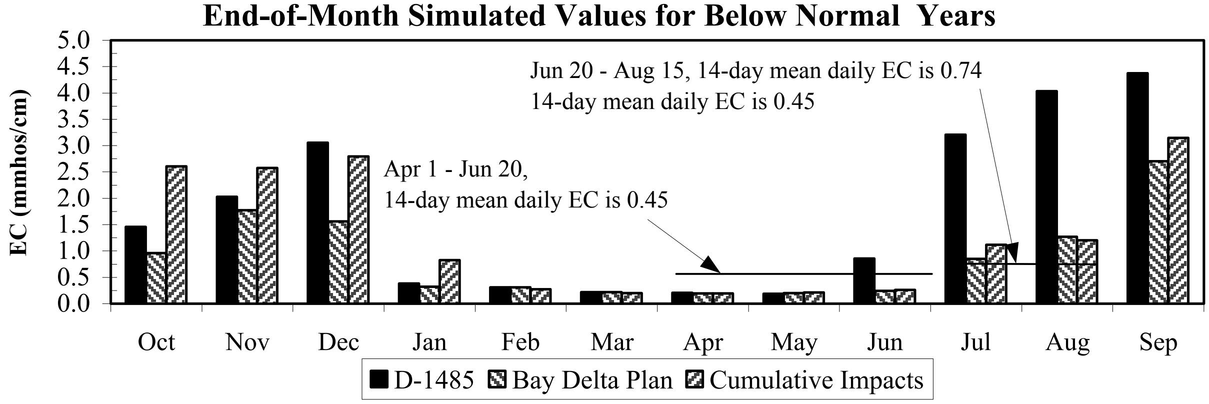
Figure XII-17
Salinity for San Joaquin River at Jersey Point
End-of-Month Simulated Values for Above Normal Years



The agricultural salinity objectives are the same for D-1485 & Bay/Delta Plan. The fish and wildlife Bay/Delta Plan salinity objective for Apr-May is 0.44 mmhos/cm

Sacramento "40-30-30" **above normal** years averaged (1978 & 80)

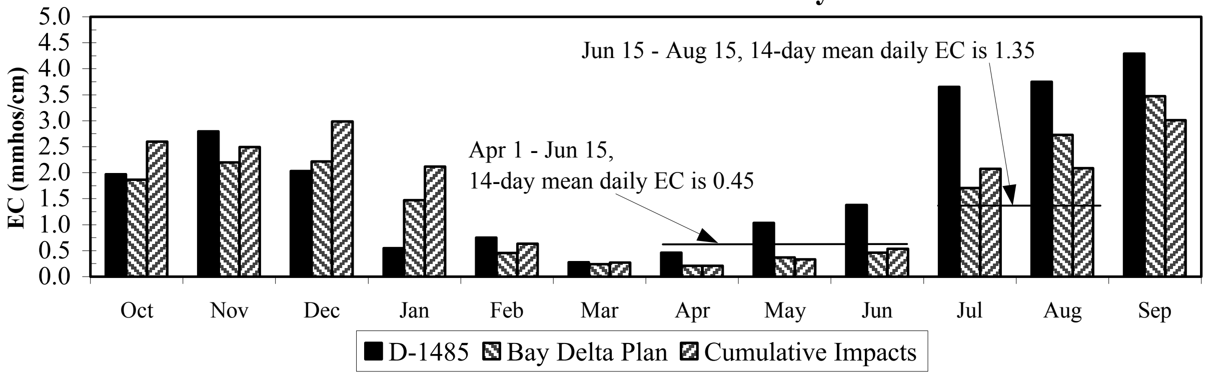
Figure XII-18
Salinity for San Joaquin River at Jersey Point
End-of-Month Simulated Values for Below Normal Years



The agricultural salinity objectives are the same for D-1485 & Bay/Delta Plan. The fish and wildlife Bay/Delta Plan salinity objective for Apr-May is 0.44 mmhos/cm

Sacramento "40-30-30" **below normal** year (1979)

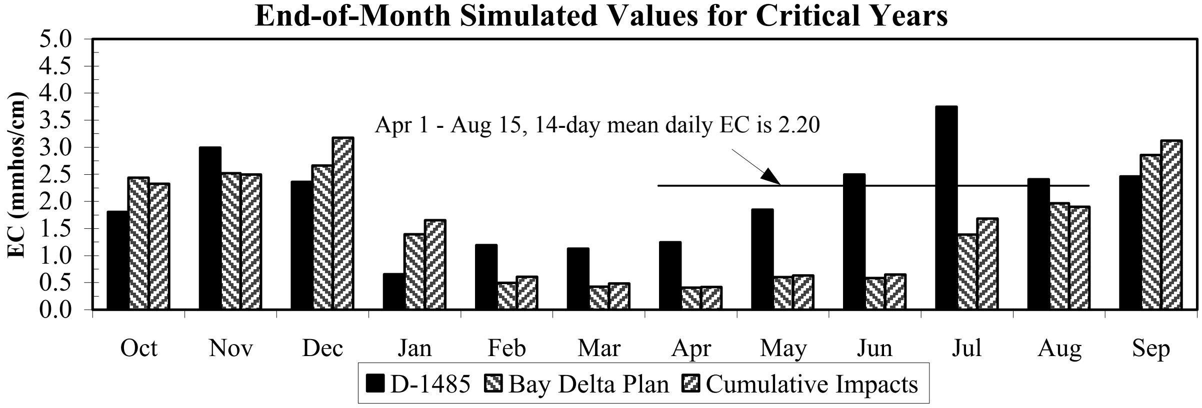
Figure XII-19
Salinity for San Joaquin River at Jersey Point
End-of-Month Simulated Values for Dry Years



The agricultural salinity objectives are the same for D-1485 & Bay/Delta Plan. The fish and wildlife Bay/Delta Plan salinity objective for Apr-May is 0.44 mmhos/cm

Sacramento "40-30-30" **dry** years averaged (1981, 85, 87 & 89)

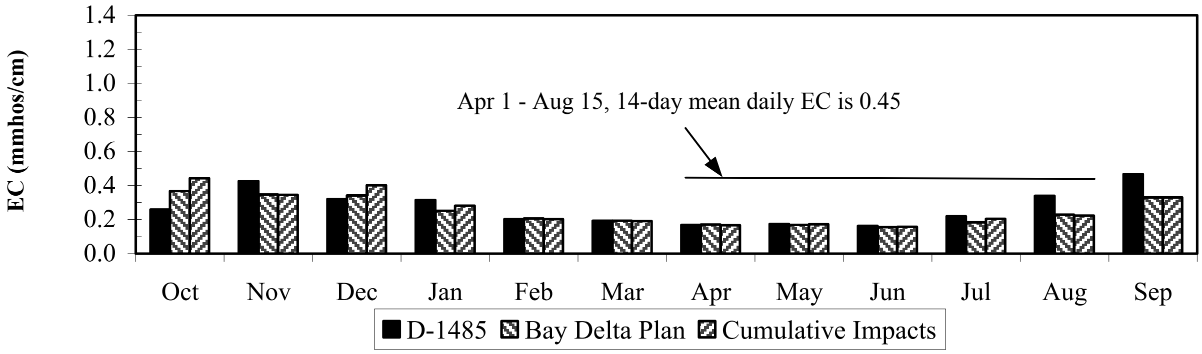
Figure XII-20
Salinity for San Joaquin River at Jersey Point
End-of-Month Simulated Values for Critical Years



The agricultural salinity objectives are the same for D-1485 & Bay/Delta Plan. The fish and wildlife Bay/Delta Plan salinity objective for Apr-May is 0.44 mmhos/cm

Sacramento "40-30-30" **critical** years averaged (1976, 77, 88, 90 & 91)

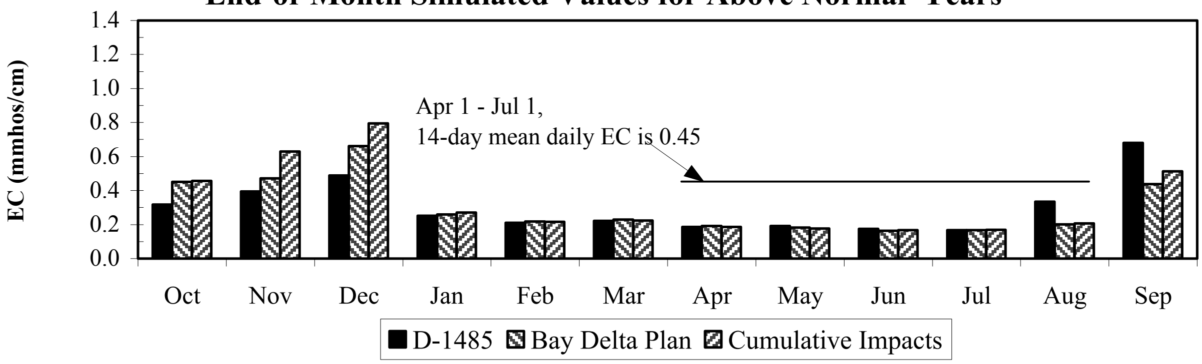
Figure XII-21
Salinity for San Joaquin River at San Andreas Landing
End-of-Month Simulated Values for Wet Years



The agricultural salinity objectives are the same for D-1485 & Bay/Delta Plan. The fish and wildlife Bay/Delta Plan salinity objective for Apr-May is 0.44 mmhos/cm

Sacramento "40-30-30" **wet** years averaged (1982, 83, 84 & 86)

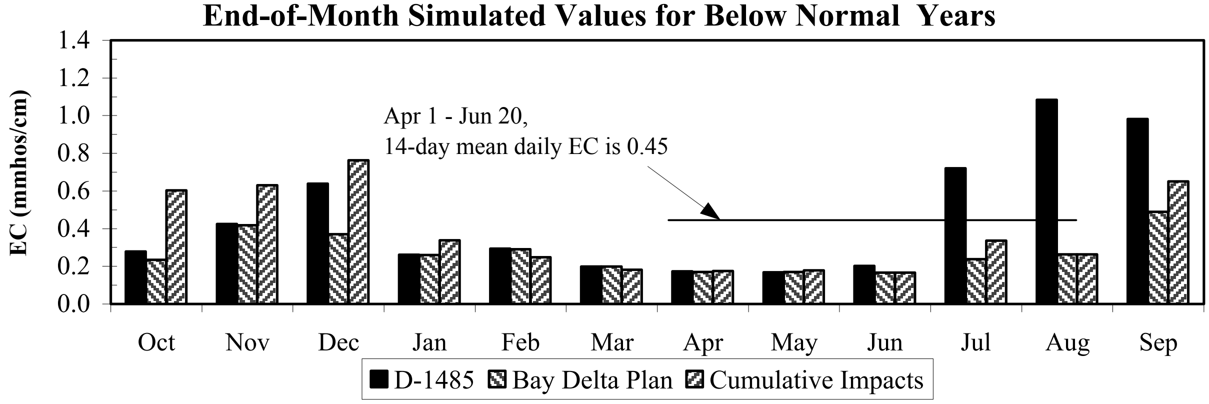
Figure XII-22
Salinity for San Joaquin River at San Andreas Landing
End-of-Month Simulated Values for Above Normal Years



The agricultural salinity objectives are the same for D-1485 & Bay/Delta Plan. The fish and wildlife Bay/Delta Plan salinity objective for Apr-May is 0.44 mmhos/cm

Sacramento "40-30-30" **above normal** years averaged (1978 & 80)

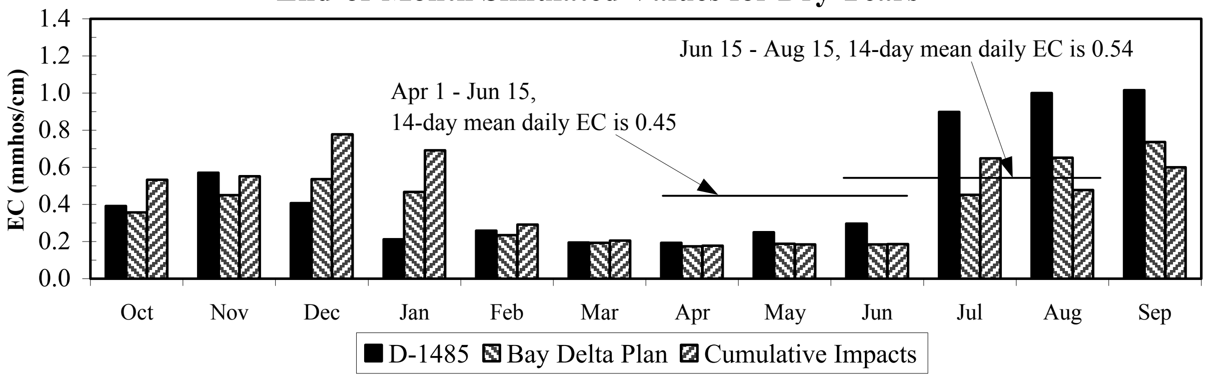
Figure XII-23
Salinity for San Joaquin River at San Andreas Landing
End-of-Month Simulated Values for Below Normal Years



The agricultural salinity objectives are the same for D-1485 & Bay/Delta Plan. The fish and wildlife Bay/Delta Plan salinity objective for Apr-May is 0.44 mmhos/cm

Sacramento "40-30-30" **below normal** year (1979)

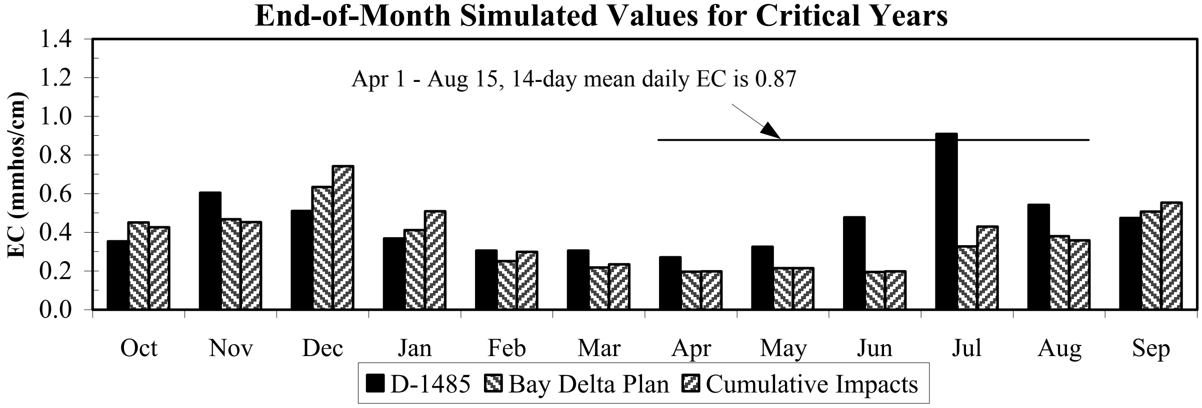
Figure XII-24
Salinity for San Joaquin River at San Andreas Landing
End-of-Month Simulated Values for Dry Years



The agricultural salinity objectives are the same for D-1485 & Bay/Delta Plan. The fish and wildlife Bay/Delta Plan salinity objective for Apr-May is 0.44 mmhos/cm

Sacramento "40-30-30" **dry** years averaged (1981, 85, 87 & 89)

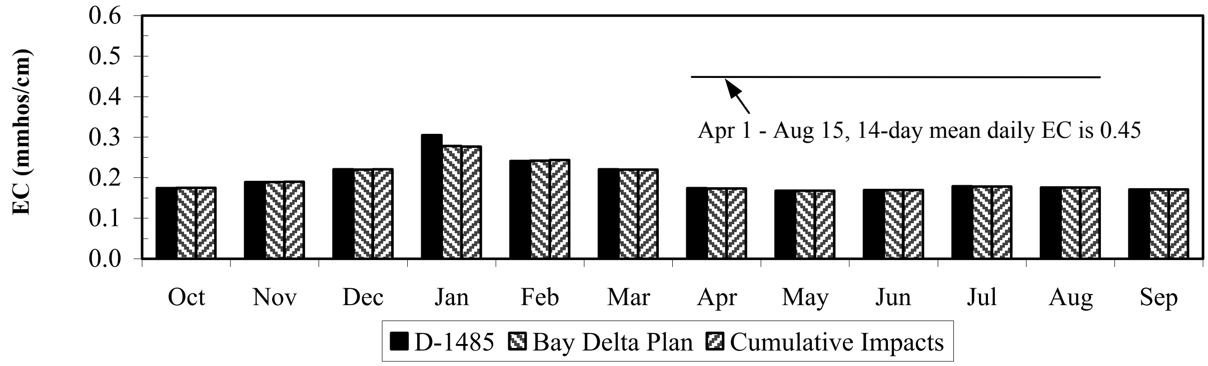
Figure XII-25
Salinity for San Joaquin River at San Andreas Landing
End-of-Month Simulated Values for Critical Years



The agricultural salinity objectives are the same for D-1485 & Bay/Delta Plan. The fish and wildlife Bay/Delta Plan salinity objective for Apr-May is 0.44 mmhos/cm

Sacramento "40-30-30" **critical** years averaged (1976, 77, 88, 90 & 91)

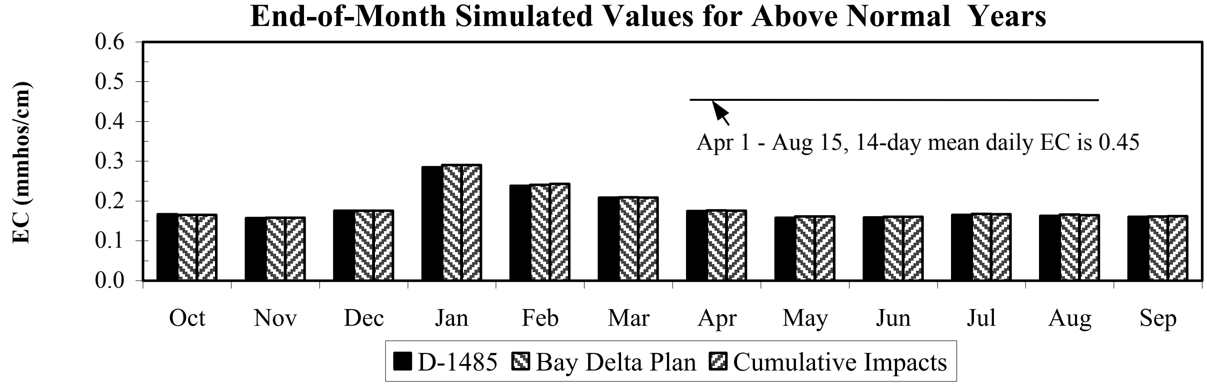
Figure XII-26
Salinity for South Fork Mokelumne River at Terminous
End-of-Month Simulated Values for Wet Years



Salinity objectives are the same for D-1485 & Bay/Delta Plan

Sacramento "40-30-30" **wet** years averaged (1982, 83, 84 & 86)

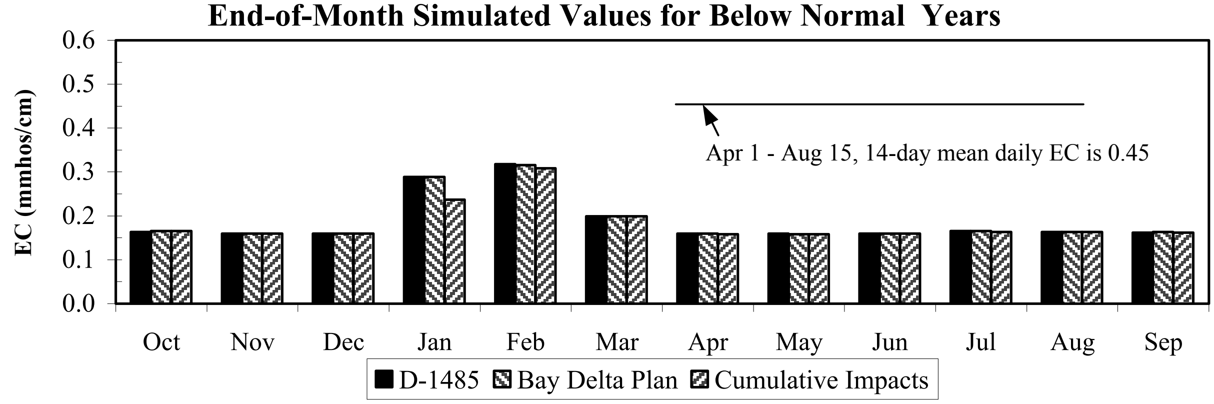
Figure XII-27
Salinity for South Fork Mokelumne River at Terminous
End-of-Month Simulated Values for Above Normal Years



Salinity objectives are the same for D-1485 & Bay/Delta Plan

Sacramento "40-30-30" **above normal** years averaged (1978 & 80)

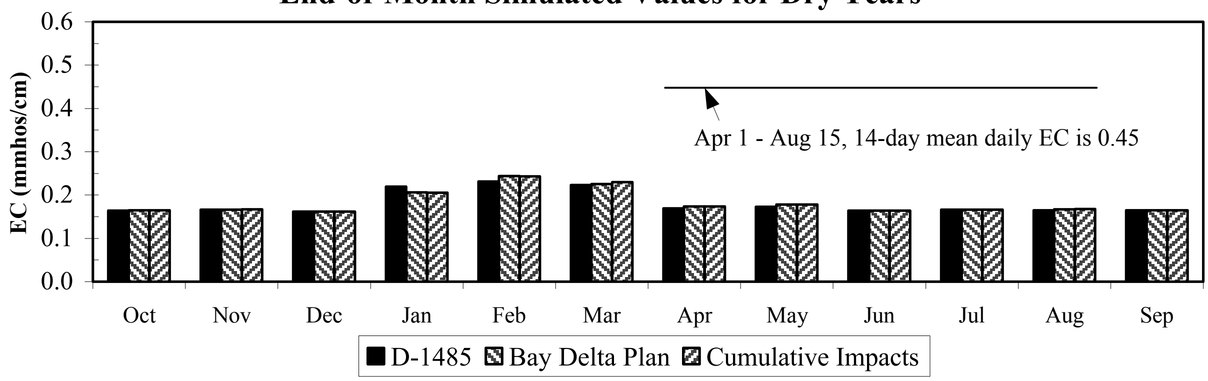
Figure XII-28
Salinity for South Fork Mokelumne River at Terminous
End-of-Month Simulated Values for Below Normal Years



Salinity objectives are the same for D-1485 & Bay/Delta Plan

Sacramento "40-30-30" **below normal** year (1979)

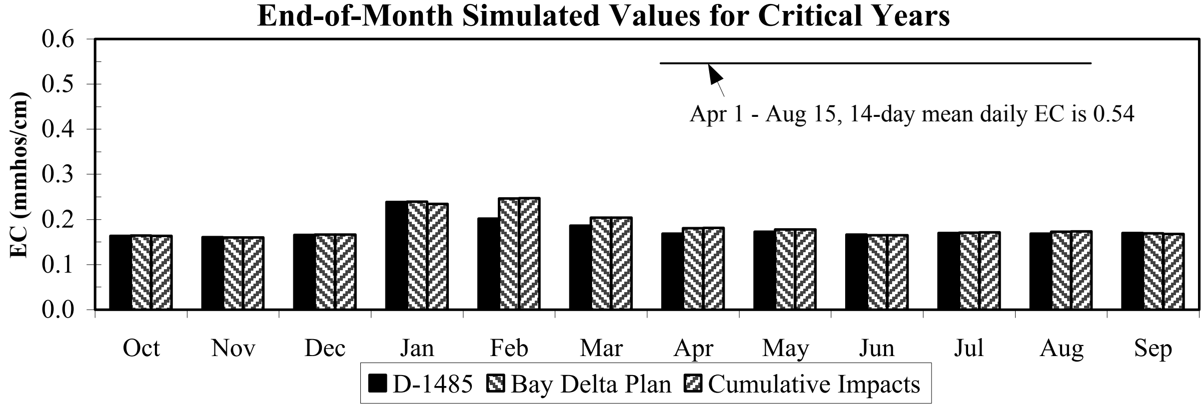
Figure XII-29
Salinity for South Fork Mokelumne River at Terminous
End-of-Month Simulated Values for Dry Years



Sacramento "40-30-30" **dry** years averaged (1981, 85, 87 & 89)

Salinity objectives are the same for D-1485 & Bay/Delta Plan

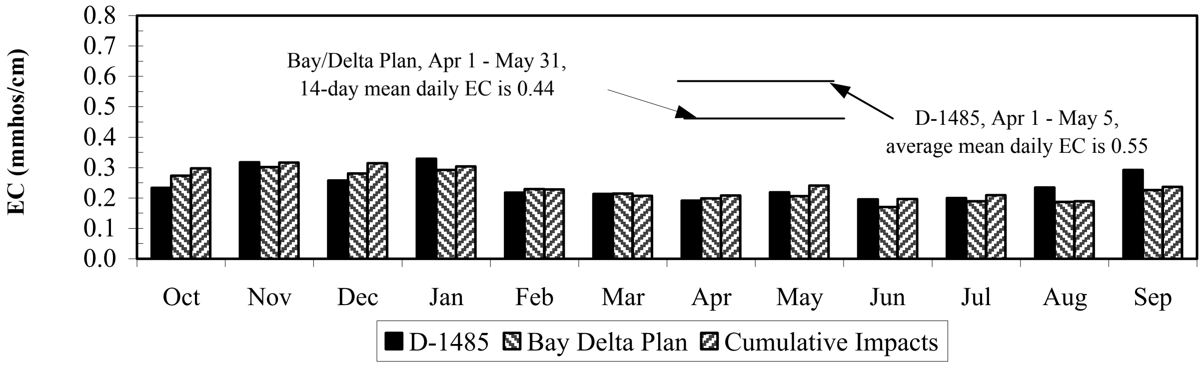
Figure XII-30
Salinity for South Fork Mokelumne River at Terminous
End-of-Month Simulated Values for Critical Years



Sacramento "40-30-30" **critical** years averaged (1976, 77, 88, 90 & 91)

Salinity objectives are the same for D-1485 & Bay/Delta Plan

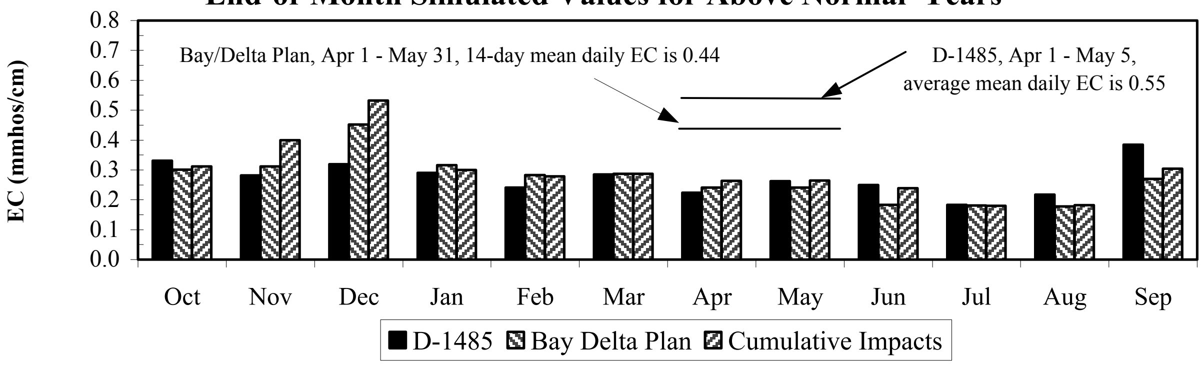
Figure XII-31
Salinity for San Joaquin River at Prisoners Point
End-of-Month Simulated Values for Wet Years



The 14 - day mean daily salinity objectives for Bay/Delta Plan are 0.44 EC from Apr 1 - May 31, and for D-1485 is 0.55 EC from Apr 1 - May 5

Sacramento "40-30-30" **wet** years averaged (1982, 83, 84 & 86)

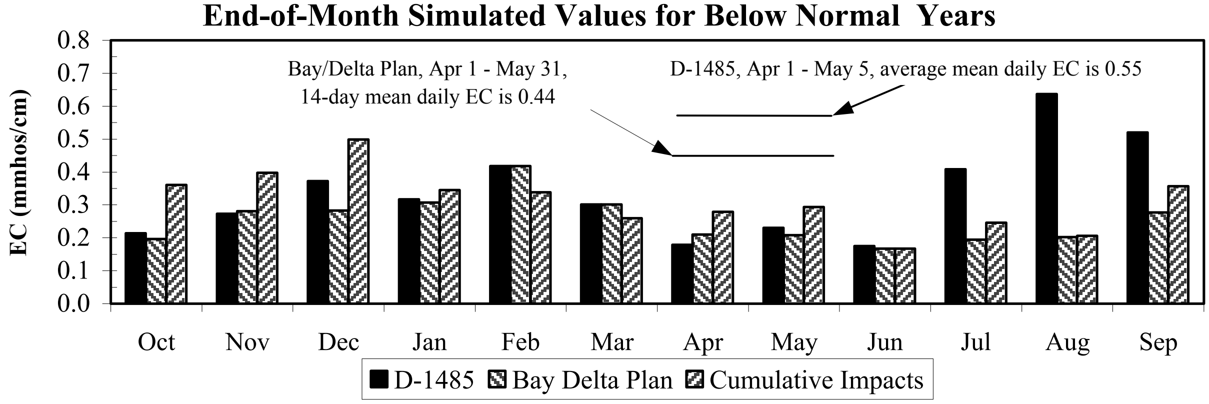
Figure XII-32
Salinity for San Joaquin River at Prisoners Point
End-of-Month Simulated Values for Above Normal Years



The 14 - day mean daily salinity objectives for Bay/Delta Plan are 0.44 EC from Apr 1 - May 31, and for D-1485 is 0.55 EC from Apr 1 - May 5

Sacramento "40-30-30" **above normal** years averaged (1978 & 80)

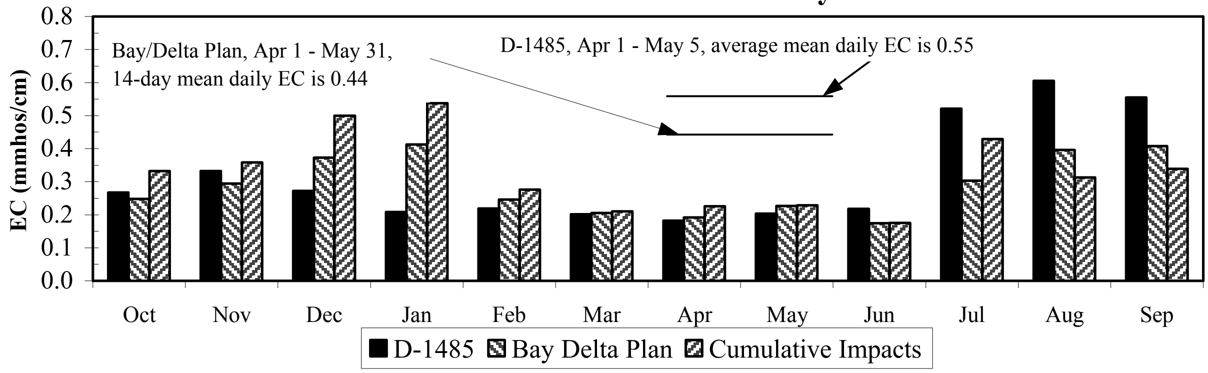
Figure XII-33
Salinity for San Joaquin River at Prisoners Point
End-of-Month Simulated Values for Below Normal Years



The 14 - day mean daily salinity objectives for Bay/Delta Plan are 0.44 EC from Apr 1 - May 31, and for D-1485 is 0.55 EC from Apr 1 - May 5

Sacramento "40-30-30" **below normal** year (1979)

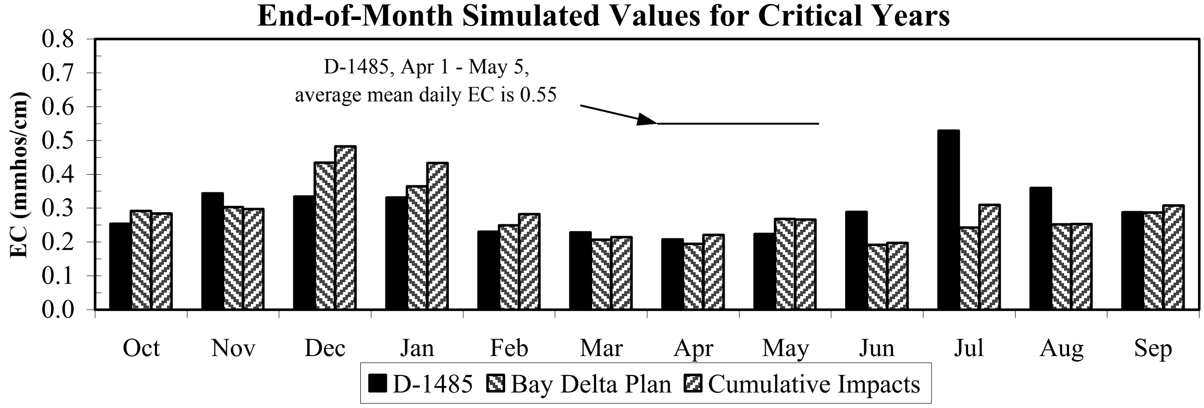
Figure XII-34
Salinity for San Joaquin River at Prisoners Point
End-of-Month Simulated Values for Dry Years



The 14 - day mean daily salinity objectives for Bay/Delta Plan are 0.44 EC from Apr 1 - May 31, and for D-1485 is 0.55 EC from Apr 1 - May 5

Sacramento "40-30-30" **dry** years averaged (1981, 85, 87 & 89)

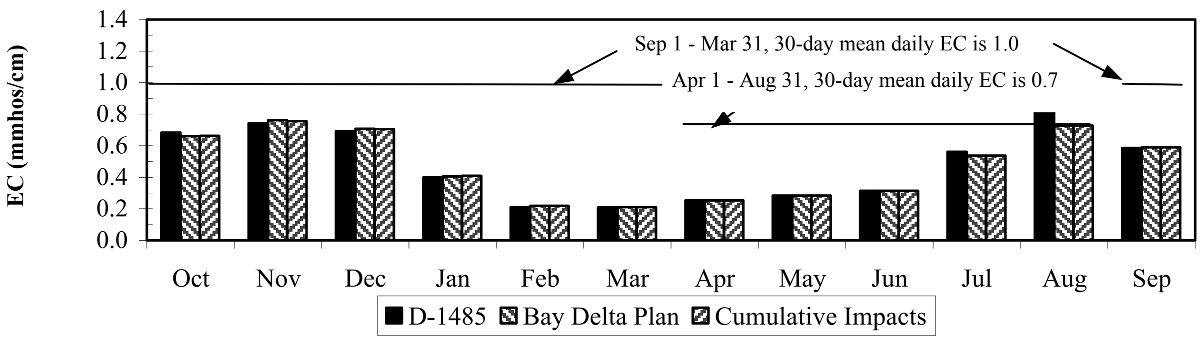
Figure XII-35
Salinity for San Joaquin River at Prisoners Point
End-of-Month Simulated Values for Critical Years



Salinity objectives are the same for D-1485 & Bay/Delta Plan

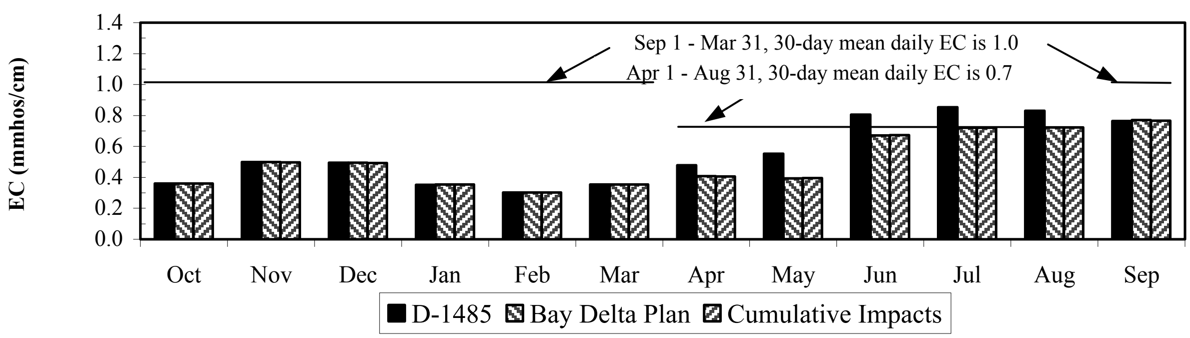
Sacramento "40-30-30" **critical** years averaged (1976, 77, 88, 90 & 91)

Figure XII-36
Salinity for San Joaquin River at Airport Bridge (Vernalis)
End-of-Month Simulated Values for Wet Years



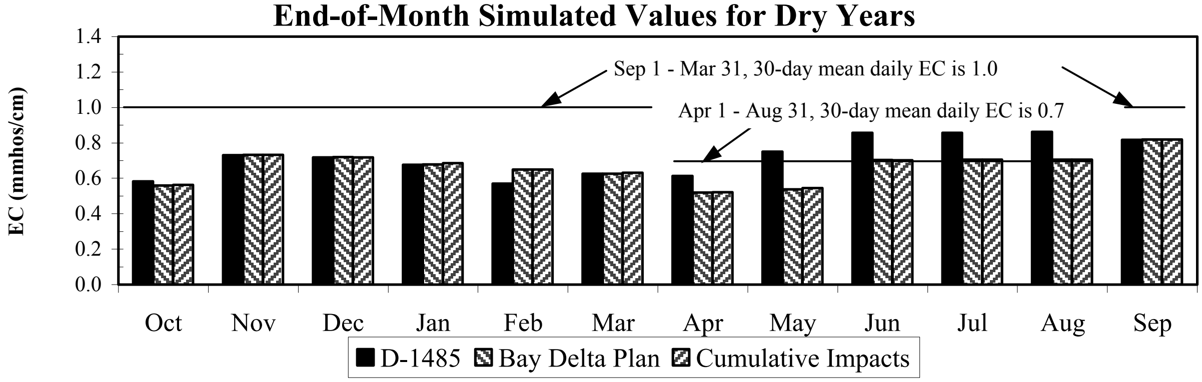
Water quality salinity objectives are for Bay/Delta Plan except Alternative 1. The Vernalis salinity objective for Alternative1 is 500 ppm TDS (approximately equals 0.86 mmhos/cm) year-round.
San Joaquin "60-20-20" wet years averaged (1978, 80, 82, 83 & 86).

Figure XII-37
Salinity for San Joaquin River at Airport Bridge (Vernalis)
End-of-Month Simulated Values for Above Normal Years



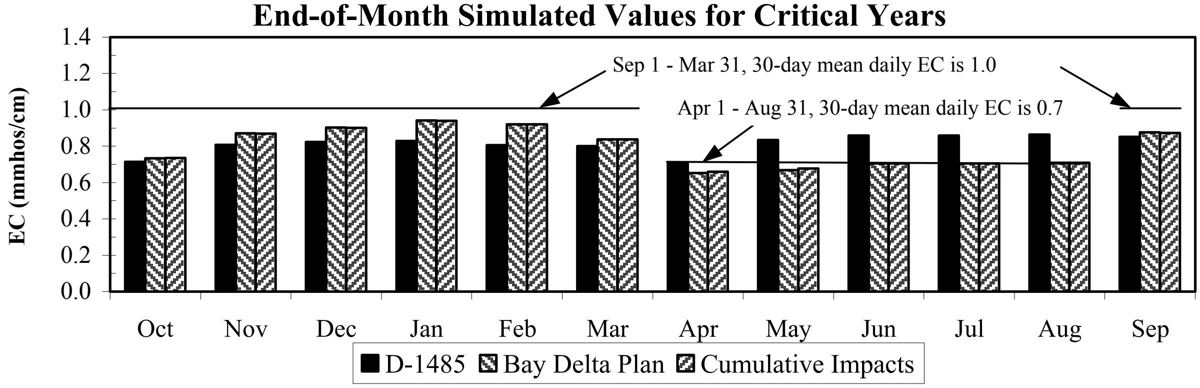
Water quality salinity objectives are for Bay/Delta Plan except Alternative 1. The Vernalis salinity objective for Alternative1 is 500 ppm TDS (approximately equals 0.86 mmhos/cm) year-round.
San Joaquin "60-20-20" wet years averaged (1979 & 84).

Figure XII-38
Salinity for San Joaquin River at Airport Bridge (Vernalis)
End-of-Month Simulated Values for Dry Years



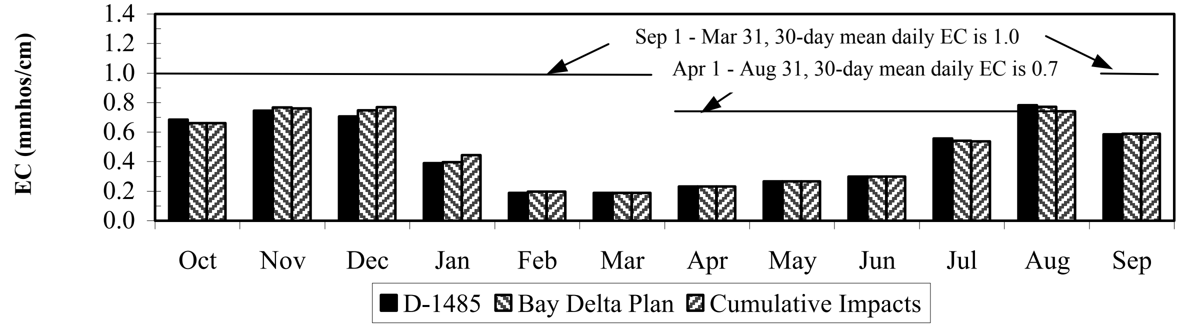
Water quality salinity objectives are for Bay/Delta Plan except Alternative 1. The Vernalis salinity objective for Alternative 1 is 500 ppm TDS (approximately equals 0.86 mmhos/cm) year-round.
San Joaquin "60-20-20" dry years averaged (1981 & 85).

Figure XII-39
Salinity for San Joaquin River at Airport Bridge (Vernalis)
End-of-Month Simulated Values for Critical Years



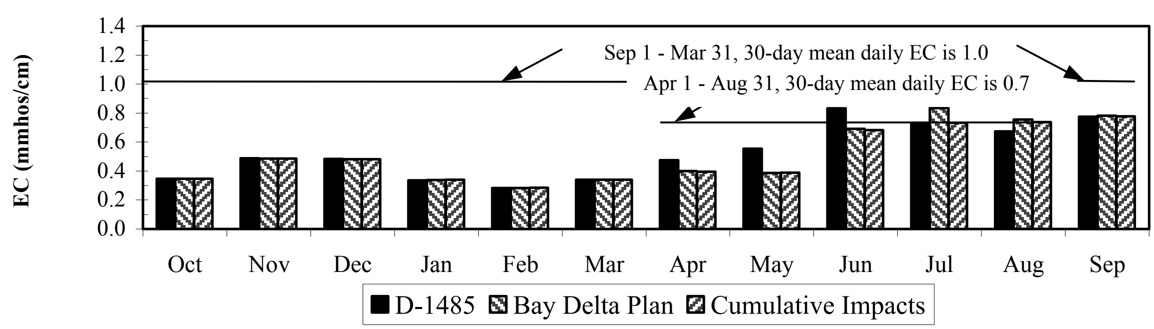
Water quality salinity objectives are for Bay/Delta Plan except Alternative 1. The Vernalis salinity objective for Alternative 1 is 500 ppm TDS (approximately equals 0.86 mmhos/cm) year-round.
San Joaquin "60-20-20" critical years averaged (1976, 77, 87, 88, 89, 90 & 91).

Figure XII-40
Salinity for San Joaquin River at Brandt Bridge
End-of-Month Simulated Values for Wet Years



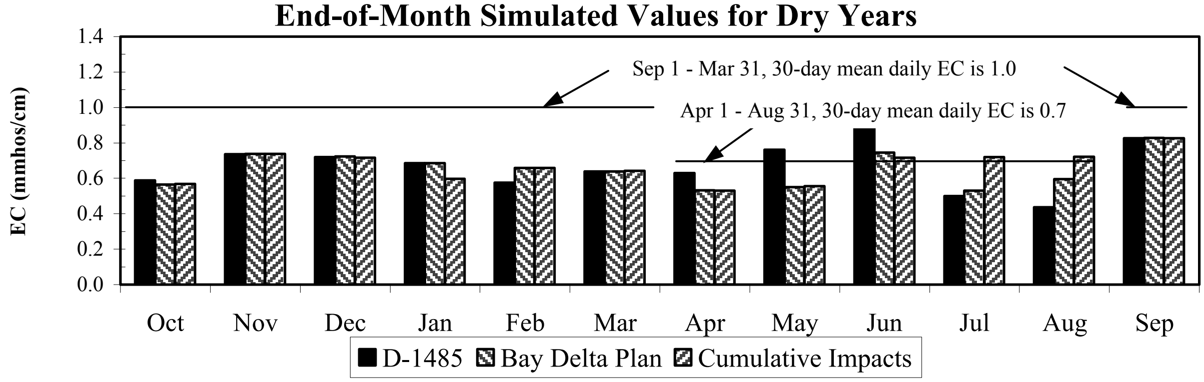
Water quality salinity objectives are for Bay/Delta Plan except Alternative 1. The Vernalis salinity objective for Alternative1 is 500 ppm TDS (approximately equals 0.86 mmhos/cm) year-round.
San Joaquin "60-20-20" wet years averaged (1978, 80, 82, 83 & 86).

Figure XII-41
Salinity for San Joaquin River at Brandt Bridge
End-of-Month Simulated Values for Above Normal Years



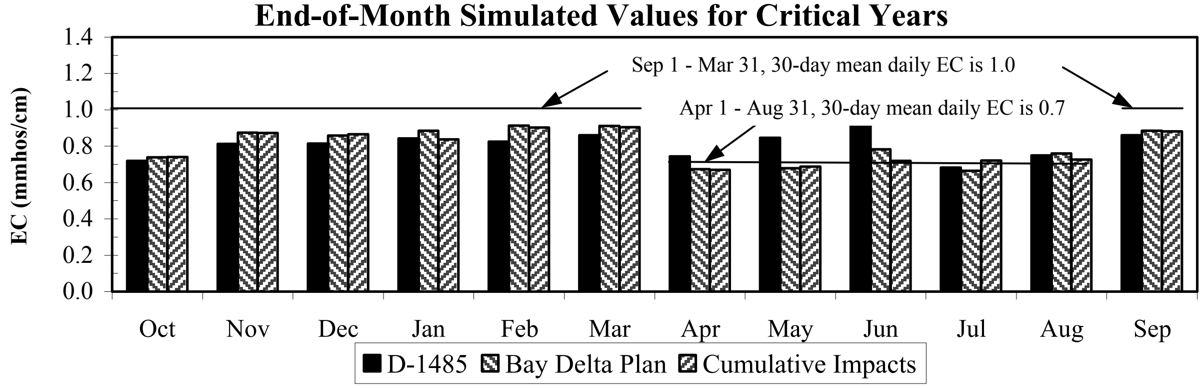
Water quality salinity objectives are for Bay/Delta Plan except Alternative 1. The Vernalis salinity objective for Alternative1 is 500 ppm TDS (approximately equals 0.86 mmhos/cm) year-round.
San Joaquin "60-20-20" wet years averaged (1979 & 84).

Figure XII-42
Salinity for San Joaquin River at Brandt Bridge
End-of-Month Simulated Values for Dry Years



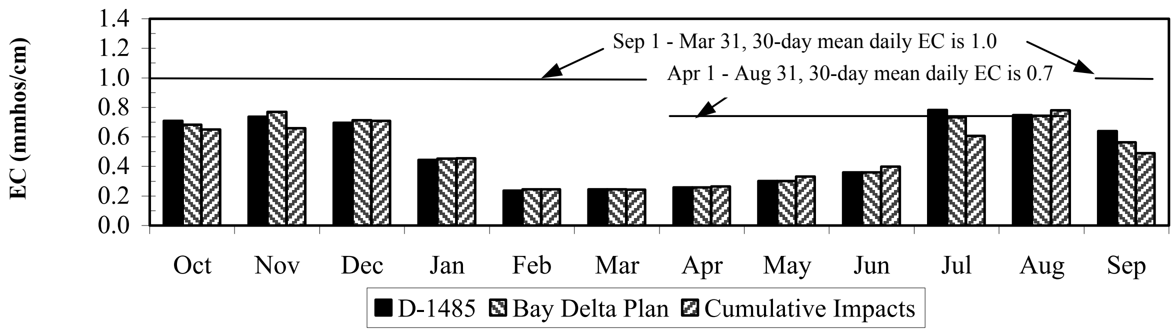
Water quality salinity objectives are for Bay/Delta Plan except Alternative 1. The Vernalis salinity objective for Alternative 1 is 500 ppm TDS (approximately equals 0.86 mmhos/cm) year-round.
San Joaquin "60-20-20" dry years averaged (1981 & 85).

Figure XII-43
Salinity for San Joaquin River at Brandt Bridge
End-of-Month Simulated Values for Critical Years



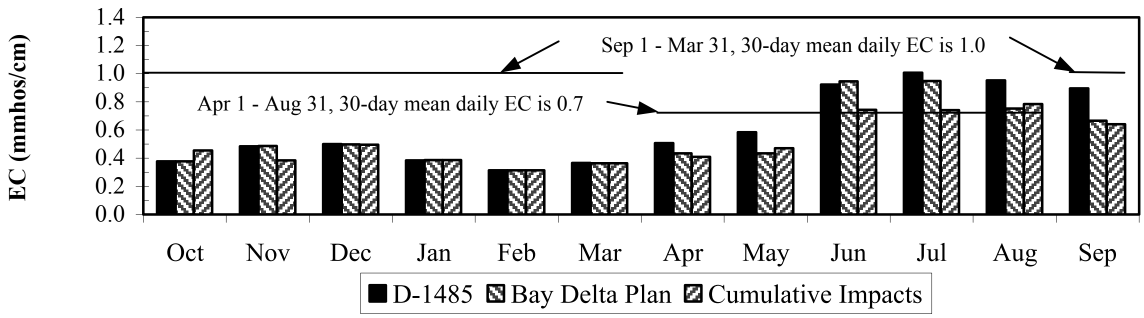
Water quality salinity objectives are for Bay/Delta Plan except Alternative 1. The Vernalis salinity objective for Alternative 1 is 500 ppm TDS (approximately equals 0.86 mmhos/cm) year-round.
San Joaquin "60-20-20" critical years averaged (1976, 77, 87, 88, 89, 90 & 91).

Figure XII-44
Salinity for Old River at Tracy Road Bridge
End-of-Month Simulated Values for Wet Years



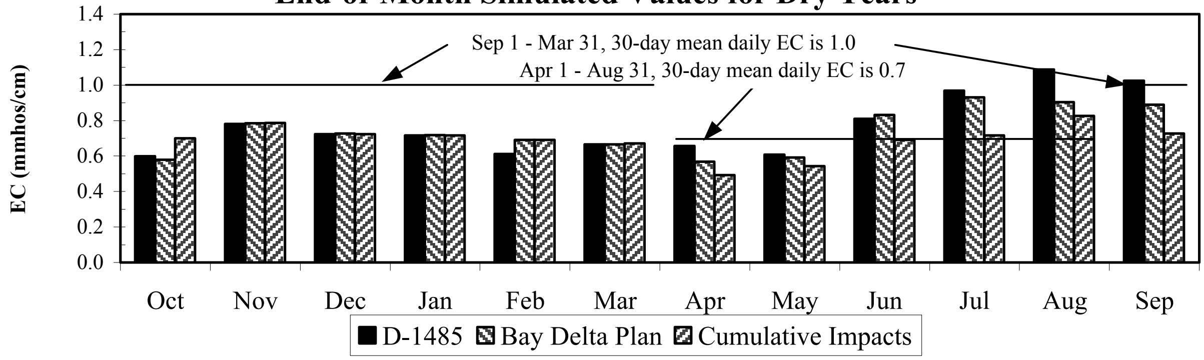
Water quality salinity objectives are for Bay/Delta Plan except Alternative 1. The Vernalis salinity objective for Alternative1 is 500 ppm TDS (approximately equals 0.86 mmhos/cm) year-round.
San Joaquin "60-20-20" wet years averaged (1978, 80, 82, 83 & 86).

Figure XII-45
Salinity for Old River at Tracy Road Bridge
End-of-Month Simulated Values for Above Normal Years



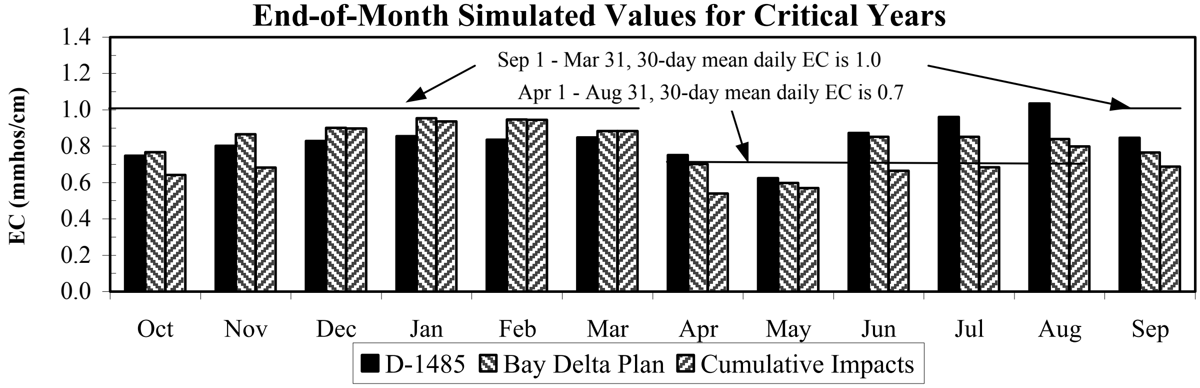
Water quality salinity objectives are for Bay/Delta Plan except Alternative 1. The Vernalis salinity objective for Alternative1 is 500 ppm TDS (approximately equals 0.86 mmhos/cm) year-round.
San Joaquin "60-20-20" wet years averaged (1979 & 84).

Figure XII-46
Salinity for Old River at Tracy Road Bridge
End-of-Month Simulated Values for Dry Years



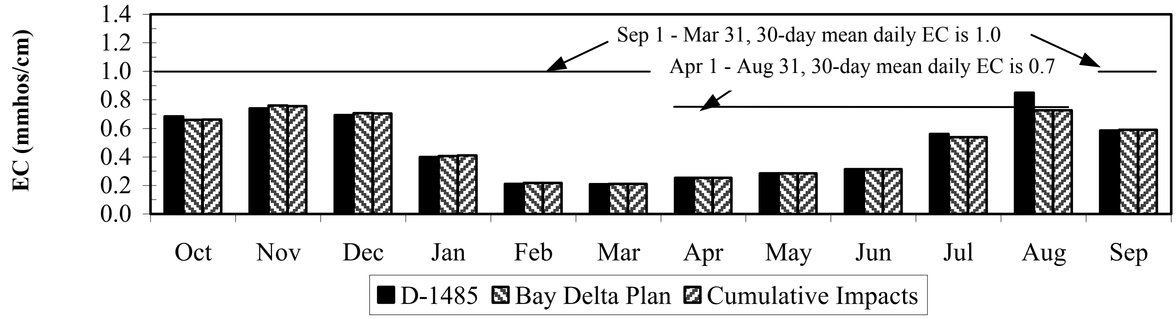
Water quality salinity objectives are for Bay/Delta Plan except Alternative 1. The Vernalis salinity objective for Alternative 1 is 500 ppm TDS (approximately equals 0.86 mmhos/cm) year-round.
San Joaquin "60-20-20" dry years averaged (1981 & 85).

Figure XII-47
Salinity for Old River at Tracy Road Bridge
End-of-Month Simulated Values for Critical Years



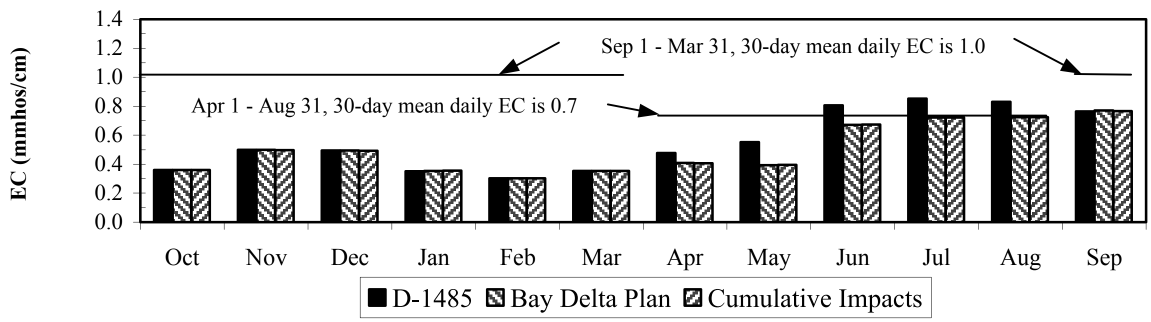
Water quality salinity objectives are for Bay/Delta Plan except Alternative 1. The Vernalis salinity objective for Alternative 1 is 500 ppm TDS (approximately equals 0.86 mmhos/cm) year-round.
San Joaquin "60-20-20" critical years averaged (1976, 77, 87, 88, 89, 90 & 91).

Figure XII-48
Salinity for Old River Near Middle River
End-of-Month Simulated Values for Wet Years



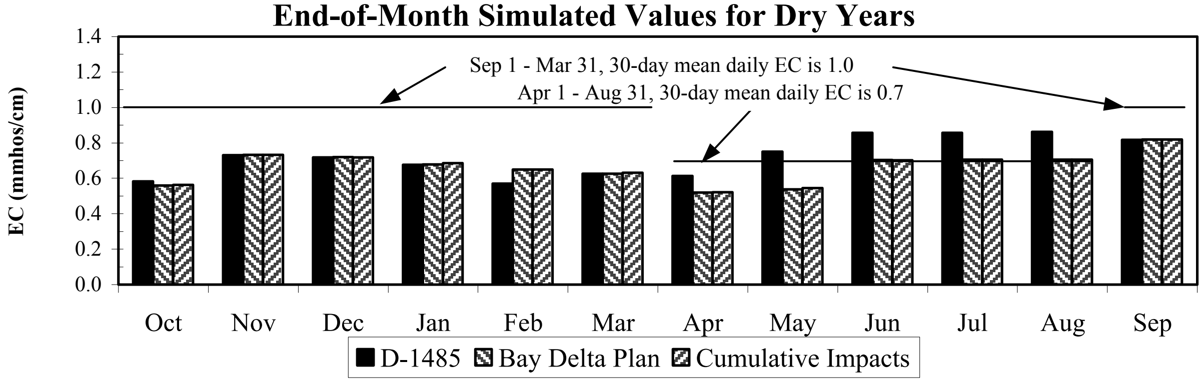
Water quality salinity objectives are for Bay/Delta Plan except Alternative 1. The Vernalis salinity objective for Alternative1 is 500 ppm TDS (approximately equals 0.86 mmhos/cm) year-round.
San Joaquin "60-20-20" wet years averaged (1978, 80, 82, 83 & 86).

Figure XII-49
Salinity for Old River Near Middle River
End-of-Month Simulated Values for Above Normal Years



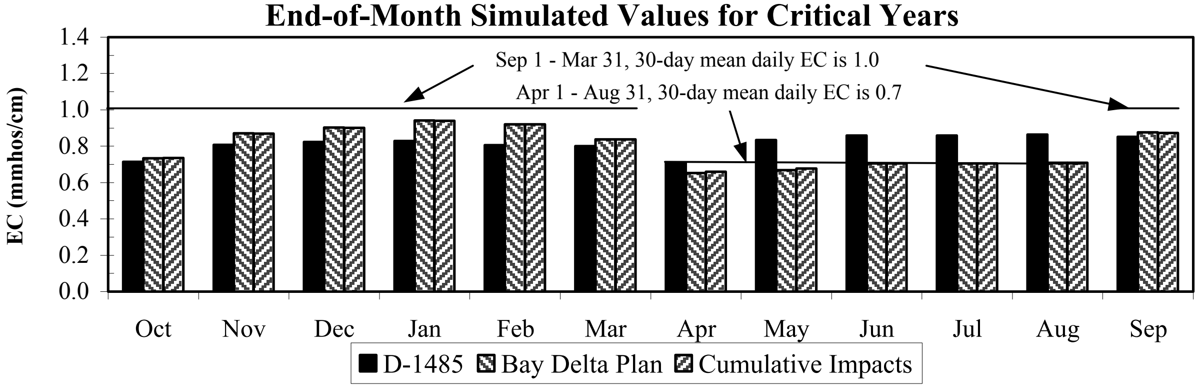
Water quality salinity objectives are for Bay/Delta Plan except Alternative 1. The Vernalis salinity objective for Alternative1 is 500 ppm TDS (approximately equals 0.86 mmhos/cm) year-round.
San Joaquin "60-20-20" wet years averaged (1979 & 84).

Figure XII-50
Salinity for Old River Near Middle River
End-of-Month Simulated Values for Dry Years



Water quality salinity objectives are for Bay/Delta Plan except Alternative 1. The Vernalis salinity objective for Alternative 1 is 500 ppm TDS (approximately equals 0.86 mmhos/cm) year-round.
San Joaquin "60-20-20" dry years averaged (1981 & 85).

Figure XII-51
Salinity for Old River Near Middle River
End-of-Month Simulated Values for Critical Years



Water quality salinity objectives are for Bay/Delta Plan except Alternative 1. The Vernalis salinity objective for Alternative 1 is 500 ppm TDS (approximately equals 0.86 mmhos/cm) year-round.
San Joaquin "60-20-20" critical years averaged (1976, 77, 87, 88, 89, 90 & 91).

However, most programs that would implement any of these measures would require a specific environmental impact analysis of the particular action and disclosure of any significant environmental impacts identified in that analysis.

1. Conservation

The history and the measures associated with urban and agricultural water conservation are different. Therefore, urban and agricultural water conservation are discussed separately.

a. Urban Water Conservation. In 1988, during the Bay/Delta Proceedings, interested parties gave the SWRCB widely divergent estimates of water conservation potential in California. To resolve these differences, urban water agencies, environmental groups, and State agencies actively participated in a three-year effort which culminated in the publication of the 1991 Memorandum of Understanding Regarding Urban Water Conservation in California. This memorandum identified 16 Best Management Practices (BMPs) for urban water conservation; it committed the signatories to implementing the BMPs; and it established the California Urban Water Conservation Council (CUWCC) to both oversee implementation of the existing BMPs and evaluate new BMPs. Over 100 water agencies, plus over 50 public advocacy groups and other interested parties, have signed the memorandum.

The CUWCC developed a strategic plan in 1996 that included evaluating the BMPs and revising them to make them easier to quantify. The revised BMPs were adopted by the CUWCC in September 1997. The revisions included restructuring the original 16 BMPs to 14 (including two new) BMPs, revising implementation schedules and coverage requirements, and adding new evaluation criteria. Implementation of some BMPs was extended beyond the original 10-year term of the existing MOU. The revised list of BMPs is provided below; a more detailed description can be found in the MOU.

BMP	Description
1	Water Audit Programs for Single-Family Residential and Multifamily Residential Customers
2	Residential Plumbing Retrofit
3	System Water Audits, Leak Detection and Repair
4	Metering with Commodity Rates for All New Connections and Retrofit of Existing Connections
5	Large Landscape Conservation Programs and Incentives
6	High-Efficiency Washing Machine Rebate Programs (New)
7	Public Information Programs
8	School Education Programs
9	Conservation Programs for Commercial, Industrial, and Institutional Accounts
10	Wholesale Agency Assistance Programs (New)
11	Conservation Pricing
12	Conservation Coordinator (formerly BMP 14)
13	Water Waste Prohibition
14	Residential ULFT Replacement Programs (formerly BMP 16)

Water conservation will play a significant role in managing California's urban water needs. The widespread acceptance of urban BMPs in California ensures that their implementation will be the industry standard for water conservation programs. However, the SWRCB recognizes that, as water use continues to become more efficient, agencies will lose flexibility in dealing with shortages.

b. Agricultural Water Conservation. There are three principal pieces of legislation that encourage agricultural water conservation: The California Agricultural Water Management Planning Act of 1986 (Stats. 1986, C. 954, Water Code §10800 et seq.), The federal Reclamation Reform Act of 1982, and the Agricultural Water Suppliers Efficient Water Management Practices Act (Stats. 1990, C. 739, Water Code §10900 et seq.). These pieces of legislation are discussed in section A.3 of Chapter VIII.

In addition to legislative programs, agricultural water conservation is also encouraged through the San Joaquin Valley Drainage Program (SJVDP), which was established as a joint Federal and State effort in 1984. The SJVDP published its recommended plan in September 1990 (SJVDP 1990). The recommended plan should guide management of the agricultural drainage problem, and one of the major elements of the plan is increased conservation efforts. In December 1991, eight State and Federal agencies, including the SWRCB, signed a Memorandum of Understanding to coordinate activities implementing the plan.

2. Groundwater Management

Groundwater basin management includes: protecting the natural recharge and using supplemental recharge; varying the amount and location of extraction over time; using groundwater storage conjunctively with surface water from local and imported sources; and protecting and maintaining the groundwater quality (DWR 1994b). Because groundwater will be used to replace much of the shortfall in surface water supplies, limitations on Delta exports will exacerbate groundwater overdraft in regions receiving some portion of their supplies from the Delta. Effective groundwater management can minimize overdraft problems and provide sustainable water supplies.

Managing groundwater in California has generally been considered a local responsibility. This view is strongly held by landowners and has been upheld by the Legislature, which has enacted a number of statutes establishing local groundwater agencies. State agencies have encouraged local agencies to develop effective groundwater management programs to maximize their overall water supply and to avoid lengthy and expensive lawsuits resulting in adjudicated basins.

Conjunctive use is an essential element of groundwater management. Conjunctive use programs are designed to increase the total useable water supply by jointly managing surface and groundwater supplies as a single source. The basin is recharged, both directly and indirectly, in years of above average precipitation so that ground water can be extracted in years of below average precipitation when surface water supplies are below normal. There are some instances, however, where conjunctive use is employed for annual regulation of supplies. These programs involve recharge with surface water or reclaimed water supplies and same-year extraction for use. An example of a large scale conjunctive use program is the Kern Water Bank which could be developed to store as much as one MAF and contribute as much as 140 TAF per year in drought years (DWR 1994b). The DWR is currently studying other conjunctive use programs in the American River basin and the Sacramento Valley.

In the future, the number of conjunctive use projects is expected to increase and become more comprehensive because of the need for more water and the higher cost of new surface water facilities. Conjunctive use programs generally promise to be less costly than new traditional surface water projects because they increase the efficiency of water supply systems and cause fewer negative environmental impacts than new surface water reservoirs (DWR 1994b).

3. Water Transfers

Currently, water transfers are a promising way of closing the gap between water demands and dependable water supplies over the next ten years. There are fewer environmental impacts associated with transfers than with construction of conventional projects, and although difficult to implement, transfers can be implemented more quickly and usually at less cost than construction of additional facilities. Unfortunately, water transfers are not available on a statewide basis because some regions of the State are physically isolated from water conveyance facilities.

Under existing law, holders of both pre-1914 and modern appropriative water rights can transfer water. Holders of pre-1914 appropriative rights may transfer water without seeking approval of the SWRCB, provided others are not injured. Holders of modern appropriative rights may transfer water, but the SWRCB must approve any transfer requiring a change in terms and conditions of the water right permit or license, such as place of use, purpose of use, or point of diversion. Water transfers must also comply with any applicable local ordinances. Water held pursuant to riparian rights is transferable if the new use will preserve or enhance public trust uses (Water Code §1707). There is a recent practice in which downstream appropriators contract with riparian users to leave water in a stream for potential downstream diversion under the appropriator's water right. Water obtained pursuant to a water supply contract is also transferable. However, most water supply contracts require the consent of the entity delivering the water.

Transfers of ground water, and ground water substitution arrangements whereby ground water is pumped as a substitute for transferred surface water, are in some cases subject to statutory restrictions designed to protect ground water basins against long-term overdraft and to preserve local control of ground water management.

Short-term (one year or less) temporary transfers of water under Water Code section 1725 et seq. are exempt from compliance with CEQA, provided SWRCB approval is obtained. The SWRCB must find no injury to any other legal users of the water and no unreasonable effect on fish, wildlife, or other instream beneficial uses. CEQA compliance is required for long-term transfers. Because of complex environmental problems in the Delta, the SWRCB has announced that it will not approve long-term transfers that increase Delta pumping until completion of an environmental evaluation of the cumulative impacts. If the parties to a transfer intend to use facilities belonging to the SWP, the CVP, or other entity for transporting the water, they must make arrangements with the owner of the facility. In addition, permits from fish and wildlife agencies may be required if a proposed transfer will affect threatened or endangered species.

The CVPIA also contains provisions intended to increase the use of water transfers by providing that all individuals and districts receiving CVP water (including that under water right settlement and exchange contracts) may transfer it to any other entity for any project or purpose recognized as a beneficial use under State law. The Secretary of the Interior must approve all transfers. The approval of the affected district is required for any transfer involving over 20 percent of the CVP water subject to long-term contract with the district. Section 3405(a)(1) also sets forth a number of conditions on the transfers, including conditions designed to protect the CVP's ability to deliver contractually obligated water or meet fish and wildlife obligations because of limitations in conveyance or pumping capacity. The conditions also require transfers to be consistent with State law, including CEQA. Transfers are deemed to be a beneficial use by the transferor, and are only permitted if they will have no significant long-term adverse impact on ground water conditions within the transferor district, and will have no unreasonable impact on the water supply, operations, or financial condition of the district.

4. Water Recycling

Water recycling, formerly referred to as waste water reclamation, has been used as a source of nonpotable water in California for nearly a century. In recent years, more stringent treatment requirements for disposal of municipal and industrial wastewater have reduced the incremental cost of obtaining the higher level of treatment required for use of recycled water. The higher level of treatment allows recycled water to be safely used for a wider variety of applications. Increased use of recycled water can lessen the demand for new fresh water supplies.

The feasibility of recycling water is somewhat dependent on the quality of the source water. Current technology allows municipal wastewater treatment systems in some regions to consistently produce safe water supplies at competitive costs. The degree of treatment depends on the intended use, with public health being the primary concern. As a minimum, wastewater is treated to a secondary level to remove dissolved organic materials. Secondary effluent can be treated to a tertiary level by additional filtering and disinfecting, but the costs can be high in comparison to other fresh water supply augmentation options.

Water reuse in California was estimated to be over 380 TAF in 1993. Most of the recycling occurs in the South Coast, Central Coast, and Tulare Lake regions. Ground water recharge accounts for nearly half of all recycled water used. Other uses of recycled water include agricultural irrigation, landscape irrigation, environmental (wildlife habitat), industrial, recreational, and seawater intrusion barriers (DWR, 1994b).

5. Combined Use of SWP/CVP Points of Diversion in the Delta

Currently, a water imbalance exists in the two major water projects. The CVP occasionally has an excess water supply north of the Delta, but it doesn't have sufficient conveyance capacity to transport it to its ultimate place of use south of the Delta. The SWP on the other hand has surplus capacity in its conveyance facilities but an insufficient upstream water supply. Therefore, the excess capacity in the SWP facilities could be used to transport more CVP water to the San Joaquin Valley without impairing the SWP, and a share of the CVP water supply could be sold to the SWP for use in its service area. The CVP has limited rights under its water right permits to use the SWP diversion facilities in the Delta. D-1485 authorizes the CVP to use SWP facilities to make up deficiencies caused by the export restrictions in May and June established by the decision. The SWP water rights do not identify the CVP export facilities as an authorized point of diversion or rediversion.

In addition to the water supply issues, combined use of CVP and SWP points of diversion and rediversion has the potential to decrease fishery impacts. The two diversions are at different locations and different fish species are entrained at the diversions at different times. A combined point of diversion would allow pumping to shift between diversion points based on the density of fish near the diversion points. SWRCB Order WR 98-9 authorizes combined use of SWP and CVP points of diversion to benefit fish. Order WR 98-9 is a temporary order that expires on December 31, 1999.

The USBR has petitioned the SWRCB to add the Clifton Court Forebay as a point of diversion and rediversion in the water right permits of the CVP and to remove the 4,600 cfs rate of diversion restriction on pumping through the Delta Mendota Canal. Chapter XIII of this draft EIR discusses the environmental impacts of authorizing combined use of points of diversion.

6. Offstream Storage Projects

Enhanced water supply reliability in the future can be achieved, in part, by construction of additional offstream storage. There are several major offstream storage projects presently under development or consideration: Eastside Reservoir, Los Vaqueros Reservoir, Los Banos Grandes Reservoir, Delta Wetlands, and Mandeville Island. The Eastside Reservoir, currently under construction by the Metropolitan Water District, could provide 0.26 MAF of drought year net water supplies

(DWR 1994). Los Vaqueros Reservoir, which will be used to improve water quality in the Contra Costa Water District and provide emergency storage, has recently been completed and is now operating. Los Banos Grandes Reservoir, a proposed feature of the SWP, would be located south of San Luis Reservoir, and it could provide 0.3 MAF of average and 0.26 MAF of drought year net water supplies under D-1485 conditions. Delta Wetlands is a proposed storage project in the Delta with a capacity of approximately 238 TAF. Surplus flows would be diverted onto two islands, Bacon Island and Webb Tract, and subsequently wheeled through the SWP or CVP export pumps or released to meet Delta outflow requirements. Recently, a water right application for a similar project was filed to impound 330 TAF on Mandeville Island.

7. ISDP

The ISDP is being undertaken by the DWR to increase the yield and flexibility of operation of the SWP and to improve the conditions for local diverters. The principal features of the ISDP can be divided into five components: (1) construct and operate a new intake structure at the SWP Clifton Court Forebay; (2) perform channel dredging along a reach of Old River just north of Clifton Court Forebay to improve channel capacity; (3) increase diversions into Clifton Court up to a maximum of 20,430 acre-feet per day on a monthly averaged basis; (4) construct and operate a barrier seasonally in both the spring and fall to improve fishery conditions for salmon migrating along the San Joaquin River; and (5) construct and operate three flow control structures to improve existing water level and circulation patterns for agricultural users in the southern Delta. This program could augment SWP supplies by about 60 TAF per year (DWR 1994b).

C. GROWTH-INDUCING EFFECTS

Implementing the Bay/Delta Plan will reduce the amount of water available to water utilities in areas served by the CVP, the SWP, and other parties charged by the SWRCB with responsibility for meeting the objectives of the Plan. To the extent that historic patterns are any indication of future trends, reduced water availability is unlikely to affect growth in these areas.

Growth patterns have historically been influenced by market conditions far more than by any other factor. Water shortages have rarely done more than slow the progress of adequately financed development proposals. Growth moratoriums have occasionally been imposed due to inadequate water supplies but, in most cases, enough water has been found to sustain most economically viable growth. Because the costs of water supply augmentation projects can usually be spread over a large user base, the cost of new supplies has seldom been high enough to significantly reduce the profitability of new development projects.

Land fallowed in response to irrigation water cutbacks could become available for other uses, including development. Because development is primarily driven by demand, however, the availability of fallowed land is not expected to result in significant new growth. Without a tangible demand for new housing, an increase in the amount of available, affordable land will not stimulate the construction of new housing.

D. RELATIONSHIP BETWEEN SHORT-TERM USES AND THE MAINTENANCE OF LONG-TERM PRODUCTIVITY

The principal issue associated with the relationship between short-term uses and the maintenance of long-term productivity is groundwater overdraft. As discussed in Chapter VI, implementation of the Bay/Delta Plan will aggravate groundwater overdraft problems. Additionally, changes in the use of water may well occur, from agricultural uses to municipal uses, or from one type of agricultural use or crop to another, in the short- and long-term.

Implementation of the Plan has the potential to affect water levels in reservoirs, flows in the rivers, water management operations, and the quantity of water deliveries to various districts in the short- and long-term. Surface water is, however, renewable from precipitation. Also, the Plan will be reviewed every 3 years to evaluate the effectiveness of the objectives and the water supply needs of the State.

The Bay/Delta Plan will provide better protection to aquatic habitat-related beneficial uses in the Estuary, and long-term increases in fresh- and brackish-water aquatic and terrestrial habitats in the Delta should result. If the Plan is not implemented, there will probably be further declines in those resources and additional species may be listed under the federal and State ESAs.

E. IRREVERSIBLE OR IRRETRIEVABLE COMMITMENT OF RESOURCES

Most of the environmental impacts identified in this report are reversible. The principal hydrologic effects of implementing the Bay/Delta Plan will be to change Delta outflow, reservoir levels, and deliveries to export areas. These parameters presently fluctuate a great deal due to the variable hydrology in the Central Valley. If the Plan's objectives are implemented and then rescinded at a future date, the hydrology will be dependent on the regulatory conditions in effect at that time. However, there are three irreversible impacts that might occur as a result of this situation: land use changes, fossil fuel combustion, and land subsidence. These irreversible changes are discussed below.

The most likely irreversible land use change that might occur as a result of the objectives is accelerated agricultural land retirement. Without a firm agricultural water supply, the conversion of this land to some other use may occur, especially if the land is adjacent to an urban area. The extent to which this land use change will actually occur is dependent on decisions by local authorities.

The second irreversible impact is increased fossil fuel combustion. The dedication of additional water to the environment will decrease the availability of water in some upstream reservoirs for summer peak power generation, as discussed in Chapter VI. In addition, the development of replacement water through groundwater pumping and reclamation is power intensive. Fossil fuel combustion will likely be an element in replacing lost power and meeting new power requirements as a result of the Plan.

The third irreversible impact is land subsidence. As discussed in Chapter VI, implementation of the Plan's objectives is likely to result in increased groundwater pumping, which can cause land subsidence. Land subsidence can damage surface structures, and it can result in permanent loss of aquifer capacity.

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