CALFED

TECHNICAL REPORT
ENVIRONMENTAL CONSEQUENCES

SURFACE WATER RESOURCES

Including Surface Water Supply and Management and Bay-Delta Hydrodynamics and Riverine Hydraulics

DRAFT

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CALFED
BAY-DELTA
PROGRAM

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LIST OF ACRONYMS

Br	bromide
CALFED	CALFED Bay-Delta Program
cfs	cubic foot per second
Cl	chloride
Corps	U.S. Army Corps of Engineers
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
DCC	Delta Cross Channel
DFG	California Department of Fish and Game
DOC	dissolved organic carbon
DWR	California Department of Water Resources
EBMUD	East Bay Municipal Utilities District
EC	electrical conductivity
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ET	evapotranspiration
FERC	Federal Energy Regulatory Commission
fps	foot per second
ISDP	Interim South Delta Program
km	kilometer
MAF	million acre-feet
mg/L	milligrams per liter
M&I	municipal and industrial
MWD	Metropolitan Water District of Southern California
NCP	navigation control point
PEIS	Programmatic Environmental Impact Statement
ppm	parts per million
ppt	part per thousand
Reclamation	U.S. Bureau of Reclamation
SWP	State Water Project
SWRCB	State Water Resources Control Board
TAF	thousand acre-feet
TCD	temperature control device
TDS	total dissolved solids
USFWS	U.S. Fish and Wildlife Service
WQCP	Water Quality Control Plan

SURFACE WATER RESOURCES

INTRODUCTION

This technical report discusses impacts on surface water resources associated with implementing the CALFED Bay-Delta Program (CALFED). Surface water resources include surface water supply and management and Bay-Delta hydrodynamics and riverine hydraulics.

Surface Water Supply and Management

Potentially significant impacts on surface water supply and management include several interrelated reservoir storage, diversion, and stream flow conditions. Water management actions in each tributary basin would influence Delta water management conditions. Delta water management facilities may provide new opportunities for water management in tributary basins and in the export service areas. The potential connections between the tributary basins and Delta water management conditions include the following:

- Tributary basins provide sources of runoff and stored water supply for the Delta. This water enters the Delta as a result of uncontrolled runoff, releases for instream flows or Delta outflow requirements, reservoir spills, releases for export, and water transfers. Increased storage capacity may augment Delta water supplies when instream flows and Delta outflow are most beneficial for ecosystem processes or for increasing exports and water supply diversions.

- Each region receiving Delta exports obtains some local water supplies from runoff, surface storage, recharge, water reclamation, and groundwater pumping. These local supplies reduce the demands for Delta exports. Increased storage, reclamation, and conservation may further reduce the need for Delta exports during dry years when water supplies are low.

CALFED alternatives would include changes to Delta management activities and facilities that may influence water management in other regions:

- CALFED alternatives may increase the opportunities for exports during high flows (increased pumping capacity and aqueduct storage capacity) and reduce the need for exports during low-flow periods. This would most likely reduce impacts on aquatic ecosystem processes and species populations.

- CALFED alternatives may reduce Delta export impacts (fish entrainment and water quality degradation). This may allow increased exports and facilitate water transfers from upstream regions.

- CALFED alternatives may include Delta storage facilities, wetland restoration, reduced agricultural drainage, and modified channels and gates that would directly change water demands and channel flows in the Delta. These Delta management activities may thereby affect the potential quantity and quality of Delta diversions and exports.

All potentially significant water management impacts would be related to operational changes resulting from CALFED alternatives rather than construction activities. Impacts from construction of new storage and conveyance facilities are described in other reports for other resources—for example, impacts on water quality, vegetation and wildlife, and noise. Several general types of potentially significant

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direct impacts on water management were identified, as described below.

Runoff. Changes in runoff (to reservoirs or local streams) may be caused by upstream watershed management actions, including additional upstream storage, vegetation management, fire controls, and grazing controls. New groundwater management facilities for recharge to support conjunctive use would affect local runoff. Groundwater or other replacement supplies may allow upstream diversions to be reduced in some months of low-runoff years (runoff would be increased).

Reservoir Storage. Changes in reservoir storage may be caused by modified storage capacity or by different rules for allowable storage levels (increased diversions to storage). Flood control levels usually restrict diversions to storage during winter. Downstream diversion targets and flow requirements also may limit storage diversions. Changes in seasonal storage patterns may modify the flood control potential (flood risk). Evaporation loss would be slightly increased at higher storage (increased surface area).

River Flow. Changes in river flow may be caused by reservoir releases for instream flow benefits and downstream water supply diversions. The combination of all downstream demands relative to the available storage and runoff generally would control reservoir releases. The resulting flows would affect river hydraulics (depth, width, and velocity) and sediment transport (gravel movement and flushing). Modified channels may affect the stage-discharge relationship and the associated flooding risks.

Diversions. Changes in diversions for water supply (including direct use and local surface water or groundwater storage) may result from water use efficiency or other local water management programs. Exports from the Delta may be shifted in location or from months with higher potential aquatic organism entrainment effects to months with lower potential impacts. Reduced diversions may require increased groundwater pumping in the aqueduct service areas. Additional diversions may supply conjunctive use facilities or reduce groundwater pumping.

Several potentially significant indirect impacts could result from changes in Bay-Delta water management conditions:

Reservoir Storage. Changes in reservoir storage may indirectly affect recreation, fish habitat, and wildlife habitat. Reservoir storage may influence release temperatures. Hydroelectric power generation generally would be increased with higher storage.

River Flow. Changes in river flows may indirectly affect riparian or aquatic habitat conditions. Water temperatures would be affected by flow. Flows may affect groundwater recharge and storage.

Diversions. Changes in river diversions would change entrainment effects on fish. Reliable fish screens may reduce the impacts of diversions. Relocating diversions may have beneficial effects. Shifting the timing of diversions also may have beneficial effects.

Delta Outflow. Changes in Delta outflow would indirectly affect agricultural and export salinity. Changes in the location of the estuarine salinity gradient (that is X2) would indirectly affect the estuarine habitat area for representative species.

Salinity. Changes in flows may indirectly affect water quality. The salinity/flow relationship at Vernalis may be affected by upstream salinity management. A barrier at the head of Old River most likely would reduce the export salinity because more of the San Joaquin River salt load would be transported out of the Delta.

Location and Timing of Exports. Changes in export location or monthly pattern would indirectly affect water quality because water quality is influenced by Delta outflow and diversion location (Tracy vs. Hood). Changes in

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exports would change the entrainment of fish and foodweb organisms.

Water Quality of Exports. Delta channel flows along with assumed agricultural drainage flows and export locations would affect the export concentrations of salinity (electrical conductivity [EC], chloride [Cl], bromide [Br]) and dissolved organic carbon (DOC). These are very important assessment variables for the quality of drinking water.

ASSESSMENT METHODS

Surface Water Supply and Management

Water supply reliability was assessed relative to the degree and frequency at which the alternatives are able to meet future water demands. These demands include municipal, industrial, agricultural, environmental, power production, aesthetic, and recreational water needs. At the program level, only changes in water available to meet offstream and instream water uses are compared.

South of Delta State Water Project (SWP) and Central Valley Project (CVP) water deliveries have been estimated for existing conditions, no action, and the three refined program alternatives using the system operations model DWRSIM. Deliveries to the SWP and CVP service areas represent the combined offstream water users, including agricultural and municipal/industrial water users.

Existing Bay-Delta Water Quality Control Plan (WQCP) standards were used as the basis for DWRSIM modeling. Long-term conditions are represented by the historical precipitation and runoff record for the watershed of the Delta for the 73-year period from October 1921 to September 1994. Critically dry conditions are represented by the hydrologic record for the period between May 1928 and October 1934.

DWRSIM is a planning simulation model which is used to simulate the Central Valley Project (CVP) and the State Water Project (SWP) system of reservoirs and conveyance facilities. The model calculates flows on a monthly time step using 73 years of historic hydrology. The historic hydrology, for example runoff records, have been updated to reflect present and future land use.

DWRSIM is designed to simulate operation of the SWP and CVP system for the purposes of water supply, flood control, recreation, instream flows, power generation and Sacramento-San Joaquin Delta water quality and associated outflow requirements. The model is used to analyze the potential effects of proposed new features, such as additional reservoir storage or Delta export conveyance, as well as any changes to criteria controlling project operations.

In conducting these studies, expansion of the SWP and CVP facilities and/or water demands were often used as surrogates to analyze the potential effects of the various configurations under consideration. Model results provide information on expected reservoir storage, river flow, Delta inflows, Delta outflow exports, and water deliveries. In addition, spreadsheet models and other analytical tools were used for the alternatives analyses.

The monthly flows calculated by DWRSIM for the Sacramento River and for the San Joaquin River are used as input for Delta hydrodynamic/water quality modeling.

Bay-Delta Hydrodynamics

The potential impacts resulting from the implementation of CALFED alternatives were analyzed using the Department of Water Resources' (DWR's) operations planning model

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(DWRSIM) and Bay-Delta hydrodynamic model (DWRDSM1).

MODELING ASSUMPTIONS

DWRSIM modeling studies used in preparation of this report included:

- A study representing existing conditions;
- A No Action benchmark study representing the effects of increased water demand for the year 2020;
- Five studies that added, progressively, south Delta improvements, north and south Delta surface storage (representing basic components of Alternatives 1 and 2);
- Two studies that included a 5,000-cubic-foot-per-second (cfs) isolated facility representing Alternative 3 with and without surface storage, respectively; and
- One study that included a 15,000-cfs isolated facility, representing Alternative 3 without storage.

These studies provided a basic framework for comparison of the major features affecting hydraulics and water supply.

A summary description of assumptions used in the CALFED Existing Conditions Study 1995D06A-CALFED-558 is presented here. A more detailed description of study assumptions is available on DWR's Hydrology and Operations Section Home Page at: *http://wwwhydro.water.ca.gov/index.html.*

- **1995-Level Hydrology.** A 1995-level hydrology, HYD-D06A, is used. This hydrology is similar to HYD-C06B, which is described in a DWR Division of Planning June 1994 memorandum report, entitled "Summary of Hydrologies at the 1990, 1995, 2000 and 2020 Levels of Development" for use in DWRSIM Planning Studies" published by DWR's Division of Planning (now Office of SWP Planning). The 1995-level hydrology and upstream depletions are based on DWR Bulletin 160-98 land use projections (73 years: 1922-1994).
- **SWP Demands.** SWP demands are varied between 3,529 TAF in drier years down to 2,619 TAF in wetter years based on local wetness indices. SWP demands of San Joaquin Valley agricultural contractors are reduced in wetter years from 1,175 to 915 TAF using a Kern River flow index. SWP demands of Metropolitan Water District of Southern California (MWD) are reduced in wetter years from 1,433 to 783 TAF using a Southern California precipitation index. Deliveries to all other SWP municipal and industrial (M&I) contractors are not adjusted for a wetness index and are set at 857 TAF/year in all years.
- **CVP Demands.** CVP demands, including wildlife refuges, are set at 3,573 TAF/year. CVP Delta export demands are reduced in certain wet years (in the San Joaquin River Basin) when James Bypass flows are available in the Mendota Pool. Sacramento Valley refuge demands are modeled implicitly in the hydrology through rice field and duck club operations. Level II refuge demands in the San Joaquin Valley are explicitly modeled at an assumed level of 288 TAF/year.
- **Refuge Demands.** Affected environment assumptions for the CALFED Environmental Impact Statement/Environ-mental Impact Report (EIS/EIR) include Level II wildlife refuge demands plus 30 percent of Level IV demands. Sacramento Valley refuge demands are modeled implicitly in the hydrology (depletion analysis) developed for DWRSIM. Sacramento Valley refuges include Gray Lodge, Modoc, Sacramento, Delevan, Colusa, and Sutter. Refuge

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demands in the San Joaquin Valley are explicitly modeled as a component of CVP demand. San Joaquin Valley refuges include Grasslands, Volta, Los Banos, Kesterson, San Luis, Merced, Mendota, Pixley, and Kern. As described in the Central Valley Project Improvement Act (CVPIA) Draft Programmatic EIS (PEIS), water would be acquired from willing sellers to provide the difference in Level II and Level IV refuge demands. This water would be acquired as a first priority from reliable sources in the same geographic region as the refuges. Under this approach, no additional water would be transported through the Delta for San Joaquin Valley refuges. As a modeling assumption simplification to the affected environment assumptions for the CALFED EIS/EIR, only Level II refuge demands were modeled in DWRSIM. It is assumed that differences in Level II and Level IV deliveries will come from nearby willing sellers, and that differences in total consumptive use and affects on system operations will be negligible.

- **Instream Requirements**

Sacramento River - Sacramento River navigation control point (NCP) flows are maintained at 5,000 cfs in wet and above-normal water years and at 4,000 cfs in all other years, with possible relaxations to 3,250 cfs. Flow objectives between 3,250 and 5,500 cfs are maintained below Keswick Dam on the Sacramento River in accordance with an April 26, 1996 letter from the U.S. Bureau of Reclamation (Reclamation) to SWRCB defining early CVPIA flow criteria.

Feather River - Feather River fishery flows are maintained per an agreement between DWR and the California Department of Fish and Game (DFG) (August 26, 1983), with October through March minimum flows at 1,700 cfs and at 1,000 cfs from April through September.

Yuba River - Yuba River minimum fishery flows below Englebright Reservoir at Smartville range between 600 and 800 cfs from October 15 through February under 1993 Federal Energy Regulatory Commission (FERC) requirements. The river flows are not dynamically modeled by the DWRSIM model but are contained in the HYD-D06A hydrology used as model input into DWRSIM. The HYD-D06A hydrology does not reflect the 1993 FERC requirements, but water supply impacts are not substantially different from those modeled in HYD-D06A.

American River - Flow objectives between 250 and 4,500 cfs are maintained below Nimbus Dam on the American River in accordance with an April 26, 1996 letter from Reclamation to SWRCB defining early CVPIA flow criteria.

Mokelumne River - Mokelumne River minimum fishery flows below Camanche Dam are per an agreement between East Bay Municipal Utilities District (EBMUD), U.S. Fish and Wildlife Service (USFWS), and DFG (FERC Agreement 2916), with base flows ranging from 100 to 325 cfs from October through June, and at 100 cfs from July through September. The river flows are not dynamically modeled by the DWRSIM model but are contained in the HYD-D06A hydrology used as model input into DWRSIM.

Stanislaus River - Stanislaus River required minimum fish flows below New Melones Reservoir are met as a function of New Melones Reservoir storage and range from 98 up to 467 TAF/year, according to the interim Operations Plan provided by Reclamation staff. The actual minimum fish flow for each year is based on the water supply available for that year. CVP contract demands above Goodwin Dam are met as a function of New Melones Reservoir storage and inflow per interim Operations Plan provided by Reclamation staff.

Tuolumne River - Tuolumne River minimum fishery flows below New Don Pedro Dam are maintained between 50 and 300 cfs per an agreement between Turlock and Modesto Irrigation districts, City of San Francisco, DFG, and others (FERC Agreement 2299).

Merced River - Merced River minimum fishery flows below Shaffer Bridge are maintained between 15 and 180 cfs per an agreement between Merced IrrigationDistrict, DFG, and others (FERC, Davis-Grunsky).

- **Delta Standards.** Operation of CVP and SWP export facilities in the Delta are coordinated with the upstream SWP and CVP reservoirs to meet the SWRCB's May 1995 Water Quality Control Plan for the Bay-Delta (WQCP). A summary description of these assumptions are summarized below:

X2 Requirement - For February through June, outflow requirements are maintained in accordance with the 2.64 electrical conductivity (EC) criteria (also known as X2) using the required number of days at Chipps Island (74 kilometers [km]) and Roe Island (64 km).

Export Limits - Ratios for maximum allowable Delta exports are specified as a percentage of total Delta inflow as shown below. In February, the export ratio is a function of the January Eight River Index.

Export/Import Ratio
(in %)

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
65	65	65	65	35-45	35	35	35	35	65	65	65

Based on the WQCP, April 15 to May 15 total Delta exports are limited to 1,500 cfs or 100 percent of the San Joaquin River flow at Vernalis, whichever is greater. Additional water is provided from the San Joaquin River upstream of its confluence with the Stanislaus, if necessary, to meet salinity and pulse flow objectives at Vernalis. Additional water requirements are shared equally between the Tuolumne (Don Pedro Reservoir) and Merced (Lake McClure) River basins. If these sources are insufficient to meet objectives at Vernalis, nominal deficiencies are applied to upstream demands. Additional releases from the Tuolumne and Merced Rivers are assumed to be of fresh water quality (50 parts per million [ppm] total dissolved solids [TDS]). Furthermore, it is assumed that these additional releases do not incur losses between the reservoirs and Vernalis.

Delta Cross Channel - The Delta Cross Channel (DCC) is closed 10 days in November, 15 days in December, and 20 days in January—for a total closure of 45 days. The DCC is fully closed from February 1 through May 20 of all years and is closed an additional 14 days between May 21 and June 15.

Water Quality Objectives - The water quality objective at Contra Costa Canal intake is maintained in accordance with the WQCP. A "buffer" was added to ensure that the standard is maintained on a daily basis. Thus, DWRSIM uses a value of 130 milligrams per liter (mg/L) for the 150 mg/L standard and a value of 225 mg/L for the 250 mg/L standard.

Water quality objectives on the Sacramento River at Emmaton and on the San Joaquin River at Jersey Point are maintained in accordance with the WQCP. WQCP water

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quality objectives on the San Joaquin River at Vernalis are 0.7 EC in April through August and 1.0 EC in other months. These objectives are maintained primarily by releasing water from New Melones Reservoir. A cap on water quality releases is imposed per criteria outlined in the April 26, 1996 letter from Reclamation to SWRCB. The cap varies between 70 and 200 TAF/year, depending on New Melones storage and projected inflow. The interior Delta standards on the Mokelumne River (at Terminous) and on the San Joaquin River (at San Andreas Landing) are not modeled.

The 0.44 EC standard is maintained at Jersey Point in April and May of all but critical years. This criterion is dropped in May if the projected Sacramento River Index is less than 8.1 MAF. Average high-tide EC standards to be maintained at Collinsville for eastern Suisun Marsh salinity control are shown below. All other Suisun Marsh standards are assumed to be met through operation of the Suisun Marsh salinity control gates.

EC Standards at Collinsville (in mS/cm)

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
19.0	15.5	12.5	12.5	8.0	8.0	11.0	11.0

<u>Trinity River Imports</u> - Trinity River minimum fish flows below Lewiston Dam are maintained at 340 TAF/year for all years, based on a May 1991 letter agreement between Reclamation and the USFWS.

- **CVPIA Flow Criteria.** CALFED affected environment assumptions include implementation of CVPIA (b)(2) water management actions; however, targets and an accounting system for use of the (b)(2) water have not yet been thoroughly defined. CALFED Study 1995D06A-CALFED-558 includes a partial implementation of CVPIA (b)(2) water management in accordance with the April 26, 1996 letter from Reclamation to the SWRCB. This letter describes upstream actions on the Sacramento and American rivers. For the CALFED affected environment simulation, additional actions will be included as a surrogate for final implementation of CVPIA (b)(2). These additional actions were selected from a list of possible water management actions evaluated in the CVPIA PEIS. Selection of specific actions for this surrogate approach is not intended to signify endorsement of any action by CALFED.

<u>Delta Cross Channel</u> - The DCC is closed from November through June and open from July through October.

<u>April-May Export Restriction</u> - Total CVP/SWP exports are restricted during the 30-day pulse flow period from April 15 through May 15 to the following ratios of total export to flow at Vernalis for the following year types:

1:3 in below-normal, dry, and critical years,

1:4 in above-normal years, and

1:5 in wet years.

<u>Additional Chipps Island X2 Days</u> - Additional Chipps Island X2 days are required to approximate a 1962 level of development for May and June.

- **Discrepancies with Affected Environment Assumptions.** Several discrepancies exist between CALFED affected environment assumptions and modeling assumptions used

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in 1995D06A-CALFED-558 for instream flow requirements on the Yuba, Mokelumne, and Tuolumne rivers, pursuant to recent FERC agreements.

Yuba River - CALFED affected environment assumptions for the Yuba River maintain that the 1993 FERC requirements are not imposed. These river flows are not dynamically modeled by the DWRSIM model but are contained in the HYD-D06A hydrology used as model input into DWRSIM. As described in the previous summary description of 1995D06A-CALFED-558, the HYD-D06A hydrology does not reflect the 1993 FERC requirements,; therefore, no modification in modeling assumptions is required for the CALFED affected environment simulation.

Mokelumne - CALFED affected environment assumptions for the Mokelumne River maintain that recent FERC requirements are not imposed. CALFED Study 1995D06A-CALFED-558 includes Mokelumne River minimum fishery flows below Camanche Dam as defined in FERC Agreement 2916. The river flows are not dynamically modeled by the DWRSIM model but are contained in the HYD-D06A hydrology used as model input into DWRSIM. To more accurately simulate the CALFED affected environment assumptions, Mokelumne River flow requirements should be modified to reflect requirements that existed prior to FERC Agreement 2916.

Tuolumne River - CALFED affected environment assumptions for the Tuolumne River maintain that recent FERC requirements are not imposed. CALFED Study 1995D06A-CALFED-558 includes Tuolumne River minimum fishery flows below New Don Pedro Dam as defined by FERC Agreement 2299. To more accurately simulate the affected environment assumptions, Tuolumne River flow requirements should be modified to reflect requirements that existed prior to FERC Agreement 2916.

Assumptions for CALFED No Action Study 2020D09B-CALFED-516 are comparable to assumptions described above for the CALFED Study 1995D06A-CALFED-558, except for the level of demand and hydrology as described here. A more detailed description of study assumptions is available on DWR's Hydrology and Operations Section Home Page at: *http://wwwhydro.water.ca.gov/index.html.*

- **SWP Demands.** Combining these SWP agricultural and urban demand assumptions, total annual SWP demand is varied between a minimum of 3,480 TAF and a maximum of 4,130 TAF.

  San Joaquin Valley SWP agricultural demands will be reduced in wetter years to reflect an expected reduction in SWP water use due to availability of local water supply sources and local flooding that prevents agricultural production. Total SWP agricultural demands will be reduced from full contractual entitlement by 25 percent in wetter years based on a Kern River flow index. When inflow to Lake Isabella is less than 1.5 MAF, agricultural demand will be set at a maximum 1,180 TAF. In years when inflow to Lake Isabella exceeds 1.5 MAF, agricultural demands will be reduced to 890 TAF. This logic is similar to the reduction logic used in the 1995D06A-CALFED-558 study.

  In planning studies conducted for their Integrated Resources Planning process, MWD has assumed reduced SWP deliveries in some drier years. In these studies, full contractual entitlement deliveries are requested in most wetter years, with a portion of these supplies reserved in local storage. These local storage options include groundwater conjunctive use operations and the future Eastside Reservoir. Subsequently, these local storage sources are drawn upon when SWP supplies are reduced in drier years. MWD has provided CALFED with a set of annual 2020-level SWP demands, varying from a minimum of 1,460 TAF to full entitlement of 2,010 TAF. Remaining SWP urban demands (other than MWD) will be assumed at a constant 950 TAF per year.

- **CVP Demands.** CVP demands, including wildlife refuges, are set at 3,766 TAF/year. CVP Delta export demands are reduced in certain wet years (in the San Joaquin River Basin) when James Bypass flows are available in the Mendota Pool. Sacramento Valley refuge demands are modeled implicitly in the hydrology through rice field and duck club operations. Level II refuge demands in the San Joaquin Valley are explicitly modeled at an assumed level of 232 TAF/year. The Contra Costa Canal monthly demand pattern assumes Los Vaqueros operations in accordance with a July 11, 1994 E-mail from CCWD.

- **2020-Level Hydrology.** A new 2020-level hydrology, HYD-D09B, has been developed similar to hydrology HYD-C09B described in a June 1994 memorandum report, entitled "Summary of Hydrologies at the 1990, 1995, 2000, 2010, and 2020 Levels of Development for Use in DWRSIM Planning Studies" published by DWR's Division of Planning (now Office of SWP Planning). HYD-D09B is based on DWR Bulletin 160-98 land use projections and simulates the 73-year period from 1922 through 1994. Major assumptions in developing the hydrology compared to the 1995-level HYD-D06A are:

  A. For areas upstream of the Delta (Sacramento River Basin and eastside stream area), land use projections at the 2020-level of development based on Bulletin 160-98 preliminary projections.

  B. The stand-alone HE-3 models of the American, Yuba, and Bear river systems were updated and extended through 1994.

  C. A new EBMUD study (Study No. 5977) of the Camanche/Pardee reservoir system on the Mokelumne was used in the hydrology development process.

  D. Net Delta water requirements were estimated based on variable crop evapotranspiration (ET) values.

  E. For the San Joaquin Valley, the hydrology was based on Reclamation's SANJASM run NF1 used in the base case for the CVPIA PEIS.

DWRSIM OPERATION STUDIES FOR PROGRAM ALTERNATIVES

The three CALFED Program alternatives consist of the four common programs of ecosystem restoration, water quality, water use efficiency, and levee system integrity together with various configurations of storage and conveyance facilities. Alternative 1 uses only existing Delta channels for water conveyance, preserving the Delta common pool as currently in place. Three configurations with various south Delta modifications and one new storage configuration differentiate the variations in this alternative. Alternative 2 uses significant modifications of through-Delta channels to improve water conveyance across the Delta. Combinations of four potential conveyance configurations and three new storage configurations differentiate the five variations of this alternative. Alternative 3 adds an isolated facility to the through-Delta modifications of Alternative 2. Combinations of seven potential conveyance configurations and two new storage configurations differentiate the nine variations of this alternative.

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A summary description of the three Program alternatives with multiple storage and Delta conveyance variations along with the proposed DWRSIM operation studies is shown in Table 1. The operation studies for the three Program alternatives with multiple storage and Delta conveyance variations are intended: 1.) to display the range of system benefits and impacts between CALFED alternatives, with focus primarily on the re-operation of surface water supply facilities, and 2.) to describe changes in existing and new reservoir storage operations, resulting downstream river flows, deliveries of surface water pursuant to CVP and SWP contracts, and required water acquisition quantities.

- **Ecosystem Restoration Program Flow Targets.** As an initial policy, the Ecosystem Restoration Program flow targets are not interpreted as constraints to water supply diversion. Water supplies required to meet the flow targets would be developed through construction of new storage facilities or purchased from willing sellers. Ecosystem Restoration Program water used for in-stream flows are not diverted at the Delta; however, these flows are added to the Delta mass balance and influence export patterns. To accurately simulate CALFED alternatives, including Ecosystem Restoration Program actions in DWRSIM, the Ecosystem Restoration Program flows were added to the system in each monthly time step, after simulation of SWP and CVP operations. The Ecosystem Restoration Program flow targets were applied to all the program alternative operation studies.

  Ecosystem Restoration Program Upstream Environmental Flow Targets - The Ecosystem Restoration Program outlines many environmental flow objectives to improve the ecological functions in the Bay-Delta in order to support sustainable populations of diverse and valuable plant and animal species. The Ecosystem Restoration Program identifies monthly and 10-day flow event targets for many of the river basins in the Bay-Delta watershed. The additional river flows targeted by the Ecosystem Restoration Program would occur through the following prioritized actions: 1.) implementation of actions under consideration through the CVPIA Draft PEIS, 2.) releases from new environmental storage created under the CALFED Program, and 3.) water acquisitions from willing sellers.

  As a simplification for DWRSIM modeling, the operation studies focus only on the 10-day flow event and monthly Freeport flow targets, which represent the most significant Ecosystem Restoration Program flow actions. These flow targets are shown in Table 2.

  Environmental Storage Operations - As an initial assumption for CALFED Program alternatives, the total volume of all new storage is assumed to be split among the three beneficial use sectors, such that one-third of storage is dedicated to environmental purposes, one-third to urban purposes, and one-third to agricultural purposes. In the current operation studies, only portions of Sacramento River and San Joaquin River tributary surface storage were allocated for environmental purposes. Groundwater storage, in-Delta surface storage, and south of Delta off-aqueduct surface storage would require transfer arrangements to serve Ecosystem Restoration Program flow targets. Operational parameters and appropriate code modifications to DWRSIM may be developed in the future, to allow simulation of these types of storage operations for environmental purposes.

  In the simulations of CALFED Program alternatives, environmental storage was operated to maximize average annual yield by not imposing carryover provisions.

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Alternative Configuration	Delta Modifications					Storage Components (Maximum Storage Volumes in MAF)						Available DWRSIM Study
	CVPS Improvements	North Delta Channel Modifications	South Delta Modifications	Isolated Conveyance Facility (Conveyance Capacity in TCFS / Type)	Comments	Sacramento Valley Groundwater Storage	Upstream Surface Storage Sacramento River	Upstream Surface Storage San Joaquin River	In-Delta Surface Storage	San Joaquin Valley Groundwater Storage	South of Delta Aqueduct Surface Storage	
1A												51[illegible]
1B	1											518
1C	1		1,2			0.5	3.0			[illegible]	[illegible]	[illegible]
2A	1	1,2	1,2,3									[illegible]
2B	1	1,2	1,2,3			0.5	3.0	0.5		0.5	2.0	532a
2D	1	Special	Special		Extensive Habitat Restoration						2.0	530
2E	1	Special	Special		Extensive Habitat Restoration	0.5	3.0	0.5		0.5	2.0	532b
3A	1	2	1,2,3	5 / Open Channel								[illegible]
3B	1	2	1,2,3	5 / Open Channel		0.5	3.0	0.5	0.2	0.5	2.0	579
3E	1	2	1,3	15 / Open Channel		0.5	3.0	0.5	0.2	0.5	2.0	[illegible]
3H	1	*Special*	*Special*	5 / Open Channel	Extensive Habitat Restoration	0.5	3.0	0.5		0.5	2.0	579
3I	1	*Special*	*Special*	15 / Open Channel	IF / Multiple Intakes	0.5	3.0	0.5	0.2	0.5	2.0	[illegible]

Table 1. Summary Description of Alternative Configurations

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Location/Time Period	Critical	Dry	Below Normal	Above Normal	Wet
Sacramento-San Joaquin Delta Outflow					
• March - 10 days	-	20,000	30,000	40,000	-
• April/May - 10 days	-	20,000	30,000	40,000	-
Sacramento (Freeport - Between CP 137 & CP 503)					
• May	-	13,000	13,000	13,000	13,000
Sacramento (Knights Landing - Between CP 61 & CP 43)					
• March - 10 days	-	7,500	17,500	17,500	-
Feather (Gridley - Between CP 106 & CP 38)					
• March - 10 days	-	5,000	7,000	9,000	-
Yuba (Marysville - Additional Nodes Connected to CP 37)					
• March - 10 days	-	2,500	3,500	3,500	-
American (Nimbus Dam - Between CP 9 & CP 41)					
• March - 10 days	-	3,500	5,000	5,000	7,000
Stanislaus (Goodwin - Between CP 16 & CP 672)					
• April/May - 10 days	-	-	2,750	2,750	3,500
Tuolumne (La Grange - CP 662 & CP 663)					
• April/May - 10 days	-	2,750	3,750	3,750	5,500
Merced (Shaffer Bridge - CP 645 & CP 646)					
• April/May - 10 days	-	1,250	2,250	2,250	3,750

Table 2. Proposed Ecosystem Restoration Program Flow Targets (in cfs)

Upstream Ecosystem Restoration Program Add Water - To fully meet Ecosystem Restoration Program flow targets, water acquisitions from willing sellers are required when sufficient flow is unavailable from environmental storage releases. To model the effects of these upstream water acquisitions, new DWRSIM nodes were added at the flow target locations identified in Table 2. Flow is added at these control points to represent the net amount of "real water" needed to fully meet the Ecosystem Restoration Program targets.

- **New Facility Operation Assumptions.** Operating parameters and assumptions established for evaluation of the CALFED Program Alternatives include the assumptions described previously for the CALFED No Action Alternative. In addition, the following assumptions associated with operation of new facilities were included in the appropriate simulations.

Surface and Groundwater Storage Operational Goals - All new surface storage facilities were operated primarily to maximize average annual deliveries in order to meet all beneficial uses. All new groundwater and conjunctive use facilities were operated to maximize average dry year deliveries to meet all beneficial uses.

Storage Filling and Discharge Priorities - Filling of and discharging from new storage were made with the following priorities (the following will be modified as necessary for consistency with local water management practices and water rights):

1. Tributary groundwater storage facilities have first priority for filling and last priority for discharging from storage (withdrawals from groundwater basins will be made only in dry and critical years).

2. Aqueduct groundwater storage facilities have second priority for filling and fourth priority for discharging from storage.

3. Aqueduct surface storage facilities have third priority for filling and third priority for discharging from storage.

4. Tributary surface storage facilities have fourth priority for filling and second priority for discharging from storage.

5. Delta storage facilities have fifth priority for filling and first priority for discharging from storage.

Groundwater Filling and Discharge Assumptions - Maximum storage capacity of both upstream of Delta and off-aqueduct groundwater storage is assumed at 250 and 500 TAF, respectively. Diversion capacity for both upstream of Delta and off-aqueduct groundwater storage is assumed at 500 cfs. All in-stream flow requirements must be met before diversions to new storage are allowed. Discharge capacity for both upstream of Delta and off-aqueduct groundwater storage also is 500 cfs.

Sacramento River Tributary Storage Filling and Discharge Assumptions - Maximum capacity for Sacramento River tributary surface storage is assumed to be 3.0 MAF. Assumed diversion and discharge capacity is 5,000 cfs. All in-stream flow require-ments must be met before diversions to new storage are allowed.

San Joaquin River Tributary Storage Filling and Discharge Assumptions - San Joaquin River tributary surface storage will be initially modeled as a 260-TAF maximum capacity off-stream reservoir located between the Merced and Tuolumne rivers. Spills in both rivers that exceed in-stream and Delta requirements would be diverted into the reservoir. Diversion capacity will be assumed at 2,000 cfs for the Merced River and 1,000 cfs for the Tuolumne River.

In-Delta Storage Filling and Discharge Assumptions - Maximum capacity for in-Delta surface storage is assumed to be 200 TAF. Assumed diversion and discharge capacity is 15,000 cfs. All instream flow requirements must be met before diversions to new storage are allowed. Diversion to in-Delta storage is considered an export for export-inflow ratio calculations. Discharge from in-Delta storage is not considered in export-inflow ratio calculations.

Off-Aqueduct Storage Filling and Discharge Assumptions - Maximum capacity for off-aqueduct surface storage is assumed to be 2 MAF. New storage is assumed to be connected to the California Aqueduct with 3,500-cfs diversion and discharge capacity.

Delta Requirements with Isolated Conveyance - The DCC is closed from September through June and open July through August. Isolated facilities are assumed to be operated to maximize isolated conveyance year round, consistent with the need to meet south Delta water quality objectives. Isolated flow is assumed not to be included in both export and inflow in export-import ratio; but total project exports, including isolated conveyance, are limited to

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5,000 cfs in May. A 3,000-cfs minimum flow requirement for the Sacramento River at Rio Vista for July and August was added as an additional constraint. The minimum levels of monthly export flows taken through the south Delta export facilities are 1,000 cfs only through March and 0 cfs April through June.

DELTA HYDRODYNAMIC CONDITIONS

The hydrodynamic model DWRDSM1 was used to simulate the channel flows, tidal effects, and water quality of the Bay-Delta estuary. The model was used to simulate 16 years of record from October 1975 to September 1991. This period was selected to cover a broad range of inflow and Delta export values, including High-Inflow, low-inflow/high-pumping, and low-inflow/low-pumping.

The most fundamental hydraulic variable is streamflow discharge, which is often expressed in cubic feet per second (cfs), and sometimes referred to simply as flow or flow rate. Channel geometry and slope affect stream velocity, width, and depth. For a given rate of flow, average stream velocity and depth increase as a channel narrows and decrease as a channel broadens. The ability of a stream to transport sediment is mainly a function of its velocity. Therefore, changes in channel shape and slope as well as flow can affect the sediment-carrying capacity of a stream. Broad, shallow streams with gentle slopes expose more water surface area to ambient temperature conditions, which can have an effect on the water temperature during summer months.

A greater number of variables are needed to describe flows in the Delta. The Delta is a network of interconnected channels. The water flowing in these channels is acted upon by a number of competing forces from different directions. Freshwater enters the Delta from tributary streams, primarily the Sacramento River but also the Mokelumne River, the Calaveras River, the San Joaquin River, and several smaller streams. During much of the year, these tributaries to the Delta are largely controlled by operation of upstream reservoirs.

Prior to development, Delta inflow flowed through the Delta and discharged in the Bay. But now some of the inflow is captured by pumping facilities or used for local irrigation of agricultural lands within the Delta. The largest of these are the Banks and Tracy pumping plants located in the south Delta. Additional pumping is done by the Contra Costa Water District at its intakes at the Contra Costa Canal and at Rock Slough in the southwest Delta. Some north Delta water is pumped to the North Bay Aqueduct. This Delta pumping not only draws freshwater toward the pumps, it also draws in salt water from the Bay.

The third and most regular influence on the flow of water in Delta channels is tidal action. Tidal inflows move water into portions of the Delta where freshwater outflows and channel geometry offers the least resistance. The relatively large freshwater inflows from the Sacramento River have the capacity to resist tidal inflows more than the small inflows from the San Joaquin River. Combined with pumping in the south Delta, saline Bay water tends to move further into the South Delta than it does into the north Delta. The pattern of flows is in a continual dynamic state of change as a result of these competing forces, making it difficult to describe the dominant patterns.

A number of methods have been developed to define and characterize the hydrodynamic conditions of the Delta. For example, the Delta may be divided into general regions, north, south, central, and west. Each of these regions may be dominated by a different pattern during any given period of time. In the west Delta, for example, tidal influences are strong, and reverse flows occur frequently. The north Delta is more dominated by Sacramento River and Mokelumne River inflows. The south Delta is affected by both San Joaquin River inflows and pumping. The central Delta is the region in which the different regimes intersect. Evaluating the

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dominant flow pattern in each of these compartments tends to be a qualitative approach.

Delta hydrodynamic modeling enables the analyst to "inject" a tracer at some point in the model network, for example at Vernalis on the San Joaquin River, and track the movement and spread of the tracer in the Delta. Also, average flows (in both direction and magnitude) can be calculated at selected locations. Sacramento River is generally described by the flow at Rio Vista. Cross Delta flow is flow diverted to the east central Delta from the Sacramento River through the DCC and Georgian Slough or into the Mokelumne River from the Sacramento River, and thus into the central Delta (as in Alternative 2).

Another measure of dominant hydrodynamic conditions in the Delta is salinity. Salinity in the Delta is primarily a result of seawater intrusion, although upstream sources, such as agricultural drainage from the San Joaquin Valley, contributes to Delta salinity. X2 is the distance upstream from the Golden Gate Bridge, at which the mixing of freshwater from the Delta inflow and saltwater from the Bay results in a salinity of 2,000 parts per million total dissolved solids. Changes in each of these variables is used in this report to describe the effects of Program actions on hydrodynamic conditions in the Delta.

CALFED has continued to upgrade and refine the assumptions of the simulation models used to represent the configurations of the Program alternatives. Initial modeling efforts focused on evaluating the feasibility of proposed storage and conveyance components and on narrowing the list of alternatives. Subsequent modeling efforts focused on evaluating the impacts of the alternatives with respect to their major distinguishing characteristics.

Thus the modeling effort has continued to advance with the alternative refinement process and is expected to continue as Program elements are further refined. At any point in time within this process, the modeling results are only as accurate a predictor of real-world conditions as the assumptions on which the modeling is based.

A number of modeling studies were used in the analysis presented in this report. Early studies, discussed in the surface water technical support document, were later supplemented by additional, more detailed, studies. The conclusions of the earlier studies generally supply an adequate level of detail to support a Program level analysis. But, where appropriate, the results of more recent studies are discussed to further support the conclusions presented in this report.

DELTA MODELING

Delta hydrodynamic simulation studies using the DWRDSM1 model were performed using a fixed Delta inflow hydrology representing the Delta inflow determined from the DWRSIM No Action benchmark study combined with south Delta improvements (Study 472B). Although, the Delta inflow and outflow hydrology was fixed, the DWRDSM1 model was modified to represent different Delta geometries and export diversion locations to evaluate the flow of water within the Delta. The DWRDSM1 studies include the effects of and average tide on Delta flows and also include routines to calculate salinities and to track the pattern of water migration from pre-selected points throughout the Delta (so-called "particle" or "mass fate" tracking).

The DWRDSM1 model runs simulated flows corresponding to the 16-year period from October of water year 1976 to September 1991. The Delta simulations which used DWRSIM Study 472B included:

- A study in which Delta Channel geometry was not changed (no action);
- A study in which south Delta improvements were added;
- Three studies in which channels in the north and south Delta were modified to reflect Configurations 2B, 2D, and 2E;

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- A study reflecting the effects of a 15,000-cfs diversion of Delta inflow from the Sacramento River at Hood, through an isolated facility to Clifton Court, bypassing the Delta, and representing the higher capacity of Configuration 3E; and

- A study reflecting a 5,000-cfs isolated facility representing Configurations 3A and 3B.

Two of the configurations, those representing 2B and 2D, included a 10,000-cfs diversion from the Sacramento River at Hood to the North Fork of the Mokelumne River through Snodgrass Slough.

A summary of the configurations modeled by DWRDSM1 is provided in Table 3. These configurations represent the range of modifications considered in this programmatic analysis.

Where modeling results were incomplete or not applicable, impacts were estimated based on other available information and professional judgment. Other methods of analysis are documented as needed in this report.

BAY-DELTA REGION

Hydrodynamic impacts of CALFED alternatives on the Delta were evaluated based on in-Delta modifications and changes in operations of the State Water Project (SWP) and Central Valley Project (CVP) that would affect the Delta. The following potential impacts on the Delta were evaluated with DWRDSM1:

- Effects on monthly average net flows, tidal velocities, and stages in Delta channels,

- Changes in the fate of mass released at particular locations in the Delta,

- Effects on monthly average central Delta outflow, and

- Changes in monthly average salinity.

The following potential impacts on the Delta are evaluated using DWRSIM:

- Effects on monthly average net Delta outflow, and

- Changes in X2 location. (X2 represents the approximate location of the initial mixing zone of seawater from the Bay and freshwater from the streams. The position of X2 is measured in kilometers from the Golden Gate Bridge upstream to the Sacramento River.)

FLOW, VELOCITY, AND STAGE

To determine effects of the alternatives on flow patterns, velocities, and stages, three sets of conditions were analyzed in the Delta:

- High-inflow, represented by March 1983;

- Low-inflow/high-pumping, represented by October 1989; and

- Low-inflow/low-pumping, represented by July 1991.

Refer to the Draft Affected Environment Technical Report for additional information on inflow and pumping.

The inflows and pumping rates from DWRSIM used in DWRDSM1 for these periods and the average over the 16-year period modeled are presented in Table 4. For the high-inflow condition, the total inflow is 15,224 thousand acre-feet (TAF), of which approximately 33% is from the Sacramento River, 17% from the San Joaquin River, 4% from east side streams, and 46% from the Yolo Bypass. The total pumping for the high-inflow condition is 528 TAF, and the ratio of total pumping to total inflow is 0.03.

For the low-inflow/high-pumping condition, the total inflow is 870 TAF, of which 90% is from

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the Sacramento River, 9% from the San Joaquin River, and 1% from east side streams. The total pumping for the low-inflow/high-pumping condition is 549 TAF, and the ratio of total pumping to total inflow is 0.6.

For the low-inflow/low-pumping condition, the total inflow is 647 TAF, of which 86% is from the Sacramento River, 13% from the San Joaquin River, and 1% from the east side streams. The total pumping for the low-inflow/high-pumping condition is 136 TAF, and the pumping/inflow ratio is 0.2.

To compare the effects of CALFED alternatives on flows, velocities, and stages in the Delta, the following locations in the Delta were selected:

1. San Joaquin River at Fourteen Mile Slough;
2. San Joaquin River at Antioch;
3. Old River at Mossdale;
4. Old River at Fabian Tract;
5. Old River at Woodward Island;
6. Old River at Franks Tract;
7. Middle River at Woodward Island;
8. Grant Line Canal;
9. Victoria Canal;
10. Delta Cross Channel (DCC);
11. Georgiana Slough;
12. Diversion to Sutter/Steamboat sloughs;
13. Miner Slough;
14. Sacramento River at Rio Vista;
15. Mokelumne River, North Fork; and
16. Mokelumne River, South Fork.

These locations are shown by number in Figure 1. The study locations were selected because they were located:

- Along the Sacramento River, San Joaquin River, Old River, and Middle River;
- Where large diversions from the major rivers occur; and
- In an area potentially affected by CALFED alternatives.

MASS FATE

The transport and fate of mass released into the Delta at various locations was simulated using DWRDSM1 for the following flow conditions:

- High-inflow/high-pumping, represented by February 1979;
- Medium inflow/low-pumping; represented by April 1991;
- Low-inflow/high-pumping, represented by October 1989; and
- Low-inflow/low-pumping, represented by July 1991.

These flow conditions were selected to bracket the full range of conditions expected to result from implementing CALFED alternatives.

The locations at which mass was released into the Delta are shown in Figure 1. Monitoring locations for released mass include the Contra Costa Canal, export locations, Delta islands, Delta channels and waterways, and the Delta past Chipps Island. The effect of the alternatives on mass fate was evaluated by comparing the change in distribution of mass among these endpoints after 30 and 60 days.

CENTRAL DELTA OUTFLOW AND SALINITY

Central Delta outflow and salinity were evaluated using frequency analysis. Figure 1 shows a representation of central Delta outflow and locations where salinity is evaluated.

The frequency analysis consisted of evaluating long-term and substantial changes caused by CALFED alternatives. Long-term and substantial changes, or trends, were assessed by comparing distributions of the model results. The distributions are presented by percentiles on a monthly basis. Trends are defined as frequent changes in any given month or in adjacent

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months or seasons. Results are discussed on the basis of trends rather than individual changes. The long-term and substantial trends were used to define adverse impacts, which in turn were used to identify potential significant impacts.

Central Delta outflow represents the net flow in the San Joaquin River upstream of Threemile Slough plus the flow in False River and Dutch Slough. Central Delta outflow was evaluated by observing the frequency of increases or decreases in reverse flows. Reverse flows were considered detrimental to aquatic species and a source of degraded water quality in the central and southern Delta. An adverse change to central Delta outflow was defined as the long-term or substantial increase in reverse flows.

Salinity was evaluated at four locations in the Delta Region: Emmaton, Jersey Point, Rock Slough, and Clifton Court Forebay. Salinity standards are defined at these locations; these standards are used in DWRSIM to determine the allocation of water supply. Salinity was evaluated by observing the magnitude and frequency of changes between alternatives. An adverse change in salinity was defined as a long-term, or substantial, increase in salinity.

NET DELTA OUTFLOW AND X2 POSITION

The effects of changes in SWP and CVP operations on net Delta outflow and position of X2 were evaluated using frequency analysis. Figure 1 shows the location of net Delta outflow. The position of X2 varies from Suisun Marsh to Jersey Point and is not shown in the figure.

Net Delta outflow represents the net freshwater movement through the Delta and out to the Bay, excluding tides. Net Delta outflow was evaluated by observing the magnitude and frequency of changes in net Delta outflow between alternatives. Minimum flow standards apply to net Delta outflow; therefore, changes in flows that increase the frequency of minimum flows near the standards were evaluated. An adverse change in net Delta outflow was defined as the long-term, or substantial, decrease in outflow, particularly in flows near the minimum flow standards.

The X2 position is the location in kilometers of the 2 parts per thousand (ppt) isohaline. X2 position percentiles were compared between alternatives, and the differences between the frequency distributions were used to assess potential impacts. For X2 position, changes greater than 1 km were identified and discussed.

BAY REGION

Since the components of the alternatives are focused on the Sacramento and San Joaquin river systems and the Delta, impacts on flows in San Francisco Bay would be minimal. Therefore, evaluation of the hydrodynamic impacts of the alternatives in the Bay Region focuses on salinity.

A key factor in the health of the Bay-Delta is the relationship between salinity and the ecology of the estuary. During the dry season, saltwater from the Pacific Ocean moves landward within the Bay; during the wet winter season, saltwater moves seaward, driven by the increased discharge of freshwater. The principal sources of freshwater to the Bay-Delta are the Sacramento River and San Joaquin River. Between winter and summer, salinity can vary by as much as 10 ppt in many parts of the Bay.

Delta outflow is the major factor influencing seasonal and yearly variations in salinity, which in turn affects where aquatic species live within the Bay-Delta system. Most of the variations in the Bay are caused by the variations of freshwater discharge from the Delta and by the mixing of freshwater with seawater. Peak spring Delta outflows are thought to be important for maintaining the health of the Bay-Delta.

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Although little is known about the effect of salinity on estuarine habitats, the X2 position is used in the decision-making process to control freshwater flows and salinity. In this analysis, X2 and net Delta outflow were used to qualitatively discuss potential impacts on the Bay system from the CALFED alternatives.

Riverine Hydraulics

SACRAMENTO RIVER AND SAN JOAQUIN RIVER REGIONS

The model runs provide a preliminary assessment of the magnitude of changes that would be expected for each alternative and variation. The hydraulic effects of some configurations are expected to be similar to other configurations. In these cases, one set of modeling assumptions was used to represent configurations with similar hydraulic impacts. Differences between such configurations are discussed in qualitative terms.

The output from DWRSIM consists of calculated monthly flow volumes representing the amount of water in thousands of acre-feet that passes a control point defined in the model. These volumes can be readily converted to an average monthly flow rate (discharge), expressed in cfs. With a few exceptions, the control points generally represent actual locations along channels within the storage and conveyance system.

Nine locations in the Sacramento River system and three locations in the San Joaquin River system were selected as the focal points for analyzing hydraulic changes in the rivers.

These locations were selected based on the following primary goals:

- Provide adequate regional geographic coverage to support programmatic decisions;
- Assess potential changes in flow conditions at locations that are most likely to be affected by CALFED alternatives; and
- Identify potential changes at critical flow points in the system, such as the Sacramento River at Freeport and the San Joaquin River at Vernalis, at which points the rivers flow into the Delta.

The list of study locations is provided in the first column of Table 5, and a reference map showing the locations is presented in Figure 2.

Some control points in the DWRSIM model correspond reasonably well to locations with gaging stations. At these points, a historical record of discharge and other parameters often are available. The U.S. Geological Survey maintains a network of gaging stations and publishes the measured parameters. Although the DWRSIM runs used in this analysis incorporate input data representing the actual hydrologic record for water years 1922 through 1994, historical discharges are not expected to correlate well with the existing condition model simulation. This is because the existing conditions simulation is based on the existing configuration and current rules of operation of the system, which may be far different from historical conditions.

Discharge measurements reported at gaging stations are based on an empirical "rating curve" for the control section that relates the discharge to the height of water (the stage) in the stream. The rating curve was developed by directly measuring the water velocity as it passed through the control section for a number of different depth conditions. Discharge (cfs) then was calculated from the product of the average velocity of the water (feet per second [fps]) and the cross-sectional area (square feet) of the stream. Because the velocity of water in a stream is not uniform, discharge measurements were accomplished by measuring the velocity in many small vertical segments of a stream cross section, calculating the average velocity in the segment, and multiplying by the area of the

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segment to obtain discharge. The total discharge in the cross section then was calculated as the sum of the segment discharges. Because DWRSIM simulates only discharge, an additional method was needed to evaluate velocity, top width, and depth for the impacts analysis.

A detailed description of the method used to estimate hydraulic parameters is presented in the Supplement to this report (refer to "Development of Rating Curves for Hydraulic Parameters at Selected Control Points in the Sacramento and San Joaquin River Systems"). The constants used in the analysis are presented in Table 6. Extremes in discharge can cause erosion and sedimentation that can alter the geometry of an alluvial stream channel. Therefore, the resulting empirical relationships derived from the data were expected only to approximate actual conditions.

After using the simulated monthly average discharge data from the DWRSIM runs to obtain the corresponding hydraulic parameters, the differences between configurations were evaluated regionally and with respect to impact on Delta inflow.

REGIONAL ANALYSIS

For the regional analysis, the minimum, maximum, and average discharge, mean channel velocity, channel depth, and channel width were calculated by month for the 73-year simulation period. Data were evaluated for each of the locations shown in Table 6, for both high and low flow conditions. The month with the highest average discharge for existing conditions was selected to represent high flows, which, for both rivers, is February. The month with the lowest average discharge for existing conditions was selected to represent low flows, which is August for the Sacramento River and September for the San Joaquin River. For each river, data tables were prepared for each study location, showing flow conditions for each configuration.

DELTA INFLOW ANALYSIS

Because of the importance of inflow into the Delta, a more comprehensive analysis was conducted for the Sacramento River at Freeport and the San Joaquin River at Vernalis. Charts were prepared for each location showing the range of discharge by month associated with each alternative. In addition, a frequency analysis was conducted for monthly flows. The results of this analysis show how flows with various probabilities of being exceeded in a given month would be affected by each configuration. Probabilities of being exceeded of 5, 10, 25, 50, 75, 90, and 95% were calculated for each month and each configuration. A 5% probability flow is expected to be equaled or exceeded in a given month once in a 20-year period.

SIGNIFICANCE CRITERIA

Surface Water Supply and Management

The significance of effects of program actions on surface water supply is evaluated with respect to the CALFED primary water supply objective of reducing the mismatch between Bay-Delta water supplies and the current and projected beneficial uses dependent on the Bay-Delta system. Alternatives that would increase this mismatch by reducing the quantity or reliability of water that can be delivered to meet all beneficial uses are deemed to have a significant adverse impact on water supply.

Bay-Delta Hydrodynamics and Riverine Hydraulics

Although Program-induced changes in hydraulic parameters, including flow, velocity, stage, and related variables, such as X2 position, salinity, or

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sediment transport, are described in this section, their significance or environmental implications of these changes are not. The significance of these changes is discussed in other sections of this report in the context of each of the resources affected by the changes.

ENVIRONMENTAL CONSEQUENCES

Comparison of No Action Alternative to Existing Conditions

DELTA REGION

SURFACE WATER SUPPLY AND MANAGEMENT

Based on the Delta inflow modeling studies performed using DWRSIM, no substantial change in inflow to the Delta is expected for the No Action Alternative relative to existing conditions. Figure 3 compares total Delta inflow under existing conditions to no action conditions both for long-term and critical period averages.

In many months, all available Delta inflow is allocated for Delta beneficial uses. Some months have more Delta inflow than required to satisfy the 1995 Bay-Delta Water Quality Control Plan (WQCP) objectives for minimum Delta outflow (including X2 requirements), supply the in-Delta diversions, and provide all simulated export pumping (up to the allowable export ratio or permitted capacity) for approximately 7 million acre-feet (MAF) of simulated annual demands.

Table 7 provides the annual summary values for the No Action Alternative water management allocation from 1922 to 1994. The average simulated Delta inflow was about 22 MAF, with a range of less than 8 MAF (in 1977) to more than 68 MAF (in 1983). Local rainfall runoff provides additional water. The required Delta outflow under the 1995 WQCP objectives averaged 5.5 MAF, with a range of less than 4 to about 8 MAF. The simulated in-Delta net channel depletions were about 1.2 MAF (total in-Delta diversions were 1.7 MAF). The total exports averaged 6.4 MAF, ranging from less than 3 to about 8 MAF.

Table 7 also provides information on the allocation of the exports between direct delivery and San Luis Reservoir storage. The average direct delivery of Delta exports was about 5 MAF and the annual average storage diversion (sum of monthly increases in San Luis Storage) was 1.3 MAF; therefore, the amount of total delivery that depended on storage was about 20%. The annual storage diversions and releases are usually about the same; therefore, the carryover storage in San Luis Reservoir remains relatively constant from year to year, with an average simulated carryover storage of 630 TAF. Only in 8 years was the simulated carryover storage greater than 1 MAF (50% full) at the end of September. An average of only 135 TAF was used as carryover storage from one year to the next. The majority of San Luis Reservoir storage was used for seasonal storage releases.

The simulated surplus Delta outflow was relatively large in many years, ranging from less than 100 TAF to more than 50 MAF, with an average of 8.7 MAF. Table 6 indicates that the average percentage of Delta inflow allocated for beneficial uses was 61%. The remaining 40% was surplus Delta outflow and could not be used for water supply (exports or Delta outflow) purposes.

Figure 4 shows the monthly exceedance values for simulated No Action Alternative export pumping. The months with moderately reduced pumping are April, May, and June because of export limits during the San Joaquin River pulse flow from April 15 to May 15 and because the maximum allowable export of 35% of June inflow is often limiting. Nevertheless, export pumping is between 5,000 cfs (300 TAF) and 10,000 cfs (600 TAF) most of the time.

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Figure 5 shows the monthly exceedance values for simulated No Action Alternative Delta outflow. The minimum Delta outflow (90% exceedance) under the 1995 WQCP would slightly increase compared with the historical Delta outflow.

Figure 6 compares total monthly exports from the Delta under existing conditions to no action conditions both for long-term and critical period averages. According to long-term averages in January, no action shows 680 TAF of Delta exports, while existing conditions during the same time shows 600 TAF of Delta exports.

BAY-DELTA HYDRODYNAMICS

Delta modeling studies representing existing conditions were not performed. Inflow hydrology for Delta hydrodynamic modeling was from the No Action benchmark DWRSIM study (472B). This study did not include assumptions representing CVPIA flow requirements. Future refinements to the Delta hydrodynamic modeling effort are planned that would distinguish between existing conditions and the No Action Alternative. At present, however, no quantitative data are available to distinguish the two scenarios. The following is a qualitative discussion of the potential effects on Delta hydrodynamics of increased demand relative to existing conditions. Conditions under the No Action Alternative are also described to provide a baseline for comparison of Program actions.

In order to evaluate the hydrodynamic effects, high-inflow and low-inflow conditions were evaluated separately. Low-inflow conditions were further evaluated to isolate the effects of pumping. The three resulting inflow and pumping conditions evaluated are high-inflow, low-inflow/high-pumping, and low-inflow/low-pumping. The results of modeling of these conditions, which has been performed by the California Department of Water Resources using the DWRDSM1 computer model, are presented in this report.

The high-inflow simulation, shown in Figure 9 for selected points in the Delta, depicts an extreme flood event based on monthly simulated inflow hydrology for March 1993. Average flows, velocities, and stages are shown on Figure 7. For each location shown on Figure 7, Table 8 presents corresponding flow data for high-inflow conditions for No Action and other alternatives. Table 8 also shows corresponding data for low-inflow/high-pumping and low-inflow/low-pumping conditions for each location for each alternative configuration. In the table, negative flows indicate that the direction of flow is landward. The ranges of flows are expressed as maximum seaward and maximum landward flows. Landward flows occur as a result of tidal inflows from the Bay. When tidal inflows exceed downstream flows, the net flow is landward. This occurs frequently near the Bay and less frequently further upstream in the Delta.

Additional pumping from the south Delta is expected to occur under the No Action Alternative due to increased 2020 demand. Increased exports from the Delta probably would be compensated somewhat by increased inflows to the Delta (mostly from the Sacramento River) resulting from increased releases from upstream storage.

The subtle effects of this increased demand on Delta hydrodynamics cannot be evaluated without the aid of computer modeling. Modeling of existing conditions has not yet been completed. However, the results of modeling the No Action Alternative are described here.

During periods of high tributary inflow, the DCC is closed for Delta flood protection. During these periods, higher flows are observed in locations along the Sacramento River and in the north Delta, while flows in the south Delta are generally lower. Average simulated flow rates shown in Table 7 range from 0 to 185,000 cfs for high-inflow conditions, 30 to 6,200 cfs in low-inflow/high-pumping conditions and 30 to 2,900 cfs for low-inflow/low-pumping conditions.

Flow velocities in the Delta corresponding to these flows are generally well below the nominal scour velocity of approximately 3 feet per second (fps), except at a few locations in high-inflow conditions. These locations include the Old River at Mossdale, Grant Line Canal, the diversion to Sutter and Steamboat sloughs, and the Sacramento River at Rio Vista. Since DWRDSM1 provides only cross-sectionally averaged velocity, these results should be considered as indices for comparative purposes.

Because computer simulations comparing particle transport under the No Action Alternative and existing conditions have not been completed, quantitative estimates of the impacts of the No Action Alternative on mass fate relative to existing conditions are not available. Based on hydrologic reasoning, the increased demand and consequent increased export pumping under the No Action Alternative should extend the influence of pumping further from the export pumps than under existing conditions, which generally would increase the proportion of mass that ultimately is entrained at the pumps.

High-Inflow Conditions

For high-inflow conditions, approximately 40% of the inflow from the Sacramento River at Hood is diverted to Steamboat and Sutter sloughs, and 15% travels down Georgiana Slough. The remainder continues down the Sacramento River toward the Bay.

In the south Delta, about 60% of the San Joaquin River inflow at Vernalis is diverted to Old River near Mossdale and 40% remains in the San Joaquin River channel and flows past Stockton. Of the flow diverted to Old River, approximately 5% travels down Middle River toward the Bay, 75% is carried by the Grant Line Canal, and 20% is carried by Old River toward the pumping plants.

Water from the central Delta flows out through the San Joaquin River and through Franks Tract and connecting channels (False River and Dutch Slough). Central Delta water includes inflows from the San Joaquin River and east-side streams, as well as Sacramento River flow diverted through Georgiana Slough. False River carries about 35% of the central Delta outflow, and Dutch Slough carries about 5%. About 60% of the total central Delta outflow remains in the main channel of the San Joaquin River.

Low-Inflow/High-Pumping Conditions

For low-inflow/high-pumping conditions, approximately 20% of the inflow from the Sacramento River at Hood is diverted to Steamboat and Sutter sloughs, 30% is diverted to the DCC, and 20% travels down Georgiana Slough. The remainder continues down the Sacramento River toward the Bay.

In the south Delta, the San Joaquin River experiences reverse flows. Of the flow in Old River at Mossdale, approximately 85% is carried by the Grant Line Canal and 10% is carried by Old River toward the pumping plants. Water in Victoria Canal, Old River north of Victoria Island, and Middle River travels south toward the state/federal project export locations at the Banks and Tracy pumping plants.

Water in the central Delta tends to flow south toward the pumping plants when they are operating. Central Delta water enters Old and Middle river channels at their mouths and flows through Turner, Empire, and Columbia cuts, which connect the upper San Joaquin River with Middle River. Central Delta water includes inflows from the San Joaquin River and east-side streams, as well as Sacramento River flow diverted through the DCC and Georgiana Slough. False River, Dutch Slough, and the San Joaquin River carry water west from the central Delta into the west Delta.

Low-Inflow/Low-Pumping Conditions

For low-inflow/low-pumping conditions, approximately 20% of the inflow from the Sacramento River at Hood is diverted to Steamboat and Sutter sloughs, 35% is diverted to the DCC,

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and 25% travels down Georgiana Slough. The remainder continues down the Sacramento River toward the Bay.

In the south Delta, about 80% of the San Joaquin River inflow at Vernalis is diverted to Old River near Mossdale, and 20% remains in the San Joaquin River channel and flows past Stockton. Of the flow diverted to Old River, approximately 5% travels down Middle River toward the Bay, while 60% is carried by the Grant Line Canal and 5% is carried by Old River toward the pumping plants. Water in Victoria Canal, Old River north of Victoria Island, and Middle River travels south toward the SWP-CVP Project export locations at the Banks and Tracy pumping plants.

Water in the central Delta tends to flow westward through the west Delta, toward the Bay. Central Delta water enters the Old and Middle River channels at their mouths and flows through Turner, Empire, and Columbia cuts, which connect the upper San Joaquin River with Middle River. Central Delta water includes inflows from the San Joaquin River and east-side streams, as well as Sacramento River flow diverted through the DCC and Georgiana Slough. False River, Dutch Slough, and the San Joaquin River carry water west toward the Bay.

Net Delta Outflow

Using DWRSIM modeling, differences in net Delta outflows between the No Action Alternative and existing conditions were evaluated. For the No Action Alternative, average annual Delta outflow was 20,000 cfs and ranged from 5,600 to 92,000 cfs. The average annual Delta outflow for existing conditions was 20,700 cfs and ranged from 5,500 to 94,300 cfs. Monthly average outflows for the No Action Alternative would be similar to outflows for existing conditions. These represent negligible changes in both the wet and dry season outflows.

Figure 8 compares the monthly total Delta outflow under existing conditions to no action conditions both for long-term and critical period averages.

Total Delta outflow is less under existing conditions than under no action conditions for critical period averages during the months of November through January, while total Delta outflow is greater under existing conditions than no action during May through June.

Table 9 shows the distribution of monthly averaged net Delta outflow for the No Action Alternative by percentile. The flow rate corresponding to the 10th percentile represents a low rate of flow. It is the rate of flow with a probability of being exceeded 90% of the time. The rate of flow corresponding to the 90th percentile lies on the high end of the probability distribution. It has a probability of being exceeded only 10% of the time. The rate of flow corresponding to the 50th percentile, also known as the median, has a 50% probability of being exceeded. Over time, about half the flows are less than the median and half are greater.

February typically has the largest variation of net Delta outflow, ranging from 11,000 cfs (10th percentile) to 133,000 cfs (90th percentile), in addition to the largest median flow of 31,000 cfs. August has the smallest variation of net Delta outflow, ranging from 3,000 to 5,000 cfs for the 10th and 90th percentiles, respectively. The outflow distribution for the No Action Alternative is similar to that of existing conditions.

Table 9 presents two methods of comparing the differences between the No Action Alternative and existing conditions. The difference in distributions (the third set of numbers in Table 9) was obtained by subtracting the corresponding percentile values for the No Action Alternative from the values for existing conditions. For example, the outflow corresponding to the 90th percentile January net Delta outflow for the No Action Alternative is subtracted from the 90th percentile January net Delta outflow for existing conditions to obtain a negative 3% difference in the two distributions.

The distribution of differences (the last set of values in Table 9) is determined by first calculating the percentage differences in each of the paired monthly values (not shown) from DWRSIM modeling of No Action and existing conditions. The table shows the

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distribution of these percentage differences. For example, Table 9 shows that Delta outflow has about a 10% probability of being 4% higher under the No Action Alternative than under existing conditions.

The distribution of differences illustrates that, most of the time, flows under the No Action Alternative would not be much different from flows under existing conditions. The greatest departures occur in June, when 40% of the paired values differ by at least 16%, and 10% of the paired values differ by at least 30%. The negative sign indicates that flows under the No Action Alternative were less than corresponding flows under existing conditions. The results suggest that the No Action Alternative may result in a potentially significant adverse impact on June Delta outflow relative to existing conditions.

Table 9 shows that in June the largest percentage of decreases in outflows under the No Action Alternative occur when flows are low. The higher 50% flows under both the No Action Alternative and existing conditions are comparable. However, flows lower than the median tend to be 15 to 20% lower under the No Action Alternative than under existing conditions in June.

June experiences substantial reductions (changes greater than 10%) about 50% of the time. In winter, substantial decreases occur about 10 to 20% of the time.

Central Delta Outflow

As discussed above, it is likely that increased export pumping in the south Delta combined with increased inflows from the Sacramento River due to releases from storage during low runoff years would increase cross-Delta flows toward the export pumps under the No Action Alternative. Delta hydrodynamic modeling has not been completed, and no quantitative estimates of the impacts of the No Action Alternative on Central Delta outflow are available.

Salinity

Under the No Action Alternative, increased pumping from the south Delta relative to existing conditions would probably increase the potential for low quality saline water to migrate from the west Delta toward the export pumps. The difference is expected to be small most of the time because south Delta pumping is limited by the capacity of the H.O. Banks pumping plant and by the constraints on the X2 position set by the Bay-Delta WQCP. In some months, particularly June, decreased net Delta outflow during low flow periods, combined with high summer export demand, increase the potential for adverse impacts. However, as described above, the X2 position is not significantly affected by the No Action Alternative, suggesting that the salinity effects would not be severe.

BAY REGION

SURFACE WATER SUPPLY AND MANAGEMENT

As described above, Delta inflow would not change substantially except to increase south Delta deliveries. There may be a small decrease in Delta outflow to the Bay during wet years and higher inflow periods. However, little change would occur in dry periods because Delta standards will be maintained. Deliveries to the Bay Region (such as to Contra Costa Water District and Santa Clara Valley Water District) may increase to meet higher demand in the region. Increases would occur during wet years and the wet season.

BAY-DELTA HYDRODYNAMICS

The No Action Alternative would reduce freshwater flow to the Bay by 3% or more in 25% of the months. Most of these differences occur in fall and winter. If the average fall and winter Delta outflow is 30,000 cfs, the No Action Alternative would reduce net Delta outflow by 900 cfs. The amount of freshwater flowing to the Bay from the Delta would be reduced accordingly.

Seasonally, the No Action Alternative has more impact on the Bay during fall and winter. Maintaining net Delta outflow is more critical during spring and summer when municipal and agricultural demands are high and freshwater discharge is needed for fish migrations.

X2 Position

The comparison of X2 position between the No Action Alternative and existing conditions is based on DWRSIM modeling and shows very little differences. The No Action Alternative tends to move the average X2 location slightly upstream, on the order of tenths of kilometers.

Under the No Action Alternative, Delta modeling results indicate that the average X2 position over the 16-year period would range from a maximum seaward position of about 70 km (which is about 10 km west of Collinsville and within Suisun Bay) in May to a maximum landward position in September of about 85 km (which is 5 km east of Collinsville and just inside the Delta). X2 position is a regulatory standard, so system operations would be modified, as needed, to ensure that the standard is met.

Figure 9 compares the monthly X2 position under existing conditions to no action conditions both for long-term and critical period averages. For long-term averages, there is very little difference in X2 position between existing conditions and no action conditions, while critical period averages show slight fluctuations in X2 position between existing and no action conditions.

SACRAMENTO RIVER REGION

SURFACE WATER SUPPLY AND MANAGEMENT

Trinity River

Because Trinity River flow is stored in Clair Engle Reservoir and diverted to the Sacramento River, Trinity River water management is described as part of the Sacramento River Region.

Sacramento River

Table 10 provides the annual Sacramento River water management allocation summary as simulated for the No Action Alternative. Average simulated Shasta inflow from 1922 to 1994 was 5.5 MAF, with a range of 2.4 to 10.8 MAF. Total Sacramento River inflow above the Feather River averaged about 11 MAF, with a range of 4.2 to 25.1 MAF. Shasta inflow averages about half of the total Sacramento River inflow. The average simulated Trinity River export was about 900 TAF, increasing the total water available for allocation in the Sacramento River Basin above the Feather River by about 8%.

Total simulated diversions averaged 3.25 MAF, and the average simulated instream flow allocation at the Navigation Control Point at Knights Landing was 3.1 MAF. When these two beneficial uses are added together, total annual Sacramento River uses range from 4.9 to about 7.9 MAF, with an average total use of 6.7 MAF. The fraction of total runoff (not including Trinity River exports) that is used for beneficial uses therefore ranges from less than 50% in wet years to more than 100% in several dry years.

The No Action Alternative simulation results indicate that an average of 1.5 MAF of Shasta inflow are stored and later released for beneficial uses. The simulated carryover-storage sequence indicates that an average of about 375 TAF of carryover storage are used to augment water supply in dry years. The remaining 1.1 MAF are used for seasonal storage and releases. The direct uses of runoff for instream flow and diversions in the Sacramento River Basin averages 5.4 MAF; therefore, the remaining 1.3 MAF must be supplied from Trinity River exports and Shasta storage releases. Figure 10 compares monthly average storage at Lake Shasta under existing and no action conditions both for long-term and critical period averages.

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conditions both for long-term and critical period averages.

Figure 19 shows the distribution of monthly simulated flows at the Navigation Control Point near Knights Landing. The instream flow requirements are often one of the controlling factors for water management in summer and fall. Shasta storage releases are used to provide water for diversions along the Sacramento River and maintain the specified flows at the Navigation Control Point.

The No Action Alternative simulation indicates that an additional 1 MAF of storage releases and Trinity exports (managed flow releases) are made beyond that required for Sacramento River uses. These releases are presumably used in the Delta for in-Delta diversions, exports, and Delta outflow; however, the simulation results indicate that an average of 615 TAF of these managed Trinity River exports and Shasta storage releases are made during months with surplus Delta outflow and are therefore not needed for any Delta water uses. Some of these surplus Sacramento River managed flow releases are the result of flood control storage reductions, but some of this simulated water supply could possibly be reoperated to better match actual downstream water uses.

Figures 11 and 12 compare flows downstream of Keswick and Wilkins Slough, respectively, under existing and no action conditions, both for long-term and critical period monthly averages. Long-term flow averages downstream of Keswick are higher during fall and winter months under existing conditions than under critical period conditions, and are lower July through September. For critical period flow averages, flows are higher during March through June under existing conditions than they are under no action conditions. At Wilkins Slough, critical period flow averages under existing conditions show a sharp increase during May that then level off throughout June, while no action conditions show a gradual increase of flows May through June.

Feather River

Table 11 indicates that the average Oroville inflow was about 4 MAF, with a range of 0.8 to 9.0 MAF. Total inflow (including Yuba River) averaged 6.8 MAF, with a range of 1.6 to 16.9 MAF. Table 11 also indicates that total annual simulated No Action Alternative diversions on the Feather River averaged 2.5 MAF, with about 1 MAF from Thermalito Afterbay and therefore about 1.5 MAF downstream from Thermalito Afterbay. The DWRSIM diversions downstream of Thermalito Afterbay apparently represent Yuba and Bear river diversions (although these cannot be supplied with Feather River water), as well as irrigation diversions from the lower Feather River. The 1.5 MAF simulated diversions are much larger than the historical Yuba River diversions of about 500 TAF, suggesting that 1 MAF of simulated diversions occur along the Feather River downstream of Thermalito Afterbay.

The average simulated No Action Alternative instream flow allocation at Gridley (upstream of the mouth of the Yuba River) was about 850 TAF. This amount also was assumed to apply to the mouth of the Feather River for beneficial use assessment purposes. When these two beneficial uses (instream flow and diversions) combined, the total annual Feather River uses range from 2.5 to about 3.7 MAF, with an average total use of 3.3 MAF. The fraction of total runoff (including Yuba and Bear rivers) that is simulated for beneficial uses averages about 50% and ranges from less than 20% in wet years to more than 100% in several dry years.

The No Action Alternative simulation results indicate that an average of 1.1 MAF of the Lake Oroville inflow is stored and later released for beneficial uses. Figure 13 compares monthly average storage at Lake Oroville under existing and no action conditions both for long-term and critical period averages. The simulated carryover storage sequence indicates that an average of about 395 TAF of carryover storage is used to augment water supply in dry years. The remaining 700 TAF are used for seasonal storage and releases.
The direct uses of runoff for instream flow and

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diversions in the Feather River Basin averages 2.5 MAF. About 770 TAF of uses are supplied by reservoir releases. The remaining 380 TAF of releases must be for downstream uses in the Delta. Oroville releases are required for about 23% of the simulated total Feather River uses.

Figure 14 shows the distribution of monthly simulated flows at the mouth of the Feather River for the No Action Alternative. The flows from the Yuba and Bear rivers usually increase the flows at Gridley, although substantial irrigation diversions were simulated downstream of Gridley as well.

Figure 15 compares instream inflows at Verona under existing conditions to no action conditions both for long-term and critical period monthly averages.

American River

Table 12 indicates that total annual average simulated No Action Alternative Folsom Reservoir inflows from 1922 to 1994 were 2.6 MAF, with a range of 450 to 6.5 MAF. Simulated diversions on the American River averaged 400 TAF. Instream flow requirements ranged from less than 500 TAF in very dry years to a maximum of 2.3 MAF, with an average of 1.5 MAF. Figure 16 compares instream flows at H Street under existing conditions to no actions conditions for long-term and critical period monthly averages. There is notable difference in monthly flow patterns between existing and no action conditions for critical period averages.

The fraction of Folsom Reservoir inflow that is allocated for beneficial uses averages about 70%, ranging from about 40% in wet years to more than 100% in several dry years. The No Action Alternative simulation results indicate that an average of 470 TAF of the Folsom inflow is stored and later released for beneficial uses. The simulated carryover storage sequence indicates that an average of about 100 TAF of carryover storage is used to augment water supply in dry years. The remaining 370 TAF are used for seasonal storage and releases. The direct uses of runoff for instream flow and diversions in the American River Basin averages 1.5 MAF. About 300 TAF for uses are supplied by reservoir releases. The remaining 170 TAF of releases must be allocated for downstream uses in the Delta. The instream flows are also available for uses in the Delta. Figure 17 compares monthly average storage at Folsom Lake under existing condtions to no action conditions, according to long-term and critical period averages. Folsom storage is consistently higher under existing conditions than under no action conditions October through May, and lower April though September according to critical period averages.

Riverine Hydraulics

For the No Action Alternative, the demand for water would continue to increase without any modifications to the current supply. Flows in the Sacramento River were modeled using DWRSIM with predicted 2020 demands. Figure 18 illustrates the projected frequency of flows for the Sacramento River at Freeport for both existing conditions and No Action Alternative. As shown in Figure 18, the highest flows in December and January, that is, those that are equaled or exceeded in only 5 out of every 100 years, would be reduced by 2 to 3% for the No Action Alternative as compared to existing conditions. For most months, low flows actually would be greater for the No Action Alternative, as compared to existing conditions, by 2 to 3%. These differences in river flows between the No Action Alternative and existing conditions are not considered significant. Therefore, No Action flow conditions in the Sacramento River at Freeport are not expected to be substantially different than for existing conditions.

San Joaquin River Region

Surface Water Supply and Management

The Calaveras, Mokelumne, and Cosumnes rivers enter the lower San Joaquin River and are considered as Delta inflow. These flows are not

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described as part of the San Joaquin River Region water management.

Stanislaus River

Table 13 provides the annual Stanislaus River water management allocation summary as simulated for the No Action Alternative. The average inflow from 1922 to 1994 was 1,240 TAF, with a range of 415 to 3,100 TAF. The No Action Alternative simulation results indicate that an average of 385 TAF of the New Melones inflow are stored and later released for beneficial uses or released downstream as excess flows. The simulated carryover storage sequence indicates that an average of about 185 TAF of carryover storage are used to augment water supply in dry years. The remaining 200 TAF are used for seasonal storage and releases. Total water use (for instream flow and diversions) in the Stanislaus River Basin averages 900 TAF. On average, 675 TAF of this water can be supplied directly by runoff; therefore, the remaining 225 TAF must be supplied from New Melones storage releases. Consequently, an average of 160 TAF of the 385 TAF of reservoir releases are used for downstream water quality control or made for flood control purposes. Figure 19 compares monthly storage capacity at New Melones Reservoir under existing and no action conditions. Storage at Melones is considerable higher under existing conditions than under no action conditions for both long-term and critical period monthly flow averages.

Figure 20 compares monthly average instream flow at Goodwin Dam under existing conditions to no action conditions, both for long-term and critical period monthly averages. Flows under existing conditions March through June show considerably lower flows than under no action conditions. Flows are higher under existing conditions throughout the rest of the year, however.

The fraction of total runoff that is used for beneficial uses therefore ranges from less than 50% in several wet years to more than 125% in several dry years (when carryover storage is used), with an average use of 72% of the inflow. Because the downstream releases for water quality control are not included as basin uses, the actual use of Stanislaus River water is even higher than indicated by these allocation indices.

Tuolumne River

Table 14 provides the annual Tuolumne River water management allocation summary as simulated for the No Action Alternative. Under the No Action Alternative, the average simulated New Don Pedro Reservoir inflow from 1922 to 1994 was 1,542 TAF, with a range of 200 to 4.5 MAF. Total simulated water use (for instream flow and diversions) averaged 1,121 TAF and ranged from 787 to 1,314 TAF. The fraction of total runoff that is used for beneficial uses therefore ranges from 29% in wet years to more than 100% in several dry years (when carryover storage is used), with an average use of 73% of the inflow. Figure 21 compares New Don Pedro Storage under existing conditions to no action conditions according to long-term and critical period monthly averages. New Don Pedro storage is consistently higher under existing conditions than under no action conditions according to both long-term and critical period averages. The difference in storage is more notable for critical period averages.

The No Action Alternative simulation results indicate that an average of 421 TAF of the New Don Pedro Reservoir inflow are stored and later released for beneficial uses or released downstream as excess flows. The simulated carryover storage sequence indicates that an average of 146 TAF of carryover storage are used to augment water supply in dry years. The remaining 275 TAF are used for seasonal storage releases. On average, 759 TAF of the 1,121 TAF of water use can be supplied directly by runoff; therefore, the remaining 362 TAF of water used must be supplied from New Don Pedro Reservoir storage releases. Consequently, an average of about 60 TAF of the 421 TAF of reservoir releases are unused in the Tuolumne River Basin (generally in wet years).

Figure 22 shows the comparison of instream flows at La Grange under existing conditions to no action conditions for both long-term and critical period

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monthly averages. According to long-term averages, flows peak in March under existing conditions and in May under no action conditions. During critical period, flows under both existing conditions and under no action flows significantly increase throughout March and rapidly drop May through June; however, this trend is more dramatic under existing conditions.

Merced River

Table 15 provides the annual Merced River water management allocation summary as simulated for the No Action Alternative. Under the No Action Alternative, the average simulated Lake McClure inflow from 1922 to 1994 was 915 TAF. Total simulated diversions averaged 525 TAF, and the average simulated instream flow allocation below the Merced Irrigation District diversions was 43 TAF. When these two beneficial uses are added together, the total annual Merced River uses range from 395 to 647 TAF, with an average total use of 567 TAF. The fraction of total runoff for beneficial uses therefore ranges from less than 25% in wet years to more than 100% in several dry years (when carryover storage is used), with an average use of 62% of the inflow. The No Action Alternative simulation results indicate that an average of 280 TAF of the McClure inflow are stored and later released for beneficial uses or released downstream as excess flows. The simulated carryover storage sequence indicates that an average of about 90 TAF of carryover storage are used to augment water supply in dry years. The remaining 190 TAF are used for seasonal storage releases. Figure 23 compares monthly storage capacity at Lake McClure under existing and no action conditions. Storage at Lake McClure is slightly higher under no action conditions than under existing conditions for both long-term and critical period monthly flow averages.

Figure 24 compares instream flows at Crocker-Hoffman under existing condition to no action conditions for long-term and critical period monthly averages.

Upper San Joaquin River

Table 16 provides the annual upper San Joaquin River water management allocation summary as simulated for the No Action Alternative. Under the No Action Alternative, the average simulated Millerton Lake inflow from 1922 to 1994 was 1,672 TAF. Total simulated diversions averaged 1,415 TAF and ranged from 433 to 2,229 TAF. The fraction of total runoff that is used for beneficial uses therefore ranges from 28% in wet years to more than 100% in several dry years (when carryover storage is used), with an average use of 85% of the inflow.

Figure 25 compares monthly storage capacity at Millerton Lake under existing and no action conditions. There is essentially no difference in Storage at Millerton Lake between no action and existing conditions according to long-term and critical period monthly flow averages.
The No Action Alternative simulation results indicate that an average of 312 TAF of the Millerton Lake inflow are stored and later released for beneficial uses or released downstream as excess flows. The simulated carryover storage sequence indicates that an average of only about 24 TAF of carryover storage are used to augment water supply in dry years. The remaining 288 TAF are used for seasonal storage and releases. Total simulated diversions in the upper San Joaquin River Basin average 1,415 TAF. On average, 1,143 TAF of this water can be supplied directly by runoff; therefore, the remaining 271 TAF of water used must be supplied from Millerton Lake storage releases.

Instream flows at Vernalis under existing conditions and no action are compared in Figure 26, using both long-term and critical period monthly averages. Flows under existing conditions are considerably less March through May than under no action.

RIVERINE HYDRAULICS

Figure 27 illustrates the projected frequency of flows for the San Joaquin River at Vernalis for both existing conditions and the No Action Alternative.

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As shown in Figure 27, the model results suggest that there would be very little difference between the No Action Alternative and existing conditions for the San Joaquin River at Vernalis. These differences in river flows between the No Action Alternative and existing conditions are not considered potentially significant.

SWP AND CVP SERVICE AREAS OUTSIDE THE CENTRAL VALLEY

Over the long term, deliveries to the SWP and CVP Service Areas Outside the Central Valley are expected to increase slightly due to higher 2020 demand. The increases would occur during wet periods. During dry periods negligible change in deliveries is expected due to lack of storage capacity. Water supply conditions in the SWP and CVP Service Areas Outside the Central Valley depend on Delta exports. The allocation of Delta exports is not evaluated in this programmatic assessment. Water supply efforts were assumed to be proportional to Delta exports changes (see Delta water supply section).

Channel hydraulics of streams in the SWP and CVP Service Areas Outside the Central Valley are not expected to be affected in any way by the program.

Comparison of CALFED Alternatives to No Action Alternative

DELTA REGION

SURFACE WATER SUPPLY AND MANAGEMENT

Several factors may limit Delta exports. These various limitations on Delta exports would have different impacts on potential future Delta water management under the CALFED alternatives, as briefly described below.

The highest export limitation is the combined physical pumping capacity of the SWP and CVP pumping plants, which is now approximately equal to the combined physical conveyance capacity of the CVP Delta-Mendota Canal (4,600 cfs) and the California Aqueduct (10,300 cfs). The monthly maximum export rate is therefore about 15,000 cfs, with a monthly volume of about 900 TAF. None of the CALFED alternatives would increase this maximum physical export capacity.

The SWP pumping capacity is currently limited by a U.S. Army Corps of Engineers (Corps) permit to a daily average of about 6,680 cfs, except during periods of high (greater than 1,000 cfs) San Joaquin River inflow between December 15 and March 15, when the daily permitted capacity increases by one-third of the San Joaquin River flow. Each of the CALFED alternatives includes the possibility of modifying the Clifton Court intake and south-Delta channels to allow the permitted SWP capacity to increase to the physical capacity of 10,300 cfs.

Exports are limited under the 1995 WQCP to a specific fraction of the Delta inflow. The monthly fraction is 65% from July through January, and decreases to 35% from February (45% in some dry years) through June. Exports may be limited by this Delta operational rule when inflows are less than that required to allow full capacity (or permitted) export pumping. Inflows could be increased by reservoir storage releases, but only a portion (export/inflow ratio) of the increased inflows could be used to increase Delta exports. Each of the CALFED alternatives could increase Delta inflows in some months to allow higher Delta exports by reoperating existing storage or operating new storage facilities.

Exports may be limited by the minimum required Delta outflow when Delta inflow is not sufficient to provide the required minimum outflow, supply the in-Delta water supply diversions, and allow full-capacity (or permitted) export pumping. Delta inflow could be increased in these months to allow increased Delta exports. When Delta outflow limits

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exports, any increased inflow can be exported until the full (or permitted) export capacity is reached. Each of the CALFED alternatives could increase Delta inflows in some months to allow higher Delta exports by reoperating existing storage or operating new storage facilities.

Other possible limitations on Delta exports are a lack of aqueduct demands for water deliveries, a lack of reservoir storage space to store the exported water, or both. Aqueduct demands (a combination of SWP and CVP) were assumed to be approximately 7.5 MAF under each of the CALFED alternatives. Under the No Action Alternative, the San Luis Reservoir is the only simulated aqueduct storage facility. Under each of the CALFED alternatives, additional aqueduct storage facilities could be constructed to allow increased Delta exports in months with sufficient inflows that are now limited by the combination of aqueduct demands and storage capacity limitations.

The opportunity for increased Delta exports under the current Delta outflow and export/inflow ratios can be estimated using the simulated No Action Alternative Delta water management conditions. Without changing monthly Delta inflows or monthly required outflows, the simulated exports can be compared with the allowable fraction of inflow, the permitted pumping capacity, and the physical pumping capacity.

Table 17 shows average simulated No Action Alternative surface water management indicators for each tributary basin simulated in DWRSIM and for the Delta. The general water allocation conditions for each tributary can be described by the percentage of average annual runoff that is needed for assumed (from simulation model) diversions and assumed existing instream flows. Instream flows require about 27% of the average runoff that goes to the Trinity River. The Trinity River diversions are ultimately exports to the Sacramento River and the Delta. Sacramento River diversions and instream flows are approximately equal, with each requiring about 30% of the average runoff. The remainder of the Sacramento River runoff is stored for later use or flows downstream as excess (unallocated) water to the Delta. The required instream flows on each tributary also are available as Delta inflow.

Table 17 summarizes the general use of storage as simulated for the No Action Alternative. The average carryover storage indicates how much storage is available (if needed) in each tributary. The average storage release indicates how much storage is used for seasonal or carryover purposes. The Sacramento River (Shasta Reservoir), Feather River (Oroville Reservoir), and the Delta (San Luis Reservoir) have the highest average annual storage releases. The average carryover storage used indicates how much storage is used from one year to the next (generally, in dry-year sequences). The Sacramento and Feather rivers have the highest average carryover storage use, with about 400 TAF each.

Table 17 gives the three water allocation indicators for the tributary basins and the Delta. The percentage of inflow that is stored in the reservoir indicates the ability to manage runoff to supply water needs in other months or in dry years. This ratio is highest for the Trinity and Stanislaus rivers, with more than 30% of the inflow stored in the reservoir. The percentage of water that is released from storage indicates the importance of storage for satisfying water supply needs. This release ratio is slightly lower than 20% for the American and San Joaquin rivers, and greater than 30% for the Tuolumne and Merced rivers. The Trinity River has the highest release ratio of 38%.

Table 18 provides a comparison of average annual south of Delta SWP and CVP water supply that have been approximated with DWRSIM model simulations for assumed operations under all CALFED alternatives. Figure 28 provides an estimate of DELTA SWP and CVP water deliveries for existing conditions, no action and the program alternatives for the May 1928 through October 1934 critical period and for the long-term period of 1922 through 1994.

BAY-DELTA HYDRODYNAMICS

A summary of the potential hydrodynamic effects of all alternatives on the Delta is presented in Table 19. The summary is presented by the alternatives' effects on flow, velocity, and stage; mass fate; net Delta outflow; central Delta outflow; X2 position; and salinity. The summary is further broken down by configuration. The potential effects were determined based on the modeling studies performed to date. The potential effects of those configurations that were not modeled were estimated by their similarity to other configurations.

Ecosystem Restoration Program

CVPIA flow targets (which were adopted in the Ecosystem Restoration Program) would increase flows in tributary streams during specified times of year to meet environmental objectives. These flow targets were not included in the modeling studies used to prepare the quantitative analysis in this report. Therefore, this report contains only a qualitative analysis of the effects of meeting the Ecosystem Restoration Program flow targets.

Ecosystem Restoration Program instream flow targets may be met through reallocation of existing water, additional purchases of water from willing sellers, or releases from new storage facilities. Water to meet Ecosystem Restoration Program flow requirements would be provided based on the following system of priorities:

- Implementation of actions under consideration through the Central Valley Project Improvement Act (CVPIA) Draft Programmatic Environmental Impact Statement (PEIS),
- Releases from new environmental storage created under CALFED, and
- Water acquisitions from willing sellers.

The lowest 15% of average monthly flows in the San Joaquin River at Vernalis (corresponding to the percentage of critical years when Ecosystem Restoration Program targets do not apply) under the No Action Alternative are estimated to be less than 2,200 cfs in April and May. Flows would increase to about 4,000 cfs in above-normal water years. Nearly 90% of the monthly average wet year flows would be less than 13,000 cfs. Based on these observations, Ecosystem Restoration Program pulse flows would be more than double the average monthly flows in the San Joaquin River at Vernalis during dry, below-normal, and above-normal years, and would be substantially larger than average monthly flows during most wet years. The effect of 10-day pulse flows in late April and early May expressed as a percentage change in monthly averaged flows would be less. Assuming that the pulse flows occur for a 5-day period in both April and May, doubling the base flow would increase the monthly average flow by about 17%. This would be considered a large change in the monthly average flow.

Average monthly Delta outflow is estimated to be less than the Ecosystem Restoration Program flow target of 20,000 cfs for April in about 60% of water years. For May, Delta outflow is less than the Ecosystem Restoration Program target in nearly 70% of water years. In April, in about 15% of water years (about the percentage of critical years), average monthly Delta outflow is less than 9,000 cfs. In May, in about 15% of water years, it is less than 6,000 cfs. Tributary flows to the Delta would need to be increased in about 45 to 55% of water years (relative to No Action Alternative conditions) in late April and early May during dry years, to meet the Ecosystem Restoration Program targets. Delta outflow could be increased by:

- Reducing diversions from the Delta,
- Reducing diversions from streams,
- Increasing releases from storage,
- Purchasing water from willing sellers, or
- A combination of the above.

These options represent a range of effects on stream flows. The first option would not alter stream flows. The second option would not require additional storage releases and therefore stream flows would increase below the diversion points by the amount of the canceled diversion. The third and

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fourth options would increase stream flows below the points at which water is added. The effects on various reaches of the San Joaquin River and tributaries therefore would depend on the locations at which flow additions or subtractions were made. The variables represented by these options are too complex to evaluate in detail without the additional computer modeling studies. However, a general estimate of the upper range of the effects can be made if some simplifying assumptions are made.

Increases in stream flows would be needed to meet the 10-day Delta outflow pulse target for late April and early May. The estimates of Ecosystem Restoration Program Sacramento tributary flows were based on comparison of the Ecosystem Restoration Program May flow target against the flow frequency distribution for the Sacramento River at Freeport (Figure 27). The estimate of Delta inflow due to additional Ecosystem Restoration Program flows on tributaries of the San Joaquin River was estimated by subtracting total Ecosystem Restoration Program flow targets from San Joaquin River flows at Vernalis based on the frequency distribution in Figure 27. Probabilities of water-year types used to estimate flows under the No Action Alternative were based on historical frequencies, as follows: critical (16% of historical water years), dry (15%), below normal (17%), above normal (13%), and wet (39%).

Water Quality Program

In general, the Water Quality Program would rely on source reduction and treatment. This is not expected to substantially affect stream flows or the Delta. Currently, water occasionally is released from Lake Shasta to dilute concentrations of metals that originate from the abandoned Iron Mountain Mine, a Superfund site on Spring Creek. Leachate from the mine currently is treated before it enters the Sacramento River near Redding. However, remediation of the Iron Mountain Mine is being conducted under oversight by state and federal agencies, independent of the Water Quality Program. These remedial activities are considered part of the baseline conditions, and the Water Quality Program would not affect this source.

Coordinated Watershed Management

Coordinated Watershed Management could have a variety of impacts on channel hydraulics. Changes in flow in trunk streams downstream of most watershed improvement projects would generally be less than significant. The effects would be moderated by operation of major reservoirs that are present on most large tributaries between the upper watershed and the valley floor.

The various possible watershed projects could alter flow regimes both in the upper watersheds and downstream. Depending on the size and scale of the projects, effects could range from very limited changes in flows in nearby stream reaches, to large-scale changes in flow regimes. Vegetation and habitat restoration projects might increase retention of surface water in the watershed, resulting in reduced extremes in runoff (reduced peak flows and increased base flows in streams).

Improvements in timber harvesting practices could substantially reduce peak flows and total runoff from the forested areas. Maintained or reforested tree stands would increase evapotranspiration, interception, and infiltration of precipitation, all of which reduce runoff. In areas where snowmelt plays an important role in the flow regime, reducing the effects of timber harvesting would increase shading which tends to reduce direct evaporation of snow packs and maintains the snow packs longer. Range improvement activities could increase vegetation cover and reestablish riparian habitat, both of which would tend to reduce runoff velocities and increase water retention in watersheds.

Erosion control efforts could result in reductions in runoff and sediment input to tributaries and reservoirs. Because many erosion control efforts are expected to be local and small-scale, this would slightly reduce peak flows but would not substantially alter timing of those flows. Large-scale watershed improvements, such as revegetation of large tracts in steep watersheds, would result in more substantial beneficial impacts.

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During construction of erosion control projects, short-term adverse impacts could be locally significant but would not significantly affect basin areas. Implementation of standard erosion control techniques during construction would further reduce these effects.

Stream restoration projects, such as removal of logs and debris from stream channels to promote fish migration, could result in increased flow velocities and erosion as the stream gradient is reestablished to a new equilibrium. The impacts would decrease with time and distance downstream and would generally be negligible in basin areas. Mitigation measures could include placement of engineered flow control structures, revegetation of stream channels and banks, or widening and/or lengthening channels.

Levee System Integrity Program

Delta channel geometry may be altered by creating setback levees, dredging channels for levee construction material, or increasing the height of levees. Increased levee height, channel widening and deepening, and bank stabilization could result in increased channel capacity. Channel widening would result in reduced stream velocities and the potential for more sediment deposition. The Levee System Integrity Program focuses on levee improvements and modifications in the Delta. Impacts on channel hydraulics outside the Delta are expected to be negligible.

Water Use Efficiency Program

The Water Use Efficiency Program does not specify target water use reductions. The program could result in unspecified reductions in demand. This would translate to reductions in Delta inflow to the extent that reservoir releases were decreased, and proportional reductions in exports. Resulting changes in Delta hydrodynamics would depend on the size of the water use reductions. Net Delta outflow probably would be unaffected, although the quality of Delta outflow could be either reduced or improved, depending on the change in Delta inflow.

Water Transfers

Water transfers can increase streamflows by increasing the amount of water transferred through stream channels. The timing and magnitude of the changes in flows would be constrained by conveyance capacity, such as the capacity of the SWP and CVP pumps and canals south of the Delta and by system operating rules.

Storage and Conveyance

Alternative 1

Surface Water Supply and Management

Alternative 1 would maintain the existing Delta channels and export locations and therefore would maintain the existing 1995 WQCP Delta objectives. Under Alternative 1, however, it may be feasible to increase the permitted pumping capacity of the SWP Banks Pumping Plant to the physical capacity, with some modifications in the south-Delta channels as described in the Interim South Delta Program (ISDP).

Under Alternative 1, new storage facilities may be constructed in the tributary basins and in the aqueduct service area. The purpose of tributary storage would be to divert and store excess runoff for release when Delta outflow or Delta export pumping could be augmented to provide additional beneficial uses.

Some additional water may be obtained from increased export pumping capacity under Alternative 1. More water supply benefits may be obtained if additional in-Delta or aqueduct storage was constructed under Alternative 1. Additional water for allocation to either water supply or instream flow purposes may be obtained from new storage facilities. Additional aqueduct storage would allow-pumping to be shifted away from months with greatest entrainment or water quality impacts to months with reduced entrainment or water quality impacts.

Table 20 provides an annual summary of simulated Delta export deliveries for the CALFED alternatives. Results from DWRSIM 528 indicate

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that simulated exports with increased export pumping capacity would allow an average increase in exports of about 200 TAF. Results from DWRSIM 532A indicate that new storage together with the increased pumping capacity would provide considerable additional water supply reliability benefits, increasing the average annual deliveries from 6.1 to about 6.7 MAF. Figure 29 graphically compares annual average simulated long-term and critical period deliveries for these CALFED alternatives. Figures 30 and 31 graphically compare total Delta exports and Delta inflows under various Delta alternatives.

Bay-Delta Hydrodynamics

The hydrodynamic effects of Alternative 1 on the Delta are evaluated by its effects on: flow, velocity, and stage; mass fate; net Delta outflow; central Delta outflow; X2 position; and salinity.

Flow, Velocity, and Stage. DWRDSM1 modeling was performed for Configurations 1A and 1C to evaluate differences in monthly average flows, velocities, and stages between Alternative 1 and the No Action Alternative. A comparison of flows, velocities, and stages between Configurations 1A and 1C and the No Action Alternative for a number of locations in the Delta is presented in Tables 21, 22, and 23 for high-inflow, low-inflow/high-pumping, and low-inflow/low-pumping conditions, respectively. In general, only small changes in flows in the north Delta and moderate changes in the south Delta are associated with Alternative 1.

Configurations 1A and 1B. Configuration 1A involves reoperating existing facilities. Average tidal flows, velocities, and stages throughout the Delta, based on DWRDSM1 modeling, are shown in Figures 32 through 34 for the high-inflow, low-inflow/high-pumping, and low-inflow/low-pumping conditions, respectively. For these conditions, flows, velocities and stages of Configuration 1A and the No Action Alternative do not differ substantially.

Configuration 1B is similar to Configuration 1A, with the addition of operable barriers, flow control measures, and fish screens. Thus, flows and velocities in the Delta would be similar to Configuration 1A except in the immediate vicinity of the barriers and flow control measures while they are operating. The barrier at the head of Old River would prevent flow reversal in the San Joaquin River.

Configuration 1C. Configuration 1C involves south Delta modifications that improve the circulation of flow and reduce reverse flows in the south Delta. Average tidal flows, velocities, and stages throughout the Delta based on DWRDSM1 modeling are shown in Figures 35 through 37 for the high-inflow, low-inflow/high-pumping, and low-inflow/low-pumping conditions, respectively.

For high-inflow conditions, differences in average flows between Configuration 1C and the No Action Alternative are generally insignificant.

For low-inflow/high-pumping conditions, flows for Configuration 1C are similar to flows for the No Action Alternative, except near the operable barriers. Similar to the No Action Alternative, approximately 20% of the inflow from the Sacramento River is diverted to Steamboat and Sutter sloughs, 30% is diverted to the DCC, and 20% travels down Georgiana Slough. The remainder continues down the Sacramento River. In the south Delta, however, a flow control structure at Old River at Mossdale limits flow down the Old River, which eliminates reverse flow in the San Joaquin River upstream of Disappointment Slough. Therefore, water in Middle River at upper Roberts Island is reversed, and flow in Grant Line Canal is reduced.

For low-inflow/low-pumping conditions, approximately 20% of the inflow from the Sacramento River is diverted to Steamboat and Sutter sloughs, 35% is diverted to the DCC, and 20% travels down Georgiana Slough, similar to the No Action Alternative. In the south Delta, of the San Joaquin River inflow at Vernalis, more flow is directed down the San Joaquin River for Configuration 1C, than in the No Action Alternative (about 50% is diverted to Old River and 50% remains in the San Joaquin River channel).

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Thus, more flow is carried to the pumps via Old River, and less is carried via Grant Line Canal.

There are no substantial differences in velocities and stages between Configuration 1C and the No Action Alternative except in areas near the flow control structures. For low-inflow/high-pumping conditions, the flow control barriers were operating and large changes in velocity and stage were observed in the San Joaquin River and Middle River near upper Roberts Island.

Average velocities in the Delta for both low-inflow/high-pumping conditions and low-inflow/low-pumping conditions are well below the nominal scour velocity of approximately 3 fps at all locations in the Delta. Average velocities in the Delta for high-inflow conditions are generally below the nominal scour velocity of approximately 3 fps except on the outskirts. The Sacramento River at Hood, diversion to Steamboat/Sutter sloughs, Steamboat slough, San Joaquin River at upper Roberts Island, and Old River at Mossdale all have average velocities higher than 3 fps. This is generally consistent with the No Action Alternative.

Mass Fate. The mass fate is presented in Tables 24 through 27 for high-inflow/high-pumping, medium inflow/low-pumping, low-inflow/high-pumping, and low-inflow/low-pumping conditions, respectively.

Mass fate for Configuration 1A was based on the same modeling study as the No Action Alternative; therefore, the tables show no differences between the mass fate for Configuration 1A and the No Action Alternative. Modeling of both indicates that the number of months with Delta outflows in the 3,000- to 4,000-cfs range do not change.

Configuration 1B is similar to Configuration 1A, with the addition of operable barriers, flow control measures, and fish screens. Thus, mass fate in the Delta would be similar to Configuration 1A.

For high-inflow/high-pumping conditions, medium inflow/low-pumping conditions and low-inflow/high-pumping conditions, the fate of mass released at all locations under Configuration 1C is similar to the fate of mass under the No Action Alternative. For low-inflow/low-pumping conditions, mass released at all locations would have a similar fate as that for the No Action Alternative except for mass released at Vernalis. Less mass released at Vernalis reaches the pumps, and more is trapped on Delta islands.

Net Delta Outflow. Figure 38 compares total Delta outflow under various Delta alternatives. Under Alternative 1, net Delta outflows would be reduced as a result of the increased export capacity from the SWP and CVP improvements and the north and south Delta surface storage. The higher export capacity would increase the number of months with flows in the range of the minimum flow requirements (3,000 to 8,000 cfs) specified in the State Water Resources Control Board (SWRCB) WQCP (SWRCB 1995).

Table 28 shows the distribution of the differences in net Delta outflow between Alternative 1 variations and the No Action Alternative. The primary changes occur in late summer through winter (September through March), resulting in less Delta outflow about 25% of the time. The magnitude of changes during this time period range from zero to more than 40%. The differences in net Delta outflow from April through August are negligible. The largest percentage reductions occur when Delta outflow is relatively small, most often just above the required outflow. When Delta outflow is large, as during winter high flows, percentage reductions are typically small.

To further analyze the critical (low) net Delta outflow, changes in outflow in the range of the WQCP minimum flow requirements (3,000 to 8,000 cfs) were examined more closely. Figure 39 shows the distribution of net Delta outflows in the lower outflow range. This analysis indicates that the number of months with Delta outflows in the 3,000- to 4,000-cfs range would not change. The number of months with flows between 4,000 and 6,500 cfs would increase by 3% (from 226 to 250 months). The number of months with flows greater than 6,500 cfs would decrease by approximately the same amount.

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Central Delta Outflow. Figure 40 shows the frequency distributions for Configurations 1A and 1C and the No Action Alternative. Alternative 1 did not affect the number of months with reverse flows (shown as negative). However, the figure suggests an increase in the magnitude of upstream flows; the number of months in the -5,000 to -2,500 cfs range decreased while the number of months in the <-5,000 cfs range increased.

Table 29 shows the distribution of central Delta outflows by month. The distribution does not appear to change when compared to the No Action Alternative. Of those flows originally in the upstream direction, about half increased in magnitude; the maximum increase is around 3,600 cfs, with an average of 1,200 cfs. Of those flows originally in the downstream direction, about half decreased in flow; the maximum decrease is around 3,500 cfs, with an average of 350 cfs.

Configuration 1B is similar to Configuration 1A, with the addition of operable barriers, flow control measures, and fish screens. The barrier at the head of Old River would reduce reverse flows in the San Joaquin River.

X2 Position. Table 30 shows the distribution of X2 position. Potential impacts were assessed by identifying relative changes in the X2 position greater than or equal to 1 km. Differences greater than 1 km are highlighted in the table. The same general patterns of change observed in net Delta outflow are observed in the X2 position; that is, upstream movements in the X2 position tend to occur in fall when Delta outflow tends to decrease. Figure 41 compares X2 positions under various Delta alternatives.

Under Alternative 1, the western positions of X2 (lowest No Action Alternative values in Table 31) move upstream from 1.3 to 4.2 kms during late summer and fall. The changes in September are 13 to 19% of the hydrologic range in X2 position. The changes in December are 10 to 19% of the hydrologic range in X2 position. In January, the X2 position tends to move eastward from 1.2 to 3.5 kms. The range in the position of X2 in January is 30 kms, which represents 4 to 13% of the natural variability in X2 positions. The eastern X2 positions (highest No Action Alternative values in Table 31) do not change from the No Action Alternative.

Salinity. Salinity for the No Action Alternative was based on the same modeling study as Configuration 1A; therefore, Configuration 1C is compared to Configuration 1A. Salinity was analyzed at four locations: the San Joaquin River at Jersey Point, the Sacramento River at Emmaton, Old River at Rock Slough, and Clifton Court Forebay. Tables 31 through 34 show the percentiles for the differences in salinity between Configuration 1C and the No Action Alternative. Increases greater than 10% are highlighted. The effects of Alternative 1 on salinity can be summarized as follows:

No substantial change in salinity was observed at Jersey Point or Emmaton. Configuration 1C increased salinity in April, May, and June about 50% of the time, with increases in magnitude ranging from 10 to 30%. Configuration 1C substantially affected the salinity at Clifton Court Forebay. On average, about 50% of the monthly salinities increased 10% or more. Essentially no decreases in salinity were observed.

These results suggest that Configuration 1C would increase salinity in the south Delta, presumably due to increased flow in Old River toward the export pumps. Configuration 1C also would increase the amount of saline water entering the south Delta from the Bay. These results are analogous to reduced net Delta outflow and increased upstream flows in the central Delta also seen under Alternative 1.

Alternative 2

Surface Water Supply and Management

Alternative 2 would modify the Delta channels to allow a much greater through-Delta transport of water and could include an in-Delta storage facility and larger new aqueduct storage capacity.

Substantial benefits may be associated with land use changes and both terrestrial and aquatic habitat improvements. Reduced agricultural drainage may result in water quality benefits, and reduced salinity intrusion could result from changes in the tidal flows and mixing between the Suisun Bay and central Delta. No distinct water supply benefits are associated with Alternative 2 compared to Alternative 1, however, because the same potential for increasing the permitted Delta export pumping capacity and constructing additional upstream and aqueduct storage may be included in both Alternative 1 and Alternative 2; therefore, the same range of potential water supply benefits (compared with the No Action Alternative) is possible for Alternative 2 as for Alternative 1 (Table 20).

Figures 42, 43, and 44 graphically compare total Delta exports and Delta inflows under various Delta alternatives.

Bay-Delta Hydrodynamics

Flow, Velocity, and Stage. A comparison of flows, velocities, and stages between Configurations 2B, 2D, and 2E and the No Action Alternative for a number of locations in the Delta is presented in Tables 21, 22, and 23 for high-inflow, low-inflow/high-pumping, and low-inflow/low-pumping conditions, respectively. In general, Alternative 2 would increase flows through the Delta from the Sacramento River in the north to the export locations in the south.

Configurations 2A and 2B. Configurations 2A and 2B include north and south Delta improvements and a 10,000-cfs Hood intake. These alternatives improve conveyance and circulation of flow and reduce reverse flows in the Delta. For Configuration 2B, average tidal flows, velocities, and stages throughout the Delta, based on DWRDSM1 modeling, are shown in Figures 45 through 47 for the high-inflow, low-inflow/high-pumping, and low-inflow/low-pumping conditions, respectively.

For high-inflow conditions, differences in the average flows between Configurations 2B and the No Action Alternative generally would be small, except at locations with channel modifications. Under Configuration 2B, approximately 35% of the inflow from the Sacramento River would be diverted to Steamboat and Sutter sloughs, and 10% would be diverted to Georgiana Slough. These diversions would be less than the diversions for the No Action Alternative. Under Configuration 2B, approximately 20% of the Sacramento River flow would be diverted to the Hood intake and subsequently travel down the Mokelumne River, where flows in the North Fork would approximately double due to setback levees.

For low-inflow/high-pumping conditions for Configuration 2B, Sacramento River water flowing into the Delta generally would increase. For Configuration 2B, approximately 10% of the inflow from the Sacramento River would be diverted to Steamboat and Sutter sloughs, and 5% would be diverted to Georgiana Slough. These diversions would be less than those for the No Action Alternative. Under Configuration 2B, approximately 60% of the Sacramento River flow would be diverted to the Hood intake and subsequently travel down the improved channels of the Mokelumne River, where flows would more than double those of the No Action Alternative. In the south Delta, a flow-control structure at Old River at Mossdale would limit flow down Old River, eliminating reverse flow in the San Joaquin River between Prisoners Point and the head of Old River. The flow down the San Joaquin River would be increased, flow in Old River at Fabian Tract would be reversed, and flow down the Grant Line Canal would be reduced.

Contrary to the No Action Alternative, most of the water in the central Delta would flow west. Central Delta water would enter Old River and Middle River channels at their mouths. Flows through the Turner, Empire, and Columbia cuts, which connect the San Joaquin River with Middle River, would be increased under Configuration 2B. Dutch Slough would carry water into the Delta, while False River and the San Joaquin River would carry water westward.

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For low-inflow/low-pumping conditions, the results are similar to the low-inflow/high-pumping conditions but less extreme due to the reduced demand at the pumps. Diversions would be less to the DCC and to Georgiana Slough than the diversions for the No Action Alternative. Under Configuration 2B, approximately 30% of the Sacramento River water would be diverted to the Hood intake and subsequently travel down the Mokelumne River. In the south Delta, more flow would remain in the San Joaquin River (about 50% would be diverted to Old River near Mossdale and 50% would remain in the San Joaquin River channel and flow past Stockton). Of the flow diverted to Old River, approximately 35% would be carried by the Grant Line Canal, and 20% would be carried by Old River toward the pumping plants. Water in Middle River at upper Roberts Island would flow upstream toward the head of Middle River. The ratio of flow in Old River to flow in Middle River (about 1.5) would be slightly higher for Configuration 2B than for the No Action Alternative. As with the No Action Alternative, most of the water in the central Delta would flow west.

The velocities and stages of Configuration 2B and the No Action Alternative do not differ substantially, except in areas near flow-control structures. During low-inflow/high-pumping conditions, the flow-control structures were operating and large changes in velocity and stage were observed in the San Joaquin River and Middle River near upper Roberts Island.

Average velocities in the Delta for both low-inflow/high-pumping conditions and low-inflow/low-pumping conditions are well below the nominal scour velocity of approximately 3 fps at all locations within the Delta. Average velocities in the Delta for high-inflow conditions are generally below the nominal scour velocity of approximately 3 fps, except on the outskirts. The Sacramento River at Hood, diversion to Steamboat/Sutter sloughs, Steamboat Slough, San Joaquin River at upper Roberts Island, and Old River at Mossdale all have average velocities higher than 3 fps, which is generally consistent with the No Action Alternative.

The hydrodynamic effects of Configuration 2A would be the same as presented for Configuration 2B, except that Configuration 2A does not include SWP and CVP improvements. The main hydrodynamic effect of the SWP and CVP improvements is that the source of water for the Tracy Pumping Plant may be the Clifton Court Forebay instead of Old River.

Configuration 2D. Configuration 2D would improve circulation of flow and reduce reverse flows in the Delta via a Mokelumne River Floodway, east and south Delta habitats, and a 10,000-cfs Hood Intake. Average tidal flows, velocities, and stages throughout the Delta, based on DWRDSM1 modeling, are shown in Figures 48 through 50 for the high-inflow, low-inflow/high-pumping, and low-inflow/low-pumping conditions, respectively.

During high-inflow conditions, differences in average flows between Configuration 2D and the No Action Alternative are generally small, except in locations where channel modifications occurred. Under Configuration 2D, approximately 35% of the inflow from the Sacramento River would be diverted to Steamboat and Sutter sloughs, and 10% would be diverted to Georgiana Slough. These diversions are slightly less than the diversions for the No Action Alternative. Under Configuration 2D, approximately 20% of the Sacramento River flow would be diverted to the Hood intake and subsequently travel down the Mokelumne River, increasing the flow in the South Fork of the Mokelumne River. In the south Delta, as for the No Action Alternative, about 60% of the San Joaquin River inflow at Vernalis would be diverted to Old River near Mossdale, and 40% would remain in the San Joaquin River channel and flow past Stockton. Of the flow diverted to Old River, approximately 5% would travel down Middle River, while 65% would be carried by the Grant Line Canal and 20% would be carried by Old River toward the pumping plants. Water in Victoria Canal, Old River north of Victoria Island, and Middle River would travel north. The ratio of flow carried north from the south Delta in Old River to Middle River would be about 3, an increase over the No Action Alternative due to setback levees. As for

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the No Action Alternative, water from the central Delta would flow out of the Delta through the San Joaquin River and through Franks Tract and connecting channels (False River and Dutch Slough).

For low-inflow/high-pumping, the hydrodynamic effects of Configuration 2D would be similar to those of Configurations 2A and 2B, except in areas with setback levees. Sacramento River water flowing through the Delta to the pumps generally would increase, and San Joaquin River water flowing to the pumps would decrease. For Configuration 2D, approximately 10% of the inflow from the Sacramento River would be diverted to Steamboat and Sutter sloughs, and 5% would be diverted to Georgiana Slough. These diversions are less than those for the No Action Alternative. Additionally, for Configuration 2D, approximately 70% of the Sacramento River flow would be diverted to the Hood intake and subsequently travel down the Mokelumne River, increasing flow down the South Fork of the Mokelumne River. In the south Delta, of the San Joaquin River inflow at Vernalis, no water would be diverted to Old River near Mossdale due to the operable barrier at the head of Old River, eliminating reverse flow in the San Joaquin River. Water in Old River at Fabian Tract and Middle River at upper Roberts Island would be reversed. Contrary to the No Action Alternative, water in Victoria Canal, Old River north of Victoria Island, and Middle River would travel south toward the Delta export locations at the Banks and Tracy pumping plants. The ratio of flow in Old River to flow in Middle River, approximately 3, would be higher for Configuration 2D. Most water in the central Delta would flow west. Central Delta water would enter Old River and Middle River channels at their mouths and through Turner, Empire, and Columbia cuts, which connect the upper San Joaquin River with Middle River. Dutch Slough would carry water into the Delta, while False River and the San Joaquin River would carry water westward.

For low-inflow/low-pumping conditions, the hydrodynamic effects of Configuration 2D were similar to those for low-inflow/high-pumping, but to a lesser degree because of the reduced demand at the pumps.

In most of the Delta, velocities or stages would not differ substantially between Configuration 2D and the No Action Alternative. In locations with setback levees, however, the velocity would decrease and minimum stages would increase. In Old River and the South Fork of the Mokelumne River, the velocities would decrease by up to a factor of 4; minimum stages would almost double in channels with setback levees. Also, in areas near flow-control structures, changes in velocities and stages were observed. During low-inflow/high-pumping conditions, the flow barriers were operating and the velocity in the San Joaquin River near upper Roberts Island increased while the velocities in Grant Line Canal and Old River at Fabian Tract decreased substantially. A slower velocity would decrease sediment transport and increase sedimentation in the channel.

Average velocities in the Delta for both low-inflow/high-pumping conditions and low-inflow/low-pumping conditions were well below the nominal scour velocity of approximately 3 fps at all locations in the Delta. Average velocities in the Delta for high-inflow conditions generally were below the nominal scour velocity of approximately 3 fps except on the outskirts. The Sacramento River at Hood, diversion to Steamboat/Sutter sloughs, Steamboat Slough, San Joaquin River at upper Roberts Island, Old River at Mossdale, and the Grant Line Canal had average velocities higher than 3 fps, which is generally consistent with the No Action Alternative.

Configuration 2E. Average tidal flows, velocities, and stages throughout the Delta, based on DWRDSM1 modeling, are shown in Figures 51 through 53 for the high-inflow, low-inflow/high-pumping, and low-inflow/low-pumping conditions, respectively. For high-inflow conditions, differences in the average flows between Configurations 2E and the No Action Alternative are mostly in the north Delta. A large increase in flow down Georgiana Slough (50% of the Sacramento River flow) is due to the increased capacity at Tyler Island. Therefore, less Sacramento River flow is diverted to Steamboat

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and Sutter sloughs (30% of the Sacramento River flow), less flow travels down the Sacramento River, and more water flows into the Central Delta and out to the Bay via the San Joaquin River near Antioch.

In the south Delta, the ratio of flow in Old River to flow in Middle River is about 3, which is higher for Configuration 2E due to setback levees.

For low-inflow/high-pumping conditions for Configuration 2E, a large increase in flow through Georgiana Slough (70% of the Sacramento River flow) would result in less Sacramento River flow diverted to Steamboat and Sutter sloughs (15% of the Sacramento River flow) and less flow traveling down the Sacramento River. In the south Delta, of the San Joaquin River inflow at Vernalis, a flow-control structure at Old River at Mossdale would limit flow down Old River, eliminating reverse flow in the San Joaquin River. Therefore, the flow down the San Joaquin River would be increased; and flows in Old River at Fabian Tract, Grant Line Canal, and Middle River at upper Roberts Island would be reversed. The ratio of flow in Old River to flow in Middle River is about 3, which is higher due to setback levees.

For low-inflow/low-pumping conditions, the results in the north Delta are similar to the low-inflow/high-pumping conditions but less extreme due to the reduced demand at the pumps.

Velocities and stages of Configuration 2E and the No Action Alternative do not differ substantially, except in the channels with setback levees or nearby habitats. In Old River and the South Fork of the Mokelumne River, the velocities decreased by up to a factor of 4 in the channels with setback levees. A slower velocity would decrease sediment transport and would increase sedimentation in the channel. Minimum stages in channels with setback levees increased by almost a factor of 1. In Georgiana Slough at high-inflow conditions, the stage is considerably less for Configuration 2E than for the No Action Alternative. Velocities and stages also changed in the areas near flow-control structures while they were operating. During low-inflow/high-pumping conditions, the velocity in the San Joaquin River near upper Roberts Island increased, while the velocities in Grant Line Canal and Old River at Fabian Tract decreased substantially.

Average velocities in the Delta for both low-inflow/high-pumping conditions and low-inflow/low-pumping conditions are well below the nominal scour velocity of approximately 3 fps at all locations within the Delta. Average velocities in the Delta for high-inflow conditions are generally below 3 fps, except on the outskirts.

Mass Fate. Using DWRDSM1 modeling, the fate of mass released into the Delta waterways at various locations was analyzed. The mass fate is presented in Tables 24 through 27 for high-inflow/high-pumping, medium inflow/low-pumping, low-inflow/high-pumping, and low-inflow/low-pumping conditions, respectively.

For high-inflow/high-pumping conditions and mass released at Freeport under Configurations 2B and 2D, substantially more mass remained in the Delta after 60 days. Also, for mass released at Terminous, slightly more flowed past Chipps Island.

For medium inflow/low-pumping conditions, all Alternative 2 variations, and injections at Jersey Point, San Andreas Landing, and Prisoners Point, the percentage of mass flowing past Chipps Island is larger and the percentage of mass reaching the export locations is smaller than those for the No Action Alternative. For the injection of mass at Freeport, more mass remains in the Delta after 60 days for Configurations 2B and 2D. For Configuration 2E, more mass released at Terminous remains in the Delta and less reaches the pumps after 60 days.

For low-inflow/high-pumping conditions, there is no significant difference between the fate of mass under Configuration 2B and the fate of mass under the No Action Alternative. For Configurations 2D and 2E for injections at Terminous and Freeport, mass remains in the Delta longer due to habitat improvements. Also at Terminous, less mass flows to the exports and more flows past Chipps Island.

For low-inflow/low-pumping conditions for Configuration 2B, more mass released at Vernalis is trapped on Delta islands and less reaches the exports. For Configurations 2D and 2E for injections at Terminous and Freeport, mass remains in the Delta longer due to habitat improvements. Also at Terminous, less mass flows to the exports and more flows past Chipps Island.

The mass fate of Configuration 2A would be the same as presented above except that Configuration 2A does not include SWP and CVP improvements. The main effect of the SWP and CVP improvements is reduced pumping; therefore, less mass may end up at the export locations.

Net Delta Outflow. Figure 54 compares total Delta outflow under various Delta alternatives. Net Delta outflows are reduced as a result of the increased export capacity in the SWP and CVP improvements. The increased export capacity increases the number of months with flows in the range of the WQCP minimum flow requirements (3,000 to 8,000 cfs).

Table 28 shows the distribution of the differences in net Delta outflow between Alternative 2 variations and the No Action Alternative. Configuration 2A adds south Delta improvements to the No Action Alternative. Overall, this configuration tends to reduce net Delta outflow. The primary changes occur in late summer through fall (September through January), resulting in less Delta outflow about 25% of the time. The magnitude of changes during this period range from zero to a little more than 30%. The differences in net Delta outflow from February through August are small (less than 10%), and these months have about an equal number of increases and decreases.

When Alternative 2 includes south Delta surface storage (Configuration 2D), the potential impacts to net Delta outflow are similar to those described for Configuration 2A, with one exception—slightly larger decreases in net Delta outflow in winter.

Because the reoperation and storage components of Configurations 1C, 2B, and 2E are the same, the effects of Configurations 2B and 2E on net Delta outflow would be similar to those described for Configuration 1C.

Central Delta Outflow. Alternative 2 shows a dramatic reduction in upstream flows in the central Delta Region for each of the configurations modeled. All of the configurations that include increased diversions from the Sacramento River into the central Delta help to reduce or eliminate upstream central Delta flows.

Configurations 2B and 2D, which include a 10,000-cfs Hood diversion from the Sacramento River into the central Delta, reduce the number of months with upstream central Delta flows from 60% to about 6% (see Figure 40). Configuration 2E, which includes Tyler Island habitat improvement, reduces the number of months with upstream flows to about 4%.

A substantial improvement in central Delta flows results from reducing the frequency that upstream flows occur (see Table 29). Upstream flows would be eliminated in all months except July and August.

The hydrodynamic effects of Configuration 2A would be the same as those presented above for Configuration 2B, except that Configuration 2A does not include the SWP and CVP improvements (10,300-cfs pumping capacity). The main effect of the SWP and CVP improvements on central Delta outflow is to increase the magnitude of upstream flows and to reduce the magnitude of downstream flows.

X2 Position. All configurations modeled under Alternative 2 show similar changes in the X2 position (see Table 30). However, Configurations 2B, 2D, and 2E tend to move the X2 position eastward in January, which was not observed under Configurations 2A and 2C. The X2 position does not appear to be sensitive to adding storage. All Alternative 2 variations show similar monthly changes when compared to the No Action Alternative, suggesting that the increased capacity of the SWP and CVP improvements has more effect on X2 than storage.

During fall and winter, the western positions of X2 move upstream from 1.1 to 3.3 kms. This corresponds to a 5% and a 33% change when compared to the hydrologic range in the X2

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positions. Changes in January range from 3 to 6% of the natural variability of X2 position.

The changes in X2 position parallel changes in net Delta outflow; eastward movements in the X2 position tend to occur in fall when decreases in Delta outflow tend to occur. Changed positions of X2 during late winter and spring (March, April, May, and June) are negligible compared to the No Action Alternative.

Figure 43 compares X2 positions under the various Delta alternatives.

Salinity. Generally, the effects on salinity are similar for all Alternative 2 variations (see Tables 31 through 34). The effects are summarized below.

A substantial improvement in salinity is observed at Jersey Point. Decreases in salinity of 10% or more are observed 75% of the time. Median decreases are about 40 to 50%. Essentially no increases in salinity are observed. Decreases in salinity of up to 70% from the No Action Alternative are possible.

Under Configuration 2B, salinity at Emmaton appears to increase substantially. On average, about 65% of the monthly salinities increased by more than 10%. Most of the increases occur in July through December. Configurations 2A, 2D, and 2E also show decreases in salinity in late fall and winter.

Alternative 2 increases salinity in April and May about 50% of the time, with increases ranging from 10 to 30%. However, for the remaining months, Alternative 2 reduces salinity on Old River. Summer through winter months show decreases in salinity of 10% or more 50 to 100% of the time.

Alternative 2 appears to improve salinity at Clifton Court Forebay. Overall, about as many decreases as increases in salinity were observed. However, the decreases are greater in magnitude than the increases. Increases occur mostly in late spring and summer; decreases occur mostly in fall and winter.

These results indicate that Alternative 2 would decrease salinity in the central and south Delta. The channel improvements and habitat improvements that increase the flow of Sacramento River water into the central and south Delta substantially would reduce salinity. Somewhat moderate improvements are observed at Clifton Court Forebay. With the increase in cross-Delta flows and corresponding decrease in Sacramento River flows, salinity is increased on the Sacramento River at Emmaton.

Because channel improvements are included in both Configurations 2A and 2B, these configurations may have a similar effect on salinity as Configurations 2D and 2E.

Alternative 3

Surface Water Supply and Management

Alternative 3 includes the potential Delta channel modifications listed under Alternative 2, but also may include an isolated transfer facility to allow diversion of a portion of Delta exports from the vicinity of Hood. Alternative 3 would certainly have water quality benefits and may have substantial fishery benefits from reduced entrainment impacts at the existing south-Delta exports; however, no distinct water supply benefits are associated with Alternative 3 compared with Alternatives 1 and 2 unless the Delta water quality objectives were modified.

Because allowing higher exports could be justified with an isolated facility (higher export/inflow ratios), increased water supply opportunities could result. The possibility of increasing the export/inflow ratio for an isolated facility has not been thoroughly investigated; therefore, the potential water supply benefits were not determined. Because the same range of benefits from storage facilities and increased export capacity can be achieved with each of the alternatives, the only distinct feature of Alternative 3 is the possibility of relaxing the export/inflow ratio. This may not provide a very large increment of water supply reliability if other improvements (storage and pumping capacity) already were accomplished.

Table 20 shows the annual aqueduct deliveries for several DWRSIM results that included maximum physical pumping capacity with a 5,000-cfs capacity isolated conveyance component (DWRSIM 578) and isolated conveyance facility with new storage facilities (DWRSIM 579 and 581). None of these simulations included relaxed Delta outflow. Results from DWRSIM 578 indicate that the isolated facility does not decrease the potential exports much beyond that provided by physical pumping capacity (DWRSIM 528). Results from DWRSIM 579 indicate that the isolated conveyance facility would not further increase the water supply benefits associated with maximum pumping capacity and new storage facilities (DWRSIM 532A) unless the export/inflow ratio or the required Delta outflow was relaxed.

Figures 56, 57, and 58 graphically compare total deliveries, Delta exports and Delta inflows under various configurations for Alternative 3.

Bay-Delta Hydrodynamics

Flow, Velocity, and Stage. A comparison of flows, velocities, and stages between Configuration 3E and the No Action Alternative for a number of locations within the Delta is presented in Tables 25, 26, and 27 for high-inflow, low-inflow/high-pumping, and low-inflow/low-pumping conditions, respectively.

In general, Alternative 3 would reduce flow through the Delta, especially for low-inflow/high-pumping conditions, because of the diversion of water to the isolated facility from the Sacramento River at Hood.

Configurations 3A and 3B. Configurations 3A and 3B would use a combination of through-Delta conveyance and an isolated facility to move water from the Sacramento River in the north Delta to the pumping plants in the south Delta. The hydrodynamic effects on the Delta of Configurations 3A and 3B would be similar to the effects of Configuration 3E, except the flows through the Delta would be reduced to a lesser degree than for Configuration 3E. The isolated facility for Configurations 3A and 3B has a smaller capacity than the isolated facility for Configuration 3E; thus, Configurations 3A and 3B would rely more on through-Delta conveyance than Configuration 3E.

Configuration 3E. For Configuration 3E, the isolated facility would allow flexibility in the system by providing an alternative intake diversion point. Operating criteria of the isolated facility would control effects on the Delta. Average tidal flows, velocities, and stages throughout the Delta based on DWRDSM1 modeling are shown in Figures 59 through 61 for the high-inflow, low-inflow/high-pumping, and low-inflow/low-pumping conditions, respectively.

For high-inflow conditions, differences in average flows between Configuration 3E and the No Action Alternative are mostly in the north Delta. For Configuration 3E, diversions from the Sacramento River are similar to the diversion for the No Action Alternative: approximately 35% is diverted to Steamboat and Sutter sloughs, and 15% travels down Georgiana Slough. Flow down the Mokelumne River would increase due to setback levees. In the south Delta, similar to the No Action Alternative, about 60% of the San Joaquin River inflow at Vernalis would be diverted to Old River near Mossdale, and 40% would remain in the San Joaquin River channel and flow past Stockton. Of the flow diverted to Old River, approximately 5% would travel down Middle River, while 65% would be carried by the Grant Line Canal and 20% would be carried by Old River toward the pumping plants. As under the No Action Alternative, water in Victoria Canal, Old River north of Victoria Island, and Middle River would travel north; and the ratio of flow in Old River to flow in Middle River would be about 1.5. Flow down the Old River and Middle River would not increase under Configuration 3E. Similar to the No Action Alternative, water from the central Delta would flow out of the Delta through the San Joaquin River and through Franks Tract and connecting channels (False River and Dutch Slough). False River would carry about 35% of the central Delta outflow, Dutch Slough about 5%, and the main channel of the San Joaquin River the remaining 60%.

For low-inflow/high-pumping conditions for Configuration 3E, less water moves through the Delta toward the pumps. For Configuration 3E, approximately 10% of the inflow from the Sacramento River is diverted to Steamboat and Sutter sloughs and 10% is diverted to Georgiana Slough. These diversions are less than the diversions for the No Action Alternative. Additionally, for Configuration 3E, approximately 65% of the Sacramento River flow is diverted at Hood to the isolated facility. Flow down the Mokelumne River would decrease due to the closure of the DCC and less flow traveling down the Sacramento River. In the south Delta, a flow-control structure at Old River at Mossdale would limit flow down the Old River, eliminating reverse flow in the San Joaquin River. Therefore, the flow down the San Joaquin River would be increased, flow in Old River at Fabian Tract would be reversed, and flow down the Grant Line Canal would be reversed. As under the No Action Alternative, water in Victoria Canal, Old River north of Victoria Island, and Middle River would travel south toward the Delta export locations at the Banks and Tracy pumping plants. The ratio of flow in Old River to flow in Middle River would be smaller, about 1, and less flow would travel via Old and Middle rivers toward the pumps. Contrary to the No Action Alternative, most water in the central Delta would flow out of the Delta. Central Delta water would enters Old and Middle River channels at their mouths and through Turner, Empire, and Columbia cuts, which connect the upper San Joaquin River with Middle River. Dutch Slough, False River, and the San Joaquin River would carry water westward.

For low-inflow/low-pumping conditions, the hydrodynamic effects of Configuration 3E are similar to the effects presented for low-inflow/high-pumping.

There are no substantial differences in velocities and stages between Configuration 3E and the No Action Alternative, except in channels with setback levees. In the Mokelumne River, the velocities decreased by up to a factor of 5 in channels with setback levees. Velocities and stages also changed in areas near flow-control structures while they were operating.

During low-inflow/high-pumping conditions, the velocity in the San Joaquin River near upper Roberts Island increased, while the velocities in Grant Line Canal and Old River at Fabian Tract decreased substantially.

Average velocities in the Delta for both low-inflow/high-pumping conditions and low-inflow/low-pumping conditions are well below the nominal scour velocity of approximately 3 fps at all locations within the Delta. Average velocities in the Delta for high-inflow conditions are generally below the nominal scour velocity of approximately 3 fps except on the outskirts. The Sacramento River at Hood, diversion to Steamboat/Sutter sloughs, Steamboat Slough, San Joaquin River at upper Roberts Island, and Old River at Mossdale all have average velocities higher than 3 fps.

Configuration 3H. Configuration 3H is similar to Configuration 2E, except that it has an east Delta isolated facility. The hydrodynamic effects of Configuration 3H would be similar to those of Configuration 2E except that the isolated facility would increase the flexibility of the system by providing an alternative intake diversion point. When flow was diverted to the isolated facility, flows through the Delta would be reduced.

Configuration 3I. Modeling of Configuration 3I is not complete. Because the channel geometry is the same as under the No Action Alternative, hydrodynamics in the north Delta should be not be affected. Hydrodynamic effects are likely to be localized in the areas of the export pump intakes, including Rock Slough, the San Joaquin River near Turner Cut, and the San Joaquin River near Lathrop.

Mass Fate. Mass fate is presented in Tables 24 through 27 for high-inflow/high-pumping, medium inflow/low-pumping, low-inflow/high-pumping, and low-inflow/low-pumping conditions, respectively.

For high-inflow/high-pumping conditions and at Vernalis and Terminous, substantially more mass released flows past Chipps Island and less reaches the exports for Configuration 3E than for the No Action Alternative. Substantially more mass released at Freeport reaches the exports for Configurations 3E than for the No Action Alternative.

For medium inflow/low-pumping conditions, Configuration 3E reduced the mass reaching the exports to zero, except for mass released at Freeport. This is due to the isolated facility, which takes in water at Hood and diverts it directly to the export locations. For low-inflow/high-pumping conditions, the mass released at all locations (except Freeport) that reaches export locations is reduced; and more of the mass released at Vernalis, Terminous, San Andreas Landing, and Prisoners Point remains in the Delta after 60 days. For low-inflow/low-pumping conditions, the mass released at all locations (except Freeport) that reaches export locations is reduced; and more of the mass released at Terminous, San Andreas Landing, and Prisoners Point remains in the Delta after 60 days.

Configurations 3A and 3B use a combination of through-Delta conveyance and an isolated facility to move water from the Sacramento River in the north Delta to the pumping plants in the south Delta. The fate of mass in the Delta for Configurations 3A and 3B would be similar to the fate of mass for Configuration 3E.

Configuration 3H is similar to Configuration 2E, except that it includes an east Delta isolated facility. The mass fate of Configuration 3H would be similar to the mass fate of Configuration 2E, except that the isolated facility would allow more mass released at Freeport to reach the exports. When flow was diverted to the isolated facility, flows through the Delta would be reduced, increasing the travel time of mass through the Delta.

Configuration 3I was not modeled. However, changes in mass fate relative to the No Action Alternative are likely to be small.

Net Delta Outflow. Figure 62 compares total Delta outflow under various Delta alternatives. Alternative 3 would reduce net Delta outflow more than the other two alternatives. Table 28 shows the distribution of the differences in net Delta outflow between Alternative 3 and the No Action Alternative. The same general pattern of reductions are observed for fall through mid-winter, as described in the previous alternatives. However, from mid-winter through spring, this alternative showed a greater number of months with reduced Delta outflow. Alternative 3 alone shows substantial reductions in outflow during April, May, and June.

Frequency analysis of the differences in monthly net Delta outflow indicates that approximately 30% of the outflows for Alternative 3 would be reduced by 2.5% or more. However, about 15% of the monthly outflows would be increased by 2.5% or more, resulting in a net decrease of 15%.

Configuration 3A reflects the effects of adding the 5,000-cfs isolated facility. Comparing net Delta outflow for Configuration 3A to net Delta outflow for Configuration 2A indicates that the isolated facility would decrease outflow in spring. Approximately 30% of the total March, April, May, and June months showed a decrease in outflow. Approximately 25% of the time outflows are increased during winter.

Adding north and south surface storage (Configurations 3B, 3E, 3H, and 3I) tends to increase the magnitude of reduced outflows but does not substantially change the number of months when decreases occur, except in spring. The effects are similar to those found for Configuration 1C.

Central Delta Outflow. As with Alternative 2, those options that allow more Sacramento River water to be diverted into the central Delta reduce average monthly upstream flows in the central Delta. Unlike Alternative 2, Configuration 3E appears to eliminate upstream flows entirely.

The number of months with flows in the upstream direction (negative) are reduced to zero see (see Figure 40). The number of months with downstream (positive) flows increased in all flow ranges. All central Delta flows are downstream, even in July and August, which are typically the critical months for reverse flows (see Table 29). Minimum downstream flows for this alternative are around 400 cfs.

The effect of Configuration 3A on central Delta outflow will be similar to the effect of Configuration 2A with the following exceptions: Configuration 2A includes a 10,000-cfs Hood intake that is not included in Configuration 3A, and Configuration 3A includes a 5,000-cfs isolated facility that is not included in Configuration 2A. The operating criteria of the isolated facility would control effects on the Delta, and, while it is operational, flows through the Delta would be reduced.

Configuration 3H is similar to Configuration 2E, except that it has an east Delta isolated facility. The effects of Configuration 3H on central Delta outflow would be similar to those of Configuration 2E, except that the isolated facility would increase the flexibility of the system by providing an alternative intake diversion point. When flow was diverted to the isolated facility, central Delta outflow would be reduced.

Although it has not been modeled, the effects of Configuration 3I are likely to be localized in the areas of the export pump intakes.

X2 Position. Table 30 shows the distribution of X2 position in kilometers from the Golden Gate. Eastward movements in X2 during fall range from 1 to 7 kms, and eastward movements during winter and spring range from 1 to 5 kms. Changes in X2 position parallel changes in net Delta outflow: movements in the X2 position tend to occur when decreases in net Delta outflow occur (see Table 28). Alternative 3 appears to move the position of X2 eastward during spring, which is not observed in Alternative 1 or 2.

Figure 63 compares X2 positions under the various Delta alternatives. In Configuration 3A, the western position of X2 tends to move upstream during fall about 1.0 to 3.5 kms. During spring, the position of X2 moves upstream from 1.1 to 2.8 kms.

Configurations 3B, 3E, 3H, and 3I appear to cause the most change in both western and eastern locations of X2. X2 moves eastward from 1.0 to 3.7 kms in fall and from 1.0 to 3.1 kms in winter and spring. These changes represent 5 to 35% of the natural variability in X2 position during fall, and 5 to 15% of the natural variability in X2 position in winter and spring.

Salinity. Salinity for the No Action Alternative was based on the same modeling study as Configuration 1A; therefore, Configuration 3E is compared to Configuration 1A. Tables 31 through 34 show the percentiles of the difference in salinity between Configuration 3E and the No Action Alternative. The effects of Configuration 3E on salinity at each location are summarized below.

Under Configuration 3E, Delta salinity would improve moderately but not as much as under Alternative 2. During summer and winter, salinity would be reduced by 10% or more about 75% of the time. However, increases in salinity would occur in all months except August and September.

Salinity at Emmaton appears to increase substantially under Alternative 3. Salinity increased by more than 10% in about 50% of the total months. Generally, increases occur throughout the year. The few decreases that do occur are mostly in June.

Alternative 3 would substantially increase salinity on Old River. About as many increases as decreases in salinity were observed; however, the increases were greater in magnitude. Most of the increases occurred in winter and spring. Summer and fall showed a greater number of decreases in salinity.

Alternative 3 appears to substantially improve salinity at Clifton Court. Only a few increases in salinity were noted under Configuration 3E. Improvements in salinity would occur throughout the year.

This analysis indicates that Configuration 3E would substantially improve the salinity conditions at Clifton Court Forebay as a result of the isolated

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facility; however, Configuration 3E would increase salinity at the other three locations.

Configurations 3A, 3E, 3H, and 3I likely would have similar effects on salinity as Configuration 3E. The configurations isolate and convey Sacramento River water to the south Delta exports. These configurations bring fresher water to the export pumps but reduce the freshwater in the Delta.

BAY REGION

ALTERNATIVE 1

Surface Water Supply and Management

Under Alternative 1, freshwater flows to the Bay would be reduced as a result of the increased export capacity in the SWP and CVP improvements. The primary changes in net Delta outflow occur in late summer through winter (September through March), resulting in less Delta outflow about 25% of the time. The magnitude of changes range from zero to more than 40%. The differences in net Delta outflow from April through August are negligible.

ALTERNATIVE 2

Surface Water Supply and Management

Configuration 2A would reduce freshwater flows to the Bay. The primary reductions would occur in late summer through fall (September through January) about 25% of the time. The magnitude of changes would range from zero to a little more than 30%. The differences in freshwater inflows in February through August would be small (less than 10%).

Under Configuration 2D, potential impacts would be similar to those described for Configuration 2A, except freshwater flows would be slightly decreased in late fall and winter (December through March).

ALTERNATIVE 3

Surface Water Supply and Management

Alternative 3 would reduce freshwater inflow to the Bay more than Alternatives 1 or 2. Also, unlike Alternatives 1 and 2, Alternative 3 would reduce freshwater inflow during spring (April to June). Approximately 30% of freshwater inflows would be reduced by 10% or more when compared to the No Action Alternative. Alternative 3 also would increase freshwater flow about 25% of the time in winter.

SACRAMENTO RIVER REGION

ALL ALTERNATIVES

Water Use Efficiency Program

In the Sacramento River Region, the water use efficiency program would have an unknown effect on the magnitude and timing of agricultural, municipal and industrial demand for water. Reductions in demand would result in fewer and/or smaller diversions and a redistribution of reservoir releases. Treatment and recycling options could result in additional return flows. Since a large portion of dry season flows in streams below reservoirs are releases for downstream users, reductions in demand could result in reduced dry season stream flows. Reduced demand would enable more water to be placed in storage, increasing the volume of water available during low-runoff years. The Water Use Efficiency Program could result not only in reduced demands during critical water years and drought periods, but could allow more water to be delivered during these periods. The Water Use Efficiency Program could result in substantial percentage increases in stream flows during very low flow periods and probably would result in negligible impacts on moderate and high flows. This discussion also applies to the San Joaquin River Region.

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Storage and Conveyance

Alternative 1

Surface Water Supply and Management

The direct effects of a Sacramento River Basin surface storage facility were simulated with the DWRSIM model for one set of possible operating rules. The range of potential new diversion opportunities can be estimated from the DWRSIM-simulated navigation control flows near Knights Landing. Monthly diversions to the surface storage facility were assumed whenever the No Action Alternative flows were greater than a specified minimum diversion threshold (assumed equal to the required navigation flow) and whenever Delta surplus outflow also was simulated. The new diversion capacity was assumed to be 5,000 cfs (300 TAF per month).

The releases from the new storage facility to augment Delta exports during years with delivery deficits or for increased Delta outflows during periods of relatively low outflow would govern the storage operations of the new storage facility.

Shasta and Clair Engle storage could be shifted (transferred) to the new storage facility to increase the flood control capacity and the refill potential for these reservoirs; however, this was not simulated with the DWRSIM model.

Trinity River. Each alternative includes some variation in Delta conveyance facilities coupled with various levels of additional storage. At the programmatic level of evaluation, the changes in Delta conveyance facilities may not appear to directly affect upstream water management operations of existing facilities because the modeling assumptions about required Delta outflows and allowable export/inflow ratios are unchanged between alternatives. As Delta conditions likely to result from different conveyance facilities are better understood, however, existing Delta requirements may change and opportunities may exist for different operations of upstream reservoir facilities. Additionally, new storage facilities may allow different operations of the existing reservoir and Delta facilities.

As a result, there are no detectible simulated differences in Trinity River operations between all alternatives attributable to Delta conveyance facilities, but substantial differences may exist in each alternative attributable to different levels of additional storage. Because Alternatives 2 and 3 have larger potential new storage capacity than Alternative 1, Trinity River water management could differ between these alternatives; however, the DWRSIM model assumes that Trinity River operations are not affected by the CALFED alternatives.

Trinity River water management may actually change because Alternative 1 would rely on both new reservoir storage and existing reservoir reoperation to increase Delta water supply during periods of delivery deficits. There are potential opportunities for modifying the monthly pattern of Trinity River exports to match the diversions to a new storage facility or to use Clair Engle as a "drought-reserve" storage facility, by reducing Trinity River exports in wet years and increasing Trinity River exports in dry years; however, these potential changes in the monthly export pattern and the seasonal and year-to-year (carryover storage targets) reservoir operations were not simulated using DWRSIM.

The Trinity River Instream Flow Study and environmental report are being prepared by the U.S. Fish and Wildlife Service (USFWS) and U.S. Bureau of Reclamation (Reclamation). These documents explore the range of potential instream flows and reallocation of water from exports to instream flows. Any reoperation of Clair Engle Reservoir storage to provide a different seasonal or year-to-year export pattern would need to be consistent with the Instream Flow Study recommendations. Temperature control on the Sacramento River also may require specific monthly Trinity River export patterns. Experience with the recently completed (1997) temperature control device (TCD) in Shasta Lake may provide information for modifying the constraints on Trinity

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River exports; however, no changes in Trinity River operations, instream flows, or monthly export patterns are being evaluated for the CALFED Programmatic EIS/EIR.

Sacramento River. Sacramento River water management may change because Alternative 1 would rely on reservoir reoperation to increase Delta water supply during periods of delivery deficits. There are also potential opportunities for increasing diversions to a new CALFED storage facility or of changing the monthly patterns of release from Shasta Reservoir if the TCD operation was effective in preserving more cold water in storage through summer; however, these potential changes in the monthly flow pattern and the seasonal reservoir operations were not simulated with DWRSIM. Some changes in Shasta operations were simulated to reflect increased aqueduct storage capacity; however, because CVP Tracy pumping is already at capacity most of the time, these changes in aqueduct storage capacity would have relatively small effects on Shasta operations. Therefore, the major changes in Sacramento River operations being evaluated for the CALFED Programmatic Environmental Impact Statement/ Environmental Impact Report (EIS/EIR) are diversions and releases for a new storage facility.

Trinity River water management allocation and monthly export patterns could change; however, these changes were not simulated with the DWRSIM model.

Figures 64 and 65 compares Shasta Storage and instream flow at Wilkins Slough under various configurations of Alternative 1.

Feather River. Feather River water management may change because Alternative 1 would rely on reservoir reoperation to increase Delta water supply during periods of delivery deficits. Because Oroville Reservoir is the major upstream SWP storage facility, Oroville operations may change if Delta pumping was modified by increased permitted Delta pumping capacity or the addition of new aqueduct storage. There are also potential opportunities for increasing diversions to a new CALFED storage facility. Instream flows at Gridley may be modified to achieve additional fisheries benefits; however, these potential changes in the monthly flow pattern and the seasonal reservoir operations were not specifically simulated with modified operational rules in the DWRSIM model. Some changes in Oroville operations and Gridley flows were simulated as a result of increased Delta exports with additional aqueduct storage and increased maximum pumping capacity. Figure 66 compares Oroville storage under various configurations of Alternative 1.

American River. American River water management may change because Alternative 1 would rely on reservoir reoperation to increase Delta water supply during periods of delivery deficits. Because Folsom Reservoir is a major upstream CVP storage facility, Folsom operations may change if Delta pumping was modified by increased permitted Delta pumping capacity or the addition of new aqueduct storage. There are also potential opportunities for increasing diversions to a new CALFED storage facility located in the American River watershed (Auburn Dam). Diversions may increase in the future on the American River. Instream flows at Nimbus may be further modified to achieve additional fisheries benefits, although the adaptive management based on available water was assumed implemented for the No Action Alternative; however, these potential changes in the monthly flow pattern and the seasonal reservoir operations were not specifically simulated with modified operational rules in the DWRSIM model. Auburn Dam has not been simulated with DWRSIM. Some changes in Folsom operations and Nimbus flows were simulated as a result of increased Delta exports with additional aqueduct storage and increased maximum pumping capacity. Figure 67 compares Folsom storage under various configurations of Alternative 1.

Riverine Hydraulics

The storage and conveyance components of alternatives with the potential for altering stream flows include increased pumping capacity at the

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Banks Pumping Plant, increased storage, and isolated conveyance facilities.

Among the assumptions of the simulations was the requirement that in each water year, diversions to the north Delta surface storage facility would not be permitted until a monthly flushing volume of at least 550 TAF occurred at the facilities diversion point. The target flushing volume is roughly equivalent to a monthly average flow rate of about 9,000 cfs. The diversion point for north Delta surface storage was assumed in DWRSIM to be Navigation Control Point No. 120 (near Colusa or Butte City). Based on the results of simulating the No Action Alternative at Navigation Control Point No. 120, the flow target would be exceeded in about 90% of water years during June and July, in about 75% of water years during May, and in 25 to 50% of water years during the rest of the year. Preliminary sensitivity analysis performed by CALFED indicates that the rate of filling of a north Delta surface storage facility is quite sensitive to the target flushing rate assumption.

The hydraulic impacts of Alternative 1 on Sacramento River flows were evaluated on a regional basis and with respect to Delta inflow. The analysis is based on DWRSIM modeling.

Configurations 1A and 1B. Configurations 1A and 1B involve reoperation of the system and SWP and CVP improvements, respectively. In both cases, flows in the Sacramento River are expected to be essentially the same as they would be under the No Action Alternative. There would be some changes with respect to existing conditions as a result of increasing demands for water.

Configuration 1C. Configuration 1C involves south Delta modifications that improve circulation of flow and reduce reverse flows in the south Delta. Average February flows at the four study locations in the reach from Butte City to Verona are projected to be between 6 and 8% lower than for the No Action Alternative. The corresponding reduction in mean velocity at these locations would be between 2 and 4%. At Freeport, the average flow discharge for February is projected to be about 2.4% lower than for the No Action Alternative, with a corresponding reduction in mean velocity of 1.3%. Average flow discharges at the seven locations along the Sacramento River (excluding the two tributary stations) are within about 1% of No Action Alternative conditions for September.

Lower Sacramento River at Freeport. Flows in the Sacramento River at Freeport represent the bulk of the inflow from the Sacramento River Region to the Delta. Figure 68 compares instream flows at Freeport under various configurations of Alternative 1.

Wet Season Flows. The summary table shows that average wet season stream flows at Freeport are relatively unaffected by any Alternative 1 variations. However, larger differences can be seen in the extreme flows. Maximum wet season flows increase under Configuration 1C, which includes an off-stream storage element. There are no substantial differences in minimum wet season flows for the variations of Alternative 1.

Dry Season Flows. As with wet season flows, the average dry season stream flows at Freeport are relatively unaffected by any variation of Alternative 1. This suggests that in most water years, the hydraulic effects of Alternative 1 on the lower portion of the basin would be small. The changes in maximum and minimum dry season flows at Freeport are negligible for all Alternative 1 variations.

Alternative 2

Surface Water Supply and Management

The potential changes in Sacramento River water management under Alternatives 2 and 3 are the same as those described under Alternative 1 if a new storage reservoir was constructed. None of the possible interactions with Trinity River exports and Shasta Reservoir operations were simulated using the DWRSIM model.

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The expected changes in Feather and American rivers operations under Alternative 2 are similar to those under Alternative 1.

The potential changes in Trinity River water management under Alternatives 2 and 3 are the same as those described under Alternative 1. Because Alternative 2 would allow the construction of a larger additional aqueduct reservoir storage capacity, the shifts in Trinity River water management might be larger than under Alternative 1; however, none of these potential changes were simulated in the DWRSIM results. Figures 69 through 72 compare Shasta, Oroville, and Folsom Storage and instream flow at Wilkins Slough, respectively, under various configurations of Alternative 2.

Riverine Hydraulics

The hydraulic impacts of Alternative 2 on Sacramento River flows were evaluated on a regional basis and with respect to Delta inflow. The analysis was based on DWRSIM modeling.

Lower Sacramento River at Freeport. Flows in the Sacramento River at Freeport represent the bulk of the inflow from the Sacramento River Region to the Delta. Figure 73 compares instream flows at Freeport under various configurations of Alternative 2.

Wet Season Flows. The summary table shows that average wet season stream flows at Freeport are relatively unaffected by any variations of Alternative 2. However, larger differences can be seen in the extreme flows. The maximum wet season flow increases slightly for Configuration 2D and decreases slightly for Configuration 2A. The minimum wet season flow, which increases under the No Action Alternative relative to existing conditions, decreases with Configuration 2D.

Dry Season Flows. As with wet season flows, the average dry season stream flows at Freeport are relatively unaffected by any variations of Alternative 2. This suggests that in most water years, the hydraulic effects of the alternatives on the lower portion of the basin would be small. The changes in the maximum and minimum dry season flows at Freeport are negligible for all Alternative 2 variations.

Alternative 3

Surface Water Supply and Management

Figures 74 and 75 graphically compares Shasta Storage and instream flow at Wilkins Slough under various configurations of Alternative 3.

Feather River. Some additional changes in Feather River operations are expected under Alternative 3 because the isolated conveyance facility may allow export pumping patterns to shift and also may allow Delta standards to be modified (export/inflow ratio objectives may be relaxed). Therefore, not all of the possible changes in Feather River water management were simulated.

Figure 76 compares Oroville storage under various configurations of Alternative 3.

American River. Some additional changes in American River operations are expected under Alternative 3 because the isolated conveyance facility may allow export pumping patterns to shift and also may allow Delta standards to be modified (export/inflow ratio objectives may be relaxed). The DWRSIM model results are slightly different with an isolated facility, but the possible relaxation of the export/inflow ratio was not included in the DWRSIM model assumptions.

Figure 77 compares Folsom storage under various configurations of Alternative 1.

Riverine Hydraulics

Lower Sacramento River at Freeport. Figure 78 compares instream flows at Freeport under various configurations of Alternative 3 and under existing conditions and no action conditions.

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Wet Season Flows. The summary table shows that average wet season stream flows at Freeport are relatively unaffected by any variation of Alternative 3. However, larger differences can be seen in the extreme flows. The maximum wet season flow increases for Configurations 3B, 3H, and 3I, which include an off-stream storage element. The maximum wet season flows decrease for Configuration 3A, which does not include storage. The minimum wet season flow, which increases under the No Action Alternative relative to existing conditions, decreases under all Alternative 3 variations. The decrease roughly compensates for the increase of the No Action Alternative and would result in a minimum flow 1 to 3% lower than under existing conditions.

Dry Season Flows. As with wet season flows, the average dry season stream flows at Freeport are relatively unaffected by any alternative. This suggests that in most water years, the hydraulic effects of the alternatives on the lower portion of the basin would be small. The change in the maximum dry season flow at Freeport is negligible for all variations of Alternative 3.

The change in the minimum dry season flow at Freeport is small. The magnitude of the difference is about the same but in the opposite direction as the difference between the No Action Alternative and existing conditions. As a result, the minimum dry season flow would be about the same as under existing conditions.

SAN JOAQUIN RIVER REGION

<u>ALL ALTERNATIVES</u>

Storage and Conveyance

Surface Water Supply and Management

Stanislaus River

Under Alternative 1, the simulated flow and storage values for the Stanislaus River would be similar to those simulated for the No Action Alternative. There is relatively little unused water from the Stanislaus River because of the high diversions and large New Melones Reservoir storage capacity that already captures a substantial portion of wet-year flows.

The few remaining opportunities for improved water management in the Stanislaus River Basin under Alternatives 2 and 3 are the same as those described under Alternative 1. Figures 79, 80, and 81 each compare the storage at New Melones Reservoir under various configurations of Alternatives 1, 2, and 3, respectively.

Tuolumne River

Under Alternative 1, the simulated flow and storage values for the Tuolumne River are similar to those simulated under the No Action Alternative; however, Alternative 1 provides opportunities for better use of excess runoff. On average, 73% of the inflow to New Don Pedro Reservoir is used for diversions and instream flow requirements under the No Action Alternative. Under Alternative 1, the percentage use could increase if flow allocations for fisheries were increased or if additional storage facilities were constructed in the Tuolumne River Basin.

The opportunities for improved water management under Alternatives 2 and 3 are the same as those described under Alternative 1. Figures 82, 83, and 84 each compare the storage at New Don Pedro under various configurations of Alternatives 1, 2, and 3, respectively.

Merced River

Under Alternative 1, the simulated flow and storage values for the Merced River would be similar to those simulated for the No Action Alternative; however, Alternative 1 provides opportunities for better use of excess runoff. On average, only 62% of the inflow to Lake McClure is used for diversions and instream flow requirements under the No Action Alternative. Water transfers from the Merced River to provide downstream flow benefits and/or Delta

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exports might be possible under Alternative 1. Under Alternative 1, the percentage of available water used might be increased if additional water was allocated for instream benefits. Increased conjunctive use is another possibility under Alternative 1.

The opportunities for improved water management in the Merced River Basin under Alternative 2 are the same as those described under Alternative 1. Additionally, Alternatives 2 and 3 could include additional storage facilities in the Merced River Basin (Montgomery Reservoir). The additional water supply could then be allocated to a combination of instream flow and diversion uses. Figures 85, 86, and 87 each compare the storage at Lake McClure under various configurations of Alternatives 1, 2, and 3, respectively.

Upper San Joaquin River

Under Alternative 1, the simulated flow and storage values for the upper San Joaquin River are similar to those simulated under the No Action Alternative; however, Alternative 1 provides opportunities for better use of excess runoff. On average, 85% of the inflow to Millerton Lake is used for diversions and instream flow requirements under the No Action Alternative. Although this is a fairly high percentage allocated, it could be even higher under Alternative 1 if a minimum flow requirement was established for fisheries benefits or if additional storage facilities were constructed in the upper San Joaquin River Basin (enlarged Millerton). Additional conjunctive use is another possibility under Alternative 1; however, DWRSIM assumes that Millerton operations would not be affected or modified by CALFED alternatives.

The opportunities for improved water management under Alternatives 2 and 3 are the same as those described under Alternative 1, although no changes were simulated by DWRSIM.

Riverine Hydraulics

San Joaquin River at Vernalis

The San Joaquin River at Vernalis represents a much smaller inflow to the Delta than the Sacramento River. The effects of the alternatives on discharge are negligible. Figures 88, 89, and 90 each compare the instream flows at Vernalis under various configurations of Alternatives 1, 2, and 3, respectively.

SWP AND CVP SERVICE AREAS OUTSIDE THE CENTRAL VALLEY

ALL ALTERNATIVES

Surface Water Supply and Management

Figures 91 through 96 each compare the CVP and SWP San Luis storage under various configurations of Alternatives 1, 2, and 3, respectively. Delta exports would generally be similar to No Action conditions except for configurations involving additional storage. Small increases in deliveries would occur due to increased permitted pumping for all configurations. The increases would occur primarily during wet years or higher runoff periods. However, new storage would enable increased deliveries whenever additional stored water and sufficient conveyance capacity are available. Export water quality would be improved dramatically. This may be considered a beneficial impact on water supply.

Riverine Hydraulics

No change in streamflows outside the Central Valley are expected as a result of CALFED Program actions.

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Comparison of CALFED Alternatives to Existing Conditions

Comparison of Program elements to existing conditions indicates:

- All potentially significant but mitigable adverse impacts that were identified when compared to the No Action Alternative would still be considered significant when compared to Existing Conditions.
- No additional significant environmental consequences have been identified when program effects are compared to existing conditions as opposed to No Action.
- The beneficial effects to water supply availability and reliability would still be beneficial when compared to Existing Conditions. These effects are beneficial compared to existing conditions and are even more beneficial when considered with respect to future demands on surface water.

In summary, the conclusions regarding the significance of project effects on water supply and management when compared to existing conditions would be similar to those compared to No Action.

The forecasted flows for the No Action Alternative differ from the existing condition flows as a result of forecasted future demands for water. In most cases, forecasted hydraulic variables for the No Action Alternative are similar to those for existing conditions, with maximum variations of less than a few percent. Therefore, the conclusions regarding the magnitude of hydrodynamic effects on the Delta would be the same if they are compared to existing conditions as compared to the No Action Alternative.

MITIGATION STRATEGIES

Surface Water Supply and Management

Although surface water impacts are considered beneficial, mitigation strategies are described here because considerable uncertainty exists concerning the actual surface water impacts that may occur as a result of implementing CALFED alternatives.

Potential mitigation strategies for potentially significant surface water impacts could include:

- *Modifying reservoir storage diversion rules to reduce the potentially significant impacts related to storage diversions;*
- *Modifying requirements for instream flows to reduce the potentially significant impacts related to reduced instream flows caused by upstream storage or diversions;*
- *Modifying diversion demand targets to reduce the potentially significant impacts caused by increased diversions during periods when aquatic organisms are vulnerable to entrainment; and*
- *Modifying instream and adjacent habitat to compensate for changes in flow patterns and make affected species less vulnerable to flow-induced impacts (such as, placing and cleaning gravel, reducing gravel mining, and promoting shaded riverine aquatic habitat).*

Bay-Delta Hydrodynamics and Riverine Hydraulics

The potential impacts discussed in this document are based on computer model simulations of programmatic alternatives. As the planning process progresses, the model simulations will be detailed design and analysis information will become available. For example, if Alternative 3 is selected for further analysis and design, it may be possible to develop specific mitigation strategies to avoid potentially significant low flow and associated salinity problems in the south Delta. In general, it is suggested that mitigation include revised operating rules to reduce flow-related problems that may occur during low flow conditions.

POTENTIALLY SIGNIFICANT UNAVOIDABLE IMPACTS

Surface Water Supply and Management

No significant unavoidable impacts have been identified in this analysis.

Bay-Delta Hydrodynamics and Riverine Hydraulics

No significant unavoidable impacts have been identified.

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REFERENCES - ENVIRONMENTAL CONSEQUENCES

Printed References

Leopold, L. B. and T. Maddock. 1953. Hydraulic Geometry of Stream Channels and Some Physiographic Implications. (U.S. Geological Survey Professional Paper 252.) Sacramento, CA.

State Water Resources Control Board. 1995. Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary. Environmental Report. May. California Environmental Protection Agency. Sacramento, CA.

SWRCB. See State Water Resources Control Board.

TABLES FOR

SURFACE WATER RESOURCES

Alternative	Variation	Description
No Action		Existing Delta geometry with predicted 2020 demands.
1	A	Existing Delta geometry with CVP and SWP improvements (10,300-cfs pumping) and predicted 2020 demands.
	C	South Delta improvements, CVP and SWP improvements (10,300-cfs pumping), and predicted 2020 demands.
2	B	North and south Delta improvements, a 10,000-cfs Hood intake, CVP and SWP improvements (10,300-cfs pumping), and predicted 2020 demands.
	D	Mokelumne River floodway, east and south Delta habitats, a 10,000-cfs Hood intake, CVP and SWP improvements (10,300-cfs pumping), and predicted 2020 demands.
	E	Mokelumne River floodway, Tyler Island, east and south Delta habitats, CVP and SWP improvements (10,300-cfs pumping), and predicted 2020 demands.
3	E	North Delta improvements, a 15,000 cfs isolated facility, CVP and SWP improvements (10,300-cfs pumping), and predicted 2020 demands.

NOTES:

cfs = cubic foot per second.
CVP = Central Valley Project.
SWP = State Water Project.

Table 3. Configurations Evaluated Using DWRDSM1 Model

Condition	Date	Sacramento River Flow	San Joaquin River Flow	East Side Streams Flow	Yolo Bypass Flow	SWP Pumping	CVP Pumping
High inflow	3/83	5,038	2,528	679	6,979	313	171
Low inflow/high pumping	10/89	783	81	6	0	285	264
Low inflow/low pumping	7/91	556	80	8	3	46	90
High inflow/high pumping	2/79	2,319	515	119	35	303	236
Medium inflow/low pumping	4/81	1,018	218	33	3	163	163
Average:	8/75 to 9/91	1,300	287	68	218	289	202
Minimum:	8/75 to 9/91	393	54	0	0	5	3
Maximum:	8/75 to 9/91	5,100	2,528	746	6,979	633	283

NOTES:

SWP = State Water Project.
CVP = Central Valley Project.
TAF = Thousand acre-feet.

Table 4. Inflows and Pumping for Representative Periods Used in DWRDSM1 Modeling (TAF)

Study Location	DWRSIM Control Point	USGS Station ID	Description	Station Location	Gage Elevation (msl)	Watershed Area (sq. miles)	Flood Thresholds	Maximum Daily Mean Discharge (cfs)	Minimum Monthly Discharge (cfs)	Maximum Monthly Discharge (cfs)	10% Exceeds (cfs)	90% Exceeds (cfs)	Minimum Mean Discharge (cfs)	Maximum Mean Discharge (cfs)	Period of Record for Statistics
S1	137	11447650	Sacramento River at Freeport	630 feet downstream of drawbridge at Freeport; 11 miles south of Sacramento	Sea level	Not determined	Flood flows bypass station through spill to Yolo Bypass	115,000	4,494 (10/78)	79,040 (2/83)	52,800	8,740	12,470 (October)	38,570 (February)	1949 to 1994
S2	61	11425500	Sacramento River at Verona (*DA* 15 at Wilkins Slough)	1.5 miles downstream of Feather River; 19.1 miles upstream from Sacramento	-3.00	21,251	Flood stage 41.3 feet; above 55,000 cfs, overflows to Yolo Bypass	92,300	4,725 (10/78)	71,340 (3/83)	44,200	7,360	10,680 (October)	32,660 (February)	1946 to 1994
S3	61	11390500	Sacramento River below Wilkins Slough near Grimes (*DA* 15 at Wilkins Slough)	5.8 miles southeast of Grimes; 62.9 miles upstream of Sacramento	-3.00	12,926	Flood stage 52.7 feet; above 23,000 cfs overflows into Sutter Bypass	32,600	3,330 (10/78)	29,490 (3/83)	21,500	5,000	6,665 (October)	16,150 (February)	1946 to 1994
S4	120	11389500	Sacramento River at Colusa (north of Delta storage release)	60 feet downstream of highway bridge at Colusa; 89.4 miles upstream of Sacramento	-2.95	12090	Flood stage 70 feet; above 30,000 cfs overflows into Butte Sink and Sutter bypasses	51,300	3,219 (10/78)	44,450 (3/83)	23,100	5,310	6,636 (October)	18,750 (February)	1946 to 1994
S5	120	11389000	Sacramento River at Butte City (north of Delta storage release)	0.5 mile south of Butte City; 115.8 miles upstream of Sacramento	-2.92	12,080	Above 90,000 cfs, overbank flow into Butte basin	158,000	3,323 (10/78)	104,500 (2/58)	23,300	5,280	6,641 (October)	24,850 (February)	1946 to 1994
S6	73	11377100	Sacramento River above Bend Bridge near Red Bluff (Sacramento River at Cottonwood Creek)	2.7 miles upstream of Bend Bridge	285.77	8,900	Flood stage 27 feet	127,000	3,935 (10/78)	75,830 (3/83)	18,800	5,370	6,901 (October)	18,140	1964 to 1994

Table 5. River Station Information

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USGS Station	Description	Period used for analysis	Elevation Datum	Flow Range (cfs)	Stage coef	Stage exp	Stage R^2	Depth Correction	Flow Range (cfs)	Average Depth coef	Average Depth exp	Average Depth R^2	Flow Range (cfs)	Width coef	Width exp	Width R^2	Flow Range (cfs)	Velocity coef	Velocity exp	Velocity R^2
11446500	American River at Fair Oaks	1987 to 1995	71.53	0 to 120,000	0.055	0.52	0.98	-3.1	0 to 120,000	0.30	0.36	0.75	0 to 120,000	110	0.14	0.62	0 to 40,000	0.028	0.52	0.80
"	"	"	"														40,000 to 120,000	0.30	0.29	1.00
11370500	Sacramento River at Keswick, Boards In	1973 to 1997	479.81	0 to 19,000	0.71	0.35	1.00	5.0	0 to 19,000	2.0	0.15	0.59	0 to 19,000	453	0.028	0.15	0 to 19,000	0.001	0.82	0.96
"	Sacramento River at Keswick, Boards Out	1973 to 1997	479.81	0 to 82,000	0.71	0.35	1.00	5.0	0 to 20,000	0.30	0.32	0.81	0 to 30,000	127	0.15	0.77	0 to 30,000	0.031	0.51	0.98
"	"	"	"						20,000 to 82,000	0.13	0.41	0.94	30,000 to 82,000	36	0.27	0.73	30,000 to 82,000	0.16	0.35	0.96
11377100	Sacramento River above Bend Bridge	1988 to 1997	285.77	0 to 135,000	0.14	0.48	1.00	7.0	0 to 40,000	0.00	0.77	0.99	0 to 40,000	149	0.10	0.75	0 to 135,000	1.21	0.15	0.93
"	"	"	"						40,000 to 105,000	0.72	0.28	0.58	40,000 to 105,000	0.68	0.62	0.78				
"	"	"	"						105,000 to 135,000	0.00	0.84	0.88	105,000 to 135,000	24	0.34	1.00				
11389500	Sacramento River at Colusa	1987 to 1997	-2.95	0 to 46,000	0.029	0.66	0.99	-33	0 to 10,000	0.04	0.61	0.83	0 to 46,000	88	0.13	0.66	0 to 46,000	0.22	0.28	0.83
"	"	"	"						10,000 to 46,000	0.06	0.57	0.93								
11389000	Sacramento River at Butte City	1987 to 1995	-2.92	0 to 105,000	0.045	0.56	0.99	-64	0 to 105,000	0.17	0.44	0.98	0 to 105,000	334	0.04	0.61	0 to 105,000	0.016	0.53	0.98
11390500	Sacramento River below Wilkins Slough	1987 to 1997	-3.00	0 to 30,000	1.92	0.31	0.99	0.0	0 to 30,000	0.094	0.54	0.97	0 to 30,000	52	0.17	0.73	0 to 30,000	0.21	0.29	0.95
11447650	Sacramento River at Freeport	1989 to 1997	Sea level	0 to 100,000	0.030	0.55	0.43	-100	0 to 100,000	0.45	0.38	0.93	0 to 100,000	368	0.05	0.50	0 to 100,000	0.008	0.55	0.89
11425500	Sacramento River at Verona	1987 to 1997	-3.00	0 to 100,000	0.11	0.52	0.99	0.0	0 to 30,000	0.039	0.59	0.93	0 to 39,000	231	0.08	0.75	0 to 30,000	0.12	0.32	0.76
"	"	"	"						30,000 to 100,000	0.23	0.42	0.84	39,000 to 100,000	7.4	0.41	0.90	30,000 to 100,000	0.25	0.25	0.66
11302000	Stanislaus River below Goodwin Dam	1989 to 1997	252.83	0 to 7,000	0.060	0.56	0.99	-7.0	0 to 2,000	0.29	0.38	0.89	0 to 2,000	40	0.15	0.79	0 to 2,000	0.086	0.48	0.94
"	"	"	"						2,000 to 7,000	0.13	0.48	0.99	2,000 to 7,000	27	0.20	1.00	2,000 to 7,000	0.28	0.32	0.98
11303500	San Joaquin River at Vernalis	1988 to 1997	Sea level	0 to 50,000	0.16	0.49	1.00	-4.0	0 to 10,000	0.028	0.67	0.98	0 to 10,000	131	0.09	0.69	0 to 50,000	0.31	0.22	0.73
"	"	"	"						10,000 to 50,000	0.029	0.63	0.92	10,000 to 50,000	101	0.15	0.85				
11274000	San Joaquin River near Newman	1995-97	Sea level	0 to 13,000	0.70	0.36	0.99	-42.0	0 to 4,000	0.10	0.55	0.73	0 to 4,000	60	0.15	0.86	0 to 13,000	0.13	0.33	0.68
"	"	"	"						4,000 to 13,000	5.35	0.07	0.44	4,000 to 13,000	13	0.60	0.92				
"	"	"	"							linear coef.	intercept									
11407150	Feather River near Gridley	1987 to 1997	-2.91	0 to 120,000	0.019	0.61	0.98	-73.5	0 to 55,000	0.00	9.11	0.98	0 to 55,000	205.29	0.043	0.61	0 to 11,000	0.00	0.87	0.99
"	"	"	"							linear coef.	intercept			linear coef.	intercept					
"	"	"	"						55,000 to 120,000	0.00	36.43	0.99	55,000 to 120,000	0.010	-221.38	0.97	11,000 to 120,000	0.05	0.44	0.98

NOTES:
USGS = U.S. Geological Survey.
cfs = Cubic foot per second.

Table 6. Coefficients and Exponents for Calculating Stream Velocity, Depth, and Width (Page 1 of 2)

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Study Location	DWRSIM Control Point	USGS Station ID	Description	Station Location	Gage Elevation (msl)	Watershed Area (sq. miles)	Flood Thresholds	Maximum Daily Mean Discharge (cfs)	Minimum Monthly Discharge (cfs)	Maximum Monthly Discharge (cfs)	10% Exceeds (cfs)	90% Exceeds (cfs)	Minimum Mean Discharge (cfs)	Maximum Mean Discharge (cfs)	Period of Record for Statistics
S7	62	11370500	Sacramento River at Keswick, ***[Boards In?]*** (Sacramento River at Keswick)	1.6 miles downstream of Keswick	479.81	6,468		79,700	2,847 (12/78)	47,170 (3/83)	14,600	3,910	6,328 (October)	12,330 (July)	1964 to 1994
S8	106	11407150	Feather River near Gridley (Feather River below Oroville-Thermalito Complex)	2.7 miles east of Gridley	-2.91	3,676		146,000	804 (4/91)	3,786 (1/70)	8,990	1,050	2,377 (October)	7,180 (January)	1969 to 1994
S9	9	11446500	American River at Fair Oaks (American River at Lake Natomas)	2,100 feet downstream of Nimbus Dam	71.53	1,888		131,000	252 (12/78)	31,140 (2/86)	7,500	2,480	1,899 (October)	5,209 (February)	1956 to 1994
SJ1	682	11303500	San Joaquin River at Vernalis	2.6 miles downstream of Stanislaus River	Sea level	13,536		70,000	92.8 (7/77)	40,040 (3/83)	11,700	638	1,311 (August)	7,504 (May)	1924 to 1994
SJ2	695	11274000	San Joaquin River near Newman (San Joaquin and Merced rivers confluence)	650 feet downstream of Merced River	Sea level	9,520		30,300	25.2 (10/78)	24,170 (3/83)	3,590	211	481 (August)	284 (March)	1944 to 1994
SJ3	675	11302000	Stanislaus River below Goodwin Dam (Stanislaus River below Goodwin Dam, near Knights Landing)	0.9 mile downstream of Goodwin Dam	252.83	986		6,330	132 (1/90)	4,905 (3/86)	1,250	149	368 (September)	1,096 (March)	1924 to 1994

NOTES:

msl = Mean sea level.
cfs = Cubic foot per second.
DA = ???

Table 6. Coefficients and Exponents for Calculating Stream Velocity, Depth, and Width (Page 2 of 2)

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Water Year	Total Delta *Inflow* (TAF)	In-Delta *Depletion* (TAF)	Required Delta *Outflow* (TAF)	Surplus Delta *Outflow* (TAF)	Total *Export* (TAF)	Storage *Increase* (TAF)	Storage *Release* (TAF)	San Luis *Carryover* (TAF)	Carryover Used (TAF)	Direct Delivery (TAF)	Total Delivery (TAF)	Simulated Aqueduct Delivery (TAF)	Inflow to Storage (%)	Delivery from Storage (%)	Inflow Used (%)
22	20,856	1,186	6,077	6,131	7,716	1,538	1,509	529	0	6,178	7,687	7,601	7	20	72
23	18,054	1,140	5,423	4,493	7,229	1,244	1,417	356	173	5,985	7,402	6,957	7	19	77
24	9,198	1,291	3,873	285	3,760	1,239	1,047	548	0	2,521	3,568	3,161	13	29	95
25	14,616	999	5,859	3,109	4,825	1,397	1,345	600	0	3,428	4,773	4,313	10	28	80
26	12,884	1,160	4,347	2,368	5,157	1,397	1,514	483	117	3,760	5,274	4,826	11	29	84
27	26,956	1,116	6,805	11,997	7,270	1,555	1,570	468	15	5,715	7,285	6,948	6	22	56
28	21,612	1,124	6,191	7,372	7,019	1,531	1,341	658	0	5,488	6,829	6,350	7	20	65
29	10,019	1,170	3,824	530	4,518	1,380	1,274	764	0	3,138	4,412	3,984	14	29	94
30	12,517	1,175	4,653	1,555	5,266	1,274	1,265	773	0	3,992	5,257	4,807	10	24	89
31	8,382	1,216	3,739	71	3,404	787	1,219	341	432	2,617	3,836	3,420	9	32	105
32	12,179	1,176	4,995	1,152	5,132	1,552	1,110	783	0	3,580	4,690	4,232	13	24	89
33	8,789	1,226	3,837	275	3,531	1,055	1,247	591	192	2,476	3,723	3,271	12	33	100
34	9,801	1,221	4,424	265	3,988	1,206	1,356	441	150	2,782	4,138	3,684	12	33	100
35	16,480	1,080	6,140	3,558	5,900	1,427	1,633	235	206	4,473	6,106	5,812	9	27	81
36	19,896	1,169	5,974	5,904	7,175	1,577	1,495	317	0	5,598	7,093	6,693	8	21	72
37	17,911	1,183	5,593	4,901	6,639	1,721	1,597	441	0	4,918	6,515	6,463	10	25	74
38	46,039	1,116	7,493	30,065	7,853	1,607	1,029	1,019	0	6,246	7,275	7,661	3	14	35
39	14,105	1,235	3,955	2,759	6,169	1,019	1,289	749	270	5,150	6,439	5,994	7	20	82
40	25,036	1,189	7,304	10,722	6,321	1,384	1,856	277	472	4,937	6,793	6,542	6	27	61
41	39,811	1,042	7,124	23,947	8,190	1,560	1,169	668	0	6,630	7,799	7,596	4	15	40
42	35,554	1,037	6,746	20,016	8,003	1,210	1,169	709	0	6,793	7,962	7,740	3	15	44
43	29,022	1,134	7,368	13,567	7,174	1,300	1,257	752	0	5,874	7,131	7,023	4	18	54
44	14,318	1,209	4,198	2,327	6,711	1,310	1,562	500	252	5,401	6,963	6,549	9	22	86
45	16,206	1,138	4,847	3,398	6,958	1,537	1,581	456	44	5,421	7,002	6,647	9	23	80
46	21,114	1,169	5,918	6,898	7,193	1,483	1,588	351	105	5,710	7,298	6,901	7	22	68
47	13,151	1,207	4,424	1,073	6,465	1,681	1,508	524	0	4,784	6,292	5,865	13	24	91
48	13,811	1,113	4,620	2,359	5,726	1,002	1,262	264	260	4,724	5,986	5,586	7	21	85
49	14,585	1,204	4,269	2,496	6,680	1,766	1,558	472	0	4,914	6,472	6,047	12	24	82
50	14,982	1,229	5,004	2,280	6,563	1,581	1,423	630	0	4,982	6,405	5,978	11	22	84
51	30,083	1,095	6,113	15,880	7,240	1,412	1,495	547	83	5,828	7,323	6,957	5	20	48
52	37,738	1,093	7,770	21,215	8,062	1,504	986	1,065	0	6,558	7,544	7,710	4	13	43
53	25,236	1,181	5,800	10,988	7,394	1,063	1,280	848	217	6,331	7,611	7,168	4	17	58
54	21,794	1,204	6,813	6,713	7,079	1,190	1,466	572	276	5,889	7,355	6,939	5	20	71
55	13,368	1,150	4,153	2,324	5,848	1,332	1,295	609	0	4,516	5,811	5,382	10	22	83
56	37,656	1,149	6,591	22,877	7,478	1,439	1,371	677	0	6,039	7,410	7,347	4	19	40

Table 7. No Action Alternative Delta Water Management Allocation (Page 1 of 3)

C-008819

C-008820

Water Year	Total Delta Inflow (TAF)	In-Delta Depletion (TAF)	Required Delta Outflow (TAF)	Surplus Delta Outflow (TAF)	Total Export (TAF)	Storage Increase (TAF)	Storage Release (TAF)	San Luis Carryover (TAF)	Carryover Used (TAF)	Direct Delivery (TAF)	Total Delivery (TAF)	Simulated Aqueduct Delivery (TAF)	Inflow to Storage (%)	Delivery from Storage (%)	Inflow Used (%)
57	17,591	1,143	5,156	4,264	7,056	1,244	1,183	738	0	5,812	6,995	6,541	7	17	76
58	41,308	1,054	6,761	26,182	7,879	1,299	1,027	1,010	0	6,580	7,607	7,586	3	14	37
59	17,527	1,256	5,128	4,559	6,682	1,041	1,527	524	486	5,641	7,168	6,701	6	21	77
60	12,464	1,248	4,472	1,143	5,686	1,514	1,596	442	82	4,172	5,768	5,349	12	28	92
61	13,094	1,199	4,403	1,461	6,112	1,596	1,324	714	0	4,516	5,840	5,410	12	23	87
62	15,590	1,248	5,910	2,632	6,031	1,366	1,949	131	583	4,665	6,614	6,255	9	29	88
63	26,880	1,019	6,844	11,606	7,643	1,700	1,164	667	0	5,943	7,107	6,828	6	16	56
64	14,124	1,265	4,210	2,328	6,383	1,225	1,490	402	265	5,158	6,648	6,180	9	22	86
65	28,774	1,121	6,725	14,072	7,021	1,734	1,377	759	0	5,287	6,664	6,249	6	21	50
66	17,225	1,211	4,719	4,481	6,898	1,191	1,681	269	490	5,707	7,388	6,986	7	23	77
67	31,493	1,042	7,759	14,908	8,184	1,771	780	1,260	0	6,413	7,193	7,589	6	11	51
68	18,906	1,194	5,622	5,556	6,606	778	1,483	555	705	5,828	7,311	6,873	4	20	75
69	40,308	1,193	7,584	24,407	7,604	1,499	1,000	1,054	0	6,105	7,105	7,656	4	14	39
70	35,304	1,196	5,519	21,906	6,955	995	1,616	433	621	5,960	7,576	7,226	3	21	40
71	24,777	1,126	6,848	9,250	7,690	1,531	1,236	728	0	6,159	7,395	7,021	6	17	62
72	14,968	1,270	4,783	2,228	6,700	1,310	1,365	673	55	5,390	6,755	6,308	9	20	86
73	27,200	1,082	6,772	12,719	7,165	1,370	1,316	727	0	5,795	7,111	6,758	5	19	55
74	41,333	1,044	6,803	25,789	7,868	1,322	1,406	643	84	6,546	7,952	7,676	3	18	38
75	25,491	1,165	6,695	9,944	7,838	1,212	1,225	630	13	6,626	7,851	7,446	5	16	62
76	12,914	1,298	3,680	1,888	6,049	1,224	998	856	0	4,825	5,823	5,400	9	17	84
77	7,601	1,242	3,943	0	2,420	380	725	511	345	2,040	2,765	2,328	5	26	105
78	24,466	1,102	7,244	10,215	6,416	1,527	1,470	568	0	4,889	6,359	6,713	6	23	60
79	17,905	1,215	5,786	3,953	7,218	1,302	1,281	589	0	5,916	7,197	6,716	7	18	79
80	30,814	1,111	6,560	16,583	6,918	1,583	1,097	1,075	0	5,335	6,432	6,673	5	17	46
81	15,577	1,225	4,723	3,276	6,416	963	1,458	580	495	5,453	6,911	6,493	6	21	83
82	45,250	973	7,016	29,906	7,843	1,466	1,120	926	0	6,377	7,497	7,577	3	15	34
83	67,571	965	6,503	53,171	7,753	1,238	516	1,648	0	6,515	7,031	8,141	2	7	21
84	35,520	1,165	6,016	21,957	6,510	390	1,629	409	1,239	6,120	7,749	7,655	1	21	42
85	15,098	1,092	4,370	3,032	6,670	1,391	1,575	225	184	5,279	6,854	6,453	9	23	82
86	34,560	1,104	6,000	21,235	6,732	1,947	1,039	1,133	0	4,785	5,824	5,896	6	18	37
87	12,981	1,242	4,249	1,969	5,570	905	1,443	595	538	4,665	6,108	5,683	7	24	89
88	10,385	1,174	4,098	956	4,244	1,075	1,064	606	0	3,169	4,233	3,842	10	25	92
89	12,881	1,163	4,369	2,194	5,171	1,403	1,511	498	108	3,768	5,279	4,881	11	29	84
90	11,163	1,174	4,065	774	5,193	1,292	1,058	732	0	3,901	4,959	4,503	12	21	91
91	9,548	1,159	4,027	1,198	3,214	742	701	773	0	2,472	3,173	2,715	8	22	88

Table 7. No Action Alternative Delta Water Management Allocation (Page 2 of 3)

C-008820

C-008821

Water Year	Total Delta Inflow (TAF)	In-Delta Depletion (TAF)	Required Delta Outflow (TAF)	Surplus Delta Outflow (TAF)	Total Export (TAF)	Storage Increase (TAF)	Storage Release (TAF)	San Luis Carryover (TAF)	Carryover Used (TAF)	Direct Delivery (TAF)	Total Delivery (TAF)	Simulated Aqueduct Delivery (TAF)	Inflow to Storage (%)	Delivery from Storage (%)	Inflow Used (%)
92	10,619	1,155	4,341	1,414	3,853	1,265	1,206	832	0	2,588	3,794	3,327	12	32	87
93	23,710	1,063	8,240	7,922	7,124	1,202	1,461	573	259	5,922	7,383	7,128	5	20	70
94	12,914	1,200	4,022	1,257	6,526	1,197	1,253	517	56	5,329	6,582	6,140	9	19	91
Minimum:	7,601	965	3,680	0	2,420	380	516	131	0	2,040	2,765	2,328	1	7	21
Average:	21,638	1,156	5,537	8,743	6,404	1,321	1,321	630	135	5,083	6,404	6,124	6	21	61
Maximum:	67,571	1,298	8,240	53,171	8,190	1,947	1,949	1,648	1,239	6,793	7,962	8,141	14	33	105

NOTE:

TAF = Thousand acre-feet.

Table 7. No Action Alternative Delta Water Management Allocation (Page 3 of 3)

C-008821

Location		No Action Alternative			Configuration 1A				Configuration 1C			
High Inflow Condition	**Loc. Key**	**Avg.**	**Max. Sea-ward**	**Max. Land-ward**	**Avg.**	**Max. Sea-ward**	**Max. Land-ward**	**% Diff***	**Avg.**	**Max. Sea-ward**	**Max. Land-ward**	**% Diff***
S.J. River at Fourteen Mile Slough	1	17,500	21,600	11,400	17,900	22,000	11,800	2%	17,800	21,900	11,800	2%
San Joaquin River at Antioch	2	55,600	170,000	110,000	56,500	170,400	109,100	2%	56,700	169,000	108,000	2%
Old River at Mossdale	3	24,300	24,300	24,200	23,800	23,800	23,800	-2%	23,900	24,000	23,800	-1%
Old River at Fabian Tract	4	4,580	4,840	4,140	4,500	4,740	4,020	-2%	4,850	5,100	4,370	6%
Old River at Woodward Island	5	9,280	15,000	1,120	9,720	15,300	402	5%	10,100	17,800	3,790	9%
Old River at Franks Tract	6	1,570	5,250	4,010	1,620	5,250	3,980	3%	1,590	5,130	3,930	1%
Middle River at Woodward Island	7	5,670	10,000	2,180	5,990	10,200	1,630	6%	5,750	11,400	4,210	1%
Grant Line Canal	8	16,000	16,500	14,700	15,700	16,300	14,400	-2%	15,500	16,100	14,200	-3%
Victoria Canal	9	-3,810	-57	5,910	-4,110	-518	6,140	8%	-3,280	1,200	5,780	-14%
Delta Cross Channel	10	0	114	283	0	114	283	NA	0	110	279	NA
Georgiana Slough	11	11,200	11,700	10,800	11,200	11,700	10,800	0%	11,200	11,700	10,800	0%
Sutter/Steamboat Sl. Diversion	12	17,900	18,200	17,400	17,900	18,200	17,400	0%	17,900	18,200	17,400	0%
Miner Slough	13	10,580	11,100	9,760	10,600	11,100	9,760	0%	10,600	11,100	9,750	0%
Sacramento River at Rio Vista	14	185,000	219,000	132,600	185,000	219,000	133,000	0%	185,000	219,000	132,000	0%
Mokelumne River, North Fork	15	5,950	7,690	2,370	5,950	7,680	2,370	0%	5,940	7,620	2,390	0%
Mokelumne River, South Fork	16	2,820	5,800	3,850	2,820	5,800	3,870	0%	2,820	5,700	3,850	0%
Low Inflow/High Pumping Condition												
S.J. River at Fourteen Mile Slough	1	-34	6,030	6,380	-51	6,050	6,370	50%	1,270	7,490	5,060	3629%
San Joaquin River at Antioch	2	-1,550	148,000	155,000	-1,520	147,000	155,000	-2%	-1,500	146,000	154,000	-3%
Old River at Mossdale	3	1,290	1,650	213	1,310	1,610	868	1%	0	88	104	-100%
Old River at Fabian Tract	4	158	763	1,020	160	742	466	1%	-294	158	771	86%
Old River at Woodward Island	5	-4,560	5,890	13,200	-4,530	6,380	14,800	-1%	-5,540	8,210	18,200	21%
Old River at Franks Tract	6	-295	4,480	3,400	-305	4,020	3,980	3%	-385	3,640	4,180	31%
Middle River at Woodward Island	7	-3,150	4,190	9,920	-3,140	4,620	10,800	0%	-3,400	5,600	12,000	8%
Grant Line Canal	8	1,080	3,630	3,810	1,100	3,700	1,580	2%	340	3,590	3,160	-69%
Victoria Canal	9	2,360	5,940	1,050	2,360	6,050	1,160	0%	2,220	6,310	2,090	-6%
Delta Cross Channel	10	3,860	7,760	597	3,870	7,740	755	0%	3,880	7,680	863	0%
Georgiana Slough	11	2,240	3,950	903	2,240	3,940	990	0%	2,250	3,910	1,040	0%
Sutter/Steamboat Sl. Diversion	12	1,880	5,050	3,420	1,880	5,020	3,420	0%	1,880	5,010	3,420	0%
Miner Slough	13	1,110	4,280	3,390	1,110	4,270	3,390	0%	1,110	4,270	3,340	0%
Sacramento River at Rio Vista	14	6,160	91,100	82,700	6,140	91,300	83,000	0%	6,140	91,500	83,400	0%
Mokelumne River, North Fork	15	3,020	4,400	1,400	3,020	4,440	1,370	0%	3,020	4,530	1,270	0%
Mokelumne River, South Fork	16	829	4,790	4,410	836	4,880	4,430	1%	845	4,940	4,500	2%
Low Inflow/Low Pumping Condition												
S.J. River at Fourteen Mile Slough	1	99	5,950	6,340	69	6,070	6,360	-30%	412	6,280	5,850	316%
San Joaquin River at Antioch	2	950	149,000	152,000	680	148,000	152,000	-28%	652	147,000	152,000	-31%
Old River at Mossdale	3	862	1,600	749	892	1,550	452	3%	554	1,400	401	-36%
Old River at Fabian Tract	4	32	993	1,110	49	875	888	53%	113	963	750	253%
Old River at Woodward Island	5	-981	8,470	11,300	-1,330	8,410	11,300	36%	-1,570	9,400	13,300	60%
Old River at Franks Tract	6	25	4,630	4,030	-11	4,300	4,030	-56%	4	4,100	4,200	-84%
Middle River at Woodward Island	7	-848	6,080	8,380	-1,090	6,050	8,390	29%	-1,220	6,490	9,110	44%
Grant Line Canal	8	525	3,920	3,940	509	3,850	4,020	-3%	190	3,560	3,240	-64%
Victoria Canal	9	429	3,210	2,080	624	4,260	2,210	45%	569	4,340	2,490	33%
Delta Cross Channel	10	2,680	6,190	528	2,880	6,400	313	7%	2,870	6,400	213	7%
Georgiana Slough	11	1,630	3,230	443	1,730	3,340	540	6%	1,730	3,340	523	6%
Sutter/Steamboat Sl. Diversion	12	1,130	4,660	4,290	1,230	4,700	4,180	9%	1,230	4,680	4,190	8%
Miner Slough	13	653	4,080	3,830	710	4,110	3,770	9%	710	4,100	3,770	9%
Sacramento River at Rio Vista	14	2,900	87,300	86,500	3,250	87,700	86,300	12%	3,250	87,700	86,300	12%
Mokelumne River, North Fork	15	2,050	3,650	385	2,190	3,820	593	7%	2,190	3,870	541	7%
Mokelumne River, South Fork	16	297	4,460	4,600	351	4,610	4,590	18%	347	4,610	4,520	17%

*Represents the percent difference between the average value of the alternative and the average value of the No Action Alternative.

Note A negative flow or velocity indicates landward direction.

Table 8. Average, Maximum, and Percent Change in Delta Channel Flows, Compared to No Action, at Selected Stations for Three Inflow/Pumping Conditions (Page 1 of 3)

Location		Configuration 2B				Configuration 2D				Configuration 2E			
High Inflow Condition	**Loc. Key**	**Avg.**	**Max. Sea-ward**	**Max. Land-ward**	**% Diff***	**Avg.**	**Max. Sea-ward**	**Max. Land-ward**	**% Diff***	**Avg.**	**Max. Sea-ward**	**Max. Land-ward**	**% Diff***
S.J. River at Fourteen Mile Slough	1	17,700	21,800	11,900	1%	17,700	20,600	13,100	1%	17,600	20,200	13,600	0%
San Joaquin River at Antioch	2	61,500	170,000	101,000	11%	62,300	164,000	94,600	12%	77,600	171,000	72,400	39%
Old River at Mossdale	3	23,900	24,000	23,800	-1%	24,000	24,000	23,900	-1%	24,000	24,100	23,900	-1%
Old River at Fabian Tract	4	4,840	5,080	4,360	5%	4,540	4,780	4,170	-1%	4,530	4,750	4,130	-1%
Old River at Woodward Island	5	10,100	17,400	3,570	9%	8,320	15,400	5,250	-10%	8,390	14,900	5,210	-10%
Old River at Franks Tract	6	1,620	5,060	3,970	3%	1,660	6,380	5,470	5%	1,900	6,460	5,600	21%
Middle River at Woodward Island	7	5,670	11,000	4,140	0%	4,130	9,540	7,230	-27%	3,810	8,940	7,500	-33%
Grant Line Canal	8	15,500	16,000	14,200	-3%	15,700	16,300	14,700	-2%	15,700	16,300	14,700	-2%
Victoria Canal	9	-3,260	1,170	5,630	-14%	-1,310	1,840	2,720	-66%	-1,200	1,990	2,560	-68%
Delta Cross Channel	10	0	46	108	NA	0	23	59	NA	0	172	185	NA
Georgiana Slough	11	10,200	10,600	9,860	-9%	10,100	10,600	9,740	-10%	39,800	47,300	35,300	256%
Sutter/Steamboat Sl. Diversion	12	16,100	16,500	15,600	-10%	16,200	16,500	15,600	-10%	14,060	14,700	13,200	-21%
Miner Slough	13	9,460	10,100	8,560	-11%	9,470	10,100	8,570	-10%	8,050	8,790	6,960	-24%
Sacramento River at Rio Vista	14	177,900	213,000	125,000	-4%	178,000	217,000	125,000	-4%	156,000	192,000	98,300	-16%
Mokelumne River, North Fork	15	7,390	10,500	1,020	24%	7,680	8,890	5,540	29%	2,960	4,150	1,090	-50%
Mokelumne River, South Fork	16	3,010	5,890	2,880	7%	2,690	6,000	3,660	-5%	2,630	8,660	9,830	-7%
Low Inflow/High Pumping Condition													
S.J. River at Fourteen Mile Slough	1	1,270	7,360	5,040	3635%	1,290	6,170	3,940	3691%	1,270	6,200	3,960	3635%
San Joaquin River at Antioch	2	1,310	144,000	151,000	-16%	1,340	138,000	147,000	-14%	712	137,000	147,000	-54%
Old River at Mossdale	3	0	87	103	-100%	0	99	79	-100%	0	97	78	-100%
Old River at Fabian Tract	4	-292	154	738	85%	-11	809	735	-93%	-11	786	698	-93%
Old River at Woodward Island	5	-5,500	7,820	17,700	21%	-4,860	8,040	17,500	6%	-4,840	7,780	17,000	6%
Old River at Franks Tract	6	-370	3,560	4,060	25%	-537	4,730	5,160	82%	-499	4,610	5,000	69%
Middle River at Woodward Island	7	-3,430	5,220	11,500	9%	-2,440	6,420	11,100	-23%	-2,450	6,230	10,700	-22%
Grant Line Canal	8	340	3,460	3,050	-69%	-47	3,080	2,930	-96%	-49	2,990	2,810	-95%
Victoria Canal	9	2,220	6,110	1,990	-6%	1,120	38,000	1,670	-49%	1,200	3,660	1,620	-49%
Delta Cross Channel	10	0	88	130	-100%	0	63	105	-100%	0	194	191	-100%
Georgiana Slough	11	903	3,350	1,640	-60%	781	3,890	2,550	-65%	9,020	26,000	4,650	302%
Sutter/Steamboat Sl. Diversion	12	783	3,850	3,930	-58%	827	3,770	3,960	-56%	1,260	5,220	4,750	-33%
Miner Slough	13	447	3,780	3,810	-60%	476	3,780	3,770	-57%	752	3,900	3,860	-32%
Sacramento River at Rio Vista	14	2,430	90,100	89,400	-61%	2,640	93,800	92,900	-57%	3,250	84,000	84,900	-47%
Mokelumne River, North Fork	15	4,280	8,970	4,730	42%	5,000	6,940	1,780	66%	-41	3,080	3,800	-99%
Mokelumne River, South Fork	16	1,330	5,420	4,120	60%	1,260	6,170	5,110	52%	136	10,300	12,100	-84%
Low Inflow/Low Pumping Condition													
S.J. River at Fourteen Mile Slough	1	394	6,090	5,670	298%	127	4,930	5,180	28%	122	4,930	5,090	23%
San Joaquin River at Antioch	2	986	145,000	151,000	4%	1,320	138,000	146,000	39%	2,240	139,000	146,000	135%
Old River at Mossdale	3	573	1,390	315	-34%	846	1,580	490	-2%	843	1,560	418	-2%
Old River at Fabian Tract	4	115	942	696	259%	40	746	714	25%	39	731	699	22%
Old River at Woodward Island	5	-1,560	9,150	12,600	59%	-1,120	9,580	13,800	14%	-1,120	9,260	13,400	14%
Old River at Franks Tract	6	-10	4,040	4,200	-60%	-126	5,110	5,050	404%	-93	4,990	5,000	272%
Middle River at Woodward Island	7	-1,200	6,310	8,520	41%	-821	8,170	9,430	-3%	-851	7,830	9,070	0%
Grant Line Canal	8	203	3,440	3,000	-61%	480	3,020	3,020	-9%	474	2,940	2,940	-10%
Victoria Canal	9	564	4,100	2,480	31%	269	2,840	2,100	-37%	282	2,730	2,010	-34%
Delta Cross Channel	10	996	7,680	5,010	-63%	1,610	7,960	3,600	-40%	1,350	5,790	2,750	-50%
Georgiana Slough	11	1,710	3,160	99	5%	1,350	3,340	1,070	-18%	5,270	18,900	5,390	222%
Sutter/Steamboat Sl. Diversion	12	1,020	4,440	4,500	-10%	995	4,220	4,500	-12%	700	5,040	5,330	-38%
Miner Slough	13	589	3,880	3,890	-10%	576	3,720	3,850	-12%	408	3,760	4,150	-38%
Sacramento River at Rio Vista	14	2,830	85,500	85,600	-2%	2,660	89,700	89,700	-8%	1,240	80,100	86,300	-57%
Mokelumne River, North Fork	15	1,580	6,410	5,410	-23%	2,260	3,640	548	10%	375	2,380	2,200	-82%
Mokelumne River, South Fork	16	272	4,430	5,430	-8%	448	5,780	5,600	51%	1	10,400	12,100	-100%

*Represents the percent difference between the average value of the alternative and the average value of the No Action Alternative

Note A negative flow or velocity indicates landward direction

Table 8. **Average, Maximum, and Percent Change in Delta Channel Flows, Compared to No Action, at Selected Stations for Three Inflow/Pumping Conditions (Page 2 of 3)**

Location		Configuration 3E			
High Inflow Condition	**Loc. Key**	**Avg.**	**Max. Sea-ward**	**Max. Land ward**	**% Diff***
S.J. River at Fourteen Mile Slough	1	17,700	21,500	12,000	1%
San Joaquin River at Antioch	2	60,700	172,000	103,000	9%
Old River at Mossdale	3	23,900	24,000	23,900	-1%
Old River at Fabian Tract	4	4,620	4,900	4,300	1%
Old River at Woodward Island	5	13,500	18,000	5,130	46%
Old River at Franks Tract	6	2,000	4,900	3,600	25%
Middle River at Woodward Island	7	8,930	12,300	3,060	58%
Grant Line Canal	8	15,700	16,300	14,800	-2%
Victoria Canal	9	-6,530	-3,230	7,520	71%
Delta Cross Channel	10	0	121	301	NA
Georgiana Slough	11	10,300	10,800	9,920	-8%
Sutter/Steamboat Sl. Diversion	12	16,400	16,700	15,900	-9%
Miner Slough	13	9,600	10,200	8,710	-9%
Sacramento River at Rio Vista	14	179,000	213,000	126,000	-3%
Mokelumne River, North Fork	15	3,960	6,570	2,080	-33%
Mokelumne River, South Fork	16	1,740	5,030	4,970	-38%
Low Inflow/High Pumping Condition					
S.J. River at Fourteen Mile Slough	1	1,270	6,830	4,760	3629%
San Joaquin River at Antioch	2	912	147,000	152,000	-41%
Old River at Mossdale	3	0	114	134	-100%
Old River at Fabian Tract	4	-17	969	1,020	-89%
Old River at Woodward Island	5	-650	9,350	11,300	-86%
Old River at Franks Tract	6	62	4,070	3,870	-79%
Middle River at Woodward Island	7	-582	6,680	8,090	-82%
Grant Line Canal	8	-54	3,520	4,050	-95%
Victoria Canal	9	383	4,630	2,500	-84%
Delta Cross Channel	10	0	243	233	-100%
Georgiana Slough	11	1,360	3,740	989	-39%
Sutter/Steamboat Sl. Diversion	12	936	4,050	3,830	-50%
Miner Slough	13	539	3,860	3,730	-52%
Sacramento River at Rio Vista	14	2,970	90,300	88,400	-52%
Mokelumne River, North Fork	15	13	4,620	5,000	-100%
Mokelumne River, South Fork	16	-26	5,000	4,820	-97%
Low Inflow/Low Pumping Condition					
S.J. River at Fourteen Mile Slough	1	131	5,760	6,180	32%
San Joaquin River at Antioch	2	1,220	148,000	152,000	28%
Old River at Mossdale	3	830	1,540	528	-4%
Old River at Fabian Tract	4	31	917	910	-3%
Old River at Woodward Island	5	-686	9,070	11,600	-30%
Old River at Franks Tract	6	27	4,080	3,910	8%
Middle River at Woodward Island	7	-632	6,490	8,380	-25%
Grant Line Canal	8	443	3,670	3,910	-16%
Victoria Canal	9	277	4,630	2,430	-35%
Delta Cross Channel	10	2,470	6,590	1,840	-8%
Georgiana Slough	11	1,640	3,250	493	0%
Sutter/Steamboat Sl. Diversion	12	1,030	4,590	4,330	-9%
Miner Slough	13	590	4,050	3,870	-10%
Sacramento River at Rio Vista	14	2,530	86,900	87,400	-13%
Mokelumne River, North Fork	15	1,040	4,070	2,370	-50%
Mokelumne River, South Fork	16	309	4,950	4,590	4%

*Represents the percent difference between the average value of the alternative and the average value of the No Action Alternative

Note A negative flow or velocity indicates landward direction.

Table 8. Average, Maximum, and Percent Change in Delta Channel Flows, Compared to No Action, at Selected Stations for Three Inflow/Pumping Conditions (Page 3 of 3)

Existing Condition

Percentile	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
90%	101435	129528	94956	70993	45099	19074	8002	5188	10961	14585	16043	66313
80%	73361	73542	62068	48266	26581	12476	8002	4850	5885	9673	11102	38268
70%	33145	57506	41309	26153	21081	10688	8002	4577	3576	5656	8934	15847
60%	26682	49020	34371	21316	15951	10339	8002	4079	3008	5465	7156	9758
50%	18508	29712	27209	18705	12360	9596	6505	4001	3008	4716	4672	7888
40%	12959	24425	21760	14436	11193	9078	6505	4001	3008	4001	4504	6609
30%	10880	19874	16234	11340	9680	8430	4993	3497	3008	4001	4504	5058
20%	6779	12533	12442	10033	7416	7993	4993	3497	3008	4001	4504	4505
10%	6001	11405	10363	8541	6333	6890	4001	2992	3008	4001	3496	4505

No Action Alternative

Percentile	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
90%	96075	121831	90369	71504	47340	22200	8002	5113	9821	12246	17316	64091
80%	71575	70022	60630	46824	26919	12507	8002	4817	4077	9410	10181	37881
70%	31200	56018	39354	27094	21120	10893	8002	4551	3570	5832	7821	16179
60%	22727	44227	32146	21578	16179	10393	8002	4316	3008	5452	6305	9582
50%	18378	30162	25078	18839	12133	9579	6505	4001	3008	4619	4790	7270
40%	11482	24310	21887	14103	10984	7663	6505	4001	3008	4027	4504	6359
30%	9374	18717	16426	11677	9647	6890	4993	3497	3008	4001	4504	5006
20%	7052	12238	12308	10087	7478	6443	4993	3497	3008	4001	4504	4505
10%	6001	11423	10197	8692	6343	6053	4001	2992	3008	4001	3496	4505

Differences Between No Action and Existing Condition

Percentile	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
90%	-5360	-7697	-4586	511	2241	3126	0	-75	-1139	-2339	1274	-2222
80%	-1786	-3521	-1438	-1442	338	30	0	-33	-1808	-263	-921	-387
70%	-1945	-1488	-1955	941	39	205	0	-26	-7	176	-1113	332
60%	-3955	-4793	-2225	262	228	54	0	237	0	-13	-850	-176
50%	-130	450	-2131	134	-228	-17	0	0	0	-98	118	-618
40%	-1477	-115	127	-333	-208	-1415	0	0	0	26	0	-250
30%	-1506	-1157	192	336	-33	-1539	0	0	0	0	0	-52
20%	273	-295	-133	54	62	-1549	0	0	0	0	0	0
10%	0	18	-166	151	10	-837	0	0	0	0	0	0

Table 9. **Net Delta Outflow (cfs): Differences Between No Action Alternatives and Existing Conditions**

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Water Year	Shasta Inflow (TAF)	Total Inflow (TAF)	Trinity Export (TAF)	Required Instream (TAF)	Total Divert (TAF)	Total Use (TAF)	Direct Use (TAF)	Storage Increases (TAF)	Storage Releases (TAF)	Carryover Storage (TAF)	Carryover Used (TAF)	Fraction of Inflow to Storage (%)	Fraction of Uses from Storage (%)	Fraction of Runoff Used (%)
										2,605				
22	4,548	8,721	1,119	3,615	3,210	6,885	5,338	1,970	1,136	3,421	0	23	22	79
23	3,635	7,270	652	2,896	2,969	6,613	5,086	501	1,689	2,233	1,188	7	23	91
24	2,439	4,243	441	2,896	2,375	5,390	3,621	248	1,525	956	1,277	6	33	127
25	5,035	10,676	484	2,352	2,984	5,500	4,466	2,904	1,243	2,617	0	27	19	52
26	3,711	7,518	599	2,896	3,047	6,274	4,477	1,253	1,817	2,053	564	17	29	83
27	6,917	14,945	862	3,615	3,518	7,193	5,608	2,712	1,318	3,447	0	18	22	48
28	5,105	10,472	944	3,615	3,228	7,114	5,190	1,313	2,006	2,754	693	13	27	68
29	3,176	5,524	570	2,896	2,425	5,756	4,356	353	1,299	1,808	946	6	24	104
30	4,147	7,954	456	2,531	2,564	5,244	4,015	1,955	1,373	2,390	0	25	23	66
31	2,536	4,260	441	2,896	2,164	5,179	3,665	304	1,344	1,350	1,040	7	29	122
32	3,624	6,670	342	2,531	3,209	5,889	4,739	1,174	920	1,604	0	18	20	88
33	3,452	5,902	354	2,531	2,853	5,533	4,448	877	932	1,549	55	15	20	94
34	3,318	5,965	441	2,531	2,227	4,907	3,674	1,130	1,373	1,306	243	19	25	82
35	4,840	10,020	414	2,531	3,111	5,791	4,591	2,496	1,230	2,572	0	25	21	58
36	4,605	9,205	441	2,896	3,412	6,531	4,880	1,790	1,552	2,810	0	19	25	71
37	4,117	7,945	483	2,896	3,105	6,540	4,817	1,498	1,721	2,587	223	19	26	82
38	9,511	21,047	1,056	3,615	3,228	6,903	5,867	2,271	1,158	3,700	0	11	15	33
39	3,470	5,540	883	2,896	3,003	6,647	4,673	526	2,466	1,760	1,940	9	30	120
40	6,998	14,041	846	2,531	3,663	6,343	4,869	2,875	1,415	3,220	0	20	23	45
41	8,701	21,529	1,569	3,615	3,714	7,600	6,407	1,412	932	3,700	0	7	16	35
42	7,603	15,773	1,622	3,615	3,240	7,126	5,997	1,334	1,334	3,700	0	8	16	45
43	5,873	12,192	1,028	3,615	4,003	7,889	6,416	1,334	1,468	3,566	134	11	19	65
44	3,670	6,573	741	2,896	3,292	6,936	5,176	612	1,927	2,251	1,315	9	25	106
45	4,837	8,909	640	2,896	4,031	7,046	5,561	2,306	1,343	3,214	0	26	21	79
46	5,893	11,254	779	2,896	4,169	7,813	6,316	1,218	1,295	3,137	77	11	19	69
47	3,904	6,784	696	2,896	3,253	6,897	5,048	835	1,811	2,161	976	12	27	102
48	5,403	9,645	596	2,896	2,885	5,900	4,823	2,428	1,017	3,572	0	25	18	61
49	4,324	8,146	695	2,896	3,272	6,916	5,330	1,368	2,084	2,856	716	17	23	85
50	4,126	7,534	702	2,896	3,300	6,735	4,928	1,374	1,631	2,599	257	18	27	89
51	6,314	12,004	937	3,615	3,835	7,510	5,844	1,958	1,413	3,144	0	16	22	63
52	7,779	16,051	1,037	3,615	3,778	7,664	6,720	1,479	923	3,700	0	9	12	48
53	6,544	13,601	1,236	3,615	3,582	7,468	6,446	1,334	1,334	3,700	0	10	14	55
54	6,558	12,400	1,300	3,615	3,408	7,294	5,999	1,328	1,518	3,510	190	11	18	59
55	4,111	7,980	853	2,896	3,663	7,307	5,863	923	1,854	2,579	931	12	20	92

Table 10. Annual Water Allocation for Sacramento River for No Action Alternative (Page 1 of 3)

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Water Year	Shasta Inflow (TAF)	Total Inflow (TAF)	Trinity Export (TAF)	Required Instream (TAF)	Total Divert (TAF)	Total Use (TAF)	Direct Use (TAF)	Storage Increases (TAF)	Storage Releases (TAF)	Carryover Storage (TAF)	Carryover Used (TAF)	Fraction of Inflow to Storage (%)	Fraction of Uses from Storage (%)	Fraction of Runoff Used (%)
56	8,821	18,293	1,117	3,615	3,888	7,563	6,493	2,053	932	3,700	0	11	14	41
57	5,371	9,149	1,028	3,615	3,321	7,207	5,903	1,352	1,495	3,557	143	15	18	79
58	9,696	21,730	1,764	3,615	3,069	6,955	6,234	2,470	2,327	3,700	0	11	10	32
59	5,098	9,027	1,097	2,896	3,670	7,314	5,923	938	1,908	2,730	970	10	19	81
60	4,728	8,520	886	2,896	3,335	6,666	5,223	1,954	1,658	3,026	0	23	22	78
61	5,070	9,512	870	2,896	3,510	7,154	5,744	1,621	1,784	2,863	163	17	20	75
62	5,255	9,944	725	2,896	3,512	6,947	5,485	1,738	1,515	3,086	0	17	21	70
63	7,003	13,099	960	3,615	3,500	7,386	6,185	1,696	1,082	3,700	0	13	16	56
64	3,903	6,776	853	2,896	3,410	7,054	5,211	578	1,990	2,288	1,412	9	26	104
65	6,976	14,572	937	3,615	3,082	6,757	5,475	2,277	963	3,602	0	16	19	46
66	5,319	9,544	1,028	2,896	3,363	7,007	5,551	1,334	1,763	3,173	429	14	21	73
67	7,385	14,234	1,108	3,615	3,150	7,036	5,933	1,571	1,044	3,700	0	11	16	49
68	4,776	9,409	1,059	2,896	3,369	7,013	5,729	1,086	1,585	3,201	499	12	18	75
69	7,666	16,811	1,162	3,615	3,490	7,376	6,510	1,454	955	3,700	0	9	12	44
70	7,904	15,644	1,489	3,615	3,894	7,780	5,957	1,015	1,623	3,092	608	6	23	50
71	7,316	13,907	1,216	3,615	3,371	7,257	6,418	1,535	927	3,700	0	11	12	52
72	5,076	8,423	1,028	2,896	3,453	7,097	5,920	1,334	1,796	3,238	462	16	17	84
73	6,162	13,819	1,028	3,615	3,425	7,311	6,064	1,345	1,113	3,470	0	10	17	53
74	10,782	21,185	2,119	3,615	3,379	7,265	6,606	1,565	1,335	3,700	0	7	9	34
75	6,391	12,808	1,277	3,615	3,383	7,269	6,513	1,503	1,503	3,700	0	12	10	57
76	3,597	6,376	914	2,896	3,152	6,796	5,662	403	1,836	2,267	1,433	6	17	107
77	2,625	4,174	510	2,896	2,185	5,200	3,967	45	1,490	822	1,445	1	24	125
78	7,827	16,632	785	2,352	3,373	5,889	5,169	3,871	993	3,700	0	23	12	35
79	4,025	8,199	823	2,896	3,488	7,132	5,547	1,239	1,800	3,139	561	15	22	87
80	6,418	13,901	945	3,615	3,213	7,099	5,907	1,587	1,087	3,639	0	11	17	51
81	4,099	8,471	876	2,896	3,141	6,785	5,142	1,259	2,041	2,857	782	15	24	80
82	9,014	18,282	1,014	3,615	3,311	6,988	6,276	1,878	1,035	3,700	0	10	10	38
83	10,797	25,102	1,867	3,615	3,408	7,294	6,881	1,419	1,419	3,700	0	6	6	29
84	6,668	13,947	1,604	3,615	3,485	7,371	6,423	1,334	1,334	3,700	0	10	13	53
85	3,972	7,616	914	2,896	3,550	7,194	5,683	637	2,005	2,332	1,368	8	21	94
86	7,548	15,232	931	3,615	3,209	6,884	5,506	1,734	1,098	2,968	0	11	20	45
87	3,945	7,315	824	2,896	3,192	6,733	5,058	1,017	2,107	1,878	1,090	14	25	92
88	3,933	7,471	725	2,531	2,855	5,535	4,449	1,362	1,582	1,658	220	18	20	74
89	4,757	8,869	596	2,531	2,704	5,384	4,360	2,570	1,326	2,902	0	29	19	61
90	3,618	6,550	539	2,896	2,911	6,452	5,184	504	1,438	1,968	934	8	20	99

Table 10. Annual Water Allocation for Sacramento River for No Action Alternative (Page 2 of 3)

C-008827

C-008828

Water Year	Shasta Inflow (TAF)	Total Inflow (TAF)	Trinity Export (TAF)	Required Instream (TAF)	Total Divert (TAF)	Total Use (TAF)	Direct Use (TAF)	Storage Increases (TAF)	Storage Releases (TAF)	Carryover Storage (TAF)	Carryover Used (TAF)	Fraction of Inflow to Storage (%)	Fraction of Uses from Storage (%)	Fraction of Runoff Used (%)
91	3,055	5,981	441	2,896	2,910	5,925	4,475	711	1,107	1.572	396	12	24	99
92	3,591	7,158	441	2,531	2,607	5,287	4,047	1,536	1,298	1,810	0	21	23	74
93	6,824	16,161	666	2,531	3,618	6,298	5,542	2,886	824	3.872	0	18	12	39
94	3,093	6,179	720	2,896	2,659	6,303	4,853	339	2,173	2,038	1,834	5	23	102
Minimum:	2,439	4,174	342	2,352	2,164	4,907	3,621	45	824	822	0	1	6	29
Average:	5,492	10,936	892	3,107	3,250	6,716	5,404	1,454	1,462	2,863	377	13	20	61
Maximum:	10,797	25,102	2,119	3,615	4,169	7,889	6,881	3,871	2,466	3,872	1,940	29	33	127

NOTE:

TAF = Thousand acre-feet

Table 10. Annual Water Allocation for Sacramento River for No Action Alternative (Page 3 of 3)

C-008829

Water Year	Total Runoff (TAF)	Release Flow (TAF)	Required Instream (TAF)	Total Diversions (TAF)	Total Use (TAF)	Direct Use (TAF)	Storage Increase (TAF)	Storage Release (TAF)	Carryover Storage (TAF)	Carryover Used (TAF)	Inflow to Storage (%)	Use from Storage (%)	Runoff Used (%)
22	3,367	2,960	2,176	401	2,577	2,261	582	479	650	0	17	12	77
23	2,912	2,672	1,812	401	2,213	1,876	518	580	588	62	18	15	76
24	907	1,061	910	353	1,263	836	33	435	186	402	4	34	139
25	2,545	1,988	1,168	389	1,557	1,296	886	622	450	0	35	17	61
26	1,554	1,422	1,135	401	1,536	1,088	496	660	286	164	32	29	99
27	3,762	3,090	1,633	401	2,034	1,821	689	325	650	0	18	10	54
28	2,708	2,595	1,638	401	2,039	1,639	284	469	465	185	10	20	75
29	1,303	1,251	999	353	1,352	1,060	219	422	262	203	17	22	104
30	1,730	1,441	1,066	389	1,455	1,175	562	562	262	0	32	19	84
31	1,049	916	531	283	814	810	148	211	199	63	14	0	78
32	2,388	2,025	1,037	320	1,357	1,357	663	536	326	0	28	0	57
33	1,402	1,211	739	341	1,080	1,009	235	288	273	53	17	7	77
34	1,324	1,228	559	341	900	771	392	539	126	147	30	14	68
35	2,577	1,884	1,302	389	1,691	1,535	726	329	523	0	28	9	66
36	3,495	3,061	1,918	401	2,319	2,004	610	483	650	0	17	14	66
37	2,493	2,223	1,841	401	2,242	1,646	685	721	614	36	27	27	90
38	4,631	4,289	2,267	401	2,668	2,447	483	447	650	0	10	8	58
39	1,289	1,444	1,191	401	1,592	1,105	185	628	207	443	14	31	124
40	3,454	2,769	1,216	401	1,617	1,329	743	364	586	0	22	18	47
41	3,277	2,909	1,948	401	2,349	1,972	478	414	650	0	15	16	72
42	4,048	3,743	2,221	401	2,622	2,385	434	434	650	0	11	9	65
43	4,056	3,750	1,978	401	2,379	2,072	346	346	650	0	9	13	59
44	1,632	1,690	1,487	401	1,888	1,430	219	571	298	352	13	24	116
45	2,643	2,009	1,360	401	1,761	1,471	700	374	624	0	26	16	67
46	2,979	2,699	1,811	401	2,212	1,812	435	459	600	24	15	18	74
47	1,569	1,673	1,294	401	1,695	1,271	298	699	199	401	19	25	108
48	2,321	1,563	1,317	401	1,718	1,472	765	314	650	0	33	14	74
49	1,993	1,868	1,678	401	2,079	1,475	523	695	478	172	26	29	104
50	2,775	2,294	1,765	401	2,166	1,794	667	495	650	0	24	17	78
51	4,806	4,511	1,841	401	2,242	1,855	670	682	638	12	14	17	47
52	5,063	4,745	2,267	401	2,668	2,532	400	388	650	0	8	5	53
53	2,847	2,543	1,993	401	2,394	2,180	392	392	650	0	14	9	84
54	2,175	2,007	1,639	401	2,040	1,598	310	440	520	130	14	22	94
55	1,679	1,516	1,387	401	1,788	1,438	288	422	386	134	17	20	106
56	4,684	4,111	1,904	401	2,305	2,108	878	614	650	0	19	9	49

Table 11. No Action Alternative Feather River Water Allocation (Page 1 of 3)

C-008829

C-008830

Water Year	Total Runoff (TAF)	Release Flow (TAF)	Required Instream (TAF)	Total Diversions (TAF)	Total Use (TAF)	Direct Use (TAF)	Storage Increase (TAF)	Storage Release (TAF)	Carryover Storage (TAF)	Carryover Used (TAF)	Inflow to Storage (%)	Use from Storage (%)	Runoff Used (%)
57	2,326	2,032	1,767	401	2,168	1,701	470	479	641	9	20	22	93
58	4,181	3,867	2,267	401	2,668	2,418	450	441	650	0	11	9	64
59	1,412	1,449	1,296	401	1,697	1,204	212	540	322	328	15	29	120
60	1,765	1,386	1,144	401	1,545	1,134	592	514	400	0	34	27	88
61	1,210	1,026	901	401	1,302	978	256	365	291	109	21	25	108
62	2,063	1,525	1,197	401	1,598	1,336	568	335	524	0	28	16	77
63	3,674	3,239	1,947	401	2,348	2,035	636	510	650	0	17	13	64
64	1,756	1,864	1,487	401	1,888	1,516	140	541	249	401	8	20	108
65	4,583	3,872	1,394	401	1,795	1,586	713	312	650	0	16	12	39
66	1,567	1,531	1,425	401	1,826	1,328	262	521	391	259	17	27	117
67	3,981	3,414	2,042	401	2,443	2,306	643	384	650	0	16	6	61
68	1,851	1,831	1,425	401	1,826	1,380	170	445	375	275	9	24	99
69	4,478	3,895	2,026	401	2,427	2,258	634	359	650	0	14	7	54
70	3,447	3,307	1,608	401	2,009	1,749	367	523	494	156	11	13	58
71	3,073	2,608	1,795	401	2,196	1,945	550	394	650	0	18	11	71
72	2,008	1,914	1,608	401	2,009	1,620	273	476	447	203	14	19	100
73	3,122	2,676	1,660	401	2,061	1,649	571	432	586	0	18	20	66
74	4,452	4,081	2,101	401	2,502	2,302	534	470	650	0	12	8	56
75	2,756	2,450	2,067	401	2,468	2,121	496	496	650	0	18	14	90
76	1,156	1,369	1,160	340	1,500	1,103	68	509	209	441	6	26	130
77	453	411	313	265	578	408	26	154	81	128	6	29	128
78	2,976	2,127	1,347	368	1,715	1,482	899	330	650	0	30	14	58
79	2,214	1,980	1,723	401	2,124	1,597	537	604	583	67	24	25	96
80	3,963	3,590	1,841	401	2,242	1,923	578	511	650	0	15	14	57
81	1,351	1,386	1,281	401	1,682	1,189	180	508	322	328	13	29	125
82	6,087	5,450	1,893	401	2,294	2,194	906	578	650	0	15	4	38
83	6,479	6,173	2,267	401	2,668	2,644	508	508	650	0	8	1	41
84	4,174	3,867	1,811	401	2,212	1,952	642	642	650	0	15	12	53
85	1,768	1,876	1,456	401	1,857	1,424	288	691	247	403	16	23	105
86	4,651	3,939	1,394	401	1,795	1,532	915	512	650	0	20	15	39
87	1,153	1,329	1,130	401	1,531	1,033	128	592	186	464	11	33	133
88	1,286	842	606	401	1,007	700	535	376	345	0	42	30	78
89	2,339	1,915	1,234	401	1,635	1,383	593	473	465	0	25	15	70
90	1,308	1,269	999	353	1,352	1,081	194	410	249	216	15	20	103
91	1,444	960	825	328	1,153	971	456	228	477	0	32	16	80
92	1,026	1,147	910	341	1,251	775	252	618	111	366	25	38	122

Table 11. No Action Alternative Feather River Water Allocation (Page 2 of 3)

C-008830

Water Year	Total Runoff (TAF)	Release Flow (TAF)	Required Instream (TAF)	Total Diversions (TAF)	Total Use (TAF)	Direct Use (TAF)	Storage Increase (TAF)	Storage Release (TAF)	Carryover Storage (TAF)	Carryover Used (TAF)	Inflow to Storage (%)	Use from Storage (%)	Runoff Used (%)
93	3,273	2,454	1,515	366	1,881	1,692	874	335	650	0	27	10	57
94	1,040	1,261	1,086	348	1,434	978	74	546	178	472	7	32	138
Minimum:	453	411	313	265	578	408	26	154	81	0	4	0	38
Average:	2,675	2,390	1,493	388	1,881	1,569	468	473	477	104	17	17	70
Maximum:	6,479	6,173	2,267	401	2,668	2,644	915	721	650	472	42	38	139

NOTE:

TAF = Thousand acre-feet.

Table 11. No Action Alternative Feather River Water Allocation (Page 3 of 3)

C-008831

C-008831

C-008832

Water Year	Total Runoff (TAF)	Release Flow (TAF)	Required Instream (TAF)	Total Diversions (TAF)	Total Use (TAF)	Direct Use (TAF)	Storage Increase (TAF)	Storage Release (TAF)	Carryover Storage (TAF)	Carryover Used (TAF)	Inflow to Storage (%)	Use from Storage (%)	Runoff Used (%)
									547				
22	3,367	2,960	2,176	401	2,577	2,261	582	479	650	0	17	12	77
23	2,912	2,672	1,812	401	2,213	1,876	518	580	588	62	18	15	76
24	907	1,061	910	353	1,263	836	33	435	186	402	4	34	139
25	2,545	1,988	1,168	389	1,557	1,296	886	622	450	0	35	17	61
26	1,554	1,422	1,135	401	1,536	1,088	496	660	286	164	32	29	99
27	3,762	3,090	1,633	401	2,034	1,821	689	325	650	0	18	10	54
28	2,708	2,595	1,638	401	2,039	1,639	284	469	465	185	10	20	75
29	1,303	1,251	999	353	1,352	1,060	219	422	262	203	17	22	104
30	1,730	1,441	1,066	389	1,455	1,175	562	562	262	0	32	19	84
31	1,049	916	531	283	814	810	148	211	199	63	14	0	78
32	2,388	2,025	1,037	320	1,357	1,357	663	536	326	0	28	0	57
33	1,402	1,211	739	341	1,080	1,009	235	288	273	53	17	7	77
34	1,324	1,228	559	341	900	771	392	539	126	147	30	14	68
35	2,577	1,884	1,302	389	1,691	1,535	726	329	523	0	28	9	66
36	3,495	3,061	1,918	401	2,319	2,004	610	483	650	0	17	14	66
37	2,493	2,223	1,841	401	2,242	1,646	685	721	614	36	27	27	90
38	4,631	4,289	2,267	401	2,668	2,447	483	447	650	0	10	8	58
39	1,289	1,444	1,191	401	1,592	1,105	185	628	207	443	14	31	124
40	3,454	2,769	1,216	401	1,617	1,329	743	364	586	0	22	18	47
41	3,277	2,909	1,948	401	2,349	1,972	478	414	650	0	15	16	72
42	4,048	3,743	2,221	401	2,622	2,385	434	434	650	0	11	9	65
43	4,056	3,750	1,978	401	2,379	2,072	346	346	650	0	9	13	59
44	1,632	1,690	1,487	401	1,888	1,430	219	571	298	352	13	24	116
45	2,643	2,009	1,360	401	1,761	1,471	700	374	624	0	26	16	67
46	2,979	2,699	1,811	401	2,212	1,812	435	459	600	24	15	18	74
47	1,569	1,673	1,294	401	1,695	1,271	298	699	199	401	19	25	108
48	2,321	1,563	1,317	401	1,718	1,472	765	314	650	0	33	14	74
49	1,993	1,868	1,678	401	2,079	1,475	523	695	478	172	26	29	104
50	2,775	2,294	1,765	401	2,166	1,794	667	495	650	0	24	17	78
51	4,806	4,511	1,841	401	2,242	1,855	670	682	638	12	14	17	47
52	5,063	4,745	2,267	401	2,668	2,532	400	388	650	0	8	5	53
53	2,847	2,543	1,993	401	2,394	2,180	392	392	650	0	14	9	84
54	2,175	2,007	1,639	401	2,040	1,598	310	440	520	130	14	22	94
55	1,679	1,516	1,387	401	1,788	1,438	288	422	386	134	17	20	106
56	4,684	4,111	1,904	401	2,305	2,108	878	614	650	0	19	9	49

Table 12. No Action Alternative American River Water Allocation (Page 1 of 3)

C—008832

C-008833

Water Year	Total Runoff (TAF)	Release Flow (TAF)	Required Instream (TAF)	Total Diversions (TAF)	Total Use (TAF)	Direct Use (TAF)	Storage Increase (TAF)	Storage Release (TAF)	Carryover Storage (TAF)	Carryover Used (TAF)	Inflow to Storage (%)	Use from Storage (%)	Runoff Used (%)
57	2,326	2,032	1.767	401	2,168	1,701	470	479	641	9	20	22	93
58	4,181	3,867	2,267	401	2,668	2,418	450	441	650	0	11	9	64
59	1,412	1,449	1,296	401	1,697	1,204	212	540	322	328	15	29	120
60	1,765	1,386	1,144	401	1,545	1,134	592	514	400	0	34	27	88
61	1,210	1,026	901	401	1,302	978	256	365	291	109	21	25	108
62	2,063	1,525	1,197	401	1,598	1,336	568	335	524	0	28	16	77
63	3,674	3,239	1,947	401	2,348	2,035	636	510	650	0	17	13	64
64	1,756	1,864	1,487	401	1,888	1,516	140	541	249	401	8	20	108
65	4,583	3,872	1,394	401	1,795	1,586	713	312	650	0	16	12	39
66	1,567	1,531	1,425	401	1,826	1,328	262	521	391	259	17	27	117
67	3,981	3,414	2,042	401	2,443	2,306	643	384	650	0	16	6	61
68	1,851	1,831	1,425	401	1,826	1,380	170	445	375	275	9	24	99
69	4,478	3,895	2,026	401	2,427	2,258	634	359	650	0	14	7	54
70	3,447	3,307	1,608	401	2,009	1,749	367	523	494	156	11	13	58
71	3,073	2,608	1,795	401	2,196	1,945	550	394	650	0	18	11	71
72	2,008	1,914	1,608	401	2,009	1,620	273	476	447	203	14	19	100
73	3,122	2,676	1,660	401	2,061	1,649	571	432	586	0	18	20	66
74	4,452	4,081	2,101	401	2,502	2,302	534	470	650	0	12	8	56
75	2,756	2,450	2,067	401	2,468	2,121	496	496	650	0	18	14	90
76	1,156	1,369	1,160	340	1,500	1,103	68	509	209	441	6	26	130
77	453	411	313	265	578	408	26	154	81	128	6	29	128
78	2,976	2,127	1,347	368	1,715	1,482	899	330	650	0	30	14	58
79	2,214	1,980	1,723	401	2,124	1,597	537	604	583	67	24	25	96
80	3,963	3,590	1,841	401	2,242	1,923	578	511	650	0	15	14	57
81	1,351	1,386	1,281	401	1,682	1,189	180	508	322	328	13	29	125
82	6,087	5,450	1,893	401	2,294	2,194	906	578	650	0	15	4	38
83	6,479	6,173	2,267	401	2,668	2,644	508	508	650	0	8	1	41
84	4,174	3,867	1,811	401	2,212	1,952	642	642	650	0	15	12	53
85	1,768	1,876	1,456	401	1,857	1,424	288	691	247	403	16	23	105
86	4,651	3,939	1,394	401	1,795	1,532	915	512	650	0	20	15	39
87	1,153	1,329	1,130	401	1,531	1,033	128	592	186	464	11	33	133
88	1,286	842	606	401	1,007	700	535	376	345	0	42	30	78
89	2,339	1,915	1,234	401	1,635	1,383	593	473	465	0	25	15	70
90	1,308	1,269	999	353	1,352	1,081	194	410	249	216	15	20	103
91	1,444	960	825	328	1,153	971	456	228	477	0	32	16	80
92	1,026	1,147	910	341	1,251	775	252	618	111	366	25	38	122

Table 12. No Action Alternative American River Water Allocation (Page 2 of 3)

C—008833

C-008834

Water Year	Total Runoff (TAF)	Release Flow (TAF)	Required Instream (TAF)	Total Diversions (TAF)	Total Use (TAF)	Direct Use (TAF)	Storage Increase (TAF)	Storage Release (TAF)	Carryover Storage (TAF)	Carryover Used (TAF)	Inflow to Storage (%)	Use from Storage (%)	Runoff Used (%)
93	3,273	2,454	1,515	366	1,881	1,692	874	335	650	0	27	10	57
94	1,040	1,261	1,086	348	1,434	978	74	546	178	472	7	32	138
Minimum:	453	411	313	265	578	408	26	154	81	0	4	0	38
Average:	2,675	2,390	1,493	388	1,881	1,569	468	473	477	104	17	17	70
Maximum:	6,479	6,173	2,267	401	2,668	2,644	915	721	650	472	42	38	139

NOTE:

TAF = Thousand acre-feet.

Table 12. No Action Alternative American River Water Allocation (Page 3 of 3)

C-008834

C-008835

Water Year	Total Runoff (TAF)	Downstream Flow (TAF)	Fish Flow Required (TAF)	Total Diversions (TAF)	Total Use (TAF)	Direct Use (TAF)	Storage Increase (TAF)	Storage Release (TAF)	Carryover Storage (TAF)	Carryover Used (TAF)	Inflow to Storage (%)	Use from Storage (%)	Runoff Used (%)
									999				
22	1,581	438	154	803	957	746	639	320	1,318	0	40	22	61
23	1,291	464	154	808	962	749	316	319	1,315	3	24	22	75
24	536	360	154	526	680	399	102	467	950	365	19	41	127
25	1,268	367	154	648	802	664	463	229	1,184	0	37	17	63
26	779	423	154	654	808	532	160	471	873	311	21	34	104
27	1,436	434	154	654	808	659	559	231	1,201	0	39	18	56
28	1,126	428	154	654	808	572	401	378	1,224	0	36	29	72
29	661	347	154	595	749	519	100	395	929	295	15	31	113
30	827	334	154	651	805	602	171	342	758	171	21	25	97
31	585	321	154	552	706	441	106	405	459	299	18	38	121
32	1,326	303	154	649	803	675	573	214	818	0	43	16	61
33	740	330	154	646	800	583	102	347	573	245	14	27	108
34	655	324	154	589	743	439	175	441	307	266	27	41	113
35	1,256	285	154	651	805	643	547	238	616	0	44	20	64
36	1,495	345	154	654	808	648	718	240	1,094	0	48	20	54
37	1,275	296	154	654	808	636	547	244	1,397	0	43	21	63
38	2,254	623	260	801	1,061	902	1,023	221	2,199	0	45	15	47
39	716	714	200	785	985	576	30	833	1,396	803	4	42	138
40	1,513	386	160	807	967	720	664	368	1,692	0	44	26	64
41	1,478	385	264	810	1,074	835	579	322	1,949	0	39	22	73
42	1,637	640	306	810	1,116	939	405	244	2,110	0	25	16	68
43	1,742	1,087	306	810	1,116	899	247	428	1,929	181	14	19	64
44	811	394	200	810	1,010	668	102	515	1,516	413	13	34	125
45	1,406	325	167	810	977	763	554	306	1,764	0	39	22	69
46	1,346	530	266	810	1,076	836	353	370	1,747	17	26	22	80
47	788	484	199	663	862	597	141	519	1,369	378	18	31	109
48	1,014	403	154	654	808	661	188	247	1,310	59	19	18	80
49	896	407	154	654	808	631	176	360	1,126	184	20	22	90
50	1,198	420	154	654	808	652	366	262	1,230	0	31	19	67
51	1,862	797	160	801	961	681	820	578	1,472	0	44	29	52

Table 13. No Action Alternative Stanislaus River Water Allocation (Page 1 of 3)

C-008835

C-008836

Water Year	Total Runoff (TAF)	Downstream Flow (TAF)	Fish Flow Required (TAF)	Total Diversions (TAF)	Total Use (TAF)	Direct Use (TAF)	Storage Increase (TAF)	Storage Release (TAF)	Carryover Storage (TAF)	Carryover Used (TAF)	Inflow to Storage (%)	Use from Storage (%)	Runoff Used (%)
52	2,060	482	264	810	1,074	930	960	220	2,212	0	47	13	52
53	1,130	946	213	810	1,023	808	63	711	1,564	648	6	21	91
54	1,044	444	164	810	974	665	228	457	1,335	229	22	32	93
55	821	394	154	662	816	610	169	421	1,083	252	21	25	99
56	2,035	505	260	801	1,061	877	1,053	349	1,787	0	52	17	52
57	1,038	522	200	810	1,010	720	190	503	1,474	313	18	29	97
58	1,816	401	260	810	1,070	848	891	310	2,055	0	49	21	59
59	783	676	200	810	1,010	579	41	765	1,331	724	5	43	129
60	728	354	154	646	800	528	169	459	1,041	290	23	34	110
61	592	345	154	557	711	445	117	437	721	320	20	37	120
62	1,031	339	154	649	803	638	285	251	755	0	28	21	78
63	1,406	337	154	654	808	669	605	211	1,149	0	43	17	57
64	791	386	154	654	808	563	179	442	886	263	23	30	102
65	1,868	494	154	801	955	779	810	260	1,436	0	43	18	51
66	892	459	154	663	817	558	249	495	1,190	246	28	32	92
67	2,039	389	260	801	1,061	926	1,010	186	2,014	0	50	13	52
68	828	674	200	810	1,010	610	49	722	1,341	673	6	40	122
69	2,313	650	260	809	1,069	878	1,092	267	2,166	0	47	18	46
70	1,510	1,317	213	810	1,023	759	69	708	1,527	639	5	26	68
71	1,239	529	164	810	974	754	318	439	1,406	121	26	23	79
72	925	544	154	662	816	567	196	494	1,108	298	21	31	88
73	1,434	329	154	654	808	633	688	258	1,538	0	48	22	56
74	1,691	503	260	801	1,061	835	673	311	1,900	0	40	21	63
75	1,388	636	306	810	1,116	852	298	381	1,817	83	21	24	80
76	617	413	200	577	777	467	121	517	1,421	396	20	40	126
77	415	373	154	440	594	345	31	444	1,008	413	7	42	143
78	1,504	274	154	645	799	711	719	158	1,569	0	48	11	53
79	1,328	402	165	801	966	686	507	403	1,673	0	38	29	73
80	1,922	773	270	810	1,080	919	542	228	1,987	0	28	15	56
81	792	612	200	810	1,010	597	41	690	1,338	649	5	41	128
82	2,425	705	260	810	1,070	934	1,093	210	2,221	0	45	13	44

Table 13. **No Action Alternative Stanislaus River Water Allocation (Page 2 of 3)**

C-008836

C-008837

Water Year	Total Runoff (TAF)	Downstream Flow (TAF)	Fish Flow Required (TAF)	Total Diversions (TAF)	Total Use (TAF)	Direct Use (TAF)	Storage Increase (TAF)	Storage Release (TAF)	Carryover Storage (TAF)	Carryover Used (TAF)	Inflow to Storage (%)	Use from Storage (%)	Runoff Used (%)
83	3,117	2,226	306	810	1,116	1,050	450	398	2,273	0	14	6	36
84	1,825	1,727	227	810	1,037	831	69	803	1,539	734	4	20	57
85	904	415	164	663	827	615	237	430	1,346	193	26	26	91
86	2,044	694	260	801	1,061	863	807	280	1,873	0	39	19	52
87	646	402	200	598	798	521	97	470	1,500	373	15	35	124
88	544	396	154	517	671	454	55	440	1,115	385	10	32	123
89	793	348	154	648	802	637	126	344	897	218	16	21	101
90	647	340	154	586	740	444	156	445	608	289	24	40	114
91	673	320	154	589	743	551	90	335	363	245	13	26	110
92	637	325	154	561	715	431	162	419	106	257	25	40	112
93	2,043	610	154	654	808	684	1,042	276	872	0	51	15	40
94	676	327	154	589	743	551	91	341	622	250	13	26	110
Minimum:	415	274	154	440	594	345	30	158	106	0	4	6	36
Average:	1,239	517	189	708	897	674	386	391	1,329	185	31	25	72
Maximum:	3,117	2,226	306	810	1,116	1,050	1,093	833	2,273	803	52	43	143

NOTE:

TAF = Thousand acre-feet.

Table 13. No Action Alternative Stanislaus River Water Allocation (Page 3 of 3)

C-008837

C-008838

Water Year	Total Runoff (TAF)	Downstream Flow (TAF)	Fish Flow Required (TAF)	Total Diversions (TAF)	Total Use (TAF)	Direct Use (TAF)	Storage Increase (TAF)	Storage Release (TAF)	Carryover Storage (TAF)	Carryover Used (TAF)	Inflow to Storage (%)	Use from Storage (%)	Runoff Used (%)
									328				
22	2,231	302	299	1,015	1,314	960	1,250	346	1,232	0	56	27	59
23	1,550	323	299	1,015	1,314	984	510	371	1,371	0	33	25	85
24	392	166	154	744	898	380	11	587	795	576	3	58	229
25	1,509	189	153	915	1,068	746	710	366	1,139	0	47	30	71
26	952	186	141	877	1,018	565	337	507	969	170	35	44	107
27	1,727	302	239	986	1,225	896	763	393	1,339	0	44	27	71
28	1,340	203	190	965	1,155	740	554	458	1,435	0	41	36	86
29	705	144	130	747	877	519	151	402	1,184	251	21	41	124
30	864	141	116	694	810	545	279	314	1,149	35	32	33	94
31	368	128	94	694	788	325	40	546	643	506	11	59	214
32	1,772	288	238	965	1,203	908	786	328	1,101	0	44	25	68
33	837	244	190	874	1,064	601	212	544	769	332	25	44	127
34	611	147	108	715	823	442	164	458	475	294	27	46	135
35	1,738	251	238	965	1,203	839	875	408	942	0	50	30	69
36	1,918	320	299	1,015	1,314	885	981	471	1,452	0	51	33	69
37	1,765	479	299	1,015	1,314	819	731	542	1,641	0	41	38	74
38	3,181	1,951	299	1,015	1,314	1,005	494	362	1,773	0	16	24	41
39	842	305	188	874	1,062	688	54	467	1,360	413	6	35	126
40	1,902	616	239	986	1,225	798	697	477	1,580	0	37	35	64
41	2,277	984	299	1,015	1,314	1,016	525	333	1,772	0	23	23	58
42	2,162	1,064	299	1,015	1,314	1,007	361	361	1,772	0	17	23	61
43	2,158	1,144	299	1,015	1,314	954	341	425	1,688	84	16	27	61
44	1,032	214	214	965	1,179	720	279	502	1,465	223	27	39	114
45	1,825	510	252	1,018	1,270	927	605	387	1,683	0	33	27	70
46	1,656	858	299	1,015	1,314	897	162	457	1,388	295	10	32	79
47	888	192	188	874	1,062	648	221	466	1,143	245	25	39	120
48	1,061	177	154	936	1,090	707	316	430	1,029	114	30	35	103
49	975	168	143	968	1,111	605	328	540	817	212	34	46	114
50	1,266	210	168	968	1,136	654	555	519	853	0	44	42	90
51	2,314	786	252	1,018	1,270	841	924	486	1,291	0	40	34	55

Table 14. No Action Alternative Tuolumne River Water Allocation (Page 1 of 3)

C-008838

C-008839

Water Year	Total Runoff (TAF)	Downstream Flow (TAF)	Fish Flow Required (TAF)	Total Diversions (TAF)	Total Use (TAF)	Direct Use (TAF)	Storage Increase (TAF)	Storage Release (TAF)	Carryover Storage (TAF)	Carryover Used (TAF)	Inflow to Storage (%)	Use from Storage (%)	Runoff Used (%)
52	2,687	1,107	299	1,015	1,314	1,031	815	333	1,773	0	30	22	49
53	1,325	495	214	965	1,179	823	209	423	1,559	214	16	30	89
54	1,183	211	167	968	1,135	654	451	526	1,484	75	38	42	96
55	899	158	141	877	1,018	615	250	457	1,277	207	28	40	113
56	2,856	1,290	239	986	1,225	931	837	341	1,773	0	29	24	43
57	1,181	312	214	965	1,179	724	354	531	1,596	177	30	39	100
58	2,388	1,113	252	1,018	1,270	948	552	375	1,773	0	23	25	53
59	834	326	188	874	1,062	580	129	570	1,332	441	15	45	127
60	790	111	103	715	818	535	222	327	1,227	105	28	35	104
61	416	124	93	694	787	377	35	493	769	458	8	52	189
62	1,486	195	153	915	1,068	759	660	342	1,087	0	44	29	72
63	1,792	321	252	1,018	1,270	922	787	402	1,472	0	44	27	71
64	930	221	188	874	1,062	724	174	411	1,235	237	19	32	114
65	2,403	802	239	986	1,225	1,017	782	249	1,768	0	33	17	51
66	1,227	740	190	965	1,155	676	9	560	1,217	551	1	41	94
67	2,723	1,066	253	1,018	1,271	1,012	881	325	1,773	0	32	20	47
68	870	285	188	874	1,062	631	144	510	1,407	366	17	41	122
69	3,529	2,095	239	986	1,225	973	674	308	1,773	0	19	21	35
70	1,763	1,041	299	1,015	1,314	946	91	461	1,403	370	5	28	75
71	1,455	356	214	965	1,179	871	413	356	1,460	0	28	26	81
72	993	169	129	877	1,006	651	314	440	1,334	126	32	35	101
73	1,739	437	239	986	1,225	827	689	452	1,571	0	40	32	70
74	2,019	844	299	1,015	1,314	966	468	390	1,649	0	23	26	65
75	1,811	641	299	1,015	1,314	951	483	411	1,721	0	27	28	73
76	497	180	163	744	907	478	7	506	1,222	499	1	47	182
77	206	105	93	694	787	206	0	642	580	642	0	74	382
78	2,401	238	238	965	1,203	983	1,373	245	1,708	0	57	18	50
79	1,735	716	299	1,015	1,314	840	443	522	1,629	79	26	36	76
80	2,772	1,530	299	1,015	1,314	1,050	470	326	1,773	0	17	20	47
81	903	287	190	874	1,064	688	124	459	1,438	335	14	35	118
82	3,473	2,067	253	986	1,239	1,068	636	301	1,773	0	18	14	36

Table 14. **No Action Alternative Tuolumne River Water Allocation (Page 2 of 3)**

C-008839

Water Year	Total Runoff (TAF)	Downstream Flow (TAF)	Fish Flow Required (TAF)	Total Diversions (TAF)	Total Use (TAF)	Direct Use (TAF)	Storage Increase (TAF)	Storage Release (TAF)	Carryover Storage (TAF)	Carryover Used (TAF)	Inflow to Storage (%)	Use from Storage (%)	Runoff Used (%)
83	4,466	3,365	299	1,015	1,314	1,245	340	340	1,773	0	8	5	29
84	2,295	1,526	299	1,015	1,314	922	170	494	1,449	324	7	30	57
85	1,059	204	188	874	1,062	748	281	376	1,354	95	27	30	100
86	2,639	1,215	239	986	1,225	921	707	352	1,709	0	27	25	46
87	506	163	163	744	907	456	44	517	1,236	473	9	50	179
88	502	111	102	694	796	386	108	470	874	362	22	52	159
89	1,010	128	115	694	809	555	416	285	1,005	0	41	31	80
90	591	125	103	694	797	514	71	351	725	280	12	36	135
91	812	109	102	694	796	553	237	272	690	35	29	31	98
92	764	115	102	694	796	553	180	272	598	92	24	31	104
93	2,138	238	238	965	1,203	924	1,184	318	1,464	0	55	23	56
94	650	184	176	744	920	547	83	428	1,119	345	13	41	142
Minimum:	206	105	93	694	787	206	0	245	475	0	0	5	29
Average:	1,542	549	209	912	1,121	759	432	421	1,326	146	28	32	73
Maximum:	4,466	3,365	299	1,018	1,314	1,245	1,373	642	1,773	642	57	74	382

NOTE:

TAF = Thousand acre-feet.

Table 14. No Action Alternative Tuolumne River Water Allocation (Page 3 of 3)

C-008840

C-008840

C-008841

Water Year	Total Runoff (TAF)	Downstream Flow (TAF)	Fish Flow Required (TAF)	Total Diversions (TAF)	Total Use (TAF)	Direct Use (TAF)	Storage Increase (TAF)	Storage Release (TAF)	Carryover Storage (TAF)	Carryover Used (TAF)	Inflow to Storage (%)	Use from Storage (%)	Runoff Used (%)
									227				
22	1,450	198	47	600	647	474	812	210	829	0	56	27	45
23	967	407	47	600	647	462	276	363	742	87	29	29	67
24	261	143	40	365	405	198	8	310	440	302	3	51	155
25	936	92	42	595	637	436	447	242	645	0	48	32	68
26	643	133	40	453	493	411	170	155	660	0	26	17	77
27	1,014	178	42	597	639	610	288	97	851	0	28	5	63
28	803	356	47	600	647	608	72	265	658	193	9	6	81
29	522	86	40	365	405	381	66	52	672	0	13	6	78
30	519	89	35	360	395	373	69	57	684	0	13	6	76
31	251	91	35	360	395	190	2	256	430	254	1	52	157
32	1,136	141	42	595	637	440	580	226	784	0	51	31	56
33	542	226	40	453	493	314	127	305	606	178	23	36	91
34	362	85	35	362	397	192	151	293	464	142	42	52	110
35	1,194	236	42	595	637	418	577	263	778	0	48	34	53
36	1,172	552	47	600	647	429	312	339	751	27	27	34	55
37	1,236	559	47	600	647	414	348	326	773	0	28	36	52
38	2,103	1,368	47	600	647	522	348	270	851	0	17	19	31
39	479	291	40	453	493	256	129	454	526	325	27	48	103
40	1,112	278	42	597	639	397	460	270	716	0	41	38	57
41	1,483	692	47	600	647	502	348	213	851	0	23	22	44
42	1,311	655	47	600	647	513	348	348	851	0	27	21	49
43	1,311	729	47	600	647	440	329	402	778	73	25	32	49
44	697	216	47	600	647	421	185	346	617	161	27	35	93
45	1,116	284	47	600	647	443	421	237	801	0	38	32	58
46	962	417	47	600	647	412	293	395	699	102	30	36	67
47	592	210	40	453	493	283	151	265	585	114	26	43	83
48	705	77	42	597	639	419	245	252	578	7	35	34	91
49	648	84	47	600	647	391	220	294	504	74	34	40	100
50	729	103	47	600	647	394	275	286	493	11	38	39	89
51	1,245	542	47	600	647	393	358	304	547	0	29	39	52

Table 15. No Action Alternative Merced River Water Allocation (Page 1 of 3)

C-008841

C-008842

Water Year	Total Runoff (TAF)	Downstream Flow (TAF)	Fish Flow Required (TAF)	Total Diversions (TAF)	Total Use (TAF)	Direct Use (TAF)	Storage Increase (TAF)	Storage Release (TAF)	Carryover Storage (TAF)	Carryover Used (TAF)	Inflow to Storage (%)	Use from Storage (%)	Runoff Used (%)
52	1,580	620	47	600	647	516	492	188	851	0	31	20	41
53	638	329	47	600	647	429	75	406	520	331	12	34	101
54	675	66	47	600	647	356	298	329	489	31	44	45	96
55	557	75	40	453	493	311	211	217	483	6	38	37	89
56	1,689	669	42	597	639	500	564	196	851	0	33	22	38
57	658	284	47	600	647	412	161	428	584	267	24	36	98
58	1,430	507	47	600	647	504	457	191	850	0	32	22	45
59	459	284	40	453	493	279	91	427	514	336	20	43	107
60	483	54	35	362	397	238	222	212	524	0	46	40	82
61	314	77	35	360	395	218	51	224	351	173	16	45	126
62	947	99	42	595	637	423	454	240	565	0	48	34	67
63	1,002	198	47	600	647	453	395	238	722	0	39	30	65
64	479	209	40	453	493	311	39	261	500	222	8	37	103
65	1,376	373	42	597	639	496	549	198	851	0	40	22	46
66	693	410	47	600	647	333	151	510	492	359	22	49	93
67	1,720	705	47	600	647	535	551	192	851	0	32	17	38
68	421	279	40	453	493	268	66	435	482	369	16	46	117
69	2,216	1,195	42	597	639	510	560	191	851	0	25	20	29
70	890	518	47	600	647	413	158	429	580	271	18	36	73
71	733	95	47	600	647	421	248	251	577	3	34	35	88
72	584	97	40	453	493	316	200	206	571	6	34	36	84
73	1,135	285	42	597	639	418	462	255	778	0	41	35	56
74	1,164	495	47	600	647	434	348	342	784	0	30	33	56
75	1,136	458	47	600	647	452	348	330	802	0	31	30	57
76	291	223	40	365	405	203	13	362	453	349	4	50	139
77	135	60	35	360	395	134	0	334	119	334	0	66	293
78	1,767	397	42	589	631	553	909	177	851	0	51	12	36
79	1,074	526	47	600	647	427	322	422	751	100	30	34	60
80	1,655	899	47	600	647	527	348	248	851	0	21	19	39
81	511	262	40	453	493	299	151	398	604	247	30	39	96
82	1,960	1,061	42	597	639	546	430	183	851	0	22	15	33

Table 15. **No Action Alternative Merced River Water Allocation (Page 2 of 3)**

C-008842

C-008843

Water Year	Total Runoff (TAF)	Downstream Flow (TAF)	Fish Flow Required (TAF)	Total Diversions (TAF)	Total Use (TAF)	Direct Use (TAF)	Storage Increase (TAF)	Storage Release (TAF)	Carryover Storage (TAF)	Carryover Used (TAF)	Inflow to Storage (%)	Use from Storage (%)	Runoff Used (%)
83	2,797	2,140	47	600	647	617	348	348	851	0	12	5	23
84	1,159	723	47	600	647	410	237	452	636	215	20	37	56
85	562	87	40	453	493	284	226	245	617	19	40	42	88
86	1,573	752	42	597	639	435	410	235	792	0	26	32	41
87	306	165	40	365	405	203	71	349	514	278	23	50	132
88	378	54	35	360	395	224	123	212	425	89	33	43	104
89	511	61	35	360	395	240	236	198	463	0	46	39	77
90	373	71	35	360	395	226	112	221	354	109	30	43	106
91	527	55	35	360	395	258	234	171	417	0	44	35	75
92	441	60	35	360	395	226	178	209	386	31	40	43	90
93	1,450	358	42	595	637	477	642	192	836	0	44	25	44
94	334	234	40	365	405	218	61	383	514	322	18	46	121
Minimum:	135	54	35	360	395	134	0	52	119	0	0	5	23
Average:	935	357	43	525	567	386	282	278	642	89	30	32	61
Maximum:	2,797	2,140	47	600	647	617	909	510	851	369	56	66	293

NOTE:

TAF = Thousand acre-feet.

Table 15. No Action Alternative Merced River Water Allocation (Page 3 of 3)

C-008843

C-008844

Water Year	Total Runoff (TAF)	Downstream Flow (TAF)	Fish Flow Required (TAF)	Total Diversions (TAF)	Total Use (TAF)	Direct Use (TAF)	Storage Increase (TAF)	Storage Release (TAF)	Carryover Storage (TAF)	Carryover Used (TAF)	Inflow to Storage (%)	Use from Storage (%)	Runoff Used (%)
									175				
22	2,315	353	0	1,919	1,919	1,569	381	366	190	0	16	18	83
23	1,661	0	0	1,685	1,685	1,361	292	339	143	47	18	19	101
24	652	0	0	640	640	473	173	179	137	6	27	26	98
25	1,234	0	0	1,198	1,198	998	229	213	153	0	19	17	97
26	1,159	0	0	1,113	1,113	779	369	346	176	0	32	30	96
27	1,947	28	0	1,898	1,898	1,556	350	356	170	6	18	18	97
28	1,178	0	0	1,169	1,169	898	270	283	157	13	23	23	99
29	857	2	0	833	833	635	215	213	159	0	25	24	97
30	855	2	0	822	822	617	230	218	171	0	27	25	96
31	644	1	0	659	659	499	137	173	135	36	21	24	102
32	1,822	3	0	1,772	1,772	1,475	334	310	159	0	18	17	97
33	1,069	3	0	1,069	1,069	838	223	247	135	24	21	22	100
34	854	4	0	785	785	614	232	188	179	0	27	22	92
35	1,714	0	0	1,705	1,705	1,259	442	458	163	16	26	26	99
36	1,844	28	0	1,793	1,793	1,428	378	380	161	2	20	20	97
37	2,196	336	0	1,854	1,854	1,488	360	381	140	21	16	20	84
38	3,612	1,779	0	1,671	1,671	1,435	681	544	277	0	19	14	46
39	1,185	4	0	1,232	1,232	890	286	361	202	75	24	28	104
40	1,669	0	0	1,702	1,702	1,393	267	325	144	58	16	18	102
41	2,599	477	0	2,003	2,003	1,728	400	310	234	0	15	14	77
42	2,236	56	0	2,229	2,229	1,844	324	400	158	76	14	17	100
43	2,077	252	0	1,802	1,802	1,440	378	381	155	3	18	20	87
44	1,277	0	0	1,248	1,248	1,107	163	153	165	0	13	11	98
45	2,094	68	0	1,974	1,974	1,643	371	346	190	0	18	17	94
46	1.728	0	0	1,728	1,728	1,369	351	375	166	24	20	21	100
47	1,145	0	0	1,121	1.121	811	325	323	168	0	28	28	98
48	1,191	3	0	1,161	1,161	907	277	271	174	0	23	22	97
49	1,168	1	0	1,134	1,134	914	245	233	186	0	21	19	97
50	1,303	0	0	1,296	1,296	1,009	284	300	170	16	22	22	99
51	1,828	210	0	1,599	1,599	1,277	333	335	168	2	18	20	87

Table 16. **No Action Alternative Upper San Joaquin River Water Allocation (Page 1 of 3)**

C-008844

C-008845

Water Year	Total Runoff (TAF)	Downstream Flow (TAF)	Fish Flow Required (TAF)	Total Diversions (TAF)	Total Use (TAF)	Direct Use (TAF)	Storage Increase (TAF)	Storage Release (TAF)	Carryover Storage (TAF)	Carryover Used (TAF)	Inflow to Storage (%)	Use from Storage (%)	Runoff Used (%)
52	2,746	639	0	2,008	2,008	1,741	526	454	240	0	19	13	73
53	1,296	0	0	1,347	1,347	1,087	203	277	166	74	16	19	104
54	1,301	0	0	1,273	1,273	966	327	321	172	0	25	24	98
55	1,190	0	0	1,157	1,157	895	286	276	182	0	24	23	97
56	2,796	709	0	2,011	2,011	1,733	420	373	229	0	15	14	72
57	1,377	0	0	1,414	1,414	1,092	271	333	167	62	20	23	103
58	2,546	415	0	2,059	2,059	1,762	356	312	211	0	14	14	81
59	1,164	0	0	1,197	1,197	840	314	371	154	57	27	30	103
60	862	4	0	827	827	696	158	145	167	0	18	16	96
61	650	0	0	660	660	457	183	214	136	31	28	31	102
62	1,725	3	0	1,679	1,679	1,327	385	366	155	0	22	21	97
63	1,945	103	0	1,743	1,743	1,461	366	296	225	0	19	16	90
64	1,122	0	0	1,149	1,149	815	298	350	173	52	27	29	102
65	2,028	17	0	1,956	1,956	1,663	342	312	203	0	17	15	96
66	1,372	0	0	1,372	1,372	956	406	431	178	25	30	30	100
67	3,128	1,011	0	1,985	1,985	1,755	583	478	283	0	19	12	63
68	1,134	1	0	1,222	1,222	937	187	300	170	113	16	23	108
69	3,798	2,084	0	1,603	1,603	1,340	658	573	255	0	17	16	42
70	1,516	89	0	1,498	1,498	1,186	232	328	159	96	15	21	99
71	1,417	0	0	1,393	1,393	1,135	275	273	161	0	19	19	98
72	1,045	0	0	1,018	1,018	796	243	237	167	0	23	22	97
73	2,004	73	0	1,914	1,914	1,519	400	409	158	9	20	21	96
74	2,199	55	0	2,125	2,125	1,712	418	426	150	8	19	19	97
75	1,800	0	0	1,758	1,758	1,422	365	346	169	0	20	19	98
76	828	0	0	775	775	567	253	224	198	0	31	27	94
77	376	0	0	433	433	323	48	119	127	71	13	25	115
78	3,041	1,154	0	1,641	1,641	1,473	619	401	345	0	20	10	54
79	1,976	17	0	2,109	2,109	1,715	235	412	168	177	12	19	107
80	2,927	886	0	1,925	1,925	1,667	440	353	255	0	15	13	66
81	1,142	4	0	1,187	1,187	922	206	278	183	72	18	22	104
82	3,140	963	0	1,978	1,978	1,817	488	320	351	0	16	8	63

Table 16. No Action Alternative Upper San Joaquin River Water Allocation (Page 2 of 3)

C-008845

C-008846

Water Year	Total Runoff (TAF)	Downstream Flow (TAF)	Fish Flow Required (TAF)	Total Diversions (TAF)	Total Use (TAF)	Direct Use (TAF)	Storage Increase (TAF)	Storage Release (TAF)	Carryover Storage (TAF)	Carryover Used (TAF)	Inflow to Storage (%)	Use from Storage (%)	Runoff Used (%)
83	4,703	3,202	0	1,308	1,308	1,272	508	338	521	0	11	3	28
84	2,097	654	0	1,766	1,766	1,468	52	402	171	350	2	17	84
85	1,216	0	0	1,192	1,192	889	319	318	172	0	26	25	98
86	2,924	1,066	0	1,839	1,839	1,494	409	418	163	9	14	19	63
87	1,002	0	0	978	978	744	247	245	165	0	25	24	98
88	853	1	0	816	816	590	253	240	178	0	30	28	96
89	928	2	0	909	909	676	243	247	174	4	26	26	98
90	768	1	0	747	747	557	201	203	172	2	26	25	97
91	926	3	0	897	897	789	126	120	178	0	14	12	97
92	449	0	0	477	477	393	49	94	133	45	11	18	106
93	2,456	283	0	2,065	2,065	1,769	391	311	213	0	16	14	84
94	1,021	0	0	1,038	1,038	791	222	260	175	38	22	24	102
Minimum:	376	0	0	433	433	323	48	94	127	0	2	3	28
Average:	1,672	234	0	1,415	1,415	1,143	312	312	186	24	19	19	85
Maximum:	4,703	3,202	0	2,229	2,229	1,844	681	573	521	350	32	31	115

NOTE:

TAF = Thousand acre-feet.

Table 16. No Action Alternative Upper San Joaquin River Water Allocation (Page 3 of 3)

C-008846

C-008847

Tributary Basin	Available Inflow (TAF)	Total Diversions (TAF)	Required Flow (TAF)	Carryover Storage (TAF)	Storage Release (TAF)	Carryover Used (TAF)	Inflow to Storage (%)	Use from Storage (%)	Runoff Used (%)
Trinity	1,254	892	340	1,329	467	164	36	38	98
Sacramento	10,936	3,250	3,107	2,863	1,462	377	13	20	61
Feather	6,845	2,478	859	2,089	1,152	395	17	26	49
American	2,675	388	1,493	477	472	104	17	17	70
Stanislaus	1,239	708	189	1,329	391	185	32	25	72
Tuolumne	1,542	912	209	1,326	421	146	27	32	73
Merced	914	525	43	642	278	89	30	33	62
San Joaquin	1,672	1,415	0	186	312	24	19	19	85
Delta	21,843	6,404[a]	5,537	630	1,321	135	6	21	60

NOTES:

TAF = Thousand acre-feet.

[a] Plus 1,156 TAF in-Delta depletions.

Table 17. Surface Water Supply Management Indicators for No Action Alternative

C-008847

Alternative Variation	Delta Conveyance Components			Storage Components (Maximum Storage Volumes in MAF)						DWRSIM System Operation Study Results (in TAF/year)				
	CVP-SWP Improvements	South Delta Improvements	Isolated Conveyance Facility (Conveyance Capacity in CFS)	Sacramento Valley Ground Water Storage	Upstream Surface Storage Sacramento River Trib.	Upstream Surface Storage San Joaquin River Trib.	In-Delta Surface Storage	San Joaquin Valley Ground Water Storage	South of Delta Aqueduct Surface Storage	DWRSIM Study	1922-94WY Average Annual SWP(Ent+Int) & CVP Deliveries	Critical Period Average Annual SWP(Ent+Int) & CVP Deliveries	Net 1922-94WY Average Annual SWP(Ent+Int) & CVP Deliveries (Compared to No Action)	Net Critical Period Average Annual SWP(Ent+Int) & CVP Deliveries (Compared to No Action)
Existing										558	5506	4014	(388)	(37)
No Action										516	5,894	4,052	0	0
1A										518	5,957	4,060	62	8
1B	*									518	5,957	4,060	62	8
1C	*	*		0.25[1]	3[2]			0.5[5]	1[6]	609	6,587	4,739	693	688
2A	*	*								528	6,163	4,171	269	119
2B	*	*		0.25[1]	3[2]	0.25[3]		0.5[5]	2[6]	532a	6,609	4,838	715	786
2D	*	*							2[6]	530	6,272	4,453	377	402
2E	*	*		0.25[1]	3[2]	0.25[3]		0.5[5]	2[6]	532a	6,609	4,838	715	786
3A	*	*	5,000							578	6,156	3,912	261	(140)
3B	*	*	5,000	0.25[1]	3[2]	0.25[3]	0.2[4]	0.5[5]	2[6]	579	6,611	5,040	716	988
3E	*	*	15,000	0.25[1]	3[2]	0.25[3]	0.2[4]	0.5[5]	2[6]	581	6,496	4,693	602	641
3H	*	*	5,000	0.25[1]	3[2]	0.25[3]		0.5[5]	2[6]	579	6,611	5,040	716	988
3I	*	*	15,000	0.25[1]	3[2]	0.25[3]	0.2[4]	0.5[5]	2[6]	581	6,496	4,693	602	641

[1] Solely Operated for CVP/SWP Water Supply Benefits
[2] 2 MAF of Storage Operated for CVP/SWP Water Supply Benefits, 1 MAF of Storage Operated for ERPP Flow Event Targets
[3] Solely Operated for ERPP Flow Event Targets
[4] Solely Operated for CVP/SWP Water Supply Benefits
[5] Solely Operated for CVP/SWP Water Supply Benefits
[6] Solely Operated for CVP/SWP Water Supply Benefits

Table 18. Summary Average Annual CVP/SWP South of Delta Deliveries (TAF)

C-008848

C-008848

Category	Alternative Variations 1A	1B	1C	2A	2B	2C	2D	2E
Flow, Velocity, and Stage	No substantial effects.	No substantial effects.	Reduces reverse flows in San Joaquin River between Vernalis and Disappointment Slough. Changes in stage and velocity in areas near flow control structures.	Similar to 2B.	Improves circulation of flows. Reduces reverse flows in San Joaquin River. Increases flows in Mokelumne River and Old River near Woodward Island. Changes in stage and velocity in areas near flow control structures.	No substantial effects in north Delta. Decreased flow through south Delta.	Improves circulation of flows. Reduces reverse flows in San Joaquin River. Increases flows in Mokelumne River. More flow carried by Old River due to channel improvements. Decreased velocity and increased minimum stage in channels with setback levees. Changes in stage and velocity in areas near flow control structures.	No substantial effects.
Mass Fate	No substantial effect.	No substantial effects.	No substantial effects.	Similar to 2B with reduced mass reaching exports.	For lower flow conditions, no significant effects except at low pumping conditions where more mass injected at Vernalis becomes trapped on Delta islands and less reaches the exports. For higher flow conditions, substantially more mass injected in north Delta remained in the Delta after 60 days.	Potentially more mass injected in central Delta reaching exports.	For lower flow conditions, mass injected at Freeport and Terminous remains in the Delta longer before reaching the endpoints. For higher flow conditions, substantially more mass injected in north remained in Delta after 60 days.	For lower flow conditions, mass injected at Freeport and Terminous remains in the Delta longer before reaching the endpoints. For higher flow conditions, no substantial effects.

Table 19. Summary of Potential Effects of Alternatives on Delta (Page 1 of 5)

C-008849

C-008850

Category	Alternative Variations							
	1A	1B	1C	2A	2B	2C	2D	2E
Net Delta Outflow	No substantial effects.	Similar to 1C.	Decreases outflow in late summer, fall, and winter about 25% of the time. No change in spring and summer. Increases the frequency of flows in the 4,000 to 6,500 cfs range. No change in the 3,000 to 4,000 cfs range.	Decreases outflow in late summer and fall about 25% of the time. No change in spring and summer. Increases the frequency of flows in the 4,000 cfs to 6,500 cfs range. No change in the 3,000 to 4,000 cfs range.	Similar to 1C.	Similar to 2A.	Decreases outflow in late summer, fall and winter about 25% of the time. No change in spring and summer. Increases the frequency of flows in the 4,000 cfs to 6,500 cfs range. No change in the 3,000 to 4,000 cfs range.	Similar to 2B.
Central Delta Outflow	No substantial effects.	Similar to 1C.	No change in the frequency of reverse flows. However, increases magnitude of reverse flows and decreases magnitude of downstream flows.	Similar to 2B.	Substantially reduces the frequency and magnitude of reverse flows. Reverse flows remain in July and August about 25% of the time.	Unknown	Substantially reduces the frequency and magnitude of reverse flows. Reverse flows remain in July and August about 25% of the time.	Substantially reduces the frequency and magnitude of reverse flows. Reverse flows remain in July and August only about 10% of the time.
X2 Position	No substantial effects.	Similar to 1C.	Moves the average seaward location 1 to 5 kilometers upstream in late summer and fall about 25% of the time.	Moves the average seaward location 1 to 3 kilometers upstream in late summer and fall about 25% of the time.	Similar to 1C.	Unknown	Moves the average seaward location 1 to 3 kilometers upstream in late summer and fall about 25% of the time.	Similar to 2B.

Table 19. **Summary of Potential Effects of Alternatives on Delta (Page 2 of 5)**

C-008850

C-008851

Category	Alternative Variations 1A	1B	1C	2A	2B	2C	2D	2E
Salinity	No substantial effects.	Similar to 1C.	No change at Jersey point and Emmaton. Increases salinity at Rock Slough in the spring about 75% of the time. Increases salinity at Clifton Court Forebay throughout the year about 50% of the time.	Similar to 2B.	Substantially reduces salinity at Jersey Point throughout the year. Increases salinity at Emmaton in the summer and fall about 75% of the time. Increases salinity at Rock Slough in the spring about 50% to 75% of the time. Increases salinity at Clifton Court Forebay in May through August about 50% of the time and in the winter about 25% of the time.	Unknown	Substantially reduces salinity at Jersey Point throughout the year. Increases salinity at Emmaton in the summer and fall about 75% of the time. Increases salinity at Rock Slough similar to 2B. Increases salinity at Clifton Court Forebay similar to 2B.	Substantially reduces salinity at Jersey Point throughout the year. Increases salinity at Emmaton in the summer about 75% of the time. Increases salinity at Rock Slough in the spring about 75% of the time. Increases salinity at Clifton Court Forebay similar to 2B.

Category	Alternative Variations 3A	3B	3C	3D	3E	3F	3G	3H	3I
Flow, Velocity, and Stage	Similar to 3E but flows through Delta reduced to a lesser degree	Similar to 3E but flows through Delta reduced to a lesser degree	Same as 3A	Same as 3B	Less flow down Sacramento River at Rio Vista and through Delta toward pumps Reduces reverse flows in San Joaquin River Decreased velocity in channels with setback levees Changes in stage and velocity in areas near flow control structures	Similar to 3E	Similar to 3E but flows through Delta reduced to a lesser degree	Similar to 2E with reduced flows through Delta	Similar to 2C with reduced flows through Delta

Table 19. Summary of Potential Effects of Alternatives on Delta (Page 3 of 5)

C—008851

C-008852

Category	Alternative Variations								
	3A	3B	3C	3D	3E	3F	3G	3H	3I
Mass Fate	Similar to 3E	Similar to 3E	Same as 3A	Same as 3B	Reduces mass reaching exports from all locations except Freeport For low flow conditions, increases travel time through Delta for mass injected in south and central Delta	Similar to 3E	Similar to 3E	Similar to 2E except isolated facility reduces mass reaching exports from all locations except Freeport	Similar to 2C except isolated facility reduces mass reaching exports from all locations except Freeport
Net Delta Outflow	Decreases outflow in late summer and fall about 25% of the time. Decreases outflow in the spring about 25% of the time (April and May). No change in July and August. Increases the frequency of flows in the 4,000 cfs to 6,500 cfs range. Negligible change in the 3,000 to 4,000 cfs range.	Decreases outflow in the late summer, fall, and winter about 25% of the time. Decreases outflow in the spring about 25% of the time. No change in July and August. Increases number of months with flows in the 4,000 cfs to 5,000 cfs range. Negligible change in the 3,000 to 4,000 cfs range.	Similar to 3A	Similar to 3B	Similar to 3B	Similar to 3B	Similar to 3B	Similar to 2D	Similar to 3B
Central Delta Outflow	Similar to 3E	Similar to 3E	Similar to 3E	Similar to 3E	Reverse flows are not observed.	Similar to 3E	Similar to 3E	Similar to 3E	Unknown
X2 Position	Moves the average seaward location 1 to 4 kilometers upstream in late summer and fall about 25% of the time. Moves the average landward location 1 to 3 kilometers upstream in winter and spring.	Moves the average seaward location 1 to 7 kilometers upstream in late summer and fall about 40% of the time. Moves the average landward location 1 to 5 kilometers upstream in winter and spring about 40% of the time.	Similar to 3A	Similar to 3B	Similar to 3B	Similar to 3B	Similar to 3B	Similar to 2D	Similar to 3B

Table 19. Summary of Potential Effects of Alternatives on Delta (Page 4 of 5)

C-008852

C-008853

Category	Alternative Variations								
	3A	3B	3C	3D	3E	3F	3G	3H	3I
Salinity	Similar to 3E	Similar to 3E	Similar to 3E	Similar to 3E	Increases salinity at Jersey Point in the winter and spring about 50% of the time. Reduces salinity at Jersey Point during the remaining times of year. Substantially increases salinity at Emmaton throughout the year about 50% of the time, more so in summer and fall. Substantially increases salinity at Rock Slough throughout the year. Rock Slough salinities increase in winter and spring about 90% of the time. Substantially reduces salinity at Clifton Court Forebay.	Similar to 3E	Similar to 3E.	Similar to 3E	Unknown.

Table 19. **Summary of Potential Effects of Alternatives on Delta (Page 5 of 5)**

C-008853

		Alternative 1 or 2		Alternative 3		
Water Year	No Action(TAF)	Alt 2A(TAF)	Alt 2B&2E(TAF)	Alt 3A(TAF)	Alt 3B&3H(TAF)	Alt 3E&3I(TAF)
1922	7289	7979	6590	7960	6484	7315
1923	6910	7522	7338	7913	7213	7307
1924	2988	2999	5177	3366	5028	4696
1925	4190	4260	5712	4170	6201	5366
1926	4882	5125	5582	4825	6125	5578
1927	6887	7289	7181	7351	6831	7326
1928	6374	6665	7509	6921	7194	7647
1929	3853	3948	5617	4123	5898	5365
1930	4929	5053	5685	5115	6258	5365
1931	3195	3251	3912	2891	4310	4044
1932	3989	4205	4543	4020	4809	4345
1933	3166	3266	3517	3059	3556	3508
1934	3467	3564	3559	3425	3684	3332
1935	5577	5751	5815	5693	5705	5937
1936	6586	6878	6899	6918	6674	6641
1937	6076	6040	6725	6264	6854	6431
1938	7323	7718	7255	7797	7289	7174
1939	6636	6788	7197	7095	7105	6712
1940	6353	6525	7291	6325	7063	7032
1941	6613	7117	7274	7098	6650	6687
1942	7136	7561	7163	7660	7041	7035
1943	6897	7077	7079	7270	7115	7092
1944	6619	6758	7043	6761	6891	6291
1945	6477	6611	7176	6619	7151	6980
1946	6428	6934	7340	6985	7453	7398
1947	5807	5898	6843	5846	6846	6278
1948	5266	5020	6221	5012	6380	6352
1949	5782	5638	6589	5673	7007	6876
1950	5701	5710	6352	5659	6691	6085
1951	7045	7275	7300	7312	7490	7430
1952	6504	6957	7099	7044	7021	7054
1953	7012	6995	7379	6958	6953	7111
1954	6801	7129	7482	7218	7129	7223
1955	5257	5575	7167	5822	6834	6555
1956	7013	7453	7353	7469	7276	7315
1957	6603	6846	7568	7001	7521	7623
1958	7024	7581	7808	7627	7869	7723
1959	6826	7042	7694	7091	7455	7408
1960	5048	5068	6283	5017	6692	6236
1961	5108	5127	6382	5059	6565	6575
1962	5853	6015	6595	5985	6743	6567
1963	6791	7473	7567	7648	7496	7476
1964	6257	6691	7046	6793	7541	7319
1965	6066	6549	7220	6683	7219	7171
1966	7016	7261	7281	7234	7474	7475
1967	7009	7885	7620	7947	7437	7420
1968	6881	7260	7811	7252	7652	7649
1969	6550	6539	6913	6510	6702	6702
1970	6947	6956	7076	6966	7004	6985
1971	6743	7359	6958	7359	6756	6824
1972	6262	6753	7740	6898	7031	7044
1973	6776	7180	7611	7229	7486	7530
1974	7267	7810	7787	7950	7959	7820
1975	7157	7742	7054	7991	7028	6683

Table 20. **Annual Aqueduct Deliveries (SWP and CVP) as Simulated by DWRSIM (Page 1 of 2)**

Water Year	No Action(TAF)	Alternative 1 or 2		Alternative 3		
		Alt 2A(TAF)	Alt 2B&2E(TAF)	Alt 3A(TAF)	Alt 3B&3H(TAF)	Alt 3E&3I(TAF)
1976	5566	6031	6290	6222	6509	6122
1977	2061	2080	4204	1743	3930	3959
1978	5957	6195	6454	6107	6416	6435
1979	6808	7000	7506	7258	7478	7447
1980	6396	6475	7169	6586	7089	7070
1981	6761	6669	7388	6700	7201	7275
1982	6942	7693	7568	7717	7333	7584
1983	7072	7708	7644	7684	7417	7441
1984	7279	7477	7286	7488	7233	7220
1985	6286	6811	7019	6879	6887	6881
1986	5975	6154	6679	6177	6501	6253
1987	5930	5900	6573	5906	6600	6009
1988	3434	3742	5623	3496	5872	5408
1989	4473	4705	5741	4740	5720	5946
1990	3937	4098	4680	3985	5127	4669
1991	2336	2340	2914	2364	3341	3058
1992	3302	3534	3989	3403	4181	4212
1993	6273	6950	6947	6823	6730	6894
1994	6297	6698	6806	6847	7163	7233

Table 20. **Annual Aqueduct Deliveries (SWP and CVP) as Simulated by DWRSIM (Page 2 of 2)**

Location		No Action Alternative			Alternative Variation 1A				Alternative Variation 1C			
Tidal Flow (cfs)	Loc. Key	Avg.	Max. Sea-ward	Max. Land-ward	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]
San Joaquin River at Fourteen Mile Slough	1	17,464	21,598	11,350	17,872	21,993	11,787	2%	17,762	21,914	11,801	2%
San Joaquin River at Antioch	2	55,602	######	######	56,535	######	######	2%	56,721	######	######	2%
Old River at Mossdale	3	24,254	24,292	24,198	23,800	23,836	23,749	-2%	23,909	23,964	23,839	-1%
Old River at Fabian Tract	4	4,584	4,842	4,136	4,495	4,743	4,023	-2%	4,853	5,104	4,367	6%
Old River at Woodward Island	5	9,275	15,015	1,121	9,715	15,316	402	5%	10,097	17,817	3,790	9%
Old River at Franks Tract	6	1,571	5,248	4,010	1,622	5,247	3,982	3%	1,592	5,130	3,929	1%
Middle River at Woodward Island	7	5,669	10,036	2,175	5,989	10,245	1,628	6%	5,746	11,407	4,210	1%
Grant Line Canal	8	15,996	16,513	14,679	15,749	16,284	14,405	-2%	15,486	16,068	14,214	-3%
Victoria Canal	9	-3,809	-57	5,911	-4,111	-518	6,136	8%	-3,280	1,199	5,784	-14%
Delta Cross Channel	10	0	114	283	0	114	283	NA	0	110	279	NA
Georgiana Slough	11	11,201	11,683	10,792	11,194	11,678	10,785	0%	11,198	11,670	10,809	0%
Diversion to Sutter/Steamboat sloughs	12	17,892	18,194	17,443	17,893	18,195	17,445	0%	17,891	18,194	17,442	0%
Miner Slough	13	10,579	11,140	9,757	10,579	11,141	9,759	0%	10,578	11,138	9,754	0%
Sacramento River at Rio Vista	14	######	######	######	######	######	######	0%	######	######	######	0%
Mokelumne River, North Fork	15	5,951	7,687	2,374	5,951	7,683	2,366	0%	5,943	7,618	2,394	0%
Mokelumne River, South Fork	16	2,823	5,803	3,845	2,824	5,795	3,866	0%	2,823	5,699	3,854	0%
Velocity (fps)	Loc. Key	Avg.	Max. Sea-ward	Max. Land-ward	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]
San Joaquin River at Fourteen Mile Slough	1	1.05	1.24	0.69	1.07	1.26	0.71	2%	1.06	1.26	0.71	2%
San Joaquin River at Antioch	2	0.92	2.75	1.58	0.93	2.76	1.57	2%	0.94	2.75	1.55	2%
Old River at Mossdale	3	6.86	6.89	6.82	6.80	6.82	6.76	-1%	6.77	6.80	6.72	-1%
Old River at Fabian Tract	4	2.07	2.18	1.79	2.02	2.13	1.74	-2%	2.07	2.21	1.79	0%
Old River at Woodward Island	5	0.90	1.53	0.10	0.94	1.56	0.04	5%	0.98	1.79	0.34	9%
Old River at Franks Tract	6	0.27	0.81	0.69	0.28	0.81	0.68	3%	0.28	0.79	0.67	2%
Middle River at Woodward Island	7	0.81	1.49	0.28	0.85	1.52	0.21	5%	0.82	1.67	0.55	2%
Grant Line Canal	8	3.16	3.33	2.80	3.13	3.30	2.76	-1%	3.04	3.23	2.69	-4%
Victoria Canal	9	-0.80	-0.01	1.30	-0.86	-0.10	1.34	7%	-0.69	0.23	1.24	-14%
Delta Cross Channel	10	0.00	0.02	0.05	0.00	0.02	0.05	NA	0.00	0.02	0.05	NA
Georgiana Slough	11	2.83	2.98	2.67	2.83	2.97	2.67	0%	2.83	2.97	2.68	0%
Diversion to Sutter/Steamboat sloughs	12	4.38	4.49	4.22	4.38	4.49	4.22	0%	4.38	4.49	4.22	0%
Miner Slough	13	2.57	2.78	2.28	2.57	2.78	2.28	0%	2.57	2.78	2.28	0%
Sacramento River at Rio Vista	14	3.04	3.65	2.07	3.04	3.65	2.07	0%	3.04	3.65	2.07	0%
Mokelumne River, North Fork	15	0.99	1.29	0.38	0.99	1.28	0.38	0%	0.99	1.27	0.38	0%
Mokelumne River, South Fork	16	0.39	0.80	0.52	0.39	0.79	0.52	0%	0.39	0.78	0.52	0%
Stage (mllw)	Loc. Key	Avg.	Max. Sea-ward	Max. Land-ward	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]
San Joaquin River at Fourteen Mile Slough	1	5.2	7.0	3.8	5.3	7.1	3.8	0%	5.3	7.0	3.9	0%
San Joaquin River at Antioch	2	4.2	6.4	2.2	4.2	6.4	2.2	0%	4.2	6.4	2.2	0%
Old River at Mossdale	3	20.8	20.9	20.8	20.6	20.7	20.5	-1%	20.8	20.9	20.7	0%
Old River at Fabian Tract	4	8.0	8.7	7.6	8.0	8.7	7.6	0%	8.6	9.3	8.0	7%
Old River at Woodward Island	5	5.2	7.0	3.8	5.2	7.0	3.9	0%	5.3	7.0	4.0	1%
Old River at Franks Tract	6	5.1	6.7	3.7	5.1	6.7	3.7	0%	5.1	6.6	3.8	0%
Middle River at Woodward Island	7	5.2	7.0	3.8	5.2	7.0	3.8	0%	5.2	7.0	3.9	1%
Grant Line Canal	8	8.1	8.9	7.6	8.1	8.9	7.6	-1%	8.3	9.1	7.7	2%
Victoria Canal	9	5.7	7.2	4.6	5.7	7.2	4.7	1%	5.7	7.2	4.6	0%
Delta Cross Channel	10	6.2	7.5	5.1	6.2	7.5	5.1	0%	6.2	7.5	5.1	0%
Georgiana Slough	11	11.1	11.6	10.7	11.1	11.7	10.7	0%	11.1	11.6	10.7	0%
Diversion to Sutter/Steamboat sloughs	12	13.6	13.9	13.3	13.6	13.9	13.3	0%	13.6	13.9	13.3	0%
Miner Slough	13	9.3	10.3	8.6	9.3	10.3	8.6	0%	9.3	10.3	8.6	0%
Sacramento River at Rio Vista	14	5.0	7.0	3.3	5.0	7.0	3.3	0%	5.0	7.0	3.3	0%
Mokelumne River, North Fork	15	5.5	7.0	4.3	5.5	7.0	4.3	0%	5.5	6.9	4.3	0%
Mokelumne River, South Fork	16	5.4	7.0	4.1	5.4	7.0	4.1	0%	5.4	7.0	4.2	0%

Table 21. **Flows, Velocities, and Stages at Locations in the Delta for High-Inflow Conditions for All Alternatives (Page 1 of 2)**

Alternative Variation 2B				Alternative Variation 2D				Alternative Variation 2E				Alternative Variation 3E			
Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]
17,671	21,760	11,877	1%	17,645	20,563	13,136	1%	17,550	20,168	13,610	0%	17,645	21,469	11,960	1%
61,470	######	######	11%	62,303	######	94,583	12%	77,546	######	72,368	39%	60,668	######	######	9%
23,914	23,968	23,844	-1%	23,995	24,042	23,929	-1%	24,004	24,056	23,933	-1%	23,941	23,992	23,890	-1%
4,836	5,078	4,356	5%	4,539	4,776	4,169	-1%	4,528	4,753	4,132	-1%	4,620	4,892	4,267	1%
10,077	17,369	3,569	9%	8,321	15,381	5,250	-10%	8,391	14,938	5,206	-10%	13,502	17,918	5,129	46%
1,617	5,057	3,965	3%	1,655	6,377	5,469	5%	1,903	6,457	5,598	21%	1,956	4,896	3,641	25%
5,668	10,987	4,136	0%	4,125	9,541	7,227	-27%	3,814	8,940	7,502	-33%	8,929	12,257	3,064	58%
15,447	16,010	14,186	-3%	15,736	16,298	14,730	-2%	15,711	16;257	14,665	-2%	15,673	16,314	14,780	-2%
-3,260	1,174	5,634	-14%	-1,306	1,844	2,717	-66%	-1,204	1,990	2,552	-68%	-6,529	-3,230	7,522	71%
0	46	108	NA	0	23	59	NA	0	172	185	NA	0	121	301	NA
10,166	10,635	9,863	-9%	10,117	10,634	9,738	-10%	39,842	47,259	35,306	256%	10,330	10,821	9,919	-8%
16,140	16,477	15,640	-10%	16,152	16,498	15,627	-10%	14,059	14,699	13,167	-21%	16,353	16,683	15,863	-9%
9,459	10,073	8,557	-11%	9,470	10,057	8,573	-10%	8,047	8,792	6,958	-24%	9,596	10,202	8,709	-9%
######	######	######	-4%	######	######	######	-4%	######	######	98,245	-16%	######	######	######	-3%
7,393	10,498	1,024	24%	7,676	8,886	5,541	29%	2,960	4,152	1,094	-50%	3,964	6,567	2,077	-33%
3,008	5,888	2,884	7%	2,689	6,003	3,661	-5%	2,625	8,655	9,832	-7%	1,743	5,026	4,965	-38%
Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]
1.05	1.25	0.71	1%	1.1	1.2	0.8	1%	1.04	1.17	0.80	0%	1.05	1.23	0.71	1%
1.01	2.76	1.45	10%	1.0	2.7	1.4	11%	1.26	2.83	1.04	37%	1.00	2.79	1.48	8%
6.77	6.81	6.73	-1%	6.8	6.9	6.8	-1%	6.83	6.86	6.79	0%	6.79	6.82	6.75	-1%
2.07	2.19	1.79	0%	2.0	2.1	1.8	-2%	2.00	2.11	1.76	-3%	1.95	2.09	1.77	-6%
0.98	1.73	0.32	8%	0.8	1.5	0.5	-11%	0.80	1.43	0.47	-12%	1.29	1.77	0.45	43%
0.28	0.78	0.67	4%	0.3	1.0	0.9	8%	0.33	1.02	0.90	22%	0.33	0.75	0.62	24%
0.81	1.60	0.54	0%	0.6	1.3	1.0	-28%	0.54	1.24	0.99	-34%	1.25	1.76	0.39	54%
3.02	3.21	2.68	-4%	3.1	3.3	2.8	-2%	3.07	3.23	2.79	-3%	3.00	3.19	2.76	-5%
-0.68	0.22	1.19	-15%	-0.3	0.4	0.6	-65%	-0.26	0.39	0.54	-68%	-1.30	-0.60	1.54	62%
0.00	0.01	0.02	NA	0.0	0.0	0.0	NA	0.00	0.03	0.03	NA	0.00	0.02	0.05	NA
2.66	2.79	2.53	-6%	2.6	2.8	2.6	-7%	3.37	3.97	2.99	19%	2.69	2.85	2.52	-5%
4.09	4.22	3.91	-7%	4.1	4.2	3.9	-6%	3.73	3.94	3.46	-15%	4.13	4.25	3.95	-6%
2.36	2.60	2.05	-8%	2.4	2.6	2.1	-8%	2.09	2.38	1.72	-18%	2.39	2.62	2.08	-7%
2.93	3.55	1.95	-4%	2.9	3.5	2.0	-3%	2.59	3.24	1.54	-15%	2.94	3.56	1.97	-3%
1.23	1.80	0.16	25%	1.3	1.5	0.9	28%	0.47	0.67	0.17	-52%	0.66	1.11	0.33	-33%
0.42	0.84	0.38	7%	0.4	0.8	0.5	-5%	0.35	1.16	1.29	-10%	0.24	0.67	0.68	-38%
Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]
5.3	7.0	4.0	2%	5.3	6.5	4.4	1%	5.5	6.6	4.8	6%	5.3	7.0	4.0	2%
4.2	6.4	2.2	0%	4.2	6.4	2.2	-1%	4.2	6.4	2.1	0%	4.2	6.4	2.2	0%
20.8	20.9	20.7	0%	20.7	20.8	20.6	-1%	20.7	20.7	20.6	-1%	20.7	20.8	20.7	0%
8.6	9.2	8.1	7%	8.1	8.7	7.7	1%	8.2	8.8	7.8	3%	8.7	9.3	8.2	9%
5.3	7.0	4.1	2%	5.3	6.5	4.4	2%	5.5	6.7	4.7	6%	5.4	6.9	4.1	3%
5.1	6.7	3.9	2%	5.1	6.2	4.2	1%	5.3	6.4	4.5	5%	5.1	6.7	3.9	2%
5.3	7.0	4.0	2%	5.2	6.5	4.4	1%	5.5	6.7	4.7	6%	5.3	7.0	4.0	3%
8.3	9.1	7.7	2%	8.2	8.8	7.8	1%	8.4	9.0	7.9	3%	8.7	9.3	8.2	7%
5.7	7.2	4.7	1%	5.4	6.7	4.5	-4%	5.6	6.9	4.8	-1%	6.2	7.3	5.2	10%
6.4	6.9	6.0	3%	6.6	6.8	6.4	6%	6.4	6.8	6.2	4%	5.7	7.2	4.5	-8%
10.4	10.9	9.9	-7%	10.4	10.9	10.0	-7%	6.4	6.8	6.2	-42%	10.4	11.0	10.0	-6%
12.6	13.0	12.3	-7%	12.6	13.0	12.3	-7%	11.3	11.7	11.1	-17%	12.7	13.1	12.4	-6%
8.8	9.8	8.0	-6%	8.7	9.8	8.0	-6%	8.0	9.1	7.1	-14%	8.8	9.8	8.1	-5%
5.0	7.0	3.2	-1%	4.9	7.0	3.2	-2%	4.8	6.9	3.0	-4%	5.0	7.0	3.2	-1%
5.6	6.7	4.7	2%	5.6	6.3	5.1	2%	6.3	6.7	6.0	15%	5.4	6.9	4.2	-2%
5.4	6.8	4.3	0%	5.5	6.1	5.0	1%	6.1	6.4	5.9	13%	5.3	7.0	4.0	-1%

NOTES:

cfs = cubic foot per second.
fps = foot per second.
mllw = ??

A negative flow or velocity indicates landward direction.
Location key numbers refer to Figure 1.

[a] Represents the percent difference between the average value of the alternative and the average value of the No Action Alternative.

Table 21. Flows, Velocities, and Stages at Locations in the Delta for High-Inflow Conditions for All Alternatives (Page 2 of 2)

Location		No Action Alternative			Configuration 1A				Configuration 1C			
Tidal Flow (cfs)	Loc. Key	Avg.	Max. Sea-ward	Max. Land-ward	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]
San Joaquin River at Fourteen Mile Slough	1	-34	6,032	6,377	-51	6,050	6,371	50%	1,268	7,494	5,063	3629%
San Joaquin River at Antioch	2	-1,552	148,346	155,223	-1,522	146,898	154,849	-2%	-1,504	145,791	154,428	-3%
Old River at Mossdale	3	1,292	1,650	213	1,311	1,609	868	1%	0	88	104	-100%
Old River at Fabian Tract	4	158	763	1,021	160	742	466	1%	-294	158	771	86%
Old River at Woodward Island	5	-4,564	5,888	13,191	-4,534	6,377	14,756	-1%	-5,540	8,208	18,174	21%
Old River at Franks Tract	6	-295	4,481	3,999	-305	4,020	3,980	3%	-385	3,644	4,176	31%
Middle River at Woodward Island	7	-3,154	4,192	9,915	-3,144	4,618	10,758	0%	-3,398	5,636	11,977	8%
Grant Line Canal	8	1,084	3,632	3,808	1,102	3,699	1,581	2%	340	3,593	3,164	-69%
Victoria Canal	9	2,355	5,935	1,049	2,364	6,053	1,159	0%	2,220	6,309	2,094	-6%
Delta Cross Channel	10	3,862	7,756	597	3,872	7,744	755	0%	3,881	7,683	863	0%
Georgiana Slough	11	2,241	3,953	903	2,244	3,941	990	0%	2,245	3,909	1,043	0%
Diversion to Sutter/Steamboat sloughs	12	1,882	5,047	3,422	1,879	5,019	3,421	0%	1,879	5,006	3,422	0%
Miner Slough	13	1,112	4,275	3,392	1,110	4,271	3,391	0%	1,110	4,271	3,396	0%
Sacramento River at Rio Vista	14	6,158	91,132	82,720	6,144	91,270	83,003	0%	6,135	91,512	83,389	0%
Mokelumne River, North Fork	15	3,018	4,395	1,404	3,022	4,444	1,370	0%	3,021	4,532	1,268	0%
Mokelumne River, South Fork	16	829	4,786	4,412	836	4,883	4,433	1%	845	4,944	4,501	2%
Velocity (fps)	Loc. Key	Avg.	Max. Sea-ward	Max. Land-ward	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]
San Joaquin River at Fourteen Mile Slough	1	0.00	0.37	0.39	0.00	0.37	0.39	NA	0.08	0.46	0.32	NA
San Joaquin River at Antioch	2	0.06	2.52	2.28	0.06	2.50	2.27	0%	0.06	2.48	2.27	0%
Old River at Mossdale	3	1.14	1.58	0.16	1.15	1.52	0.67	1%	0.00	0.07	0.10	-100%
Old River at Fabian Tract	4	0.15	0.70	0.73	0.15	0.71	0.44	-1%	-0.25	0.12	0.57	61%
Old River at Woodward Island	5	-0.46	0.68	1.32	-0.45	0.72	1.42	-2%	-0.55	0.91	1.76	20%
Old River at Franks Tract	6	-0.06	0.78	0.82	-0.06	0.70	0.82	0%	-0.07	0.65	0.80	19%
Middle River at Woodward Island	7	-0.46	0.70	1.44	-0.45	0.75	1.51	-1%	-0.48	0.90	1.68	6%
Grant Line Canal	8	0.31	1.08	0.93	0.31	1.08	0.41	1%	0.11	1.01	0.81	-66%
Victoria Canal	9	0.57	1.29	0.29	0.57	1.34	0.30	0%	0.54	1.43	0.52	-6%
Delta Cross Channel	10	0.74	1.43	0.11	0.74	1.42	0.14	0%	0.74	1.41	0.16	0%
Georgiana Slough	11	0.82	1.43	0.32	0.82	1.43	0.35	0%	0.82	1.42	0.37	0%
Diversion to Sutter/Steamboat sloughs	12	0.70	1.76	1.16	0.70	1.75	1.16	0%	0.70	1.75	1.16	0%
Miner Slough	13	0.43	1.49	0.98	0.43	1.49	0.98	0%	0.43	1.49	0.98	0%
Sacramento River at Rio Vista	14	0.13	1.56	1.46	0.13	1.56	1.47	0%	0.13	1.56	1.48	0%
Mokelumne River, North Fork	15	0.55	0.79	0.26	0.55	0.79	0.25	0%	0.55	0.80	0.23	0%
Mokelumne River, South Fork	16	0.13	0.70	0.68	0.13	0.69	0.68	1%	0.13	0.70	0.69	2%
Stage (mllw)	Loc. Key	Avg.	Max. Sea-ward	Max. Land-ward	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]
San Joaquin River at Fourteen Mile Slough	1	3.5	5.6	1.7	3.5	5.6	1.7	0%	3.5	5.5	1.7	0%
San Joaquin River at Antioch	2	3.5	6.0	0.9	3.5	6.0	0.9	0%	3.5	6.0	0.9	0%
Old River at Mossdale	3	3.5	4.8	2.4	3.4	4.6	2.4	-1%	3.2	4.8	1.8	-7%
Old River at Fabian Tract	4	3.0	4.7	1.7	3.0	4.3	1.7	-1%	3.5	4.6	2.4	17%
Old River at Woodward Island	5	3.5	5.6	1.6	3.5	5.4	1.6	0%	3.4	5.3	1.7	-1%
Old River at Franks Tract	6	3.5	5.4	1.8	3.5	5.4	1.8	0%	3.5	5.4	1.9	0%
Middle River at Woodward Island	7	3.5	5.6	1.6	3.5	5.5	1.6	0%	3.5	5.4	1.7	0%
Grant Line Canal	8	3.0	4.7	1.7	3.0	4.3	1.7	-1%	3.2	4.6	1.8	4%
Victoria Canal	9	3.2	5.3	1.5	3.2	4.9	1.5	-1%	3.2	4.7	1.6	-2%
Delta Cross Channel	10	4.1	5.7	2.5	4.1	5.8	2.5	0%	4.1	5.7	2.5	0%
Georgiana Slough	11	4.1	5.9	2.5	4.1	5.9	2.5	0%	4.1	5.9	2.5	0%
Diversion to Sutter/Steamboat sloughs	12	4.5	6.2	2.9	4.5	6.2	2.8	0%	4.5	6.2	2.8	0%
Miner Slough	13	3.9	6.3	1.6	3.9	6.3	1.6	0%	3.9	6.3	1.6	0%
Sacramento River at Rio Vista	14	3.5	6.3	0.7	3.5	6.4	0.7	0%	3.5	6.4	0.7	0%
Mokelumne River, North Fork	15	3.7	5.5	2.0	3.7	5.5	2.0	0%	3.7	5.5	2.0	0%
Mokelumne River, South Fork	16	3.6	5.6	1.9	3.6	5.6	1.9	0%	3.6	5.6	1.9	0%

Table 22. Flows, Velocities, and Stages at Locations in the Delta for Low-Inflow/High-Pumping Conditions (Page 1 of 2)

Configuration 2B				Configuration 2D				Configuration 2E				Configuration 3E			
Avg.	Max. Seaward	Max. Landward	% Diff*	Avg.	Max. Seaward	Max. Landward	% Diff*	Avg.	Max. Seaward	Max. Landward	% Diff*	Avg.	Max. Seaward	Max. Landward	% Diff*
1,270	7,355	5,043	3635%	1,289	6,174	3,944	3691%	1,270	6,200	3,963	3635%	1,268	6,832	4,762	3629%
1,308	144,267	151,290	-16%	1,341	137,747	146,793	-14%	712	137,355	147,033	-54%	912	147,280	151,988	-41%
0	87	103	-100%	0	99	79	-100%	0	97	78	-100%	0	114	134	-100%
-292	154	738	85%	-11	809	735	-93%	-11	786	698	-93%	-17	969	1,022	-89%
-5,504	7,815	17,652	21%	-4,855	8,035	17,489	6%	-4,844	7,782	16,937	6%	-650	9,350	11,307	-86%
-370	3,555	4,059	25%	-537	4,731	5,162	82%	-499	4,610	4,996	69%	62	4,071	3,868	-79%
-3,432	5,222	11,499	9%	-2,439	6,418	11,102	-23%	-2,448	6,234	10,648	-22%	-582	6,683	8,085	-82%
340	3,461	3,051	-69%	-47	3,075	2,931	-96%	-49	2,994	2,812	-95%	-54	3,517	4,052	-95%
2,224	6,106	1,985	-6%	1,195	3,793	1,674	-49%	1,200	3,658	1,620	-49%	383	4,629	2,500	-84%
0	88	130	-100%	0	63	105	-100%	0	194	191	-100%	0	243	233	-100%
903	3,351	1,641	-60%	781	3,888	2,546	-65%	9,018	26,024	4,645	302%	1,363	3,739	989	-39%
783	3,851	3,933	-58%	827	3,771	3,960	-56%	1,263	5,222	4,751	-33%	936	4,053	3,825	-50%
447	3,784	3,811	-60%	476	3,776	3,767	-57%	752	3,904	3,859	-32%	539	3,861	3,726	-52%
2,429	90,099	89,390	-61%	2,636	93,822	92,889	-57%	3,245	83,987	84,852	-47%	2,972	90,251	88,354	-52%
4,283	8,966	4,733	42%	5,003	6,937	1,782	66%	-41	3,080	3,803	-99%	13	4,623	5,002	-100%
1,327	5,416	4,123	60%	1,258	6,173	5,111	52%	136	10,334	12,093	-84%	-26	5,004	4,821	-97%
Avg.	Max. Seaward	Max. Landward	% Diff*	Avg.	Max. Seaward	Max. Landward	% Diff*	Avg.	Max. Seaward	Max. Landward	% Diff*	Avg.	Max. Seaward	Max. Landward	% Diff*
0.08	0.45	0.32	NA	0.08	0.38	0.25	NA	0.08	0.38	0.25	NA	0.08	0.41	0.30	NA
0.10	2.47	2.22	80%	0.10	2.40	2.15	84%	0.09	2.39	2.15	68%	0.10	2.52	2.23	71%
0.00	0.07	0.10	-100%	0.00	0.08	0.07	-100%	0.00	0.08	0.07	-100%	0.00	0.09	0.14	-100%
-0.24	0.11	0.55	59%	0.00	0.59	0.57	-97%	0.00	0.57	0.55	-97%	0.00	0.66	0.79	-99%
-0.55	0.86	1.71	19%	-0.50	0.86	1.77	9%	-0.50	0.84	1.72	9%	-0.04	0.98	1.08	-90%
-0.07	0.63	0.83	14%	-0.09	0.89	0.98	50%	-0.08	0.87	0.99	38%	0.01	0.72	0.78	-78%
-0.49	0.83	1.62	7%	-0.35	0.98	1.61	-24%	-0.35	0.96	1.56	-23%	-0.06	1.02	1.12	-86%
0.11	0.97	0.78	-66%	-0.01	0.78	0.76	-98%	-0.01	0.76	0.74	-98%	0.00	0.88	1.05	-100%
0.54	1.39	0.50	-5%	0.29	0.92	0.41	-49%	0.29	0.90	0.40	-49%	0.07	1.01	0.59	-88%
0.00	0.02	0.02	-100%	0.00	0.01	0.02	-100%	0.00	0.04	0.04	-100%	0.00	0.05	0.05	-100%
0.31	1.15	0.69	-62%	0.25	1.30	1.06	-70%	0.89	2.49	0.47	8%	0.49	1.31	0.41	-41%
0.31	1.39	1.36	-55%	0.33	1.40	1.37	-52%	0.49	1.98	1.65	-30%	0.37	1.45	1.32	-47%
0.21	1.34	1.11	-51%	0.22	1.33	1.10	-48%	0.32	1.45	1.13	-25%	0.24	1.36	1.09	-44%
0.07	1.54	1.58	-48%	0.07	1.61	1.63	-45%	0.09	1.46	1.49	-36%	0.08	1.54	1.56	-41%
0.79	1.70	0.79	45%	0.90	1.29	0.30	65%	0.00	0.57	0.65	-100%	0.01	0.81	0.87	-98%
0.21	0.82	0.58	64%	0.20	0.96	0.74	54%	0.03	1.59	1.78	-74%	0.00	0.71	0.75	-99%
Avg.	Max. Seaward	Max. Landward	% Diff*	Avg.	Max. Seaward	Max. Landward	% Diff*	Avg.	Max. Seaward	Max. Landward	% Diff*	Avg.	Max. Seaward	Max. Landward	% Diff*
3.6	5.4	1.9	2%	3.6	5.0	2.4	2%	3.6	4.9	2.5	2%	3.6	5.5	1.9	2%
3.5	6.0	0.9	0%	3.5	6.0	0.9	0%	3.5	5.9	0.9	0%	3.5	5.9	1.0	0%
3.3	4.8	1.9	-6%	3.4	4.9	2.1	-3%	3.4	4.8	2.1	-3%	3.6	5.3	1.8	3%
3.6	4.6	2.5	18%	3.4	4.7	2.2	12%	3.4	4.7	2.2	12%	3.6	5.2	1.9	18%
3.5	5.3	1.8	1%	3.4	4.7	2.3	-1%	3.4	4.6	2.4	-1%	3.6	5.4	1.8	4%
3.6	5.3	2.0	1%	3.6	4.9	2.5	1%	3.6	4.8	2.5	1%	3.6	5.3	2.0	2%
3.6	5.4	1.8	2%	3.6	4.9	2.4	2%	3.5	4.8	2.4	1%	3.6	5.4	1.8	3%
3.2	4.6	1.9	6%	3.4	4.7	2.2	11%	3.4	4.6	2.2	10%	3.6	5.2	1.9	17%
3.2	4.7	1.8	0%	3.4	4.7	2.2	6%	3.4	4.6	2.3	5%	3.6	5.2	1.8	11%
4.4	5.3	3.8	7%	4.4	5.0	4.0	9%	3.8	4.5	3.2	-8%	3.6	5.5	1.9	-11%
3.9	5.8	2.1	-7%	3.9	5.7	2.2	-6%	3.8	4.7	3.1	-8%	3.9	5.8	2.1	-6%
4.0	6.0	2.0	-11%	4.0	6.1	2.1	-11%	4.2	5.4	3.3	-6%	4.0	6.1	2.1	-9%
3.7	6.2	1.2	-5%	3.7	6.2	1.2	-5%	3.8	6.1	1.7	-3%	3.7	6.3	1.3	-4%
3.5	6.3	0.6	0%	3.5	6.3	0.6	-1%	3.5	6.3	0.7	-1%	3.5	6.3	0.7	0%
3.8	5.3	2.5	4%	3.8	4.9	2.9	4%	3.8	4.7	3.1	2%	3.6	5.4	2.0	-2%
3.7	5.4	2.2	2%	3.8	4.5	3.1	4%	3.7	4.3	3.3	3%	3.6	5.5	1.9	0%

NOTES.

cfs = cubic foot per second
fps = foot per second
mllw = ??

A negative flow or velocity indicates landward direction
Location key numbers refer to Figure 1

* Represents the percent difference between the average value of the alternative and the average value of the No Action Alternative.

Table 22. Flows, Velocities, and Stages at Locations in the Delta for Low-Inflow/High-Pumping Conditions (Page 2 of 2)

Location		No Action Alternative			Configuration 1A				Configuration 1C			
Tidal Flow (cfs)	Loc. Key	Avg.	Max. Sea-ward	Max. Land-ward	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]
San Joaquin River at Fourteen Mile Slough	1	99	5,945	6,340	69	6,065	6,356	-30%	412	6,278	5,850	316%
San Joaquin River at Antioch	2	950	148,752	152,312	680	148,097	152,301	-28%	652	147,294	152,041	-31%
Old River at Mossdale	3	862	1,603	749	892	1,547	452	3%	554	1,399	401	-36%
Old River at Fabian Tract	4	32	993	1,111	49	875	888	53%	113	963	750	253%
Old River at Woodward Island	5	-981	8,474	11,251	-1,331	8,409	11,319	36%	-1,565	9,429	13,260	60%
Old River at Franks Tract	6	25	4,633	4,026	-11	4,302	4,031	-56%	4	4,102	4,203	-84%
Middle River at Woodward Island	7	-848	6,082	8,379	-1,094	6,051	8,392	29%	-1,217	6,484	9,114	44%
Grant Line Canal	8	525	3,915	3,935	509	3,848	4,019	-3%	190	3,559	3,242	-64%
Victoria Canal	9	429	3,211	2,076	624	4,262	2,208	45%	569	4,340	2,485	33%
Delta Cross Channel	10	2,677	6,194	528	2,875	6,398	313	7%	2,872	6,399	213	7%
Georgiana Slough	11	1,634	3,232	443	1,730	3,336	540	6%	1,731	3,335	523	6%
Diversion to Sutter/Steamboat sloughs	12	1,131	4,664	4,292	1,228	4,704	4,182	9%	1,227	4,676	4,194	8%
Miner Slough	13	653	4,084	3,832	710	4,110	3,772	9%	710	4,104	3,769	9%
Sacramento River at Rio Vista	14	2,900	87,291	86,542	3,251	87,739	86,251	12%	3,253	87,672	86,245	12%
Mokelumne River, North Fork	15	2,053	3,649	385	2,192	3,824	593	7%	2,194	3,873	541	7%
Mokelumne River, South Fork	16	297	4,459	4,603	351	4,605	4,592	18%	347	4,609	4,536	17%
Velocity (fps)	Loc. Key	Avg.	Max. Sea-ward	Max. Land-ward	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]
San Joaquin River at Fourteen Mile Slough	1	0.01	0.36	0.38	0.01	0.37	0.39	-22%	0.03	0.38	0.36	211%
San Joaquin River at Antioch	2	0.10	2.53	2.24	0.09	2.52	2.24	-5%	0.09	2.51	2.23	-5%
Old River at Mossdale	3	0.76	1.51	0.53	0.78	1.48	0.35	3%	0.44	1.15	0.29	-42%
Old River at Fabian Tract	4	0.05	0.71	0.72	0.06	0.69	0.68	15%	0.10	0.76	0.49	80%
Old River at Woodward Island	5	-0.08	0.89	1.10	-0.12	0.89	1.10	42%	-0.14	0.98	1.26	75%
Old River at Franks Tract	6	0.00	0.80	0.81	0.00	0.75	0.81	-50%	0.00	0.72	0.86	-100%
Middle River at Woodward Island	7	-0.11	0.92	1.19	-0.14	0.93	1.20	34%	-0.16	0.98	1.26	55%
Grant Line Canal	8	0.17	1.07	0.94	0.16	1.06	0.96	-4%	0.06	0.98	0.75	-66%
Victoria Canal	9	0.08	0.67	0.49	0.13	0.91	0.51	53%	0.12	0.93	0.57	48%
Delta Cross Channel	10	0.52	1.19	0.10	0.56	1.23	0.06	7%	0.56	1.22	0.04	7%
Georgiana Slough	11	0.61	1.23	0.15	0.64	1.26	0.19	6%	0.64	1.26	0.19	6%
Diversion to Sutter/Steamboat sloughs	12	0.43	1.64	1.49	0.47	1.65	1.45	8%	0.47	1.64	1.45	8%
Miner Slough	13	0.28	1.43	1.12	0.30	1.44	1.10	7%	0.30	1.44	1.10	7%
Sacramento River at Rio Vista	14	0.08	1.50	1.53	0.08	1.50	1.52	8%	0.08	1.50	1.52	8%
Mokelumne River, North Fork	15	0.37	0.64	0.07	0.40	0.67	0.10	7%	0.40	0.68	0.09	7%
Mokelumne River, South Fork	16	0.05	0.63	0.72	0.06	0.65	0.71	16%	0.06	0.65	0.70	14%
Stage (mllw)	Loc. Key	Avg.	Max. Sea-ward	Max. Land-ward	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]
San Joaquin River at Fourteen Mile Slough	1	3.6	5.6	1.8	3.6	5.6	1.7	0%	3.6	5.6	1.7	0%
San Joaquin River at Antioch	2	3.5	6.0	1.0	3.5	6.0	1.0	0%	3.5	6.0	1.0	0%
Old River at Mossdale	3	3.9	5.3	2.5	3.8	5.2	2.5	-1%	4.3	5.3	3.8	10%
Old River at Fabian Tract	4	3.5	5.3	1.9	3.5	5.1	1.9	-1%	4.1	5.3	3.3	16%
Old River at Woodward Island	5	3.6	5.6	1.7	3.6	5.5	1.7	-1%	3.6	5.5	1.6	-1%
Old River at Franks Tract	6	3.6	5.4	1.9	3.6	5.4	1.9	0%	3.6	5.4	1.9	0%
Middle River at Woodward Island	7	3.6	5.6	1.7	3.6	5.6	1.7	0%	3.6	5.5	1.6	0%
Grant Line Canal	8	3.6	5.3	1.9	3.6	5.2	1.9	1%	3.6	5.5	1.4	1%
Victoria Canal	9	3.5	5.5	1.7	3.5	5.3	1.6	-1%	3.5	5.3	1.5	-1%
Delta Cross Channel	10	3.9	5.7	2.3	3.9	5.7	2.3	1%	3.9	5.7	2.3	1%
Georgiana Slough	11	3.9	5.7	2.2	4.0	5.7	2.3	1%	4.0	5.8	2.3	1%
Diversion to Sutter/Steamboat sloughs	12	4.1	6.0	2.5	4.2	6.0	2.5	1%	4.2	6.0	2.5	1%
Miner Slough	13	3.8	6.2	1.4	3.8	6.2	1.4	1%	3.8	6.2	1.4	1%
Sacramento River at Rio Vista	14	3.5	6.3	0.7	3.5	6.3	0.7	0%	3.5	6.3	0.7	0%
Mokelumne River, North Fork	15	3.7	5.5	2.0	3.7	5.5	2.0	0%	3.7	5.5	2.0	0%
Mokelumne River, South Fork	16	3.6	5.6	1.9	3.6	5.6	1.9	0%	3.6	5.6	1.9	0%

Table 23. Flows, Velocities, and Stages at Locations in the Delta for Low-Inflow/Low-Pumping Conditions (Page 1 of 2)

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Configuration 2B				Configuration 2D				Configuration 2E				Configuration 3E			
Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]
394	6,092	5,672	298%	127	4,928	5,181	28%	122	4,928	5,089	23%	131	5,762	6,181	32%
986	144,740	150,990	4%	1,322	138,268	146,304	39%	2,235	138,745	145,573	135%	1,215	147,681	151,716	28%
573	1,385	315	-34%	846	1,582	490	-2%	843	1,563	418	-2%	830	1,535	528	-4%
115	942	696	259%	40	746	714	25%	39	731	699	22%	31	917	910	-3%
-1,560	9,149	12,609	59%	-1,122	9,582	13,823	14%	-1,116	9,259	13,374	14%	-686	9,074	11,621	-30%
-10	4,035	4,202	-60%	-126	5,112	5,047	404%	-93	4,989	5,000	272%	27	4,079	3,913	8%
-1,196	6,308	8,519	41%	-821	8,173	9,428	-3%	-851	7,834	9,070	0%	-632	6,488	8,384	-25%
203	3,435	2,999	-61%	480	3,020	3,018	-9%	474	2,938	2,935	-10%	443	3,668	3,909	-16%
564	4,096	2,482	31%	269	2,835	2,104	-37%	282	2,732	2,011	-34%	277	4,634	2,425	-35%
996	7,677	5,006	-63%	1,609	7,952	3,593	-40%	1,346	5,790	2,752	-50%	2,474	6,592	1,837	-8%
1,712	3,157	99	5%	1,345	3,335	1,069	-18%	5,268	18,888	5,394	222%	1,641	3,245	493	0%
1,015	4,442	4,496	-10%	995	4,223	4,499	-12%	700	5,040	5,332	-38%	1,027	4,588	4,333	-9%
589	3,880	3,887	-10%	576	3,718	3,848	-12%	408	3,759	4,153	-38%	590	4,046	3,871	-10%
2,830	85,516	85,589	-2%	2,664	89,718	89,664	-8%	1,242	80,090	86,305	-57%	2,529	86,894	87,437	-13%
1,580	6,414	5,408	-23%	2,264	3,637	548	10%	375	2,381	2,194	-82%	1,036	4,066	2,372	-50%
272	4,428	5,429	-8%	448	5,776	5,598	51%	1	10,403	12,112	-100%	309	4,946	4,592	4%
Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]
0.03	0.37	0.36	200%	0.01	0.31	0.33	0%	0.01	0.30	0.32	0%	0.01	0.35	0.37	22%
0.10	2.48	2.22	1%	0.10	2.41	2.14	7%	0.12	2.42	2.13	23%	0.10	2.52	2.23	5%
0.46	1.14	0.23	-40%	0.73	1.46	0.36	-4%	0.73	1.43	0.31	-4%	0.72	1.45	0.41	-5%
0.10	0.73	0.46	85%	0.05	0.55	0.59	-15%	0.04	0.54	0.58	-19%	0.05	0.67	0.70	-11%
-0.14	0.95	1.21	75%	-0.10	0.99	1.38	26%	-0.10	0.96	1.34	26%	-0.05	0.95	1.11	-42%
0.00	0.71	0.86	-50%	-0.01	0.95	0.98	175%	-0.01	0.93	0.97	25%	0.01	0.72	0.79	50%
-0.16	0.95	1.19	54%	-0.10	1.23	1.39	-1%	-0.11	1.18	1.34	6%	-0.07	0.99	1.16	-33%
0.06	0.94	0.70	-64%	0.14	0.80	0.74	-15%	0.14	0.78	0.72	-16%	0.14	1.00	0.93	-15%
0.12	0.89	0.56	48%	0.05	0.66	0.50	-36%	0.06	0.64	0.48	-31%	0.04	1.00	0.57	-52%
0.18	1.41	1.02	-66%	0.29	1.45	0.74	-44%	0.26	1.10	0.55	-50%	0.48	1.29	0.33	-7%
0.64	1.22	0.04	5%	0.48	1.14	0.44	-20%	0.52	1.82	0.55	-14%	0.61	1.20	0.20	0%
0.40	1.65	1.57	-8%	0.40	1.64	1.57	-8%	0.28	1.92	1.89	-34%	0.40	1.60	1.51	-9%
0.26	1.40	1.14	-6%	0.26	1.36	1.12	-7%	0.21	1.40	1.22	-25%	0.26	1.42	1.13	-7%
0.08	1.47	1.51	0%	0.07	1.55	1.57	-4%	0.05	1.39	1.51	-34%	0.07	1.49	1.54	-8%
0.31	1.22	0.91	-17%	0.41	0.66	0.09	10%	0.07	0.44	0.38	-81%	0.19	0.72	0.43	-48%
0.05	0.70	0.77	6%	0.08	0.90	0.82	59%	0.01	1.60	1.78	-73%	0.05	0.70	0.71	0%
Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]	Avg.	Max. Sea-ward	Max. Land-ward	% Diff[a]
3.6	5.5	1.9	0%	3.6	5.0	2.4	0%	3.6	4.9	2.5	1%	3.6	5.5	1.8	0%
3.5	6.0	0.9	0%	3.5	6.0	0.9	-1%	3.5	6.0	0.9	-1%	3.5	6.0	1.0	0%
4.2	5.2	3.8	9%	3.8	4.9	2.8	-1%	3.8	4.9	2.8	-1%	3.9	5.2	2.6	1%
4.0	5.2	3.2	14%	3.6	4.9	2.3	1%	3.6	4.9	2.4	2%	3.6	5.2	2.0	2%
3.6	5.4	1.7	-1%	3.6	4.8	2.4	-1%	3.6	4.8	2.4	0%	3.6	5.4	1.8	0%
3.6	5.3	2.0	0%	3.6	4.9	2.4	0%	3.6	4.8	2.5	1%	3.6	5.4	2.0	0%
3.6	5.4	1.8	0%	3.6	4.9	2.4	0%	3.6	4.9	2.4	1%	3.6	5.5	1.8	0%
3.6	5.4	1.5	1%	3.6	4.9	2.4	1%	3.7	4.9	2.5	3%	3.7	5.4	2.1	4%
3.5	5.2	1.6	-1%	3.6	4.9	2.3	1%	3.6	4.8	2.4	1%	3.6	5.2	1.8	1%
3.9	5.3	2.8	1%	3.9	5.2	2.7	0%	3.8	4.6	3.1	-3%	3.9	5.6	2.2	-1%
3.9	5.5	2.5	0%	3.9	5.5	2.6	-1%	3.8	4.7	3.0	-4%	3.9	5.7	2.2	-1%
4.1	5.8	2.6	-1%	4.1	5.8	2.6	-2%	4.0	5.0	3.1	-4%	4.1	5.9	2.4	-1%
3.7	6.2	1.4	-1%	3.7	6.2	1.4	-1%	3.7	6.0	1.6	-2%	3.8	6.2	1.4	0%
3.5	6.3	0.7	0%	3.5	6.3	0.6	-1%	3.5	6.3	0.7	-1%	3.5	6.3	0.7	0%
3.7	5.3	2.3	0%	3.7	4.9	2.6	0%	3.7	4.7	3.0	1%	3.7	5.5	2.0	-1%
3.6	5.4	2.1	0%	3.7	4.5	3.0	1%	3.7	4.3	3.3	2%	3.6	5.6	1.9	0%

NOTES:

cfs = cubic foot per second.
fps = foot per second.
mllw = ??

A negative flow or velocity indicates landward direction.
Location key numbers refer to Figure 1.

[a] Represents the percent difference between the average value of the alternative and the average value of the No Action Alternative.

Table 23. Flows, Velocities, and Stages at Locations in the Delta for Low-Inflow/Low-Pumping Conditions (Page 2 of 2)

	No Action		Alternative 1				Alternative 2						Alternative 3	
			1A		1C		2B		2D		2E		3E	
Vernalis	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**
Chipps Island	4%	8%	0%	0%	4%	9%	7%	9%	9%	12%	11%	13%	80%	87%
Contra Costa Canal	1%	1%	0%	0%	1%	1%	1%	1%	0%	0%	0%	0%	1%	1%
Exports	88%	91%	67%	72%	88%	90%	88%	90%	82%	87%	83%	86%	11%	11%
Islands	0%	1%	18%	20%	1%	0%	1%	1%	0%	1%	0%	1%	1%	1%
In Delta	7%	0%	15%	8%	7%	0%	4%	0%	8%	0%	5%	0%	9%	0%
Terminous	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**
Chipps Island	56%	78%	0%	4%	57%	77%	63%	75%	80%	88%	66%	75%	99%	100%
Contra Costa Canal	1%	1%	1%	3%	1%	1%	1%	1%	0%	0%	1%	1%	0%	0%
Exports	14%	20%	19%	56%	15%	21%	19%	24%	7%	11%	13%	21%	0%	0%
Islands	0%	0%	11%	15%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
In Delta	29%	1%	69%	20%	27%	1%	17%	0%	13%	0%	20%	4%	1%	0%
Freeport	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**
Chipps Island	98%	99%	19%	46%	98%	99%	76%	76%	76%	76%	96%	97%	80%	79%
Contra Costa Canal	0%	0%	1%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Exports	1%	1%	6%	22%	1%	1%	0%	0%	0%	1%	1%	2%	21%	21%
Islands	0%	0%	8%	11%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
In Delta	1%	0%	65%	20%	1%	0%	24%	23%	24%	23%	3%	1%	0%	0%
Rio Vista	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**
Chipps Island	100%	100%	50%	79%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Contra Costa Canal	0%	0%	1%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Exports	0%	0%	2%	5%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Islands	0%	0%	2%	3%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
In Delta	0%	0%	45%	12%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Jersey Point	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**
Chipps Island	99%	99%	40%	72%	98%	99%	100%	100%	99%	99%	100%	100%	100%	100%
Contra Costa Canal	0%	0%	1%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Exports	1%	1%	7%	9%	1%	1%	0%	0%	1%	1%	0%	0%	0%	0%
Islands	0%	0%	3%	4%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
In Delta	0%	0%	49%	13%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%
San Andreas Landing	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**
Chipps Island	94%	97%	13%	39%	94%	96%	99%	99%	94%	96%	99%	99%	100%	100%
Contra Costa Canal	0%	0%	2%	3%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Exports	3%	3%	15%	33%	4%	4%	1%	1%	3%	3%	1%	1%	0%	0%
Islands	0%	0%	4%	7%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
In Delta	3%	0%	66%	18%	2%	0%	0%	0%	3%	0%	0%	0%	0%	0%
Prisoners Point	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**
Chipps Island	74%	87%	2%	10%	75%	86%	84%	88%	81%	85%	89%	91%	100%	100%
Contra Costa Canal	1%	1%	3%	4%	1%	1%	0%	1%	1%	1%	0%	0%	0%	0%
Exports	10%	12%	42%	68%	11%	13%	10%	11%	10%	14%	7%	9%	0%	0%
Islands	0%	0%	5%	8%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
In Delta	15%	0%	48%	10%	13%	0%	6%	0%	8%	0%	4%	0%	0%	0%

Table 24. **Fate of Mass Released at Specific Locations for High-Inflow/High-Pumping Conditions for All Alternatives**

	No Action		Alternative 1				Alternative 2						Alternative 3	
			1A		1C		2B		2D		2E		3E	
Vernalis	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**
Chipps Island	0%	0%	0%	0%	0%	2%	1%	4%	2%	7%	3%	8%	8%	67%
Contra Costa Canal	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Exports	77%	87%	77%	87%	76%	84%	78%	84%	70%	81%	73%	81%	0%	1%
Islands	10%	11%	10%	11%	8%	11%	8%	10%	7%	10%	7%	9%	8%	13%
In Delta	13%	2%	13%	2%	16%	3%	13%	1%	21%	2%	17%	2%	83%	19%
Terminous	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**
Chipps Island	1%	8%	1%	8%	3%	16%	7%	25%	24%	54%	7%	20%	15%	80%
Contra Costa Canal	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Exports	25%	64%	25%	64%	35%	62%	41%	60%	18%	34%	19%	37%	0%	0%
Islands	8%	12%	8%	12%	7%	11%	8%	11%	4%	5%	4%	7%	10%	11%
In Delta	66%	16%	66%	16%	55%	11%	43%	4%	54%	7%	70%	35%	75%	9%
Freeport	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**
Chipps Island	69%	81%	69%	81%	69%	81%	55%	60%	54%	60%	55%	78%	60%	69%
Contra Costa Canal	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Exports	5%	10%	5%	10%	8%	12%	3%	4%	3%	4%	7%	13%	27%	27%
Islands	3%	4%	3%	4%	3%	4%	2%	2%	2%	2%	4%	4%	3%	3%
In Delta	23%	4%	23%	4%	19%	3%	40%	33%	41%	34%	34%	4%	10%	1%
Rio Vista	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**
Chipps Island	87%	94%	87%	94%	86%	93%	94%	98%	93%	97%	94%	98%	96%	99%
Contra Costa Canal	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Exports	2%	3%	2%	3%	3%	4%	1%	1%	1%	2%	1%	1%	0%	0%
Islands	1%	2%	1%	2%	1%	2%	1%	1%	1%	1%	1%	1%	1%	1%
In Delta	10%	1%	10%	1%	9%	1%	4%	0%	4%	0%	4%	0%	3%	0%
Jersey Point	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**
Chipps Island	62%	82%	62%	82%	60%	79%	88%	94%	86%	92%	92%	95%	93%	98%
Contra Costa Canal	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Exports	8%	10%	8%	10%	13%	15%	3%	4%	6%	6%	3%	3%	0%	0%
Islands	3%	4%	3%	4%	3%	3%	2%	2%	2%	2%	1%	2%	2%	2%
In Delta	27%	4%	27%	4%	24%	3%	7%	0%	7%	0%	3%	0%	5%	0%
San Andreas Landing	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**
Chipps Island	26%	51%	26%	51%	27%	51%	65%	80%	49%	71%	71%	84%	83%	97%
Contra Costa Canal	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Exports	18%	34%	18%	34%	28%	38%	15%	16%	16%	22%	11%	13%	0%	0%
Islands	4%	6%	4%	6%	4%	5%	3%	3%	3%	3%	2%	3%	2%	2%
In Delta	53%	9%	53%	9%	40%	6%	17%	0%	33%	3%	16%	1%	15%	1%
Prisoners Point	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**
Chipps Island	6%	16%	6%	16%	8%	20%	23%	36%	23%	39%	30%	43%	63%	95%
Contra Costa Canal	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Exports	47%	72%	47%	72%	56%	69%	52%	58%	40%	53%	40%	50%	0%	0%
Islands	4%	6%	4%	6%	5%	7%	4%	6%	3%	5%	3%	5%	3%	3%
In Delta	43%	6%	43%	6%	31%	4%	21%	1%	33%	2%	27%	2%	35%	2%

Table 25. **Fate of Mass Released at Specific Locations for Medium-Inflow/Low-Pumping Conditions for All Alternatives**

	No Action		Alternative 1				Alternative 2						Alternative 3	
			1A		1C		2B		2D		2E		3E	
Vernalis	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**
Chipps Island	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%	0%	3%	0%	1%
Contra Costa Canal	0%	0%	0%	0%	1%	2%	0%	2%	1%	2%	1%	2%	1%	3%
Exports	67%	72%	67%	72%	47%	74%	45%	72%	29%	67%	31%	68%	12%	29%
Islands	18%	20%	18%	20%	13%	17%	14%	18%	12%	17%	12%	17%	13%	21%
In Delta	15%	8%	15%	8%	39%	7%	41%	8%	58%	12%	55%	10%	75%	45%
Terminous	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**
Chipps Island	0%	4%	0%	4%	1%	6%	0%	4%	4%	20%	0%	3%	0%	4%
Contra Costa Canal	1%	3%	1%	3%	2%	3%	1%	3%	1%	2%	0%	1%	0%	1%
Exports	19%	58%	19%	58%	29%	62%	27%	58%	8%	36%	6%	23%	0%	4%
Islands	10%	15%	10%	15%	10%	15%	10%	16%	4%	8%	5%	9%	15%	27%
In Delta	69%	20%	69%	20%	59%	14%	61%	18%	84%	34%	89%	63%	84%	64%
Freeport	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**
Chipps Island	19%	46%	19%	46%	20%	46%	19%	46%	19%	39%	7%	36%	19%	43%
Contra Costa Canal	1%	2%	1%	2%	1%	2%	1%	2%	0%	1%	1%	2%	0%	1%
Exports	6%	22%	6%	22%	10%	24%	8%	21%	3%	10%	3%	20%	24%	27%
Islands	8%	11%	8%	11%	8%	11%	6%	9%	4%	6%	6%	9%	6%	8%
In Delta	65%	20%	65%	20%	61%	17%	66%	21%	73%	44%	84%	34%	50%	22%
Rio Vista	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**
Chipps Island	50%	79%	50%	79%	50%	78%	49%	80%	49%	77%	40%	76%	51%	79%
Contra Costa Canal	0%	1%	0%	1%	1%	1%	0%	1%	0%	1%	0%	1%	0%	1%
Exports	3%	5%	3%	5%	4%	7%	3%	5%	3%	7%	2%	5%	1%	2%
Islands	2%	3%	2%	3%	2%	3%	3%	3%	2%	3%	3%	4%	2%	3%
In Delta	45%	12%	45%	12%	43%	11%	45%	11%	46%	12%	55%	14%	46%	14%
Jersey Point	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**
Chipps Island	40%	72%	40%	72%	40%	70%	42%	73%	39%	69%	47%	77%	40%	72%
Contra Costa Canal	1%	2%	1%	2%	1%	2%	1%	1%	1%	1%	1%	1%	1%	2%
Exports	7%	9%	7%	9%	9%	12%	8%	10%	9%	14%	6%	9%	2%	5%
Islands	3%	4%	3%	4%	3%	4%	3%	4%	3%	4%	3%	3%	3%	5%
In Delta	49%	13%	49%	13%	46%	12%	46%	12%	48%	12%	44%	9%	54%	17%
San Andreas Landing	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**
Chipps Island	13%	39%	13%	39%	14%	40%	15%	45%	9%	31%	15%	47%	13%	46%
Contra Costa Canal	2%	4%	2%	4%	2%	3%	2%	3%	1%	3%	1%	2%	1%	3%
Exports	15%	33%	15%	33%	21%	35%	20%	30%	10%	31%	10%	25%	2%	8%
Islands	4%	7%	4%	7%	4%	6%	4%	6%	3%	6%	3%	5%	4%	6%
In Delta	66%	18%	66%	18%	59%	16%	60%	17%	77%	30%	71%	21%	81%	37%
Prisoners Point	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**
Chipps Island	3%	10%	3%	10%	3%	11%	4%	13%	5%	16%	5%	18%	3%	19%
Contra Costa Canal	3%	4%	3%	4%	3%	4%	3%	4%	2%	3%	2%	3%	1%	4%
Exports	42%	68%	42%	68%	49%	68%	52%	67%	31%	61%	32%	61%	3%	21%
Islands	5%	8%	5%	8%	6%	9%	6%	9%	4%	8%	4%	8%	4%	9%
In Delta	48%	10%	48%	10%	39%	8%	35%	7%	58%	12%	56%	10%	89%	47%

Table 26. **Fate of Mass Released at Specific Locations for Low-Inflow/High-Pumping Conditions for All Alternatives**

	No Action		Alternative 1				Alternative 2						Alternative 3	
			1A		1C		2B		2D		2E		3E	
Vernalis	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**
Chipps Island	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Contra Costa Canal	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Exports	31%	32%	31%	32%	4%	18%	5%	17%	22%	23%	22%	23%	20%	20%
Islands	61%	63%	61%	63%	69%	78%	70%	79%	68%	72%	68%	72%	69%	73%
In Delta	6%	4%	6%	4%	26%	4%	25%	3%	10%	6%	10%	6%	11%	6%
Terminous	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**
Chipps Island	0%	1%	0%	1%	0%	2%	0%	1%	2%	12%	0%	1%	0%	2%
Contra Costa Canal	1%	3%	1%	3%	2%	3%	1%	3%	1%	4%	0%	1%	1%	3%
Exports	10%	30%	10%	30%	14%	33%	11%	27%	2%	19%	1%	9%	1%	11%
Islands	39%	54%	39%	54%	38%	51%	41%	57%	15%	29%	22%	39%	40%	61%
In Delta	49%	12%	49%	12%	49%	11%	47%	12%	80%	37%	76%	50%	58%	23%
Freeport	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**
Chipps Island	10%	28%	10%	28%	10%	28%	9%	27%	8%	21%	2%	19%	7%	25%
Contra Costa Canal	1%	3%	1%	3%	1%	3%	1%	3%	1%	2%	1%	3%	1%	2%
Exports	4%	15%	4%	15%	6%	17%	6%	17%	1%	7%	0%	11%	12%	17%
Islands	26%	35%	26%	35%	26%	34%	23%	32%	14%	20%	19%	29%	23%	32%
In Delta	59%	19%	59%	19%	57%	18%	61%	22%	77%	50%	78%	38%	57%	24%
Rio Vista	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**
Chipps Island	35%	62%	35%	62%	35%	62%	32%	62%	31%	60%	22%	54%	31%	62%
Contra Costa Canal	1%	2%	1%	2%	1%	2%	1%	1%	1%	2%	1%	1%	1%	2%
Exports	2%	5%	2%	5%	3%	6%	3%	5%	1%	5%	0%	3%	1%	2%
Islands	8%	11%	8%	11%	8%	11%	8%	11%	8%	12%	11%	17%	8%	12%
In Delta	55%	19%	55%	19%	54%	19%	56%	20%	59%	21%	66%	25%	59%	22%
Jersey Point	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**
Chipps Island	27%	55%	27%	55%	27%	55%	28%	58%	28%	56%	32%	63%	30%	61%
Contra Costa Canal	2%	3%	2%	3%	2%	3%	2%	3%	2%	3%	1%	2%	2%	3%
Exports	6%	9%	6%	9%	8%	11%	6%	9%	4%	10%	3%	7%	2%	4%
Islands	9%	12%	9%	12%	8%	16%	8%	11%	8%	11%	7%	10%	8%	11%
In Delta	56%	20%	56%	20%	55%	20%	55%	20%	59%	20%	56%	18%	58%	21%
San Andreas Landing	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**
Chipps Island	6%	23%	6%	23%	7%	23%	7%	27%	5%	20%	8%	31%	8%	32%
Contra Costa Canal	3%	5%	3%	5%	3%	5%	3%	8%	2%	4%	2%	4%	2%	5%
Exports	12%	28%	12%	28%	16%	31%	15%	26%	4%	21%	3%	17%	2%	10%
Islands	14%	23%	14%	23%	13%	21%	13%	20%	10%	20%	9%	17%	11%	21%
In Delta	65%	21%	65%	21%	61%	19%	62%	22%	80%	35%	77%	31%	76%	31%
Prisoners Point	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**	**30 days**	**60 days**
Chipps Island	1%	6%	1%	6%	1%	6%	2%	8%	2%	9%	2%	11%	1%	7%
Contra Costa Canal	4%	6%	4%	6%	4%	6%	4%	6%	3%	5%	4%	5%	2%	7%
Exports	30%	49%	30%	49%	35%	52%	36%	50%	15%	43%	15%	43%	7%	24%
Islands	21%	31%	21%	31%	21%	29%	21%	28%	18%	28%	17%	26%	17%	37%
In Delta	44%	9%	44%	9%	38%	8%	36%	8%	62%	15%	61%	14%	72%	25%

Table 27. **Fate of Mass Released at Specific Locations for Low-Inflow/Low-Pumping Conditions for All Alternatives**

Percentile	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
No Action Alternative												
95%	116791	142508	115207	86834	62647	33393	8002	5240	11794	14188	33184	80202
90%	96075	121831	90369	71504	47340	22200	8002	5113	9821	12246	17316	64091
75%	46953	60973	45928	33914	22655	11193	8002	4765	3815	7611	9226	17971
50%	18378	30162	25078	18839	12133	9579	6505	4001	3008	4619	4790	7270
25%	8311	13009	14946	10722	8132	6689	4993	3497	3008	4001	4504	4538
10%	6001	11423	10197	8692	6343	6053	4001	2992	3008	4001	3496	4505
5%	5377	11211	8864	7462	6037	5748	4001	2992	3008	4001	3496	3497
Difference Between Alternative 1C and No Action												
95%	1057	(4919)	(2163)	(4820)	(738)	(2665)	0	(7)	(2880)	(784)	(3613)	(1376)
90%	(651)	(5665)	(2241)	(3610)	(1311)	(1785)	0	0	(3543)	(2186)	(3617)	(3767)
75%	(3220)	(3910)	(4716)	(1513)	(114)	286	0	0	(303)	(2017)	(2487)	(4619)
50%	(6375)	(4018)	1610	(2571)	2065	0	0	0	0	(33)	67	(911)
25%	(943)	1441	2944	(353)	2944	(235)	0	0	0	0	0	130
10%	(176)	(18)	930	(286)	436	(541)	0	0	0	0	0	0
5%	(130)	(677)	(276)	(30)	33	(376)	0	0	0	0	0	0
Difference Between Alternative 2A and No Action												
95%	(1317)	3445	1812	(1707)	(442)	(2622)	0	0	(2941)	(3032)	(3633)	(4827)
90%	(3373)	4094	(420)	(1711)	(1174)	(1812)	0	0	(4114)	(2615)	(3543)	(4007)
75%	(1968)	2324	2488	(1496)	520	286	0	0	0	(2000)	(2790)	(3350)
50%	(2505)	(2000)	2293	50	2065	(118)	0	0	0	(130)	(17)	(1025)
25%	(1399)	2775	2456	50	1887	(235)	0	0	0	0	0	0
10%	3	97	891	659	436	(397)	0	0	0	0	0	0
5%	(65)	166	(172)	0	195	(225)	0	0	0	0	0	0
Difference Between Alternative 2B&2E and No Action												
95%	(107)	(3214)	472	(4669)	(807)	(3469)	0	(7)	(3452)	(3409)	(5425)	(2983)
90%	(979)	(5676)	(1470)	(4524)	(1324)	(1785)	0	(13)	(4255)	(4082)	(7704)	(5487)
75%	(3171)	(1514)	(3155)	(1496)	(98)	286	0	0	(639)	(2017)	(2487)	(6863)
50%	(5725)	(3928)	1724	(2588)	1903	0	0	0	0	(504)	(67)	(911)
25%	(1203)	541	2944	(353)	2944	(218)	0	0	0	0	0	114
10%	(319)	(18)	943	(286)	436	(541)	0	0	0	0	0	0
5%	(306)	(814)	(270)	(40)	16	(366)	0	0	0	0	0	0
Difference Between Alternative 2D and No Action												
95%	(2742)	1928	1233	(1728)	(423)	(3260)	0	0	(2649)	(2472)	(3852)	(3539)
90%	(4528)	1283	(368)	(1714)	(1230)	(1755)	0	0	(3506)	(3022)	(3593)	(2160)
75%	(2635)	54	(228)	(1513)	1041	269	0	0	17	(2000)	(2470)	(3350)
50%	(3220)	(703)	2147	34	2065	(118)	0	0	0	(81)	0	(846)
25%	(1252)	1027	2098	50	1887	(235)	0	0	0	0	0	0
10%	3	(18)	891	672	436	(397)	0	0	0	0	0	0
5%	23	(231)	13	(10)	153	(225)	0	0	0	0	0	0
Difference Between Alternative 3A and No Action												
95%	(2719)	3150	1795	(4722)	4131	(3630)	0	921	(4581)	(3220)	(3835)	(4577)
90%	163	2119	(999)	(5499)	2508	(3563)	0	934	(4117)	(3646)	(3536)	(3802)
75%	602	(541)	2521	(4420)	1203	(454)	0	732	(118)	(1691)	(2941)	(3350)
50%	260	(1279)	4115	(2941)	2065	(706)	0	1236	0	(228)	168	(1236)
25%	651	2667	1805	(706)	1025	(235)	0	1252	0	0	0	(33)
10%	(1483)	(18)	859	(1425)	436	(232)	390	1239	0	0	1008	0
5%	(872)	(2739)	(1106)	(635)	(62)	(121)	299	1008	0	(185)	1008	546
Difference Between Alternative 3B&3H and No Action												
95%	777	(68)	1428	(9485)	3754	(3422)	0	374	(5240)	(1444)	(3546)	(638)
90%	494	(4151)	(644)	(6195)	2908	(6769)	0	364	(5630)	(2583)	(3801)	(729)
75%	(3334)	(18)	(1756)	(4588)	716	(420)	0	488	(168)	(2196)	(2807)	(7221)
50%	(6001)	(3838)	1480	(4722)	797	(739)	0	520	168	(553)	185	(1854)
25%	(2309)	1423	1285	(706)	1903	(218)	0	504	0	0	0	(33)
10%	(1496)	(2223)	423	(1418)	436	(420)	0	504	0	0	1008	0
5%	(872)	(3146)	(1382)	(635)	(16)	(229)	0	504	0	(176)	1008	556
Difference Between Alternative 3E&3I and No Action												
95%	3	(609)	976	(10228)	4459	(3479)	449	2078	(5714)	(1883)	(10624)	(2384)
90%	(2755)	(4789)	(1392)	(7878)	1874	(7075)	0	2062	(4356)	(3223)	(7606)	(4606)
75%	(3367)	(1207)	(2472)	(4554)	(146)	(420)	0	2098	1042	(130)	(2084)	(8359)
50%	(7579)	(4036)	309	(5378)	1155	(756)	0	2261	1294	1399	1714	(195)
25%	(2309)	(919)	(764)	(773)	2098	(218)	0	1984	689	1578	1630	1691
10%	(1496)	(2724)	709	(1418)	423	(467)	592	2300	383	449	1428	748
5%	(872)	(3831)	(1386)	(629)	0	(393)	345	2196	40	(231)	1203	1138

Table 28. Change in Monthly Delta Outflow as Simulated by DWRSIM

Percentile	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Overall
No Action Alternative													
95%	21452	40171	36355	26262	13403	11968	3421	40	171	4371	7858	22300	22090
90%	17906	35186	25580	17280	6895	4191	1346	-298	-140	3170	2552	10488	11156
75%	4301	12292	12621	2912	2069	2342	-502	-607	-199	1318	-197	-821	1566
50%	-985	2180	564	1000	908	153	-2213	-2272	-1588	-454	-1727	-3141	-416
25%	-2844	-472	-1256	415	-242	-844	-4770	-3717	-2692	-2073	-3229	-4417	-2350
10%	-4783	-3287	-2533	265	-503	-984	-5017	-4540	-3038	-2185	-3737	-4547	-3996
5%	-4904	-3634	-2872	106	-591	-1070	-5129	-4654	-3141	-2263	-3898	-4630	-4656
Alternative Variation 1A													
95%	22340	41245	37968	26163	12892	10878	3278	747	-173	2816	7475	24061	22503
90%	18445	35899	26401	17079	6540	3473	1172	540	-181	1781	2275	10441	11707
75%	2998	12697	12362	2561	2082	2346	425	-389	-425	1167	-560	-1477	1496
50%	-1632	1824	506	1000	870	160	-1736	-1075	-1477	-1639	-1731	-3679	-569
25%	-3472	-646	-1212	409	-238	-842	-6236	-2236	-2470	-2317	-4068	-5130	-2439
10%	-5579	-2879	-3336	257	-505	-980	-7409	-4071	-3058	-2774	-5956	-5726	-4748
5%	-6257	-3148	-4335	106	-599	-1069	-7629	-4675	-3188	-3409	-7197	-5972	-5734
Alternative Variation 1C													
95%	22363	41275	38000	26188	12913	10937	3274	733	-173	2816	7557	24086	22528
90%	18463	35927	26429	17102	6533	3549	1158	529	-181	1775	2335	10459	11725
75%	3035	12712	12378	2526	2009	2370	443	-382	-422	1182	-542	-1444	1478
50%	-1617	1828	513	1006	861	165	-1723	-1064	-1466	-1633	-1712	-3660	-565
25%	-3455	-639	-1205	408	-241	-834	-6197	-2220	-2451	-2319	-4043	-5102	-2434
10%	-5543	-2868	-3312	257	-506	-972	-7356	-4052	-3034	-2774	-5881	-5687	-4722
5%	-6233	-3139	-4276	106	-600	-1060	-7576	-4657	-3159	-3418	-7073	-5920	-5699
Alternative Variation 2B													
95%	30328	50094	46259	34717	21485	16714	5725	1574	3410	10911	15937	32139	30782
90%	25228	44342	34961	25630	14930	7804	3286	1392	1844	6468	7741	18504	19375
75%	11479	20055	19316	9979	8342	6183	2103	1181	1559	2244	2149	2173	6298
50%	3606	6042	7268	5252	3120	1220	369	1019	1241	1915	1687	1562	2172
25%	2043	3735	3413	3371	2353	993	-1792	550	1131	1747	1473	1122	1228
10%	1515	3507	2863	2982	2050	895	-3077	-89	1058	1404	861	563	682
5%	1198	3440	2533	2860	1918	777	-3269	-890	1005	923	751	388	-141
Alternative Variation 2D													
95%	30281	49965	46208	34700	21421	16453	5448	1534	3239	10659	15881	32133	30789
90%	25195	44232	34911	25630	14682	7545	3091	1452	1715	6307	7698	18429	19383
75%	11301	19992	19279	9655	8136	5955	2007	1313	1516	2159	2102	2084	6046
50%	3299	5883	7109	5093	2911	970	416	947	1173	1777	1587	1457	2048
25%	1958	3511	3114	3133	2145	710	-2367	572	1060	1567	1391	879	1128
10%	1231	3266	2640	2764	1834	610	-3568	-519	973	1130	640	321	527
5%	917	3217	2298	2647	1695	506	-3763	-1254	922	601	483	119	-524
Alternative Variation 2E													
95%	43860	72775	64461	50964	28873	20802	6959	2316	5710	13137	24623	46338	46450
90%	38116	64855	51519	36758	18398	8480	4372	2185	2688	7880	13752	32849	28126
75%	20630	30395	28728	11417	8437	6279	3731	2094	1371	3077	3187	2858	8785
50%	4083	10762	13213	9238	5714	3762	1572	1714	731	1270	1542	1181	3688
25%	2999	7033	6724	5995	3934	2933	65	1438	292	773	1269	530	1337
10%	2485	5867	4690	4777	3727	2653	-880	436	169	645	770	397	548
5%	1995	5504	4173	4568	3556	2388	-964	-229	46	348	639	327	188
Alternative Variation 3E													
95%	29537	49824	45502	34920	22626	18795	7427	3126	6133	13198	16174	31329	30372
90%	24415	43763	34186	26004	16081	9054	4542	2819	3649	8850	9375	19677	20001
75%	13844	19396	18575	10164	8452	6278	3528	2518	1334	3202	2741	2982	6273
50%	4205	5231	6759	5278	3117	1201	1772	1604	715	1970	1665	1622	2709
25%	2783	2952	4115	3373	2332	968	1453	1347	527	1298	1323	1300	1398
10%	1587	2634	2197	2992	2046	889	1380	1276	478	1209	952	971	1000
5%	1488	2597	1823	2868	1909	774	1361	1246	435	1130	872	857	759

NOTE:

Central Delta includes the lower San Joaquin River upstream from Three Mile Slough plus False River and Dutch Slough. Negative values (boxed) are upstream flows.

Table 29. Monthly Averaged Central Delta Outflow (cfs) by Percentile

					No Action Alternative							
Percentile	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
95%	85	79	77	79	81	81	85	89	90	88	88	88
90%	83	78	76	77	81	81	85	89	90	88	88	86
75%	81	74	72	74	77	81	83	87	89	88	87	85
50%	74	67	67	69	73	76	79	85	89	86	85	81
25%	62	60	59	62	66	72	77	82	86	82	78	72
10%	56	52	54	55	57	65	75	82	79	77	75	64
5%	52	51	51	52	55	60	73	82	77	74	70	59
					Difference Between Alternative 1C and No Action							
95%	0.1	0.2	0.7	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90%	0.5	0.3	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75%	0.8	0.5	0.0	0.0	(2.3)	0.1	0.0	0.1	0.0	0.0	0.0	0.2
50%	3.7	1.2	0.2	0.9	(1.7)	(0.5)	(0.1)	0.0	0.0	0.1	0.6	2.0
25%	0.6	0.9	0.7	0.5	(0.1)	0.0	0.0	0.0	0.6	2.7	3.6	4.7
10%	0.9	0.7	0.4	0.8	0.4	0.4	0.2	0.0	3.4	1.2	1.4	0.9
5%	0.2	0.5	0.6	0.6	0.2	0.7	0.3	0.0	2.2	2.7	2.0	0.5
					Difference Between Alternative 2A and No Action							
95%	0.1	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90%	0.0	(0.2)	0.0	0.1	(0.0)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75%	1.5	(0.1)	(0.6)	(0.1)	(1.6)	0.3	0.1	0.1	0.0	0.0	0.0	0.0
50%	0.9	0.4	(0.9)	(0.4)	(0.6)	(0.2)	0.0	0.0	0.0	0.2	0.6	2.2
25%	1.0	(0.3)	(0.7)	(0.1)	(0.2)	0.0	0.0	0.0	0.1	2.2	3.6	2.3
10%	0.1	(0.2)	(0.4)	0.2	0.2	0.4	0.1	0.0	4.1	2.5	(0.1)	1.0
5%	0.1	(0.1)	(0.3)	0.0	0.0	0.6	0.2	0.0	2.2	2.9	1.6	1.1
					Difference Between Alternative 2B&2E and No Action							
95%	0.4	0.4	0.7	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90%	0.7	0.3	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75%	0.9	1.1	(0.1)	0.0	(2.3)	0.1	0.0	0.1	0.0	0.0	0.0	0.1
50%	3.5	1.6	0.0	0.9	(1.5)	(0.5)	(0.1)	0.0	0.0	1.2	1.1	2.6
25%	0.8	0.5	0.7	0.5	(0.1)	0.0	0.0	0.0	1.2	2.8	4.2	5.8
10%	1.0	0.7	0.2	0.8	0.4	0.4	0.2	0.0	4.4	3.5	2.1	1.1
5%	0.2	0.4	0.4	0.6	0.3	0.9	0.3	0.0	2.6	3.1	2.4	0.7
					Difference Between Alternative 2D and No Action							
95%	(0.0)	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90%	0.0	0.2	0.1	0.1	(0.0)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75%	1.3	0.6	(0.3)	0.0	(1.5)	0.3	0.1	0.1	0.0	0.0	0.0	0.0
50%	1.6	0.5	(0.2)	(0.3)	(0.5)	(0.2)	0.0	0.0	0.0	0.2	0.6	1.8
25%	1.1	0.3	(0.5)	0.2	(0.2)	0.0	0.0	0.0	0.0	2.3	3.2	2.2
10%	0.5	(0.1)	(0.1)	0.1	0.2	0.4	0.1	0.0	3.4	2.3	1.3	0.3
5%	0.1	0.0	(0.1)	0.1	0.1	0.6	0.3	0.0	1.9	2.0	1.6	1.0
					Difference Between Alternative 3A and No Action							
95%	0.7	2.5	0.9	0.9	0.0	0.0	(0.5)	(3.9)	(1.3)	(0.2)	(1.3)	(1.7)
90%	1.4	0.2	0.5	1.5	0.1	0.0	(0.7)	(4.1)	(1.4)	(0.3)	(1.3)	(0.1)
75%	(0.3)	(0.7)	0.4	0.4	(1.0)	0.2	0.1	(2.8)	(1.3)	(0.3)	(0.6)	0.0
50%	0.4	0.5	(1.1)	0.4	0.2	(0.1)	0.0	(1.8)	(1.1)	0.4	0.0	1.9
25%	0.8	(0.1)	(0.8)	0.5	(0.2)	1.7	0.5	(0.2)	0.5	2.1	4.1	2.9
10%	0.0	(0.2)	(0.4)	0.4	(0.3)	1.4	0.5	(0.3)	4.1	4.5	(0.0)	0.8
5%	0.1	(0.1)	(0.3)	0.2	(0.5)	0.8	0.3	(1.0)	3.5	3.3	2.1	1.2
					Difference Between Alternative 3B&3H and No Action							
95%	0.9	2.7	1.7	0.9	0.0	0.0	0.0	(1.7)	(0.7)	0.0	(1.2)	(1.8)
90%	1.9	1.9	0.3	1.5	0.1	0.0	0.0	(1.7)	(1.3)	(0.2)	(1.3)	(0.0)
75%	3.0	1.5	1.0	0.7	(1.6)	0.3	0.1	(2.1)	(0.9)	(0.2)	(0.2)	0.1
50%	1.5	2.1	(0.1)	2.5	(1.2)	(0.2)	0.0	(0.3)	(0.9)	1.4	(0.1)	2.1
25%	0.7	0.1	0.5	1.6	(0.2)	1.7	0.5	(0.1)	1.0	2.9	4.3	5.2
10%	0.6	0.1	0.2	1.0	(0.1)	1.5	0.5	(0.1)	5.7	1.2	1.3	0.6
5%	0.2	0.1	0.2	0.9	(0.4)	0.7	0.3	(0.7)	2.3	2.1	1.9	0.6
					Difference Between Alternative 3E&3I and No Action							
95%	0.2	3.1	1.9	0.9	0.0	0.0	(0.6)	(4.5)	(2.4)	(0.3)	(2.0)	(4.0)
90%	1.3	2.7	0.3	1.4	0.1	0.0	(0.9)	(4.6)	(2.8)	(1.8)	(2.3)	(2.5)
75%	2.3	1.4	0.6	1.1	(2.3)	0.3	0.1	(3.4)	(3.0)	(3.7)	(3.9)	(3.6)
50%	1.9	1.1	0.0	3.0	(0.9)	(0.2)	0.0	(3.5)	(4.1)	(3.0)	(3.2)	(0.2)
25%	1.4	0.3	0.5	1.5	(0.2)	1.7	0.5	(2.2)	(2.9)	(1.4)	1.8	5.2
10%	0.6	0.4	0.2	1.0	(0.0)	1.5	0.3	(3.2)	3.1	2.0	1.5	(0.1)
5%	0.1	0.1	0.3	1.1	(0.4)	0.8	0.2	(3.8)	3.2	1.9	1.6	0.5

Table 30. Change in X2 Position in km

Percentile	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Overall
Salinity (mg/L) for Alternative Variation 1A													
95%	467	492	663	643	491	238	219	220	200	403	430	443	547
90%	448	467	641	547	446	211	209	199	186	382	374	398	459
75%	374	429	584	460	275	189	197	193	179	315	302	325	316
50%	315	311	484	307	202	173	187	188	167	186	187	286	197
25%	272	254	193	199	159	154	160	174	146	159	148	265	161
10%	168	193	117	138	107	114	123	143	132	149	139	199	132
5%	136	177	105	118	97	94	103	127	118	144	132	157	109
Alternative Variation 1C													
95%	21%	29%	27%	23%	25%	39%	16%	36%	36%	24%	44%	26%	35%
90%	20%	24%	21%	15%	21%	34%	13%	34%	30%	22%	40%	23%	29%
75%	8%	14%	7%	6%	14%	29%	8%	28%	26%	17%	34%	18%	19%
50%					6%	16%		11%	19%	8%	23%	14%	7%
25%						5%			12%		7%	11%	
10%			-6%	-6%					6%			6%	
5%			-6%	-7%					5%				
Alternative Variation 2B													
95%		6%	17%	14%	14%	26%	5%	31%	31%	22%	27%	7%	24%
90%			10%	6%	10%	21%		27%	24%	18%	25%		18%
75%	-6%	-16%	-18%	-7%	6%	13%		22%	16%	5%	19%	-7%	6%
50%	-35%	-36%	-51%	-29%	-3%	7%		8%	7%	-11%		-26%	
25%	-49%	-55%	-70%	-49%	-9%					-47%	-27%	-33%	-32%
10%	-53%	-62%	-71%	-67%	-23%				-5%	-49%	-43%	-40%	-53%
5%	-56%	-62%	-71%	-70%	-31%		-5%		-9%	-49%	-50%	-46%	-63%
Alternative Variation 2D													
95%	7%	7%	16%	14%	14%	23%		25%	33%	23%	24%	9%	23%
90%			9%	6%	10%	18%		21%	26%	20%	23%	7%	18%
75%		-12%	-16%	-10%	5%	12%	0%	15%	19%	6%	16%	-5%	6%
50%	-30%	-35%	-48%	-26%	-2%	6%	-7%	6%	11%	-7%		-23%	-5%
25%	-46%	-54%	-68%	-50%	-12%		-11%			-47%	-30%	-32%	-30%
10%	-51%	-59%	-69%	-67%	-22%		-13%			-49%	-42%	-38%	-51%
5%	-52%	-60%	-69%	-70%	-31%		-15%	-8%	-5%	-49%	-49%	-42%	-60%
Alternative Variation 2E													
95%		5%	15%	14%	15%	24%		25%	33%	22%	24%	5%	22%
90%			10%	6%	10%	19%		21%	26%	18%	21%		16%
75%	-7%	-16%	-17%	-10%	5%	12%		16%	17%	6%	13%	-7%	6%
50%	-31%	-37%	-50%	-28%	-4%	6%	-6%	6%	9%	-8%		-23%	-5%
25%	-44%	-53%	-68%	-50%	-12%		-9%			-54%	-36%	-32%	-33%
10%	-49%	-59%	-68%	-68%	-22%		-13%		-6%	-62%	-50%	-39%	-56%
5%	-52%	-59%	-69%	-70%	-31%		-15%	-7%	-10%	-64%	-58%	-45%	-64%
Alternative Variation 3E													
95%	-22%	-26%			18%	15%		-21%	-11%	38%	16%	-27%	11%
90%	-24%	-34%		-10%	8%	11%	-17%	-29%	-24%	18%	12%	-28%	
75%	-40%	-43%	-29%	-33%	-15%		-37%	-42%	-31%	-5%	7%	-34%	-24%
50%	-61%	-55%	-66%	-55%	-24%	-22%	-45%	-46%	-40%	-24%	-8%	-46%	-43%
25%	-68%	-70%	-77%	-66%	-38%	-32%	-49%	-47%	-44%	-59%	-38%	-53%	-56%
10%	-72%	-74%	-78%	-74%	-50%	-35%	-51%	-49%	-46%	-68%	-61%	-61%	-70%
5%	-73%	-74%	-78%	-76%	-52%	-39%	-53%	-53%	-49%	-70%	-69%	-65%	-74%

NOTES:

Zero percent shown as blank spaces; shaded values represent increases greater than 10%.

Negative values represent decreases in salinity, while positive values represent increases in salinity

Table 31. Changes in Salinity at Clifton Court Forebay

Percentile	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Overall
Salinity (mg/L) for Alternative Variation 1A													
95%	1906	1669	1907	1615	397	287	268	374	432	1201	1653	1757	1717
90%	1744	1604	1836	1333	343	264	220	350	414	1170	1451	1711	1617
75%	1575	1453	1711	751	264	169	150	273	328	1049	1130	1523	1191
50%	1368	1285	1509	358	177	148	119	166	208	481	845	1365	342
25%	634	481	392	194	135	115	110	112	110	189	523	1243	145
10%	300	161	120	145	118	113	108	108	107	141	388	728	112
5%	113	116	115	137	116	110	104	106	100	129	335	278	109
Alternative Variation 1C													
95%					1%	1%	2%	8%	3%	2%	2%	2%	3%
90%	-1%				1%	1%	1%	7%	3%	2%	1%	1%	2%
75%	-1%	-1%	-1%	-1%			1%	4%	3%	1%	1%		1%
50%	-2%	-2%	-2%	-2%	-1%			1%	2%				
25%	-3%	-3%	-2%	-2%	-2%	-1%		1%	1%	-1%		-1%	-2%
10%	-3%	-3%	-3%	-3%	-3%	-1%			1%	-1%	-1%	-2%	-3%
5%	-4%	-3%	-3%	-3%	-5%	-2%				-1%	-1%	-2%	-3%
Alternative Variation 2B													
95%	-6%	-5%							10%		-17%	-27%	
90%	-9%	-19%		-6%					5%	-6%	-21%	-28%	
75%	-39%	-36%	-42%	-27%	-6%	-5%		-5%		-21%	-32%	-33%	-10%
50%	-58%	-51%	-61%	-52%	-33%	-14%	-8%	-28%	-24%	-31%	-45%	-49%	-38%
25%	-68%	-68%	-72%	-70%	-59%	-35%	-25%	-39%	-37%	-42%	-47%	-64%	-54%
10%	-73%	-73%	-74%	-71%	-67%	-51%	-42%	-46%	-46%	-52%	-55%	-67%	-69%
5%	-74%	-75%	-74%	-74%	-78%	-54%	-47%	-49%	-48%	-54%	-60%	-68%	-73%
Alternative Variation 2D													
95%	-9%			-5%					9%		-25%	-31%	
90%	-11%	-20%		-7%					5%	-11%	-29%	-32%	
75%	-40%	-38%	-44%	-28%	-6%					-22%	-39%	-37%	-10%
50%	-61%	-54%	-61%	-53%	-32%	-12%	-7%	-27%	-24%	-35%	-50%	-53%	-40%
25%	-70%	-68%	-72%	-70%	-53%	-34%	-22%	-39%	-38%	-46%	-55%	-65%	-58%
10%	-74%	-73%	-74%	-72%	-61%	-51%	-41%	-45%	-46%	-58%	-60%	-68%	-70%
5%	-76%	-75%	-74%	-76%	-65%	-53%	-46%	-48%	-48%	-59%	-64%	-69%	-73%
Alternative Variation 2E													
95%	-9%	-6%	-7%	-10%	-5%					-15%	-38%	-37%	
90%	-24%	-25%	-8%	-13%	-7%					-20%	-42%	-42%	
75%	-53%	-51%	-51%	-37%	-12%	-6%				-33%	-50%	-46%	-18%
50%	-62%	-57%	-66%	-63%	-34%	-17%	-8%	-30%	-30%	-60%	-58%	-53%	-51%
25%	-66%	-69%	-68%	-70%	-58%	-35%	-23%	-44%	-56%	-70%	-62%	-60%	-63%
10%	-72%	-70%	-71%	-76%	-65%	-56%	-44%	-54%	-67%	-71%	-65%	-65%	-70%
5%	-74%	-71%	-73%	-81%	-69%	-57%	-50%	-57%	-69%	-71%	-68%	-66%	-72%
Alternative Variation 3E													
95%	20%	16%	6%	12%	25%	41%	51%	41%	49%	6%	-19%	-6%	43%
90%	15%			6%	16%	35%	45%	40%	46%		-25%	-13%	35%
75%	-10%	-25%	-23%		5%	26%	42%	32%	8%	-18%	-38%	-19%	
50%	-50%	-35%	-57%	-38%	-6%		33%		-18%	-57%	-51%	-43%	-29%
25%	-65%	-62%	-64%	-53%	-31%	-9%		-29%	-47%	-75%	-62%	-56%	-55%
10%	-72%	-69%	-65%	-62%	-47%	-34%	-24%	-42%	-59%	-78%	-70%	-64%	-67%
5%	-73%	-69%	-67%	-69%	-50%	-36%	-32%	-46%	-62%	-78%	-71%	-66%	-71%

NOTES:

Zero percent shown as blank spaces; shaded values represent increases greater than 10%.
Negative values represent decreases in salinity, while positive values represent increases in salinity.

Table 32. Changes in Salinity on San Joaquin River at Jersey Point

Percentile	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Overall
						Salinity (mg/L) for Alternative Variation 1A							
95%	1374	1706	1954	1405	207	273	300	452	415	942	1759	1875	1714
90%	1318	1700	1940	1298	194	192	266	422	377	855	1709	1837	1497
75%	1132	1469	1026	282	147	126	147	393	343	640	1508	1737	880
50%	1012	1055	705	165	125	109	107	150	288	375	784	1370	258
25%	619	222	185	129	110	105	104	111	125	184	506	799	116
10%	148	110	105	112	106	104	103	103	111	169	414	418	104
5%	103	105	104	109	104	103	102	102	101	150	336	133	103
						Alternative Variation 1C							
95%							1%	2%	4%	4%	1%	1%	2%
90%								2%	3%	3%	1%	1%	1%
75%								1%	1%	2%			
50%	-1%	-1%	-1%	-1%						1%		-1%	
25%	-2%	-2%	-2%	-2%	-1%	-1%				-1%	-1%	-1%	-1%
10%	-2%	-3%	-3%	-2%	-2%	-1%	-2%	-1%	-1%	-2%	-2%	-2%	-2%
5%	-3%	-3%	-4%	-3%	-2%	-1%	-4%	-1%	-1%	-3%	-2%	-2%	-3%
						Alternative Variation 2B							
95%	44%	27%	33%	10%		6%	7%	20%	9%	22%	32%	50%	35%
90%	43%	24%	32%				6%	18%	9%	21%	29%	48%	30%
75%	34%	20%	21%					14%		16%	19%	45%	16%
50%	20%	16%	13%					7%		8%	14%	30%	
25%		5%		-14%	-9%						5%	17%	
10%				-21%	-21%				-7%			6%	-6%
5%	-9%			-22%	-26%				-9%			-6%	-12%
						Alternative Variation 2D							
95%	37%	21%	27%	5%				10%		13%	19%	41%	29%
90%	33%	17%	26%					9%		12%	18%	38%	19%
75%	26%	13%	13%					5%		7%	11%	36%	9%
50%	10%	6%	7%								8%	22%	
25%				-16%	-11%				-12%			10%	
10%	-11%	-5%	-7%	-25%	-23%	-5%			-14%	-5%			-12%
5%	-15%	-6%	-12%	-28%	-28%	-6%	-5%		-15%	-6%		-7%	-15%
						Alternative Variation 2E							
95%	8%			5%			6%	16%		19%	22%	12%	15%
90%	7%							15%		18%	19%	11%	12%
75%	5%							14%		13%	13%	10%	
50%				-7%						6%	10%	8%	
25%		-5%	-5%	-16%	-12%							5%	
10%		-6%	-15%	-28%	-23%				-7%				-7%
5%	-11%	-8%	-18%	-33%	-29%	-7%	-2%	0%	-9%			-8%	-19%
						Alternative Variation 3E							
95%	61%	37%	37%	15%	11%	16%	23%	24%	22%	74%	70%	53%	53%
90%	59%	35%	37%	10%	8%	13%	20%	23%	19%	73%	58%	50%	39%
75%	40%	21%	36%	7%	7%	9%	17%	17%		51%	37%	42%	24%
50%	27%	16%	17%			5%	13%	5%	-13%	28%	32%	19%	9%
25%	8%	7%							-22%	22%	21%	8%	
10%				-9%	-7%		-5%	-8%	-26%	8%		6%	-7%
5%				-12%	-13%		-8%	-11%	-29%				-14%

NOTES:

Zero percent shown as blank spaces; shaded values represent increases greater than 10%.
Negative values represent decreases in salinity, while positive values represent increases in salinity.

Table 33. Changes in Salinity on Sacramento River at Emmaton

Percentile	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Overall
Salinity (mg/L) for Alternative Variation 1A													
95%	682	657	830	801	386	237	166	181	192	558	635	624	688
90%	660	626	824	644	348	215	156	176	183	530	528	584	619
75%	543	562	774	544	221	158	146	151	158	444	402	493	439
50%	447	451	651	282	190	150	138	139	146	205	295	440	199
25%	294	287	208	218	159	140	131	135	126	131	175	400	144
10%	180	203	125	147	141	116	123	128	115	118	148	262	126
5%	129	160	119	142	126	108	112	124	106	117	141	156	118
Alternative Variation 1C													
95%						5%	17%	31%	16%	6%			17%
90%							16%	28%	12%	5%			13%
75%		-5%					14%	24%	5%		0%		
50%	-8%	-7%					9%	19%					
25%	-9%	-11%						13%					
10%	-11%	-11%	-5%									-5%	-6%
5%	-11%	-11%	-5%	-5%	-5%							-5%	-9%
Alternative Variation 2B													
95%							19%	26%	5%		-14%	-24%	16%
90%	-6%	-11%					17%	25%			-17%	-33%	7%
75%	-29%	-46%	-45%	-18%			14%	21%			-23%	-39%	
50%	-58%	-54%	-65%	-54%	-24%	-6%	7%	13%	-5%	-35%	-35%	-55%	-26%
25%	-69%	-71%	-79%	-64%	-44%	-25%			-19%	-55%	-47%	-62%	-55%
10%	-71%	-75%	-80%	-78%	-53%	-30%	-7%		-32%	-58%	-56%	-64%	-69%
5%	-72%	-76%	-80%	-80%	-59%	-33%	-10%		-36%	-60%	-60%	-66%	-76%
Alternative Variation 2D													
95%							23%	31%	5%		-13%	-20%	19%
90%		-9%		-6%			21%	29%			-17%	-27%	6%
75%	-24%	-41%	-43%	-20%	-8%		19%	23%			-20%	-35%	
50%	-53%	-50%	-64%	-54%	-21%	-10%	8%	16%	-5%	-34%	-33%	-52%	-24%
25%	-66%	-68%	-78%	-64%	-44%	-23%			-17%	-56%	-47%	-61%	-55%
10%	-69%	-72%	-79%	-78%	-53%	-29%	-5%		-30%	-58%	-58%	-63%	-67%
5%	-69%	-74%	-79%	-80%	-58%	-31%	-8%		-33%	-60%	-61%	-65%	-75%
Alternative Variation 2E													
95%						5%	28%	32%			-16%	-25%	22%
90%	-10%	-12%		-6%			26%	31%			-18%	-35%	6%
75%	-28%	-43%	-45%	-21%	-8%		22%	26%		-7%	-26%	-40%	
50%	-54%	-52%	-66%	-55%	-20%	-11%	12%	17%	-5%	-40%	-40%	-53%	-28%
25%	-64%	-67%	-77%	-67%	-46%	-24%			-23%	-70%	-51%	-59%	-58%
10%	-67%	-71%	-78%	-79%	-56%	-31%	-5%		-37%	-73%	-65%	-62%	-70%
5%	-69%	-73%	-79%	-80%	-62%	-34%	-8%		-41%	-74%	-70%	-63%	-74%
Alternative Variation 3E													
95%	41%	24%	192%	109%	175%	219%	222%	128%	124%	98%	24%	80%	177%
90%	34%	20%	97%	75%	149%	203%	201%	121%	109%	79%	18%	40%	130%
75%	17%			37%	81%	198%	154%	101%	80%	25%	7%	-7%	66%
50%	-16%	-3%	-30%	-7%	14%	74%	104%	64%	64%	-9%	-22%	-24%	
25%	-36%	-36%	-44%	-23%			49%	44%	50%	-57%	-39%	-39%	-24%
10%	-41%	-45%	-51%	-30%	-16%	-14%	-7%	12%	37%	-65%	-57%	-44%	-44%
5%	-47%	-46%	-52%	-36%	-24%	-24%	-13%		25%	-67%	-65%	-46%	-52%

NOTES:

Zero percent shown as blank spaces; shaded values represent increases greater than 10%.
Negative values represent decreases in salinity, while positive values represent increases in salinity.

Table 34. Changes in Salinity on Old River at Rock Slough

FIGURES FOR

SURFACE WATER RESOURCES

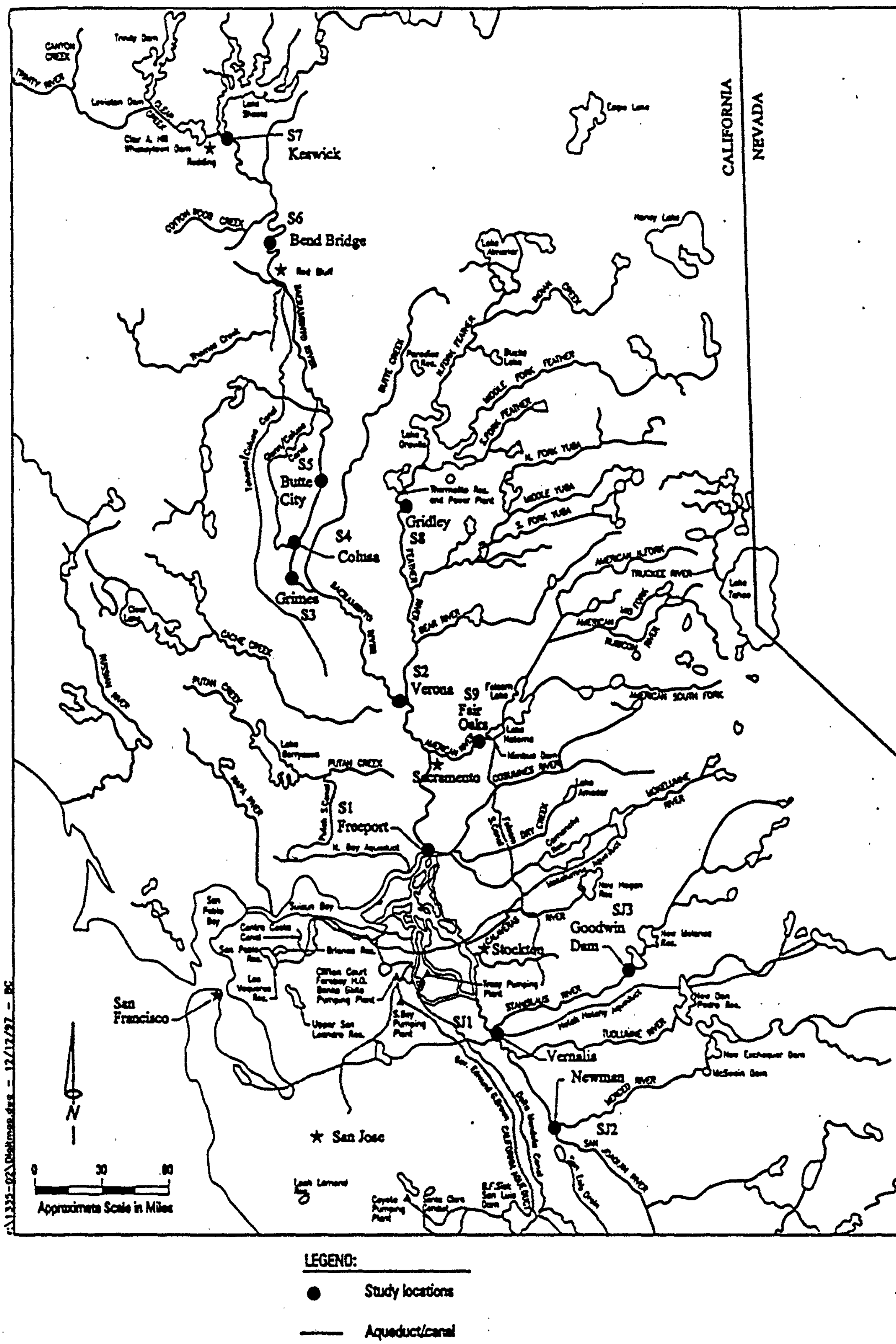


Figure 1. Key Locations Used in the Delta Hydrodynamics Analysis

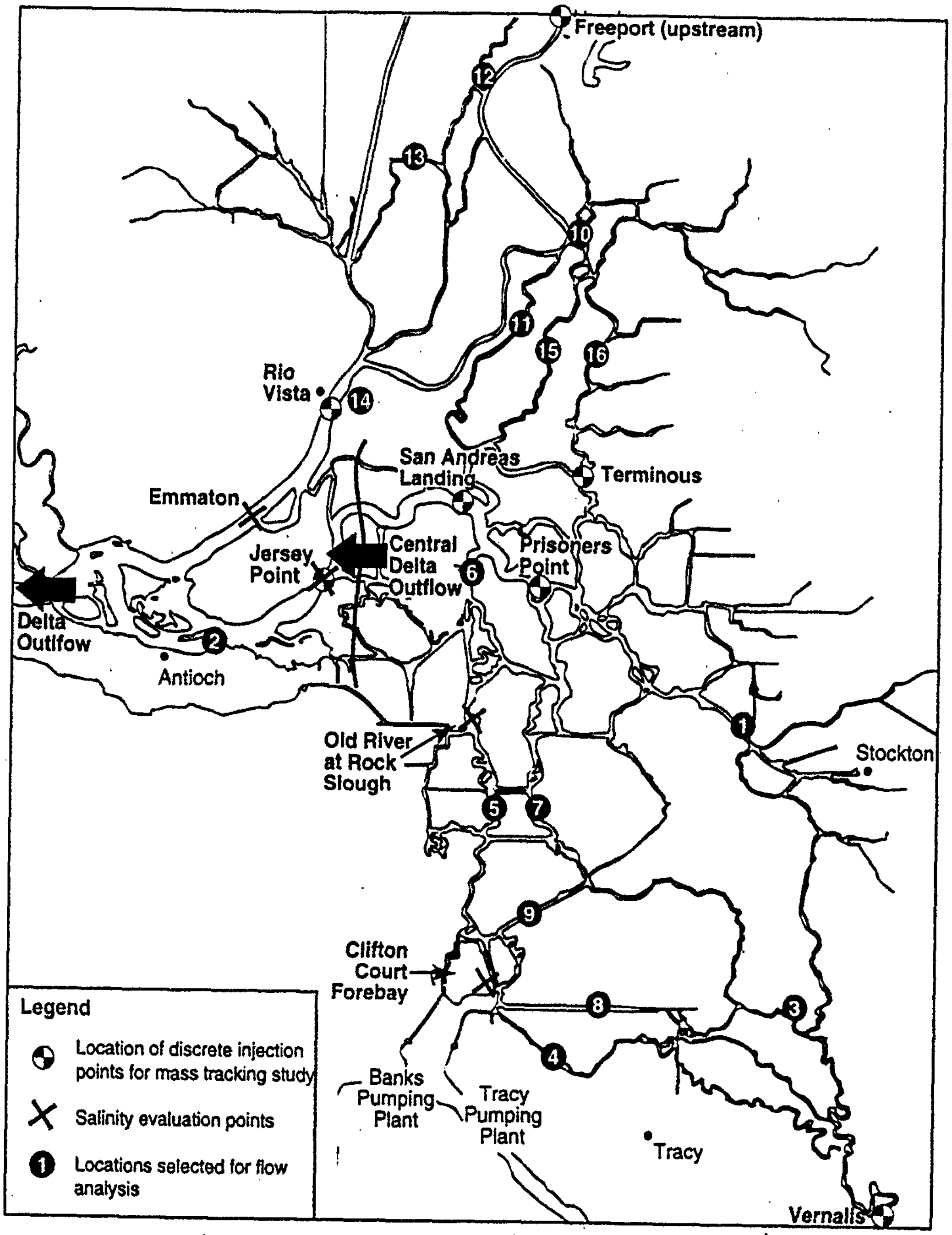
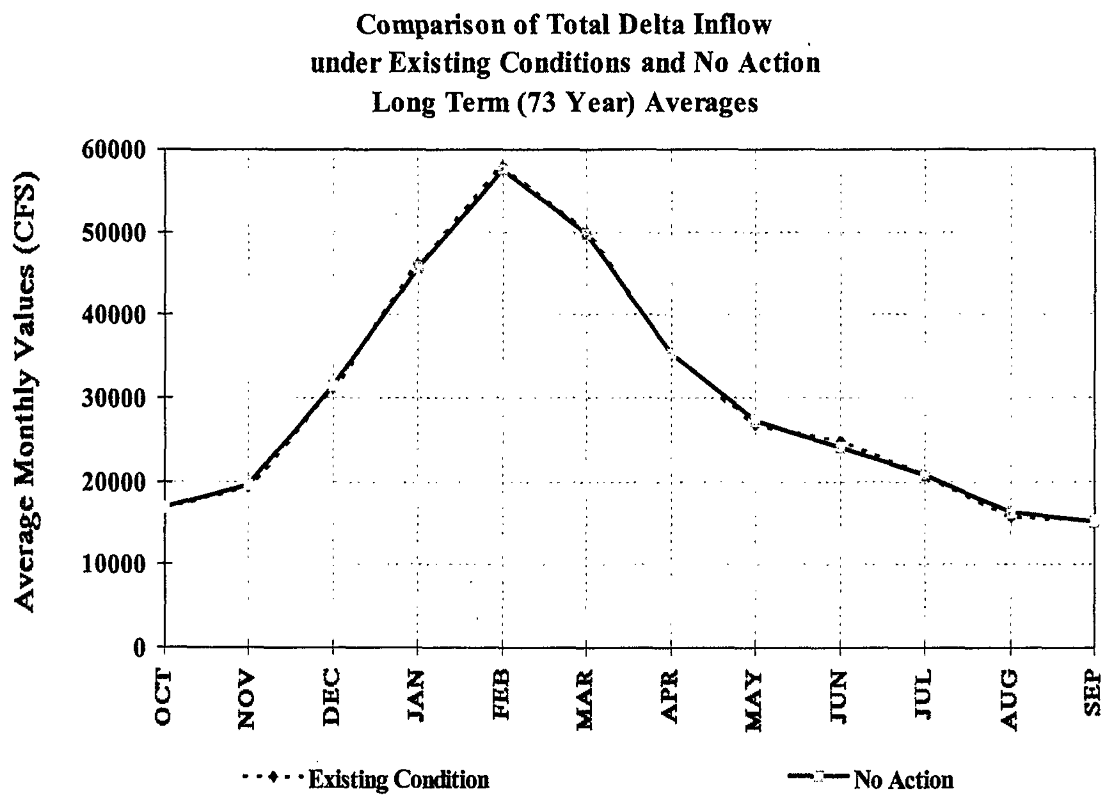


Figure 2. River Hydraulics Study Location Map



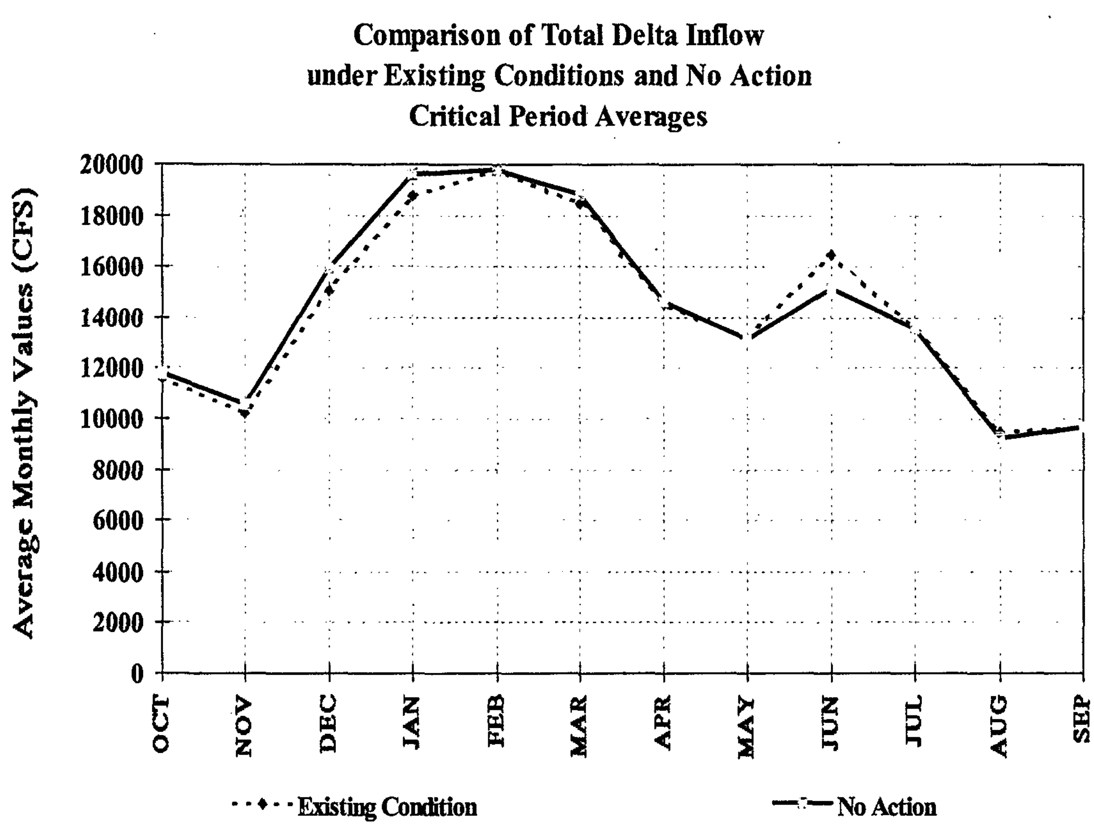


Figure 3. **Monthly Average Total Delta Inflow - Long-Term and Critical Period**

C-008877

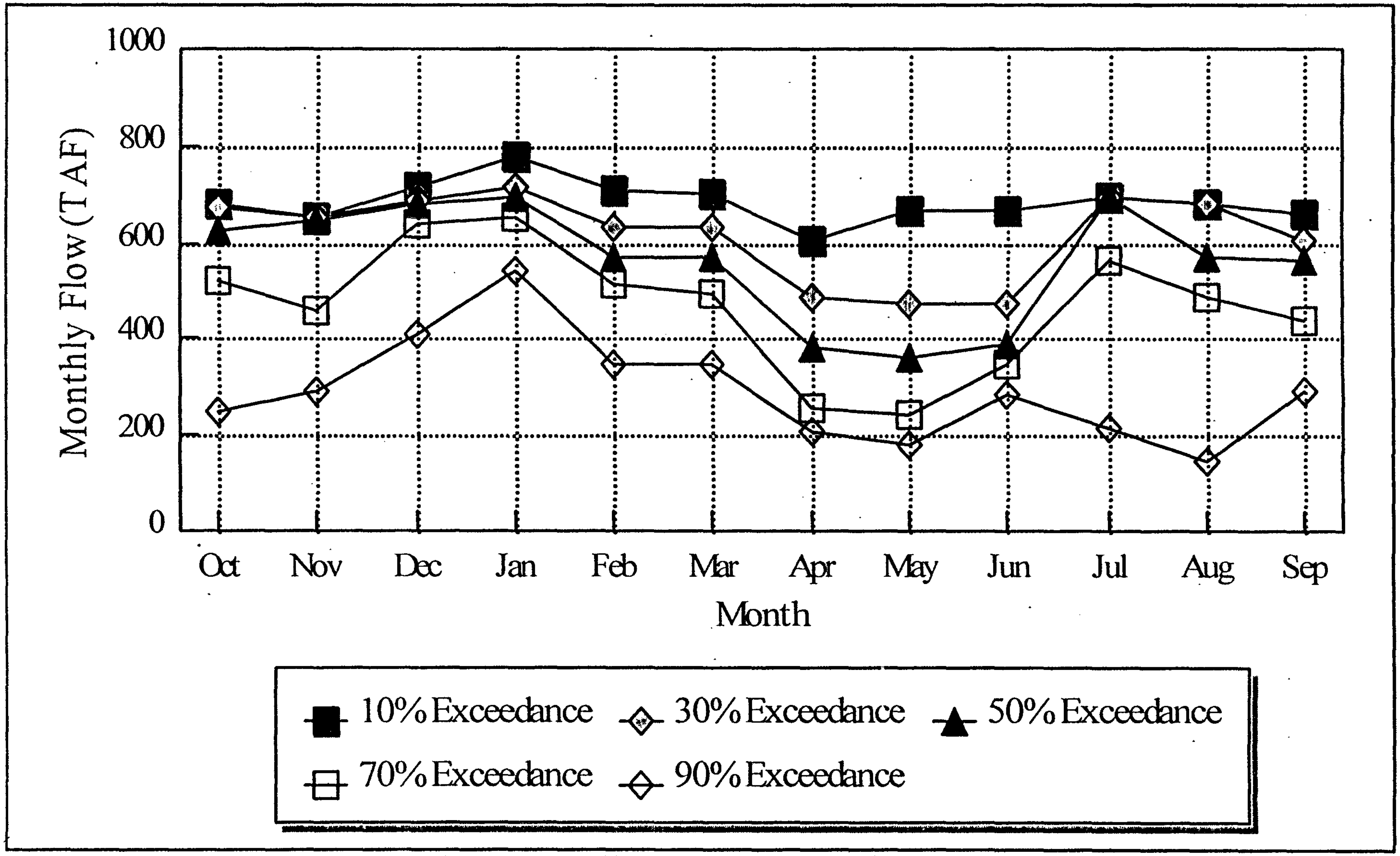


Figure 4. **Monthly No Action Alternative SWP and CVP Exports Exceedance**

C-008877

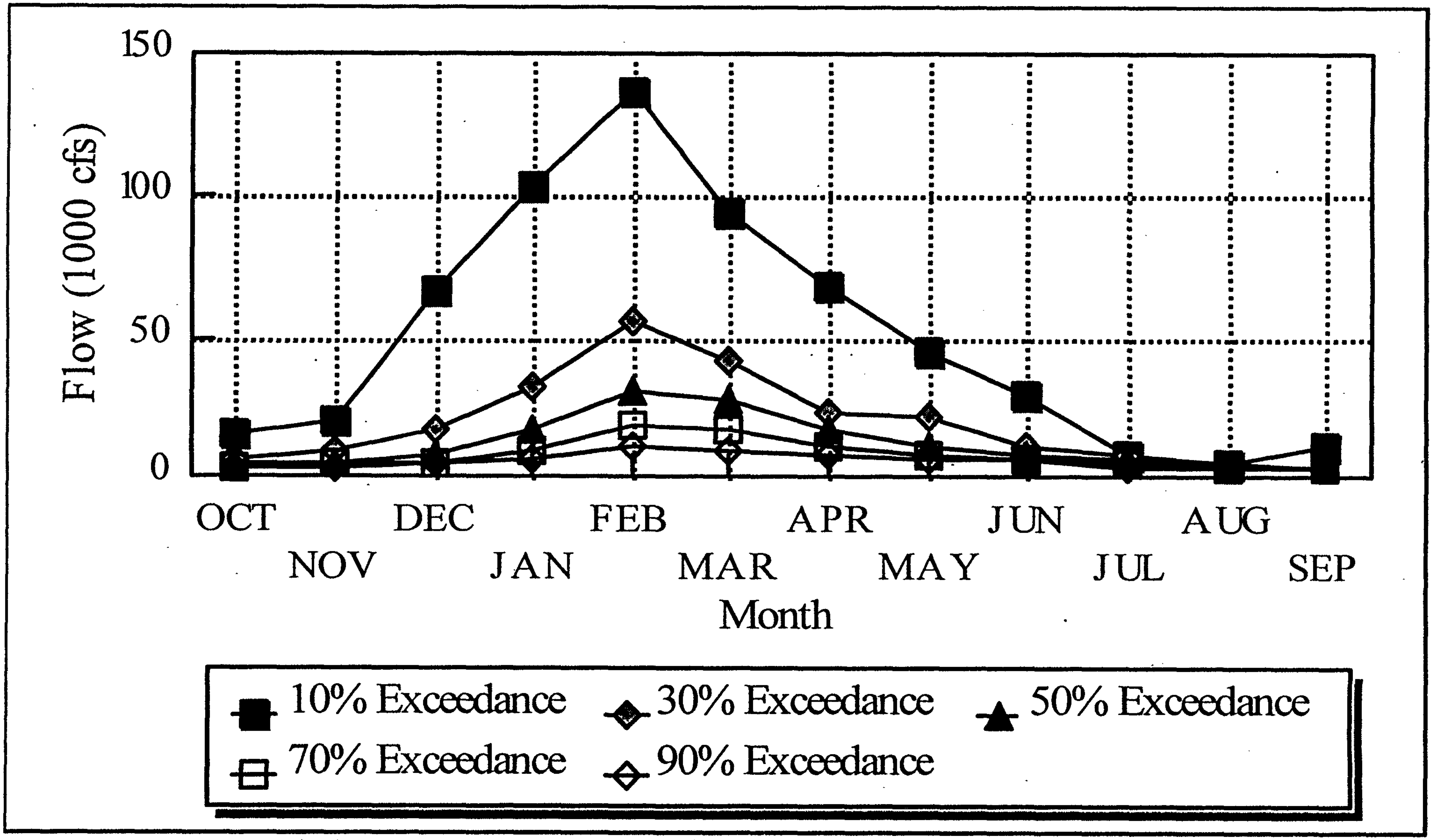
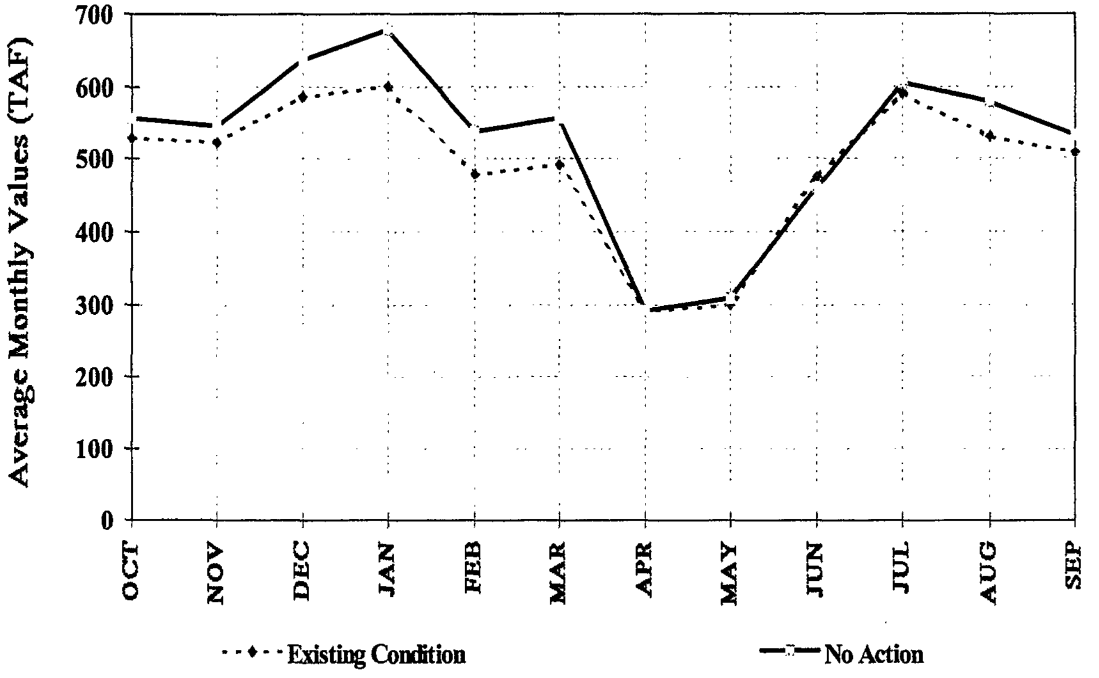


Figure 5. **Monthly No Action Alternative Delta Outflow Exceedance**

Comparison of Total Delta Exports under Existing Conditions and No Action Long Term (73 Year) Averages



Comparison of Total Delta Exports under Existing Conditions and No Action Critical Period Averages

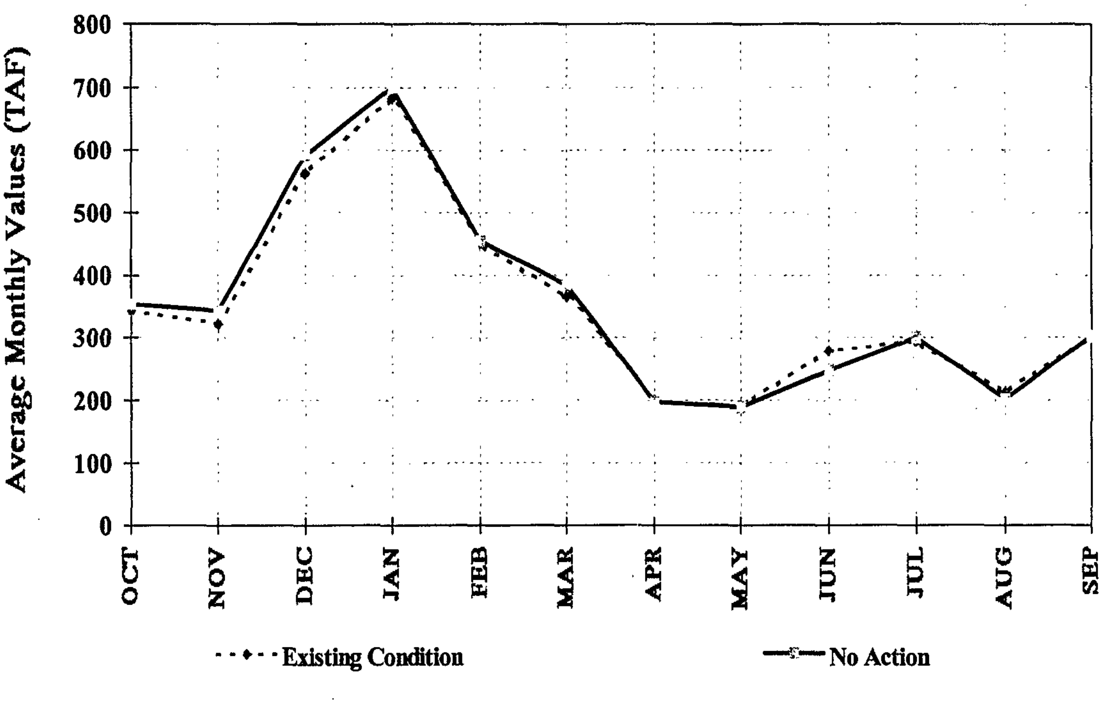


Figure 6. Monthly Average Total Delta Exports - Long-Term and Critical Period

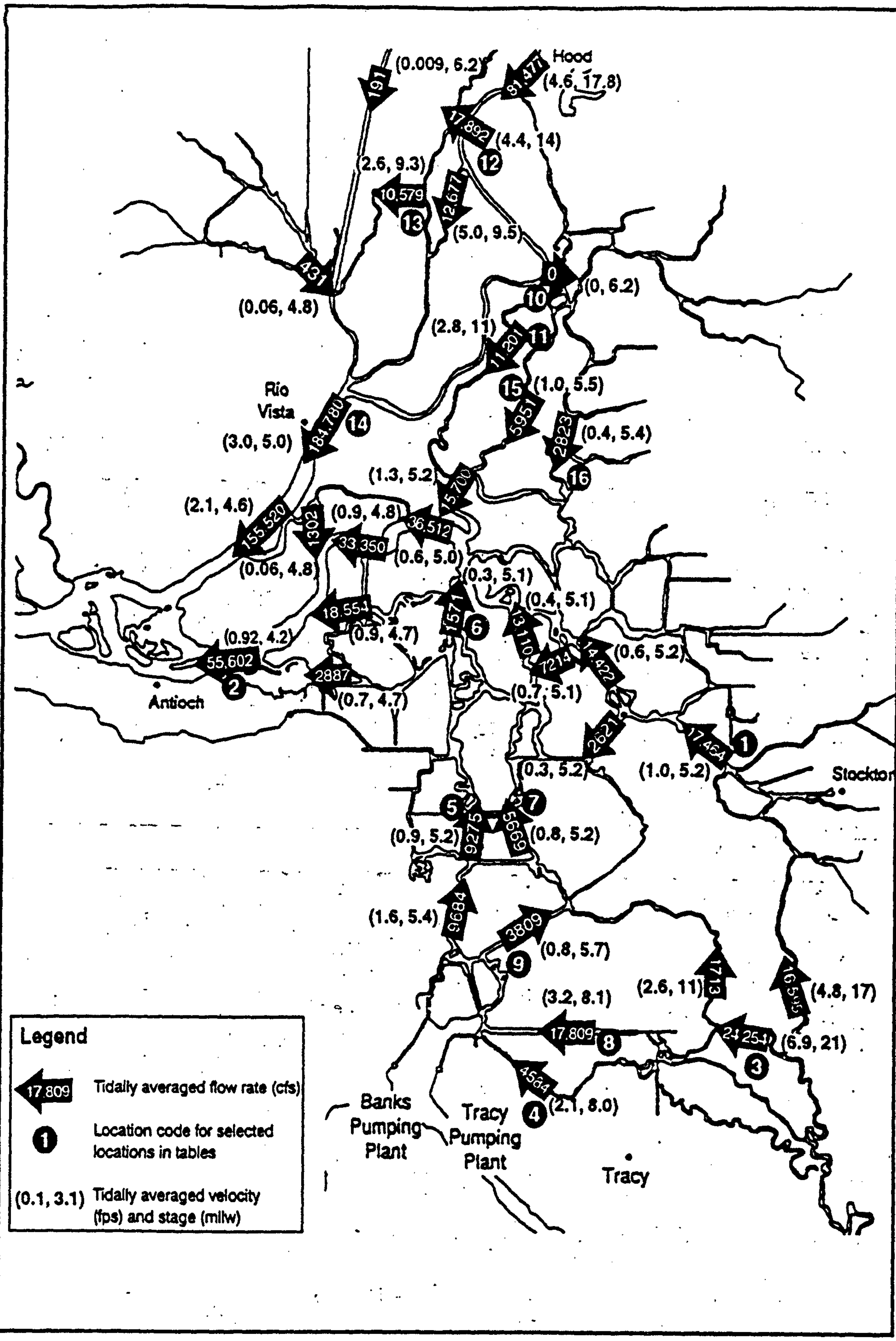
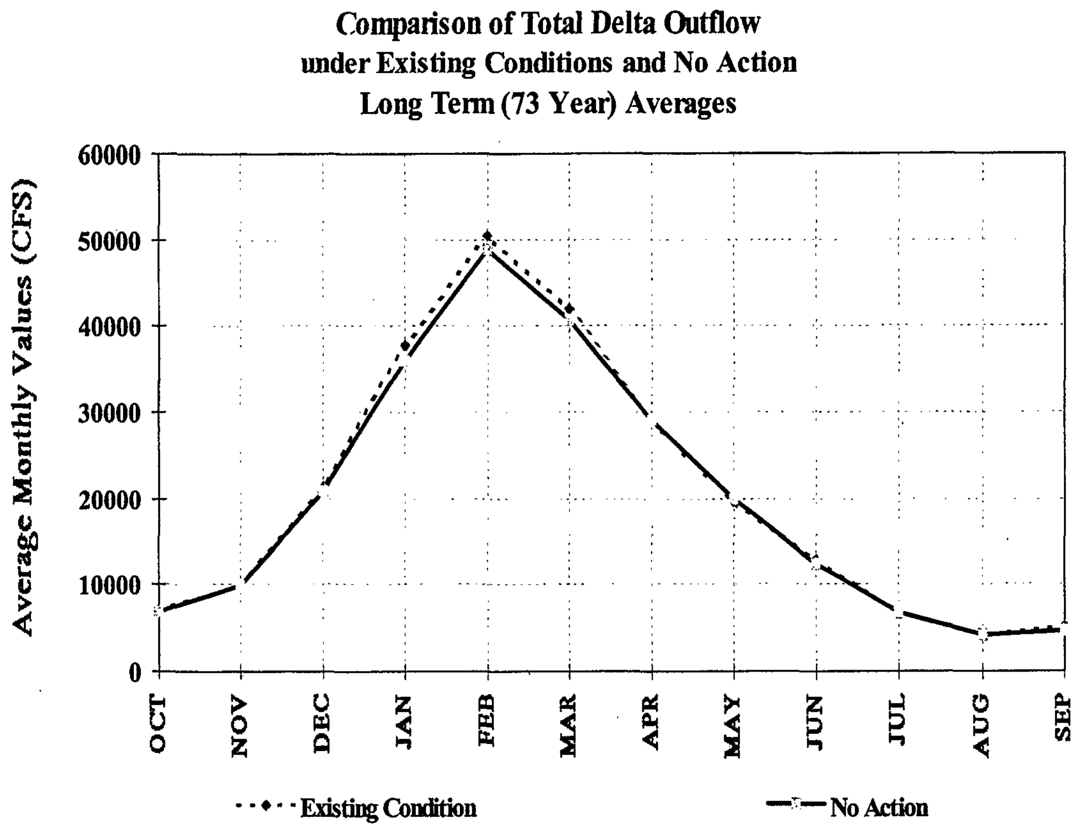


Figure 7. Average Tidal Flow Rates, Velocities, and Stages for High Flow, No Action Alternative



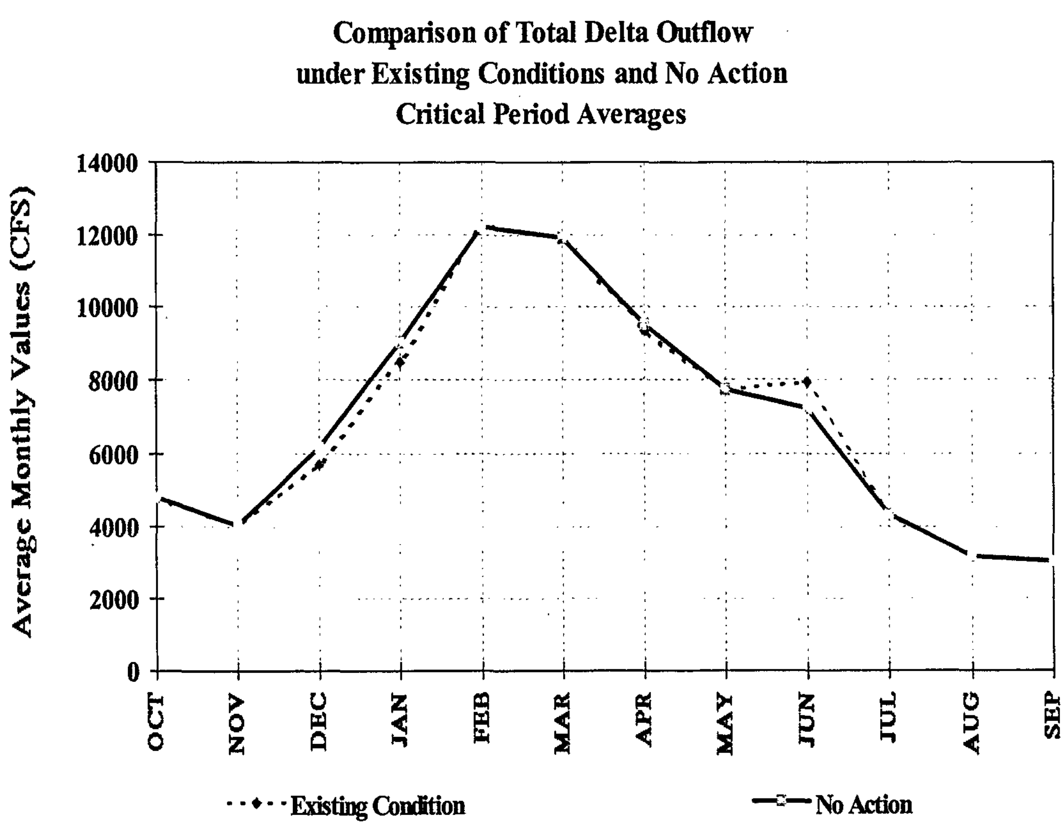
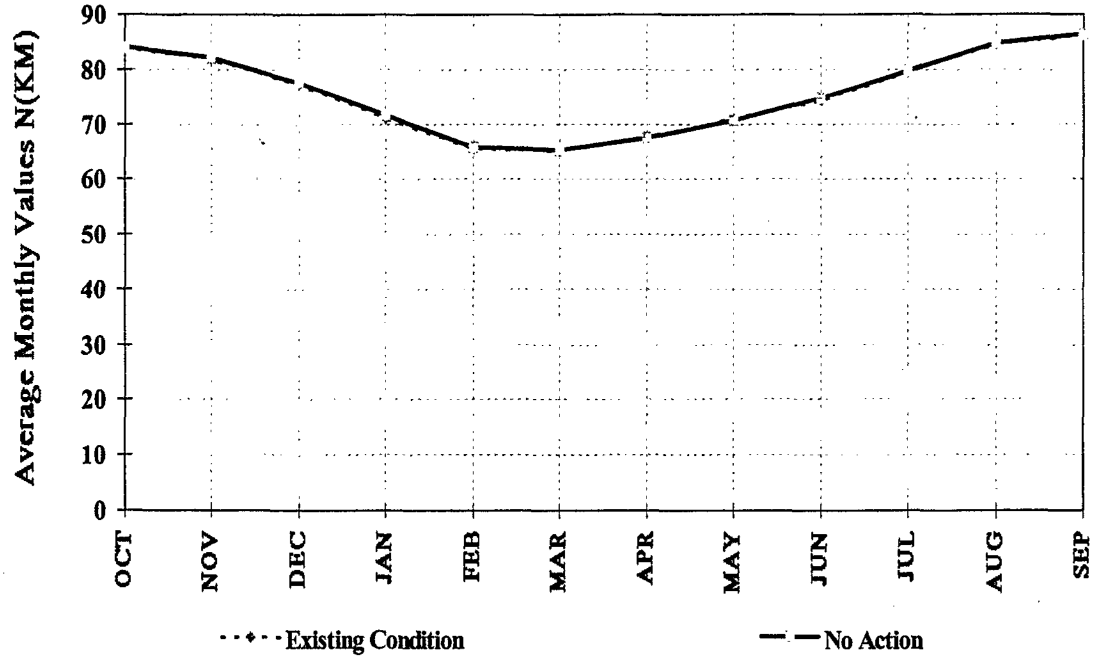


Figure 8. **Monthly Average Total Delta Outflow - Long-Term and Critical Period**

Comparison of Computed X2 Position under Existing Conditions and No Action Long Term (73 Year) Averages



Comparison of Computed X2 Position under Existing Conditions and No Action Critical Period Averages

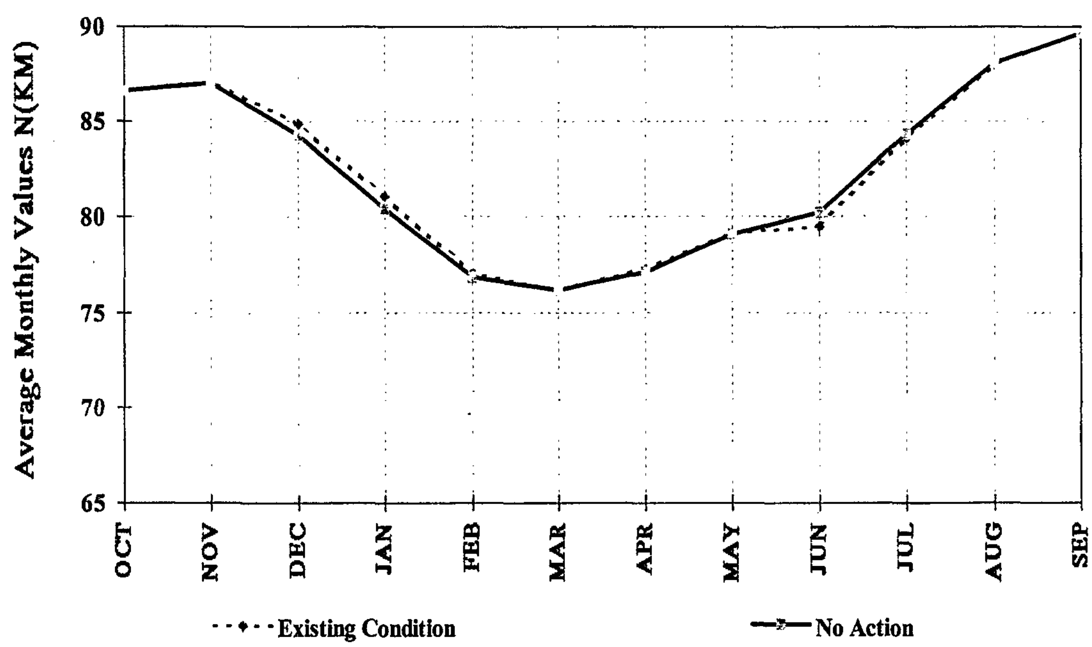


Figure 9. **Monthly Average X2 Position - Long-Term and Critical Period**

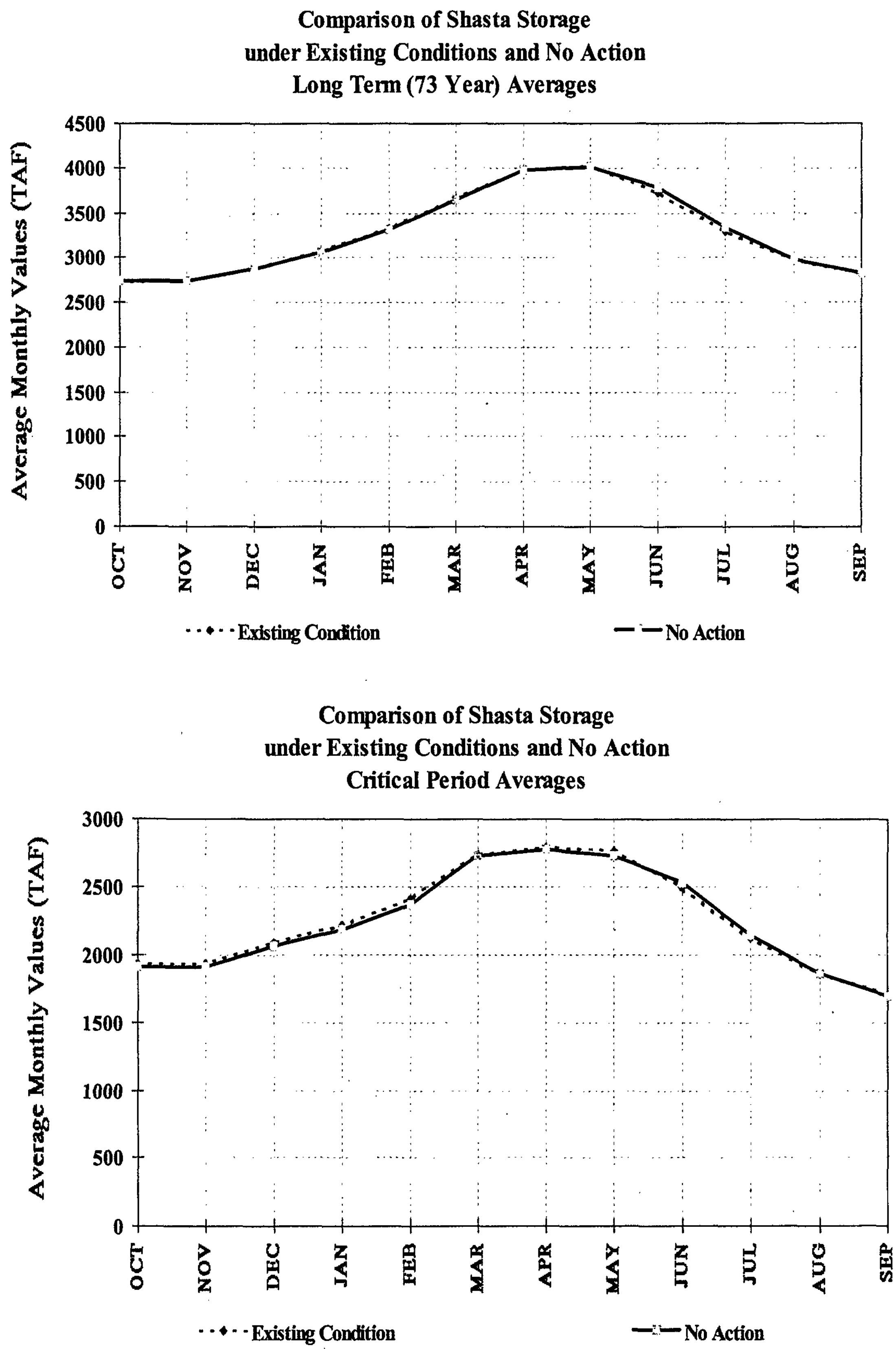
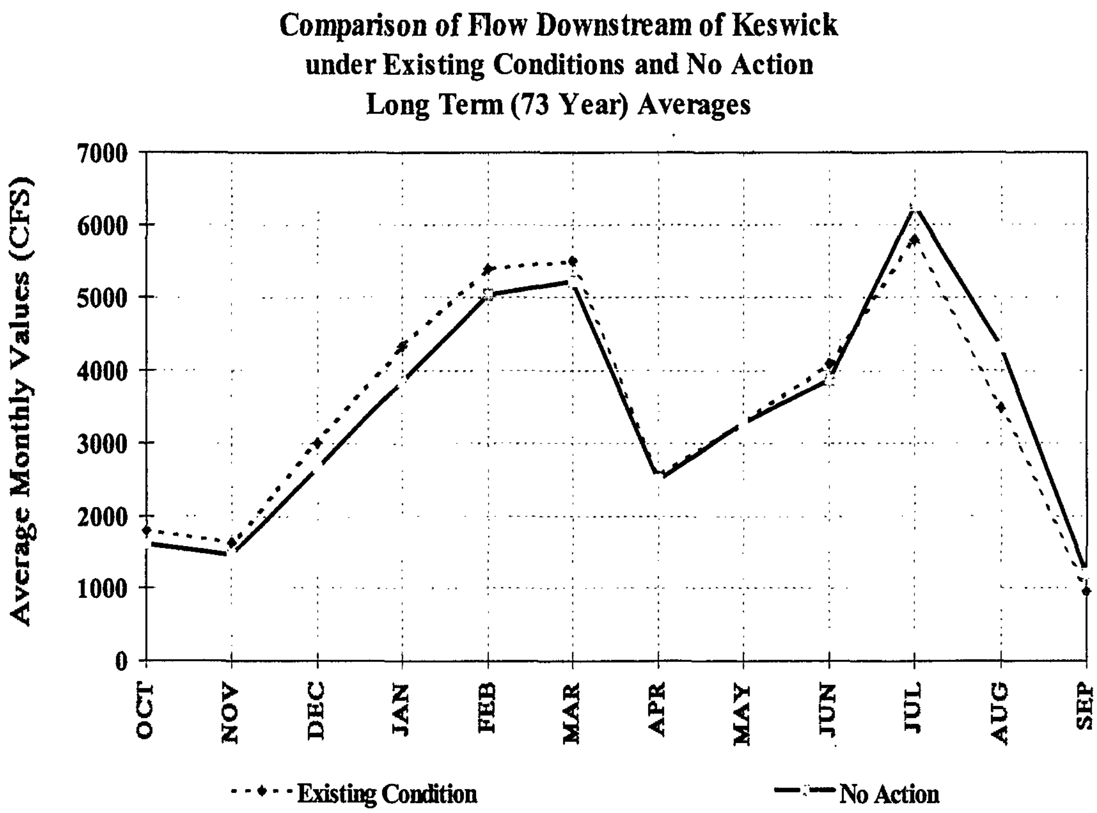


Figure 10. Monthly Average Storage at Lake Shasta - Long-Term and Critical Period



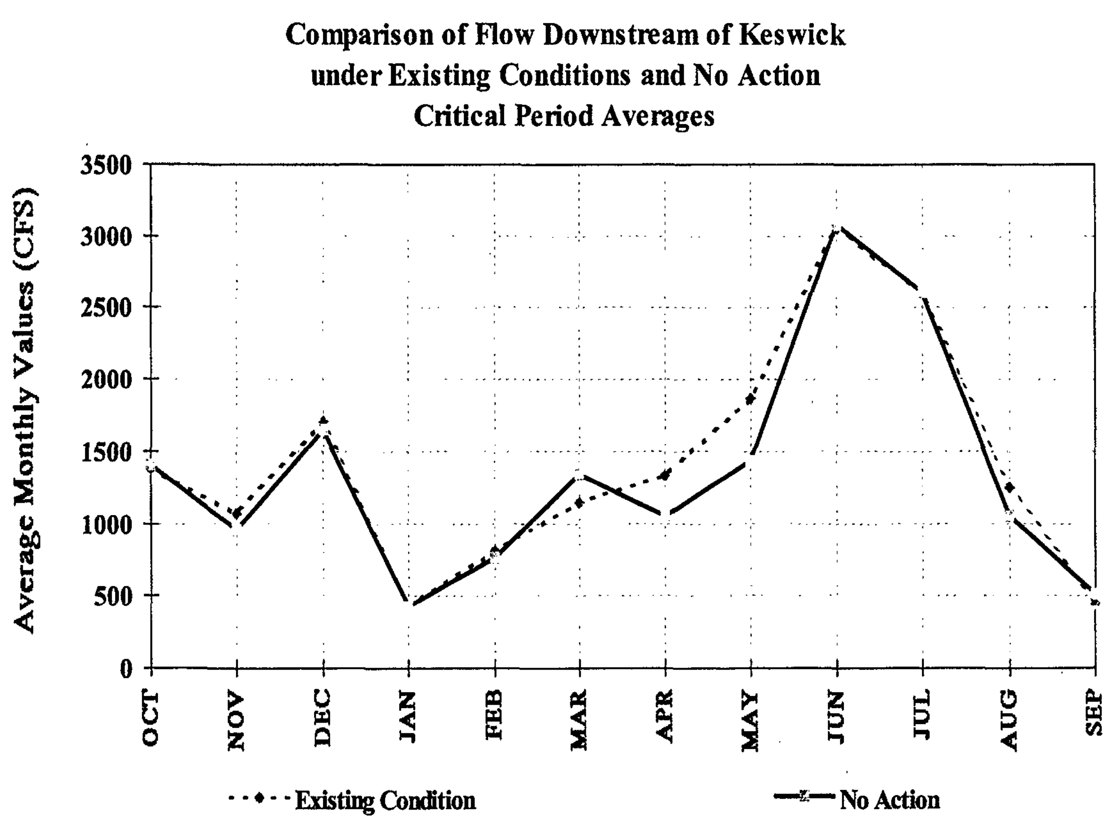
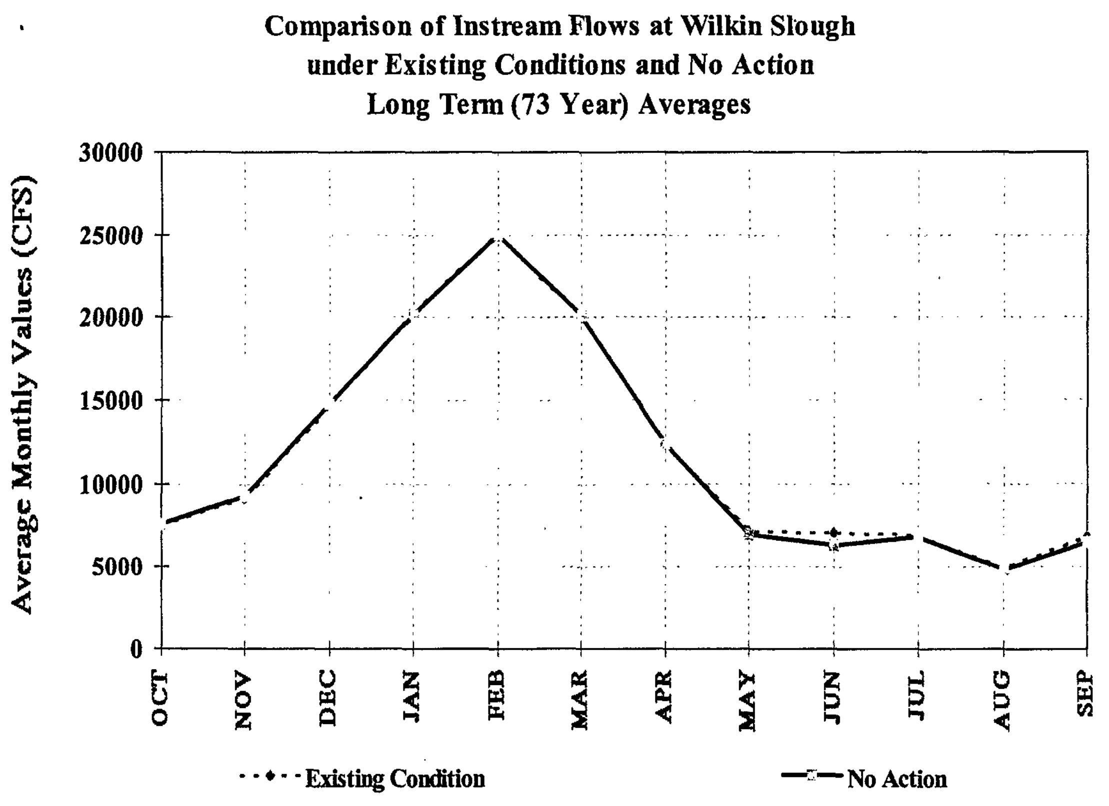


Figure 11. Monthly Average Flow Downstream of Keswick - Long-Term and Critical Period



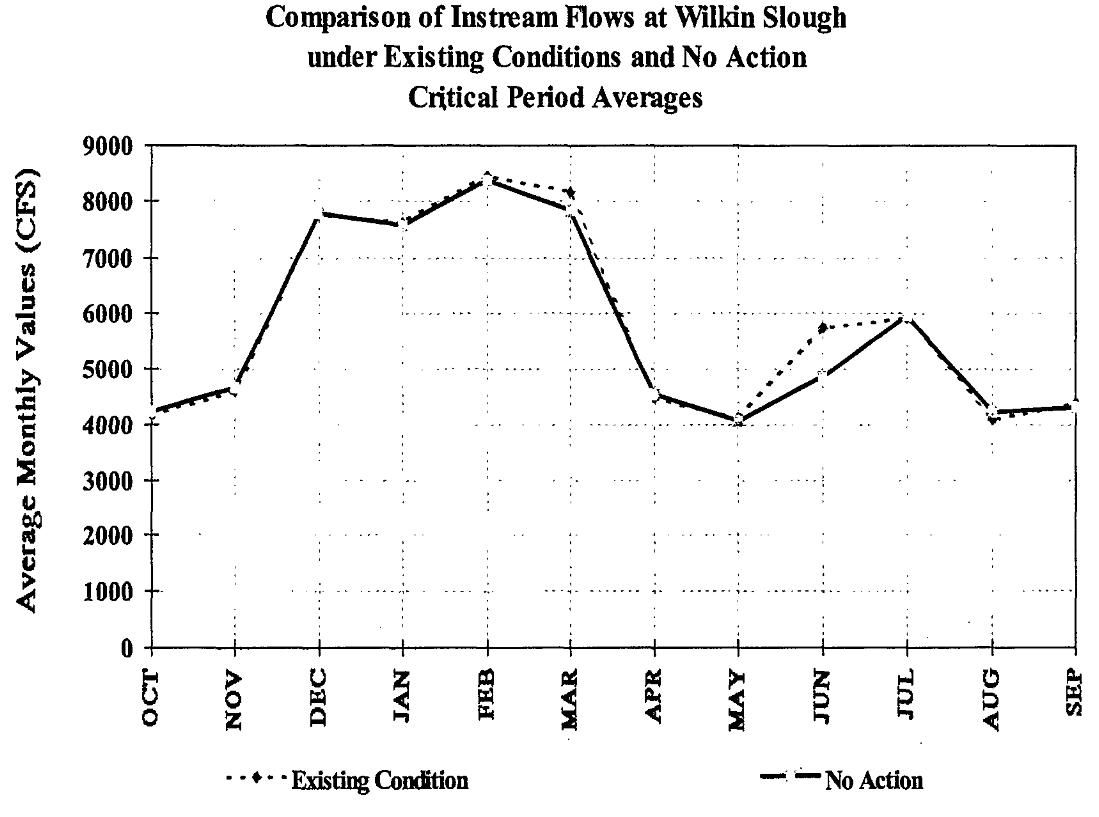
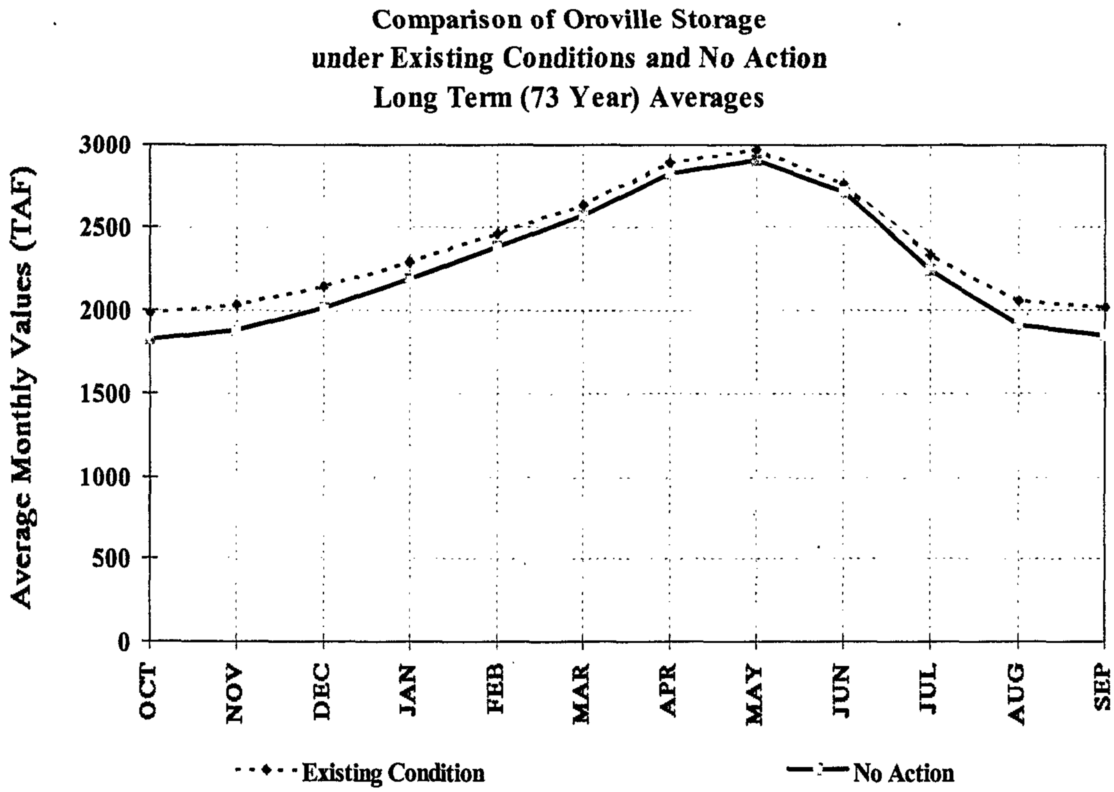


Figure 12. Monthly Average Instream Flow at Wilkins Slough - Long-Term and Critical Period



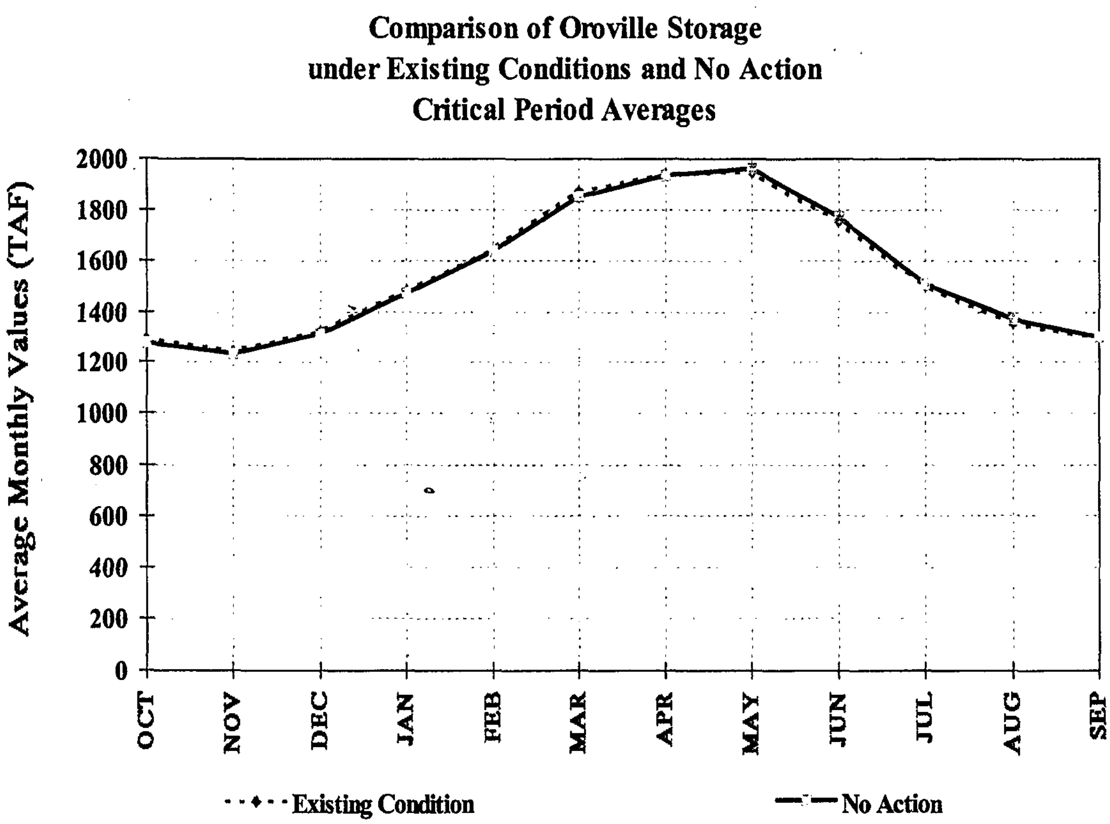


Figure 13. Monthly Average Storage at Oroville Reservoir - Long-Term and Critical Period

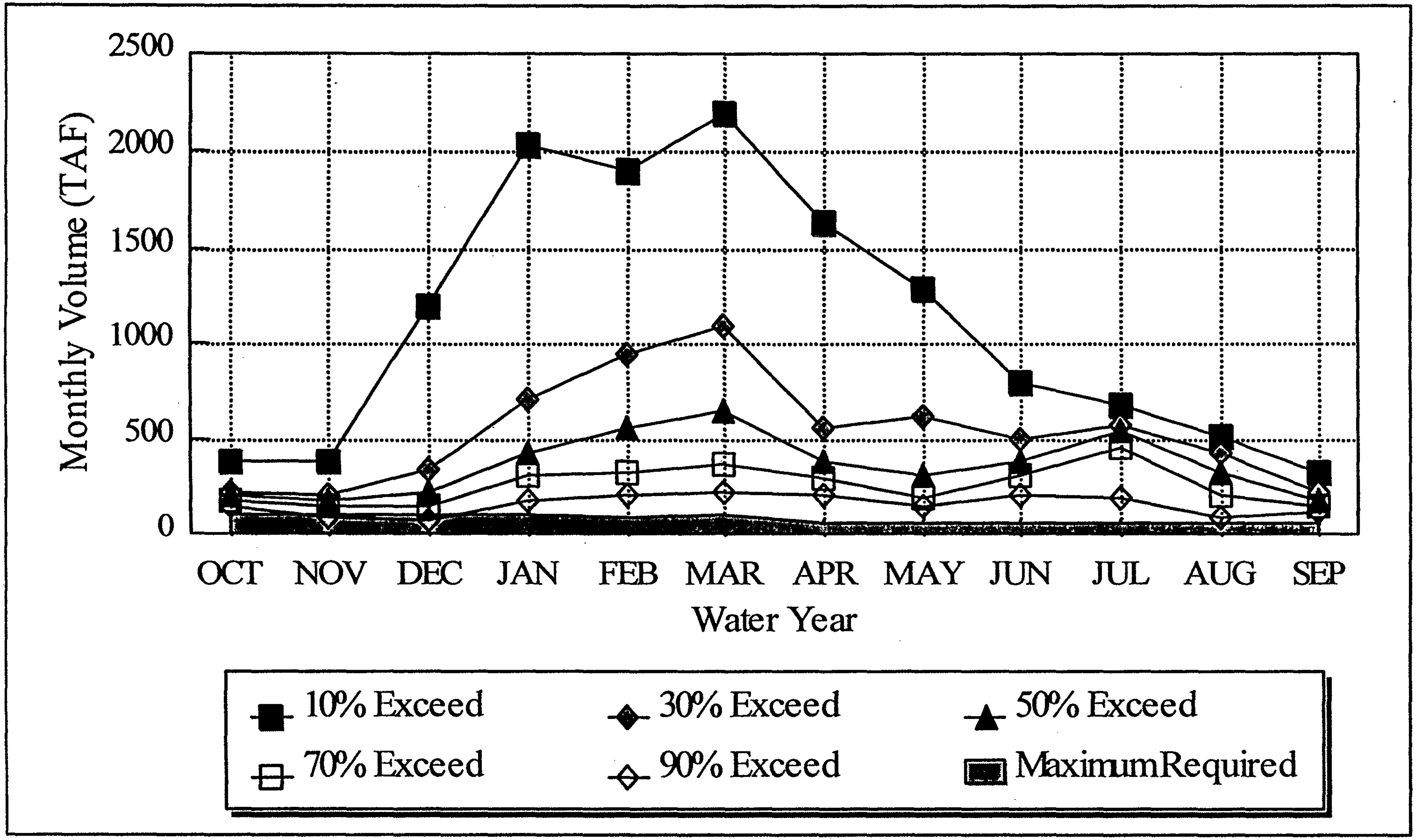
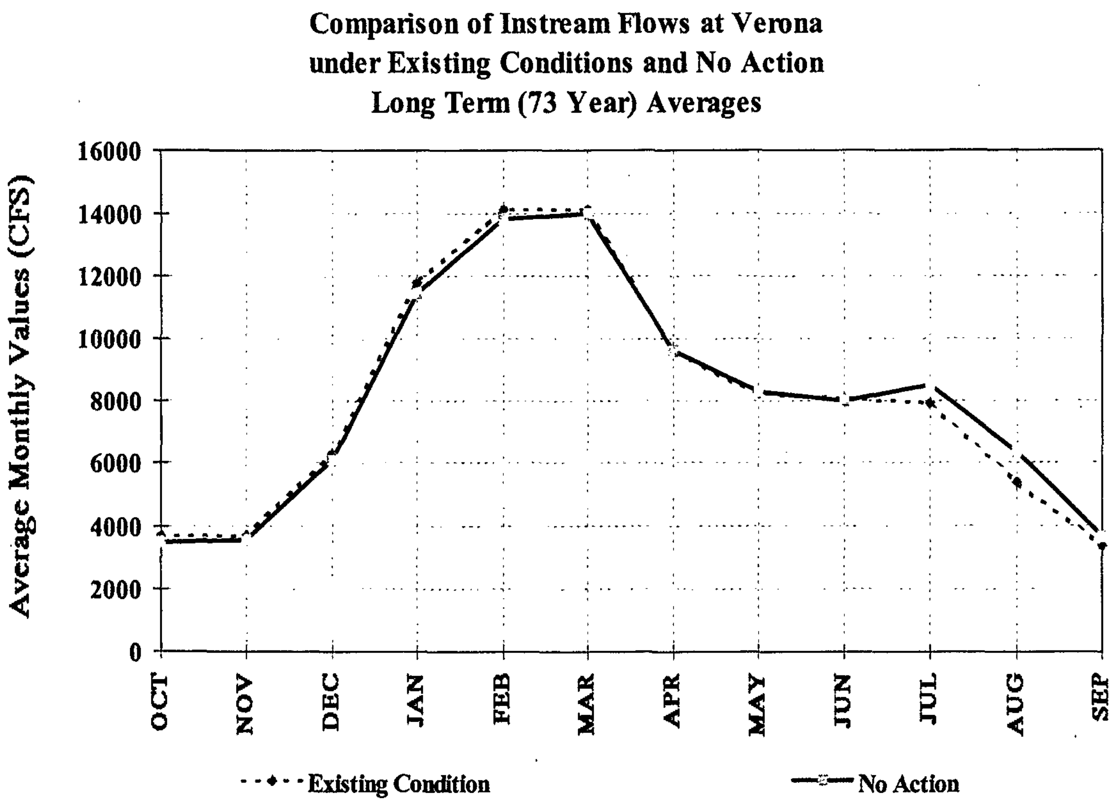


Figure 14. **Monthly No Action Alternative Feather River Flow Exceedance at Mouth (DWRSIM)**

C-008887



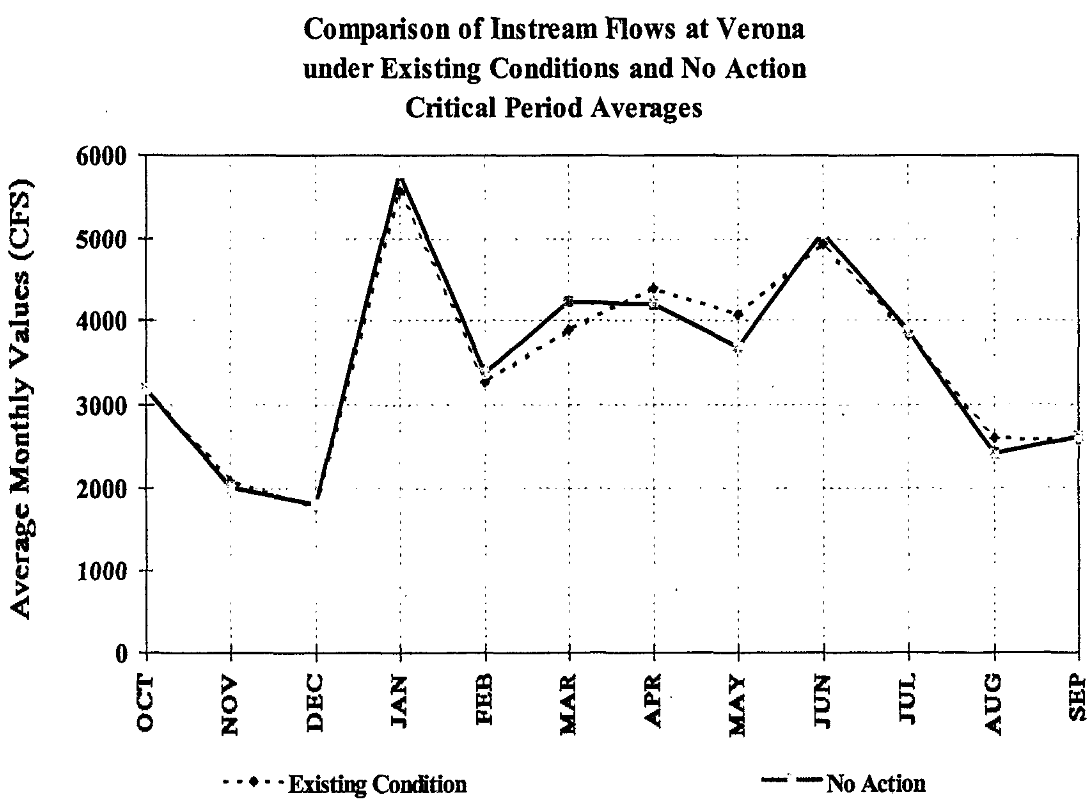
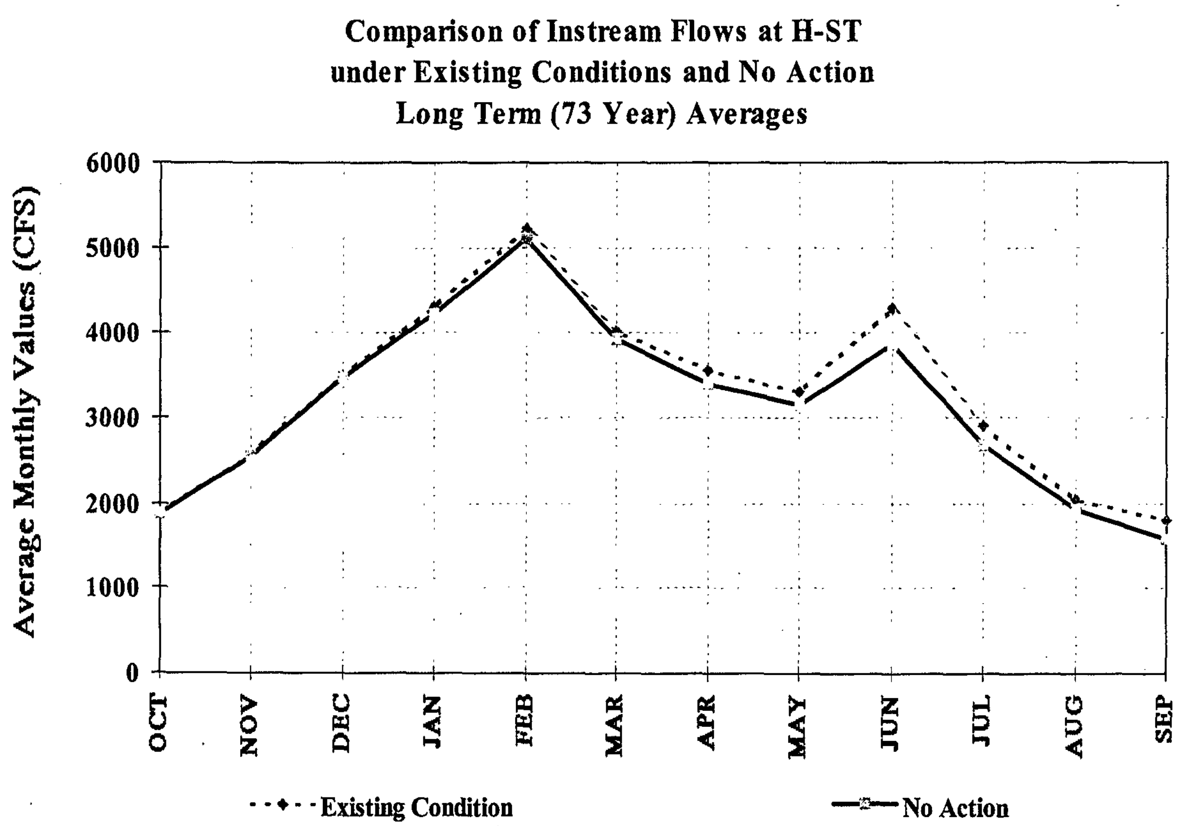


Figure 15. Monthly Average Instream Flow at Verona - Long-Term and Critical Period



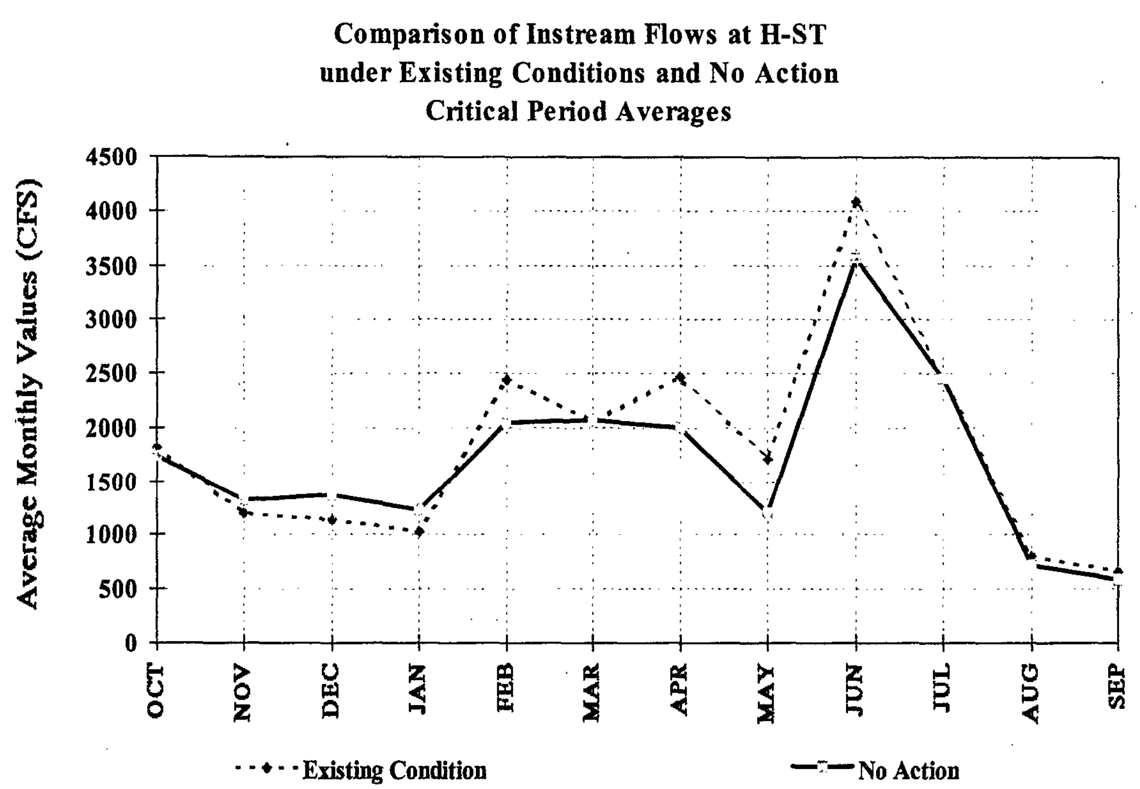
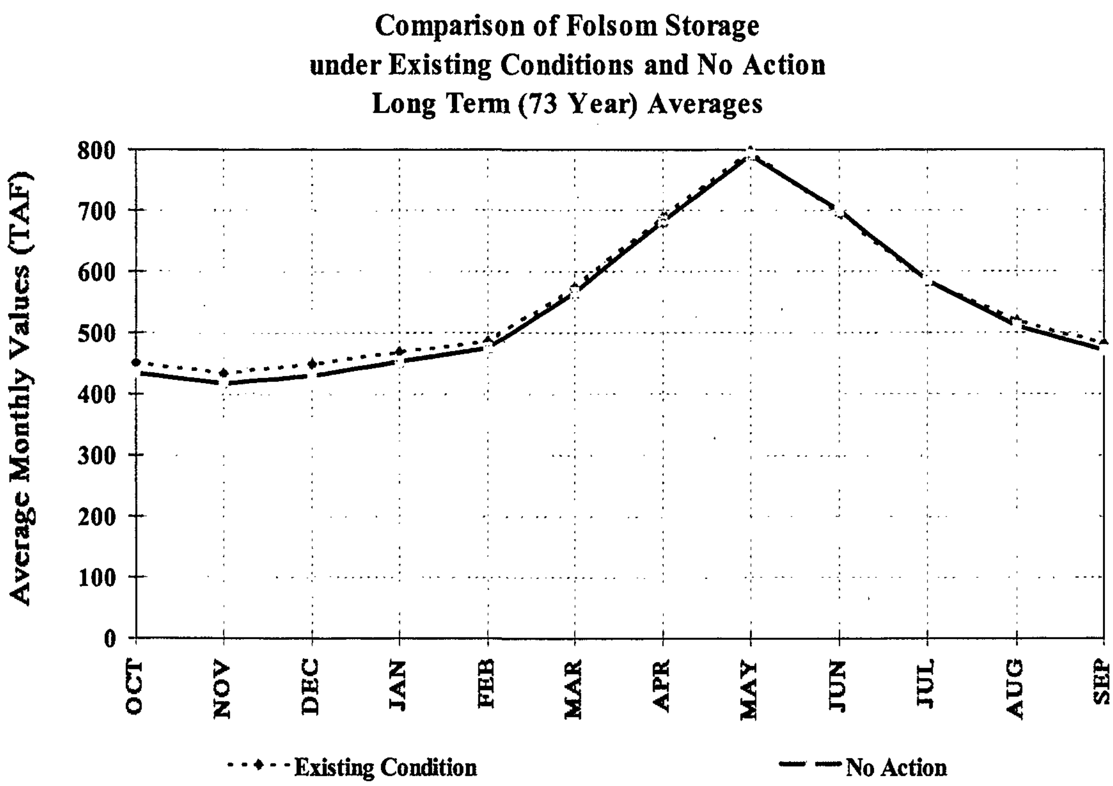


Figure 16. **Monthly Average Instream Flow at H-ST - Long-Term and Critical Period**



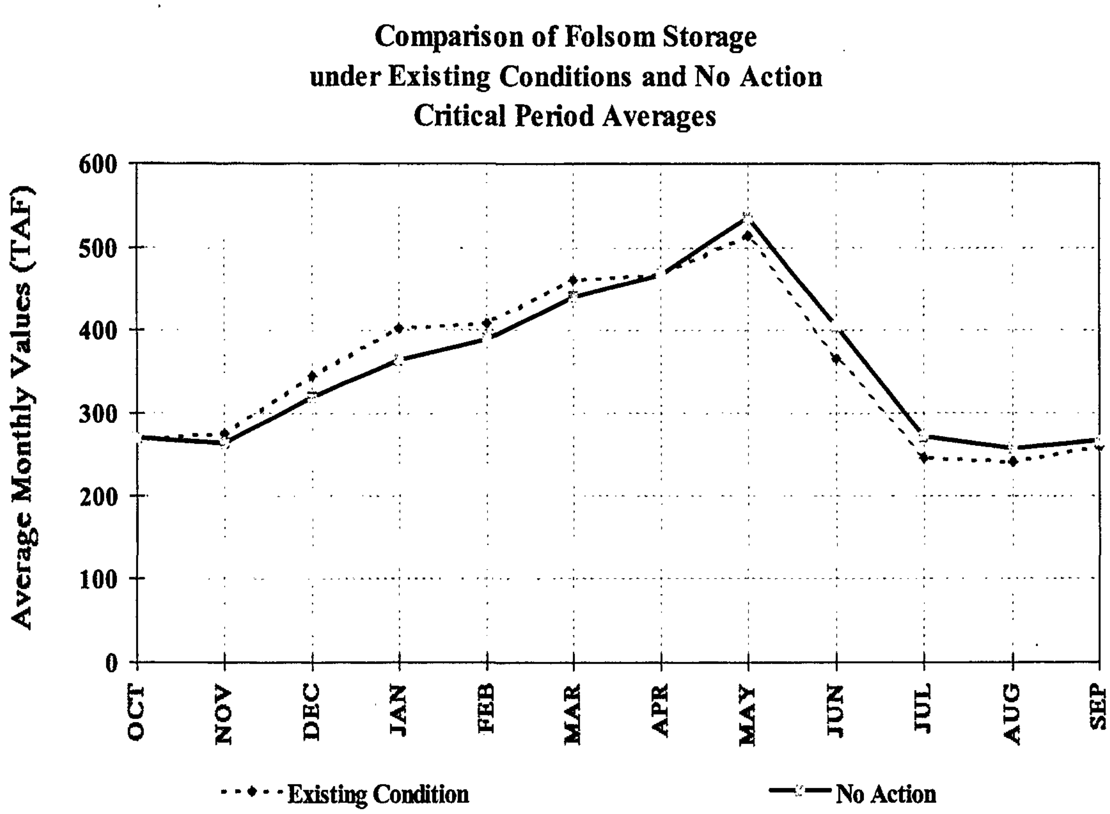


Figure 17. Monthly Average Storage at Folsom Lake - Long-Term and Critical Period

C-008891

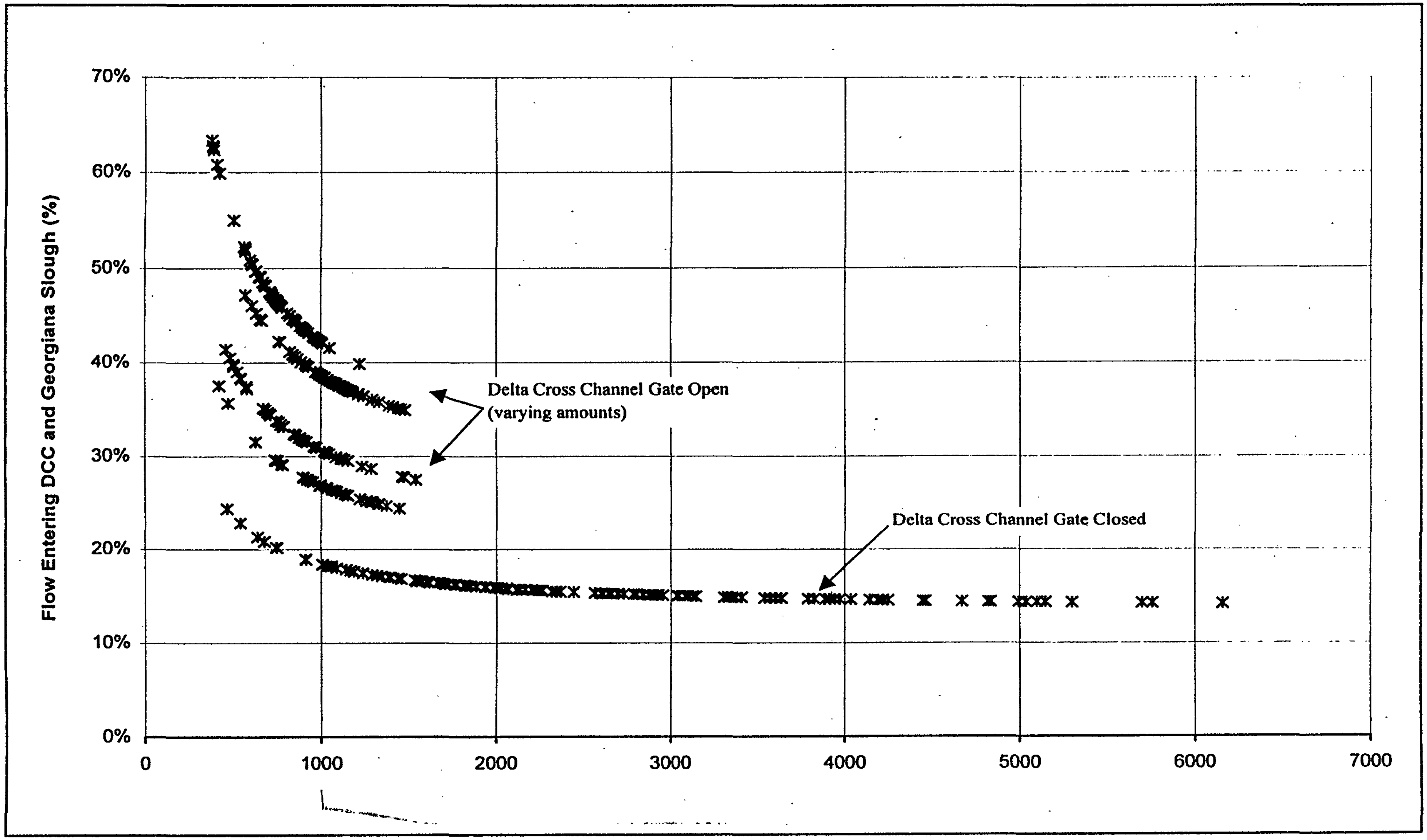
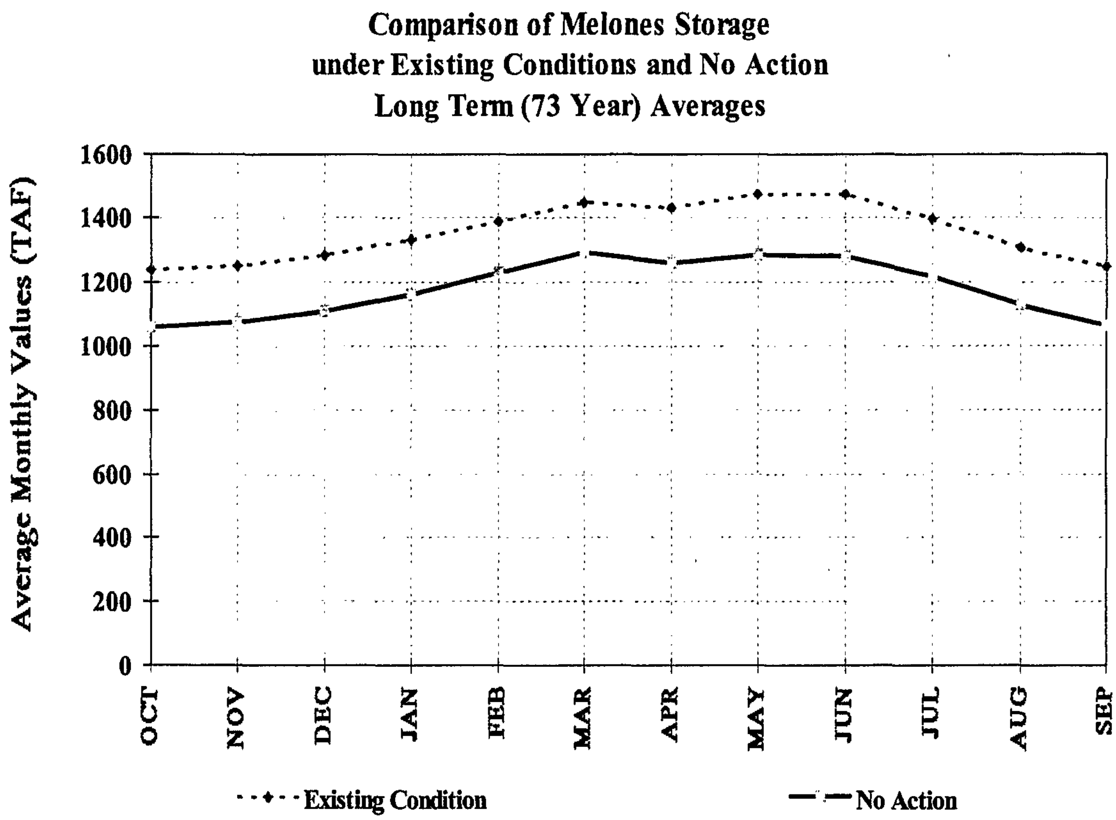


Figure 18. **Sacramento River Flow at Freeport (TAF)**

C — 0 0 8 8 9 1



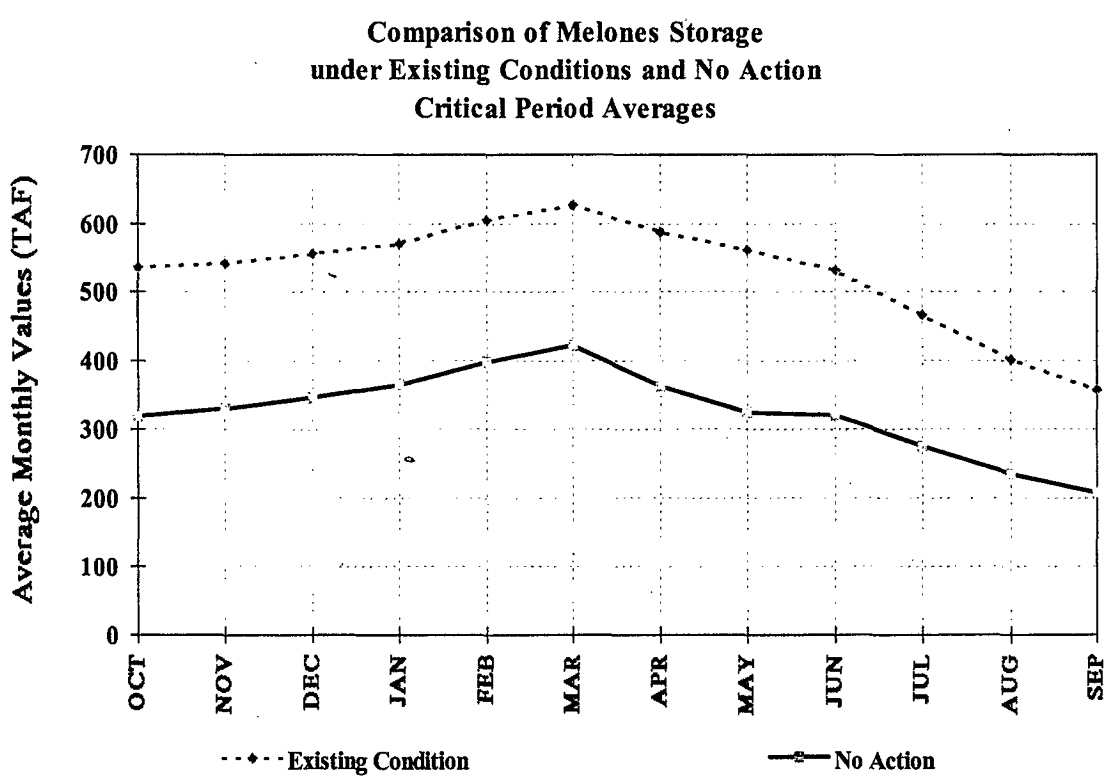
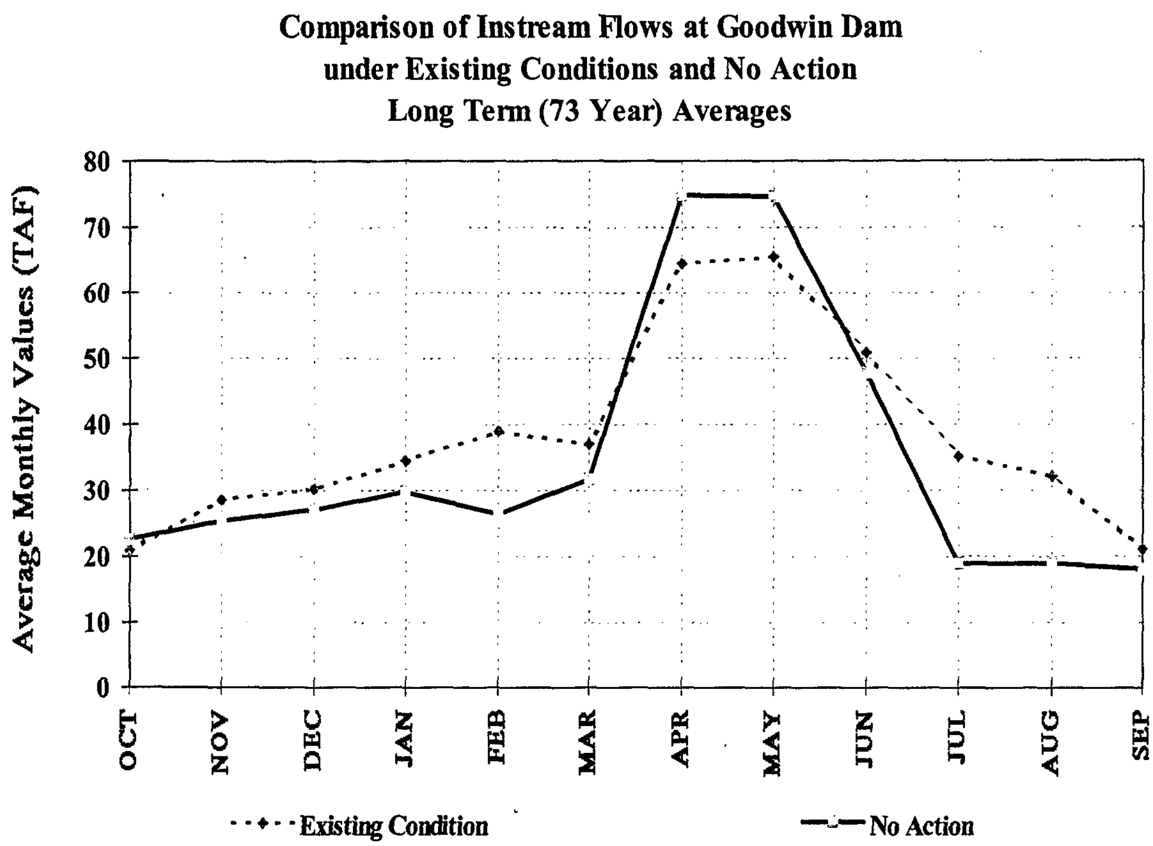


Figure 19. **Monthly Average Storage at New Melones Reservoir - Long-Term and Critical Period**



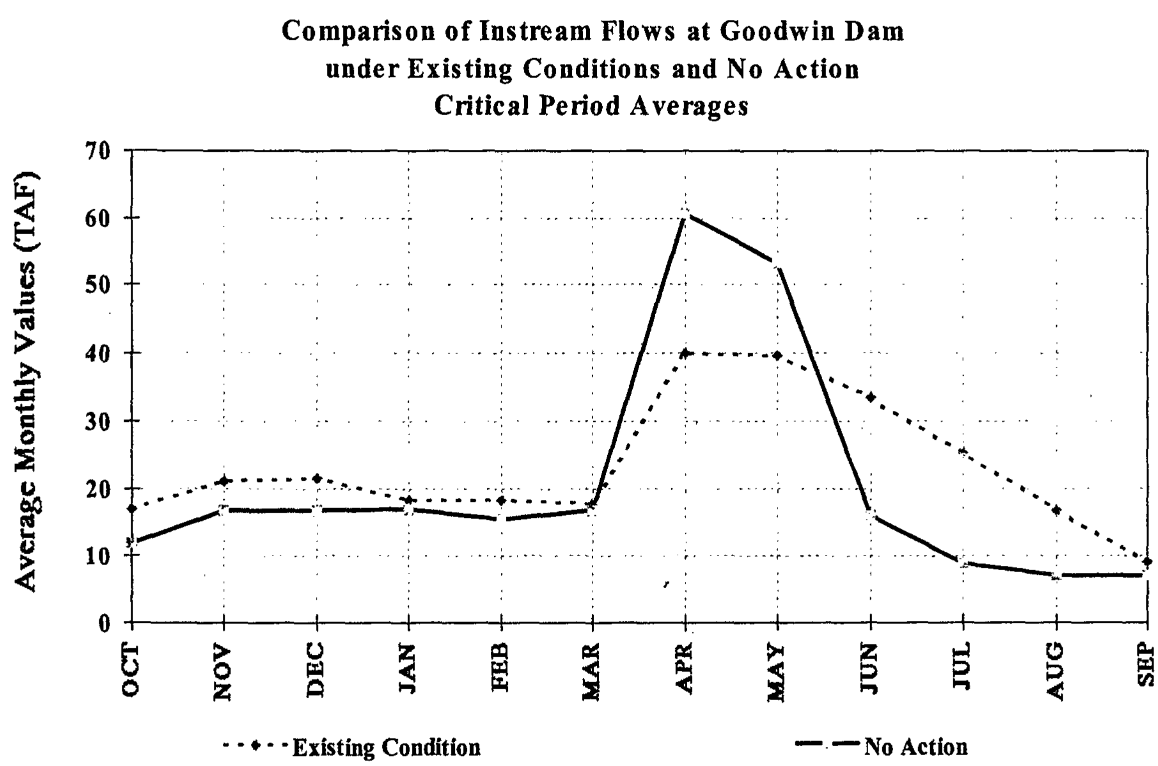
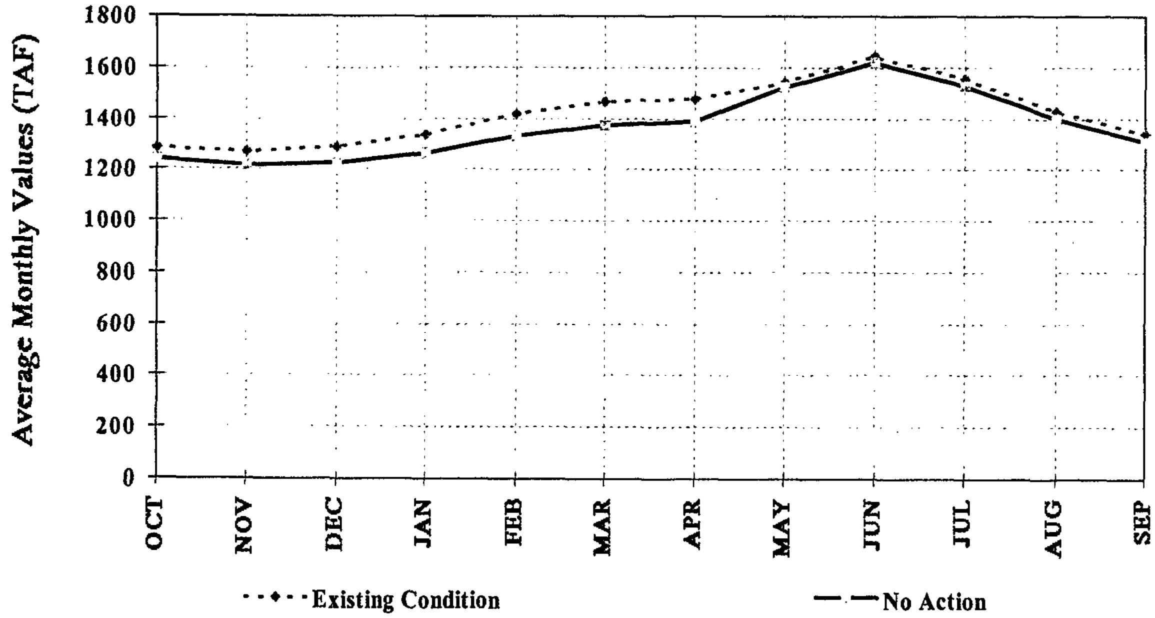


Figure 20. Monthly Average Instream Flow at Goodwin Dam - Long-Term and Critical Period

Comparison of New Don Pedro Storage under Existing Conditions and No Action Long Term (73 Year) Averages



Comparison of New Don Pedro Storage under Existing Conditions and No Action Critical Period Averages

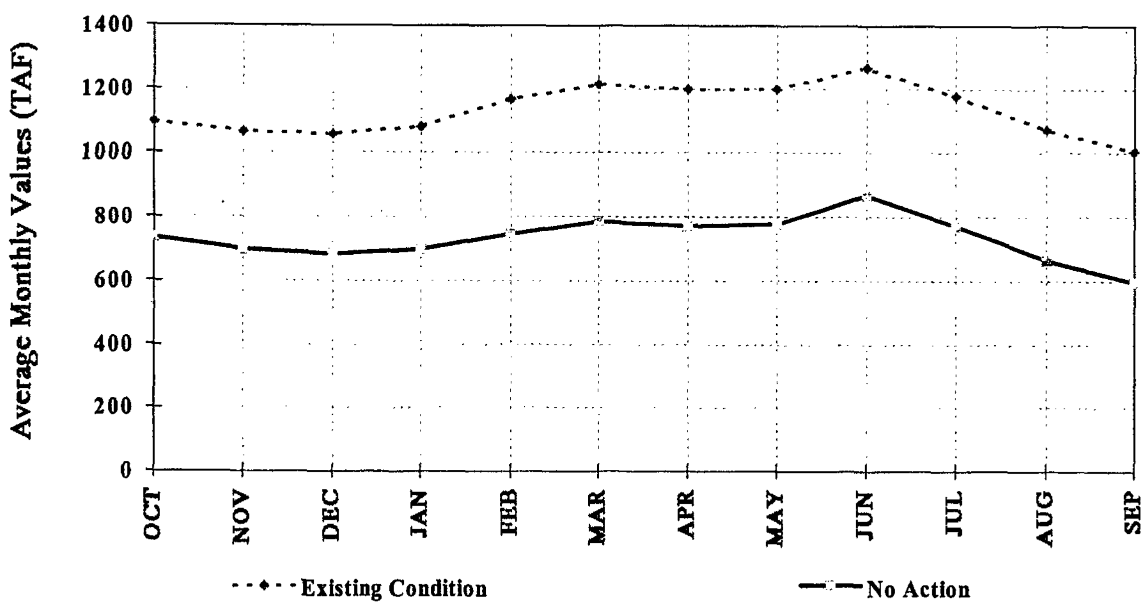
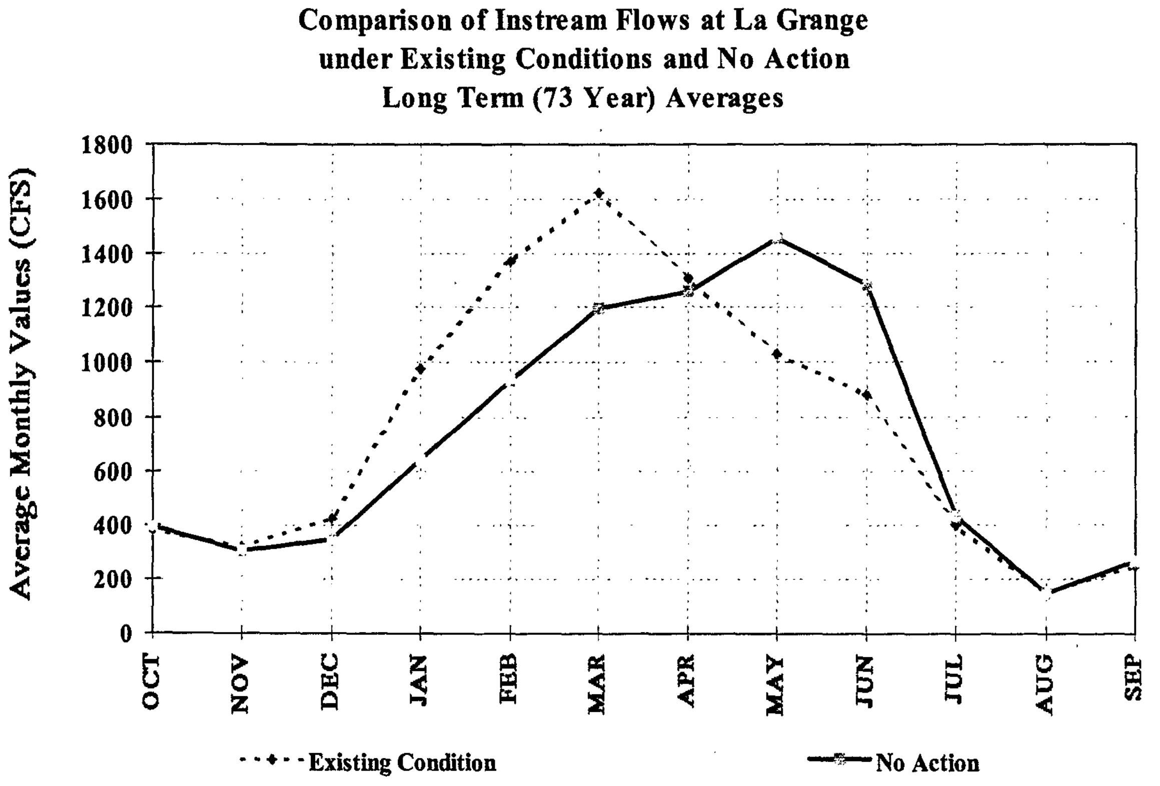


Figure x. Monthly Average

Figure 21. Monthly Average Storage at Lake New Don Pedro - Long-Term and Critical Period



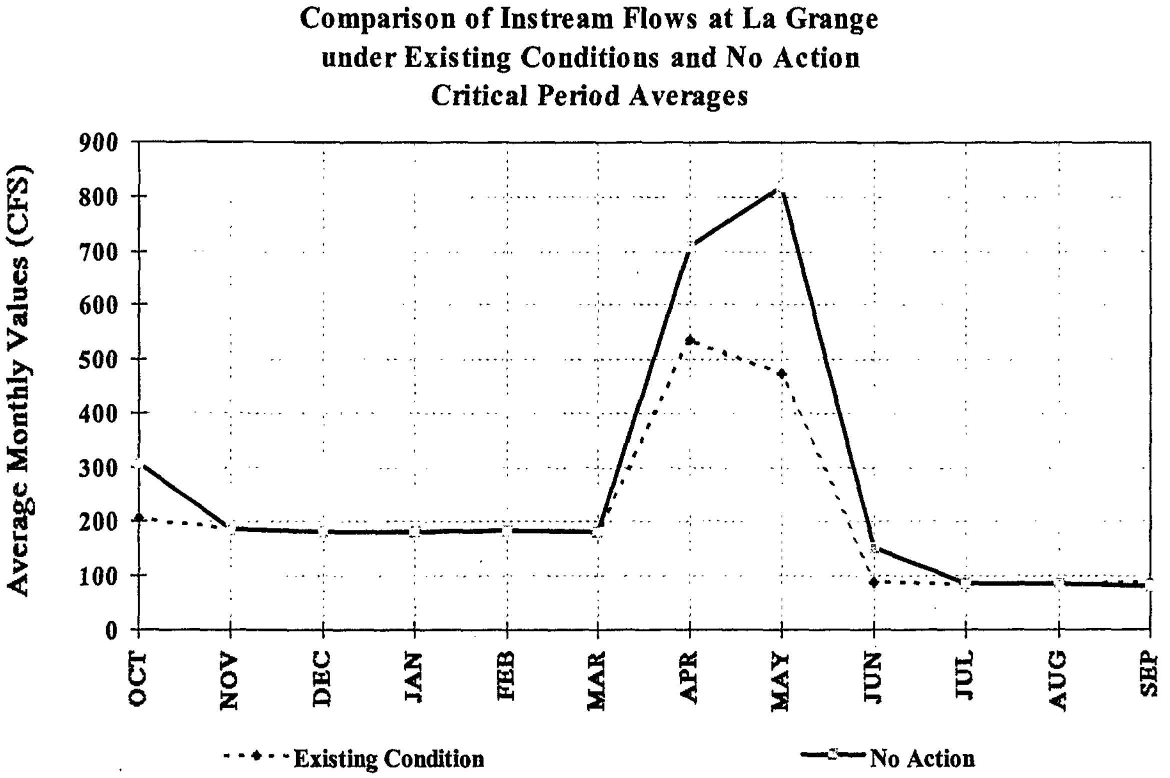
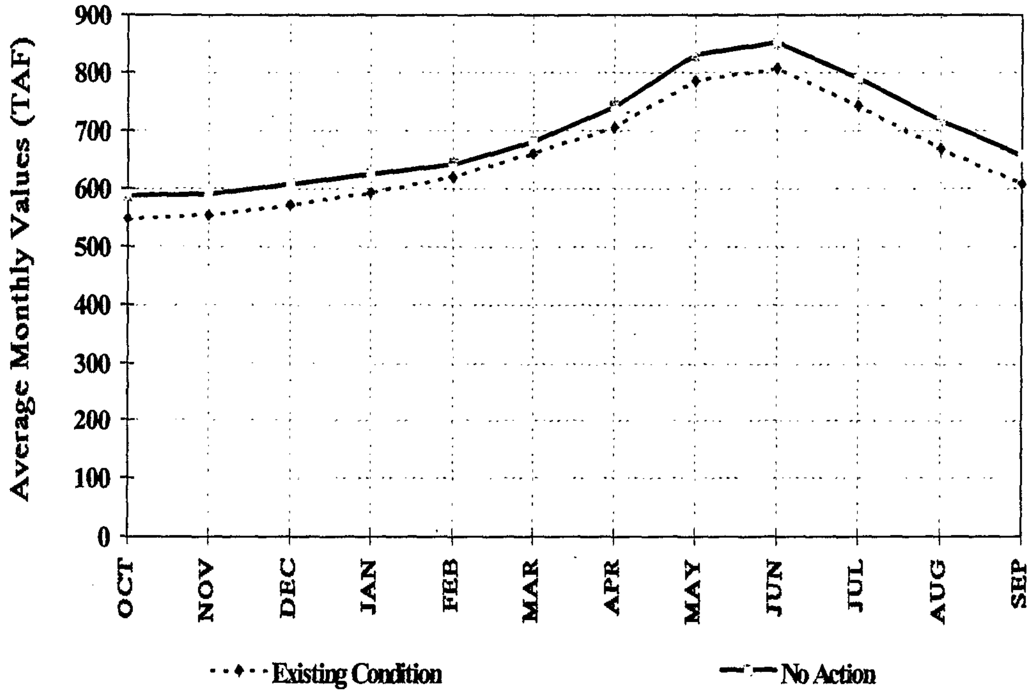


Figure 22. Monthly Average Instream Flow at La Grange - Long-Term and Critical Period

Comparison of Lake McClure Storage under Existing Conditions and No Action Long Term (73 Year) Averages



Comparison of Lake McClure Storage under Existing Conditions and No Action Critical Period Averages

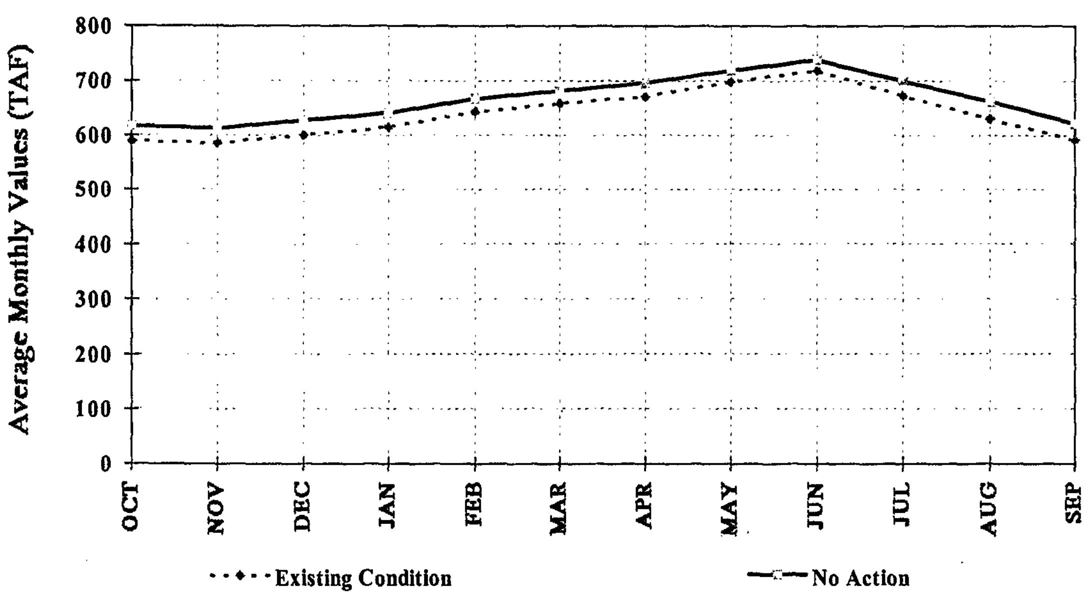
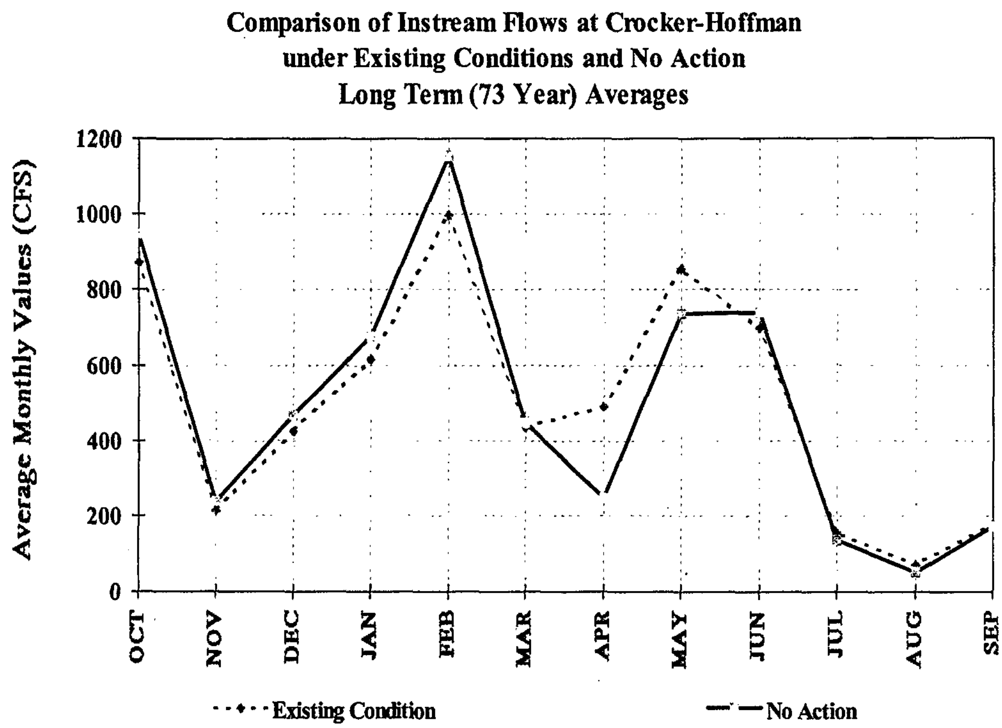


Figure 23. Monthly Average Storage at Lake McClure - Long-Term and Critical Period



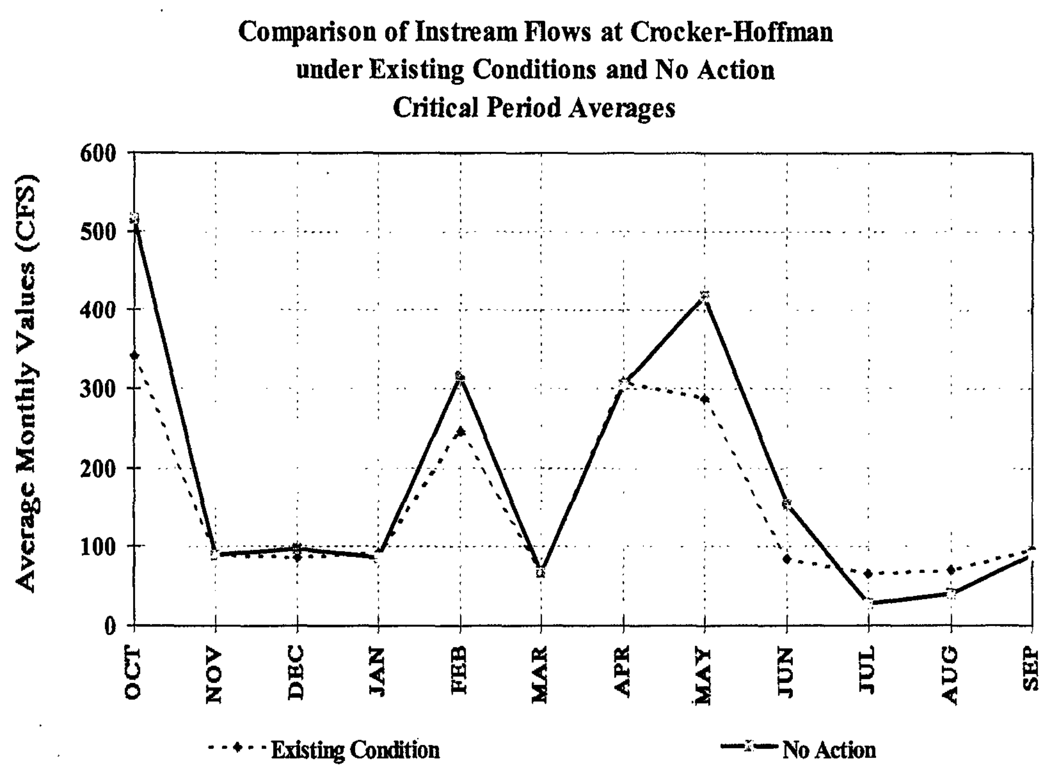
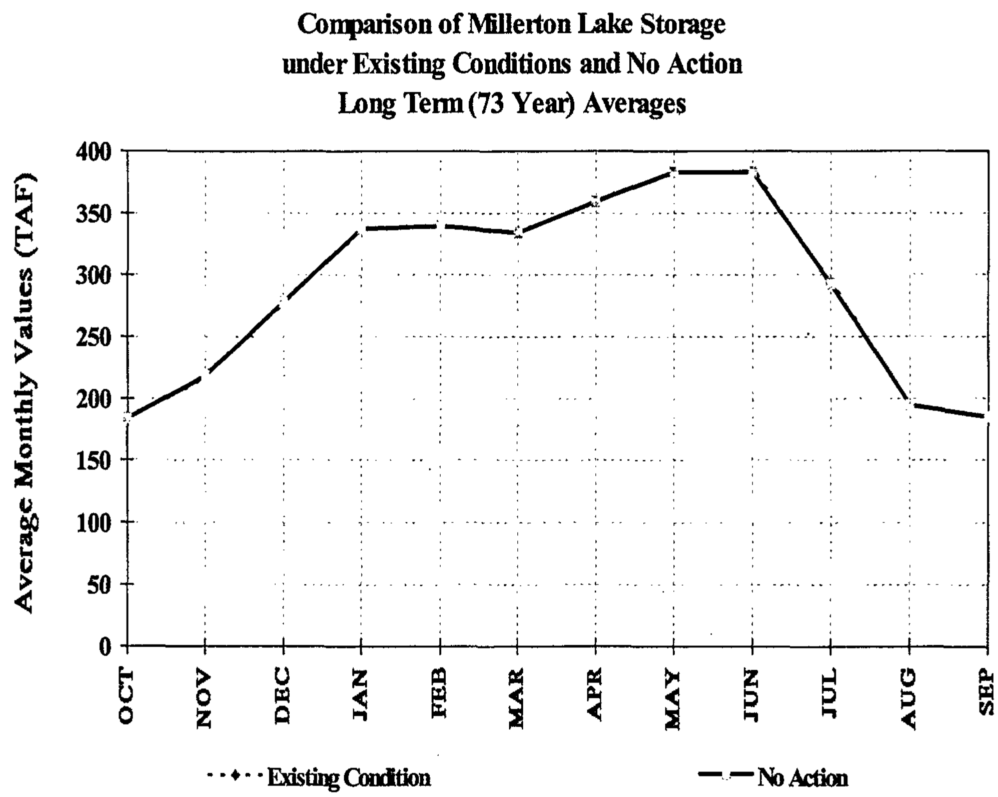


Figure 24. Monthly Average Instream Flow at Croker-Hoffman - Long-Term and Critical Period



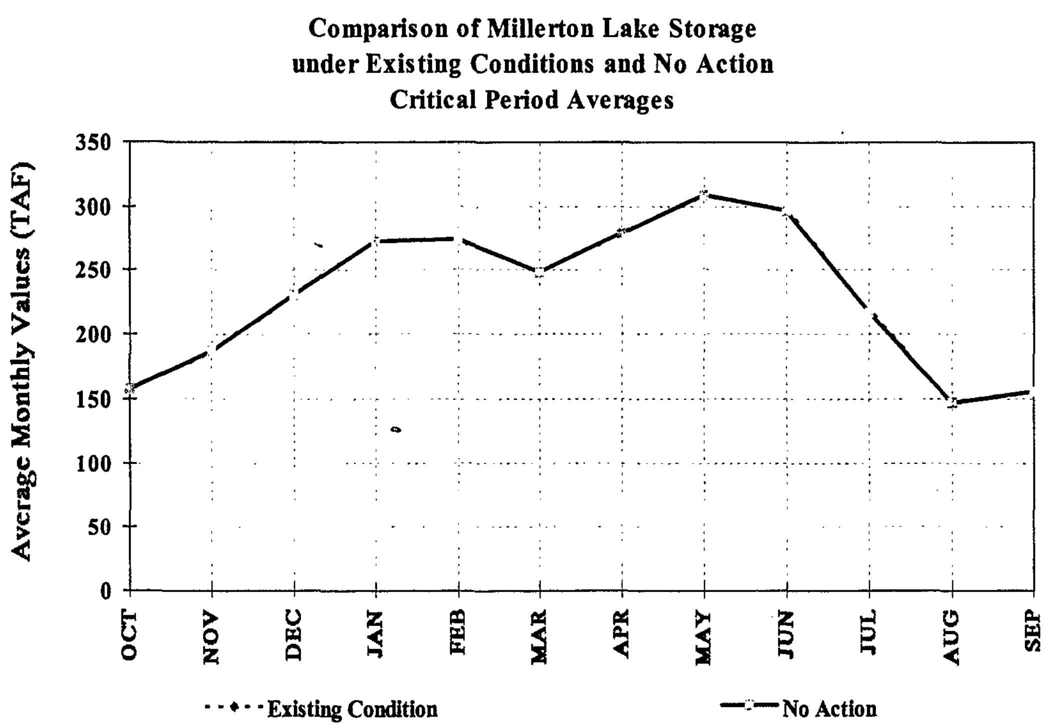
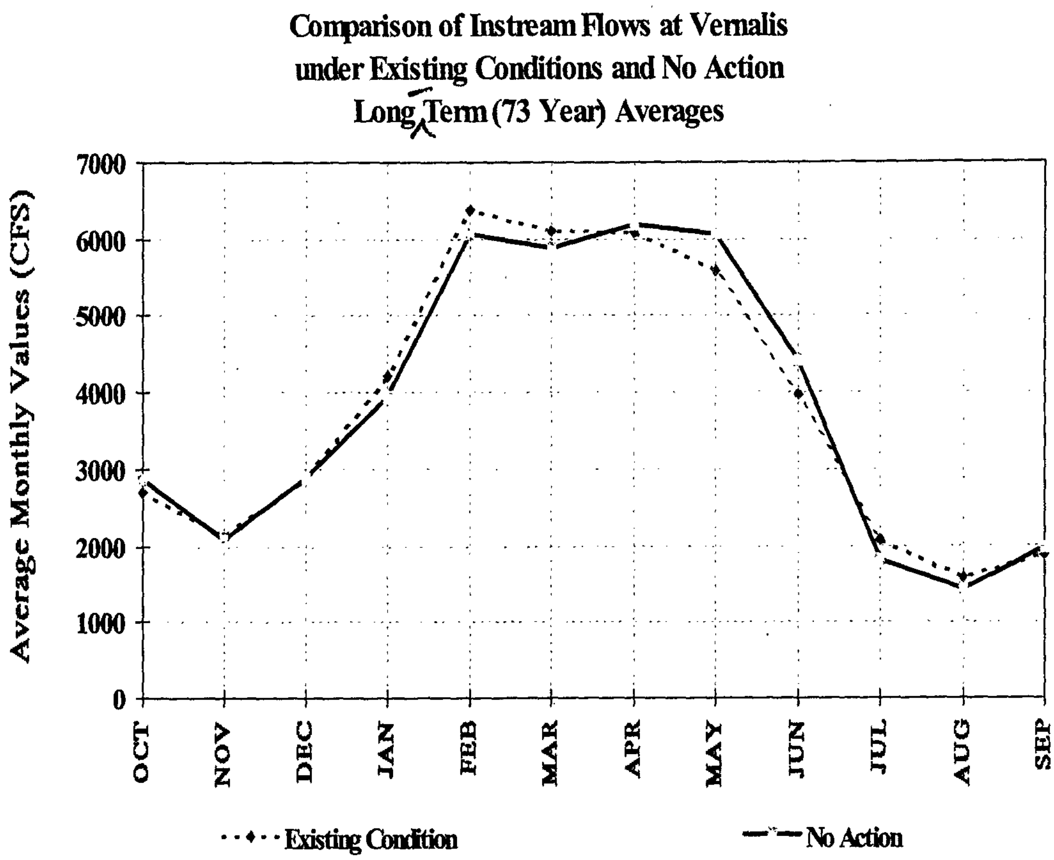


Figure 25. Monthly Average Storage at Millerton Lake - Long-Term and Critical Period



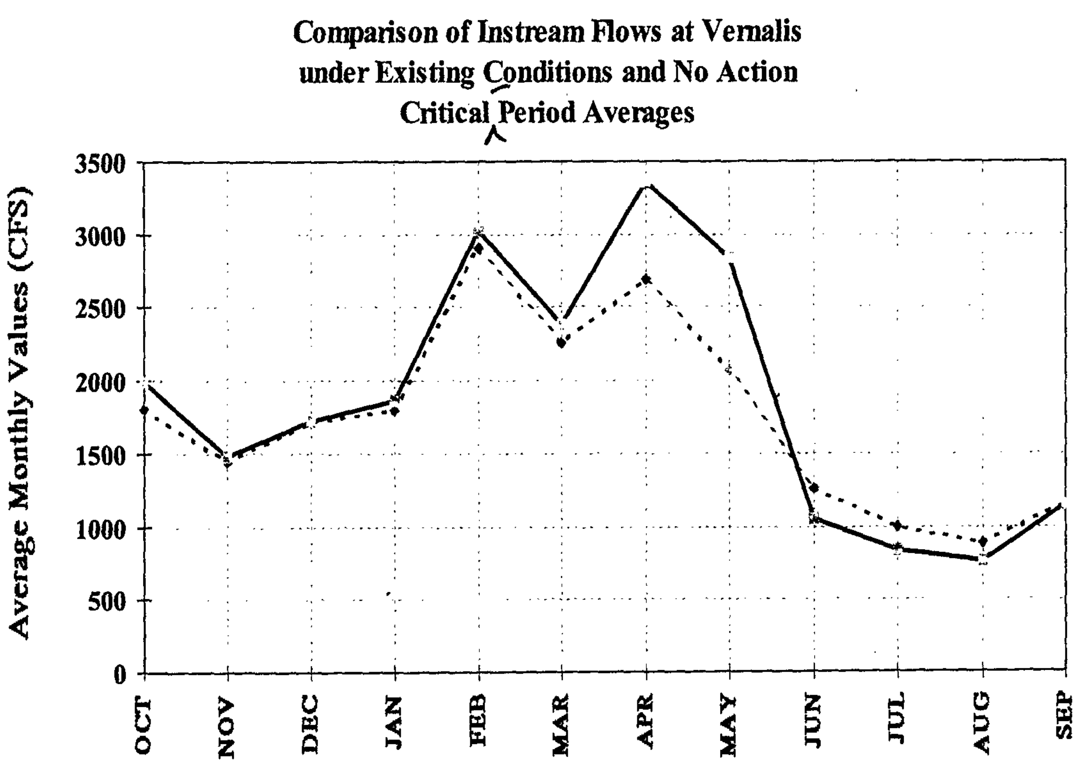
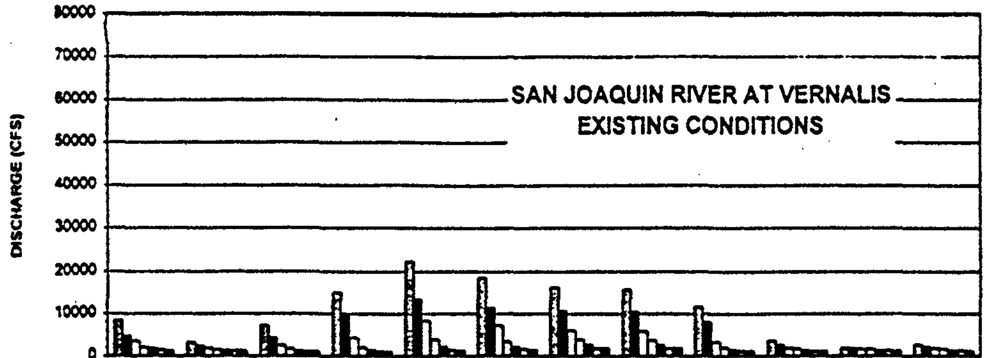
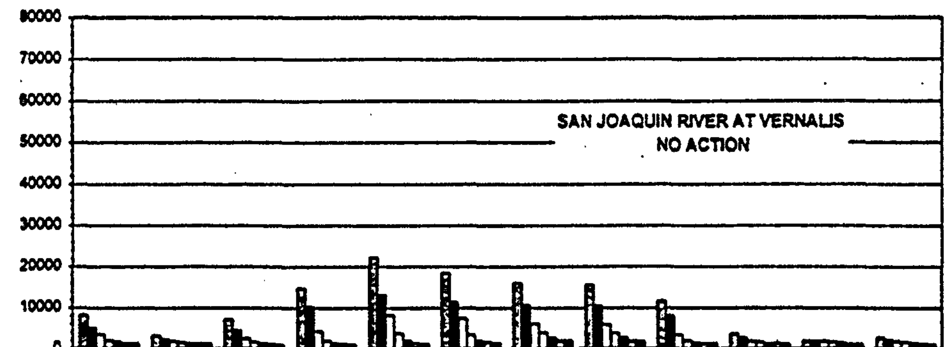


Figure 26. **Comparison of Instream Flows at Vernalis - Long-Term and Critical Period, Existing Conditions and No Action**

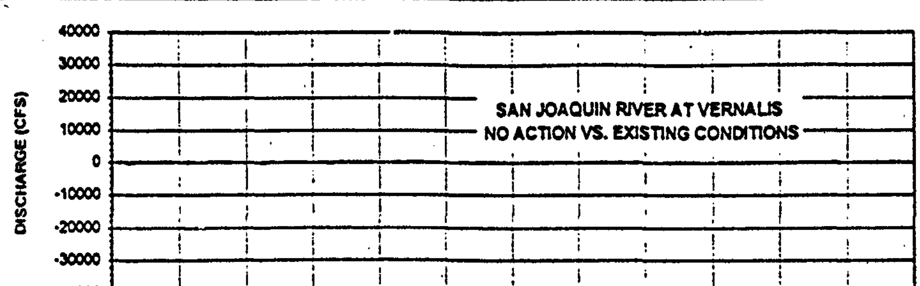


	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5 percent	8333	3247	7221	14697	22363	18634	16174	15672	11630	3889	1883	2672
10 percent	4602	2333	4349	10064	13274	11450	10886	10581	8151	2654	1867	2202
25 percent	3546	1849	2521	4375	8266	7237	6201	5606	3428	1870	1806	1949
50 percent	2000	1630	1881	2017	3887	3415	3883	3622	2134	1675	1675	1887
75 percent	1918	1412	1317	1360	2287	2277	2807	2883	1563	1447	1486	1479
90 percent	1522	1284	1171	1156	1430	1986	1983	1880	1331	1311	1286	1361
95 percent	1334	1237	1136	1132	1280	1369	1983	1870	1304	1278	1286	1287

MONTH



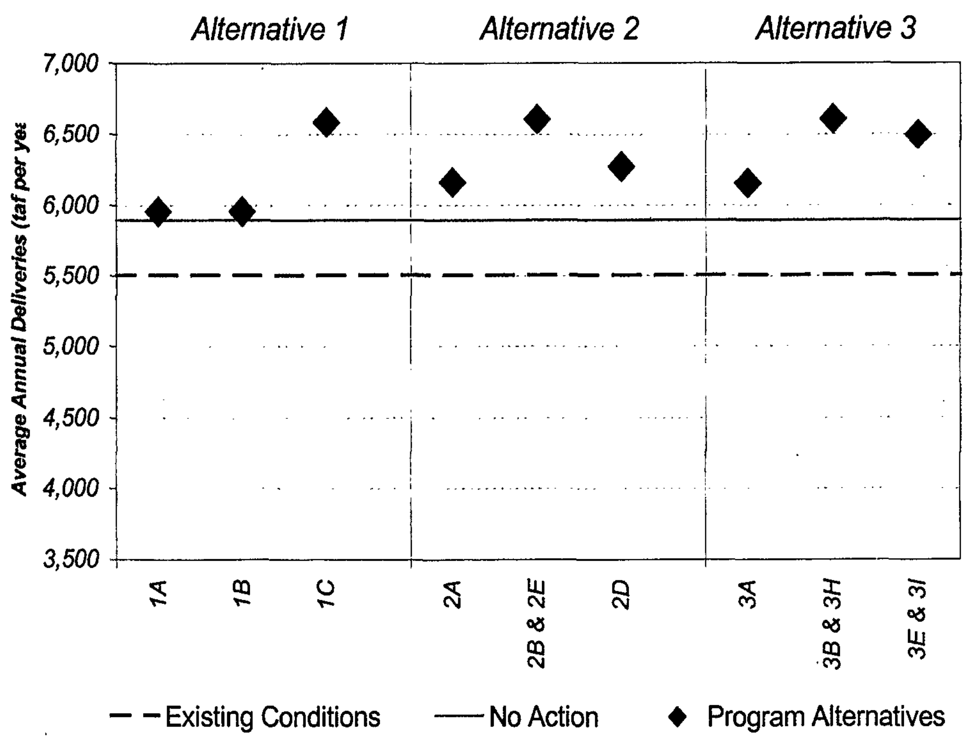
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5 percent	8333	3247	7237	14638	22384	18360	16184	15681	11636	3889	1867	2672
10 percent	5230	2346	4625	10409	13270	11456	10886	10581	8154	2651	1854	2202
25 percent	3546	1933	2521	4375	8180	7432	6201	5836	3428	1870	1806	1933
50 percent	2000	1613	1708	2000	3763	3415	3883	3622	2134	1689	1675	1887
75 percent	1903	1412	1317	1360	2017	2088	2807	2883	1563	1431	1480	1479
90 percent	1444	1284	1171	1156	1430	1986	1983	1803	1331	1306	1272	1361
95 percent	1334	1247	1126	1122	1280	1369	1983	1870	1336	1262	1213	1287



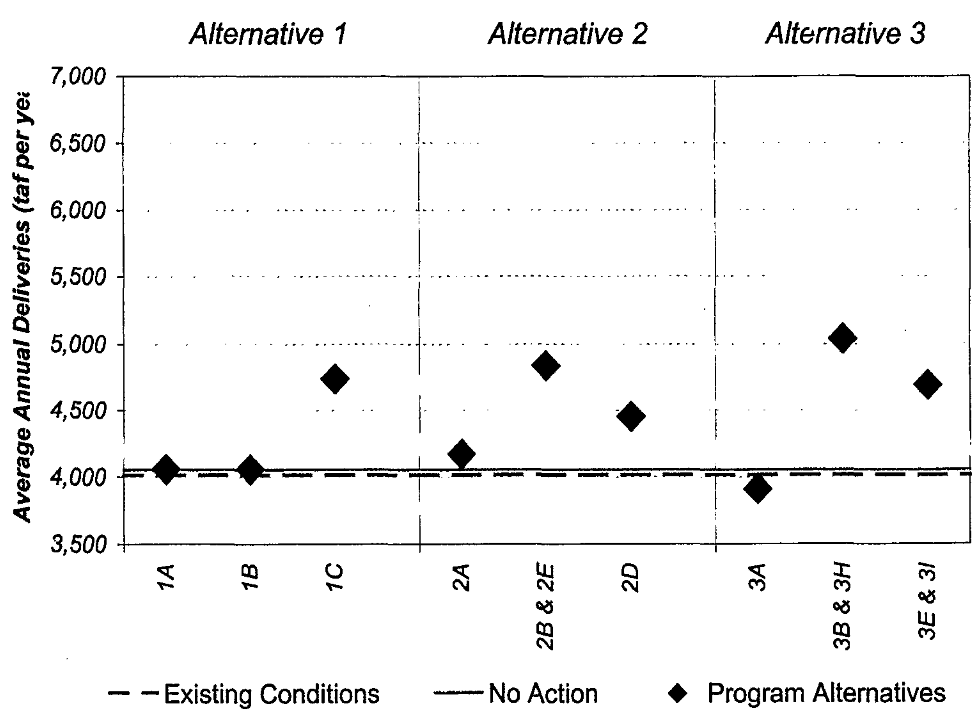
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5 percent	0	0	-16	66	-11	-16	-10	-10	-7	0	7	0
10 percent	-329	-13	-276	-346	4	0	0	0	-3	3	13	0
25 percent	0	-84	0	0	72	-196	0	0	0	0	0	17
50 percent	0	17	-16	16	234	0	0	0	0	16	0	0
75 percent	16	0	0	0	270	211	0	0	0	16	16	0
90 percent	78	0	0	0	0	0	0	-13	0	3	94	0
95 percent	0	-10	13	10	0	0	0	0	-34	16	81	-16

MONTH

Figure 27. Flow Frequencies, San Joaquin River at Vernalis, Existing Conditions and No Action

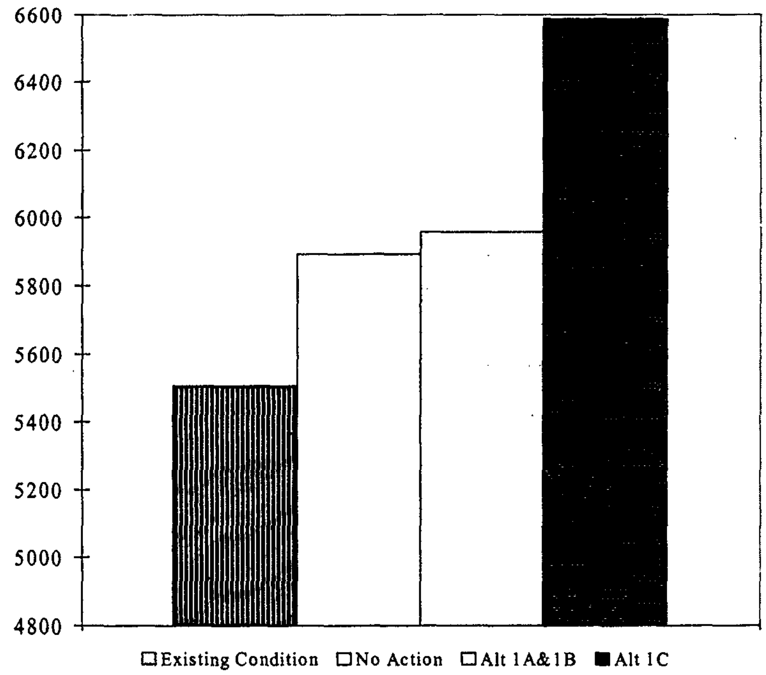


Average Annual SWP and CVP Deliveries South of Delta, Long Term (73 yr)

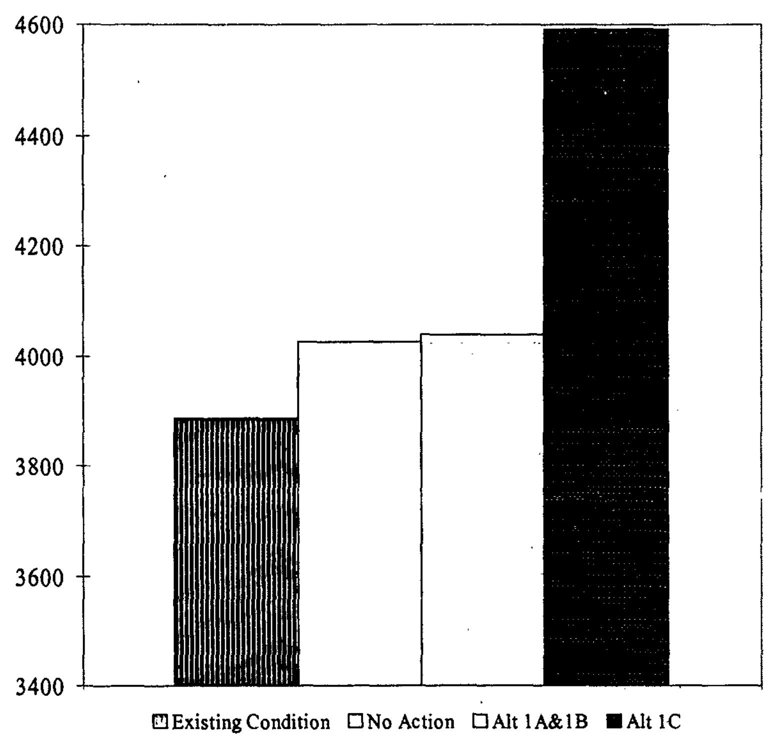


Average Annual SWP and CVP Deliveries South of Delta, Critical Period

Figure 28. Average Annual SWP and CVP Deliveries South of Delta

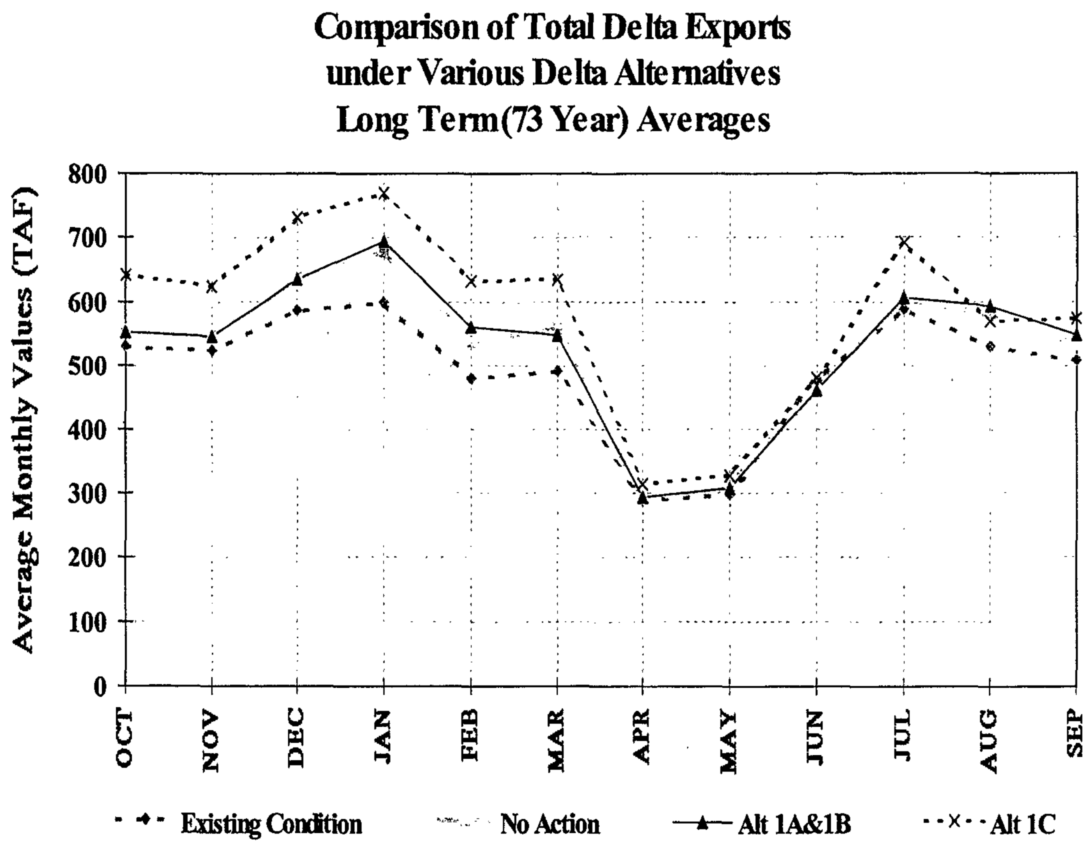


Average Annual CVP/SWP South of Delta Deliveries - Long Term (73 Year)



Average Annual CVP/SWP South of Delta Deliveries - Critical Period

Figure 29. Average Annual CVP/SWP South of Delta Deliveries



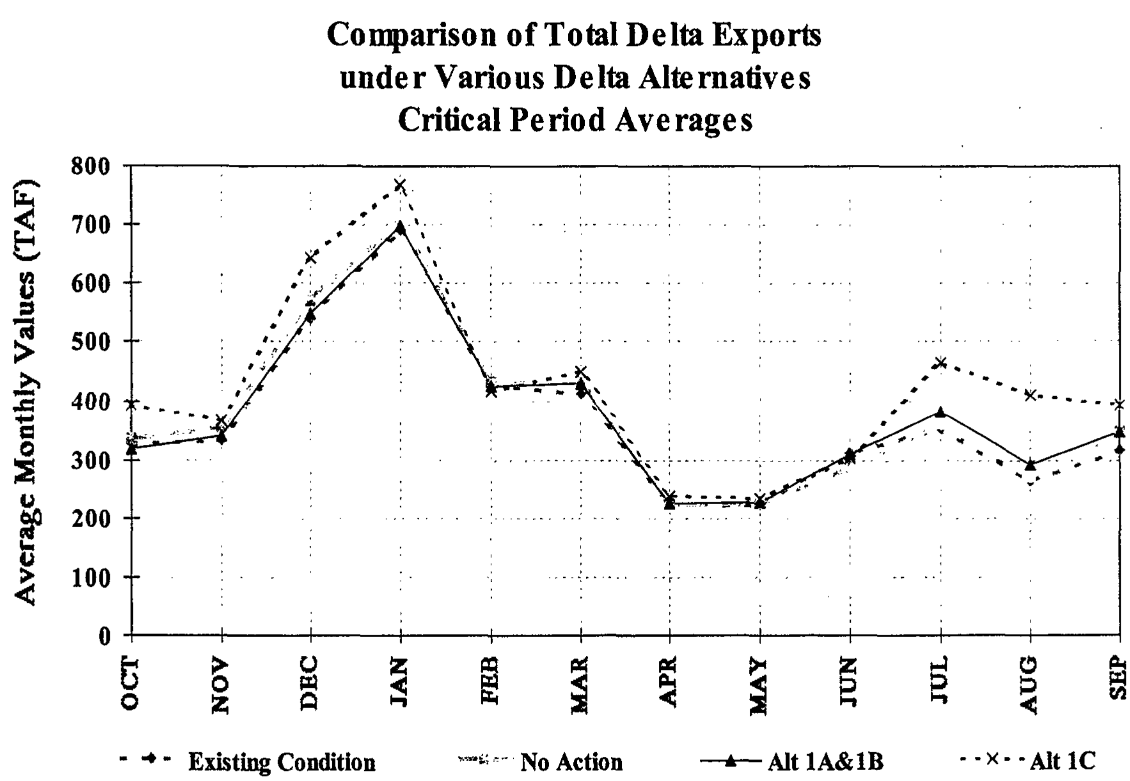
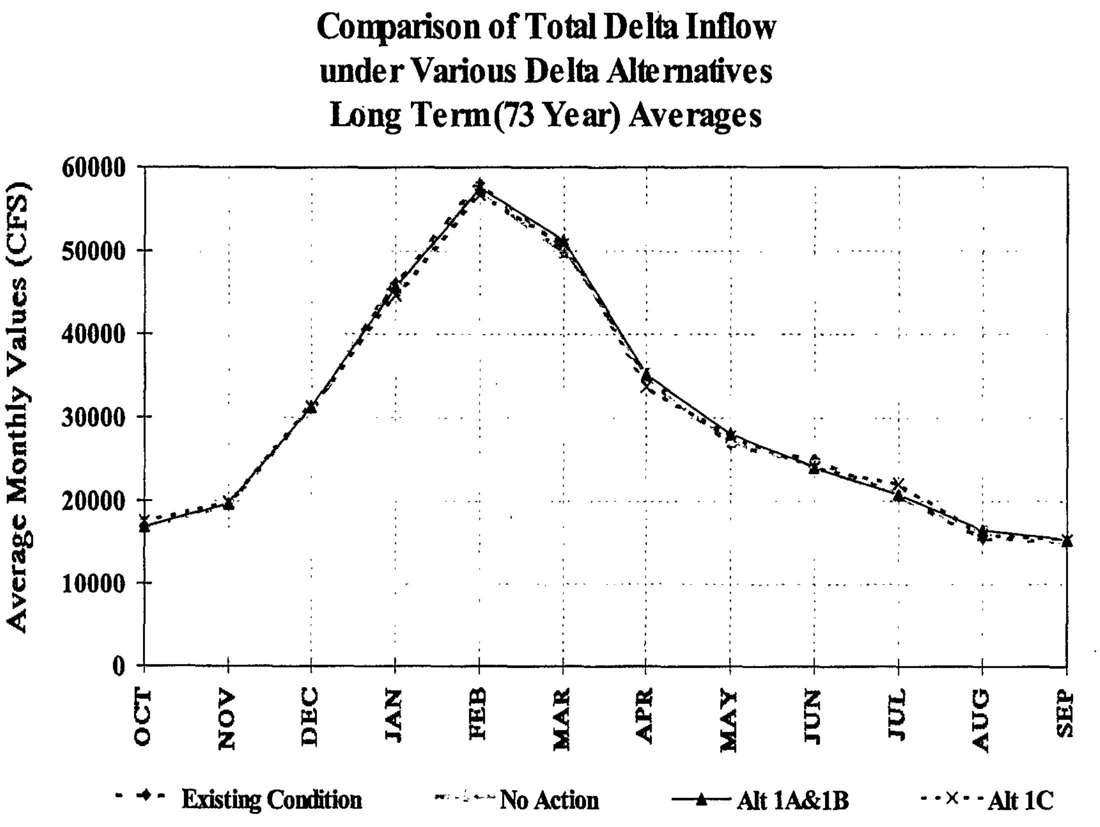


Figure 30. **Average Monthly South of Delta Exports**



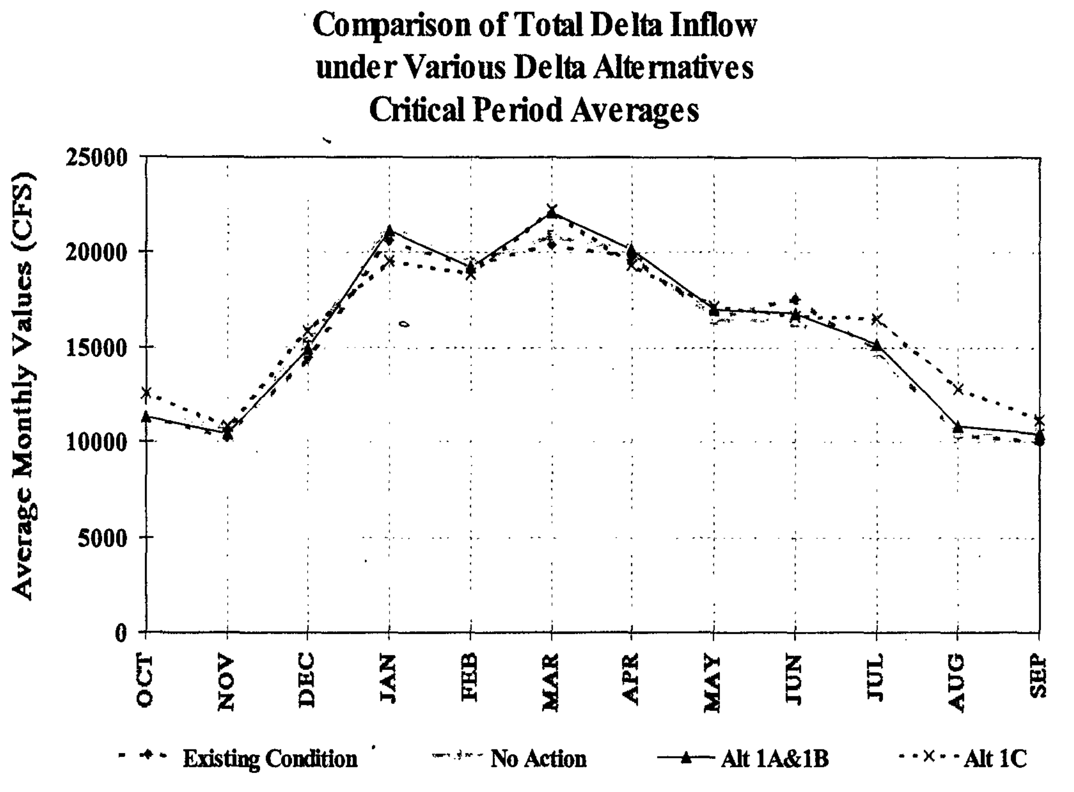


Figure 31. Average Monthly Delta Inflow

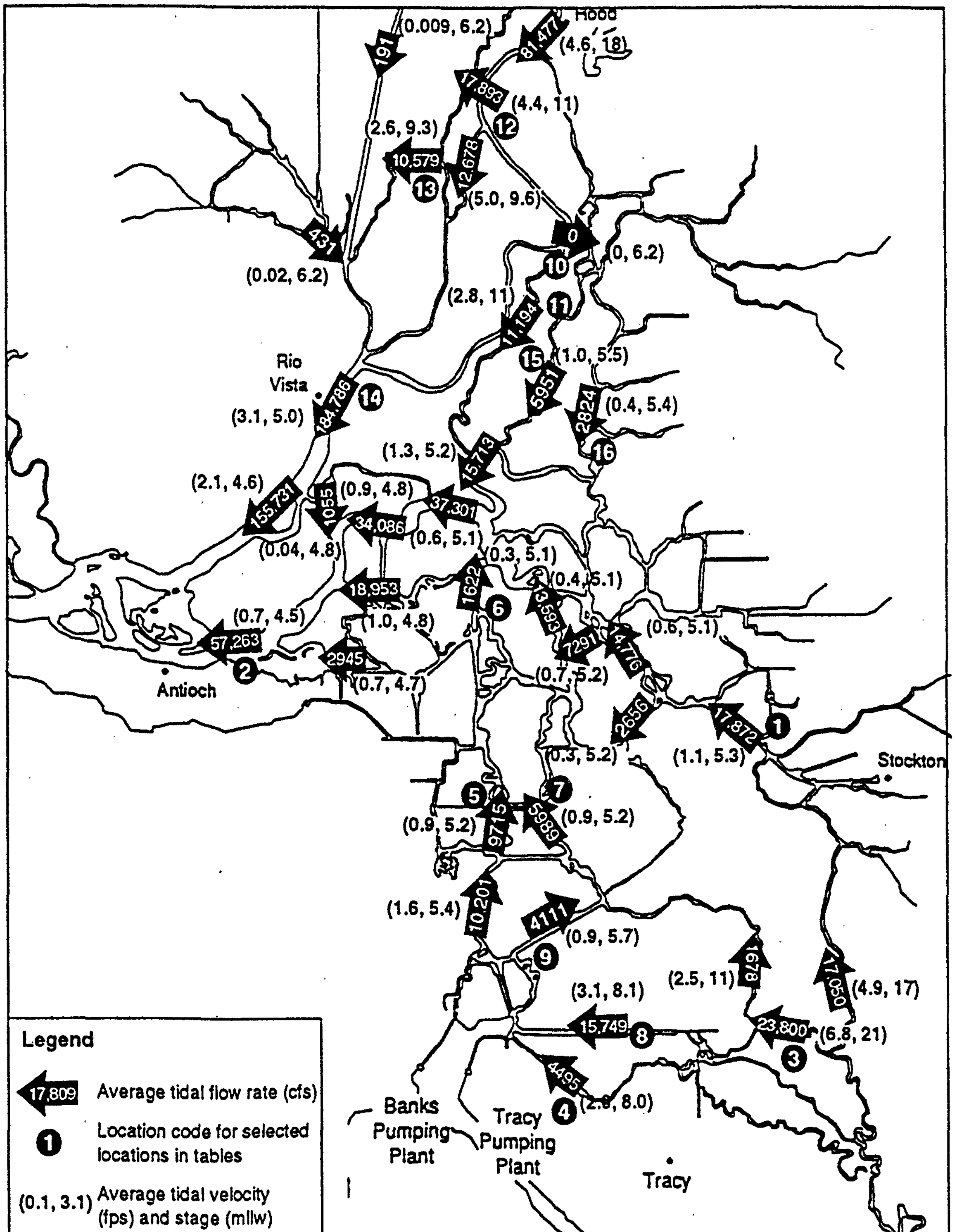


Figure 32. Average Tidal Flow Rates, Velocities, and Stages for High-Flow Conditions for Alternative 1

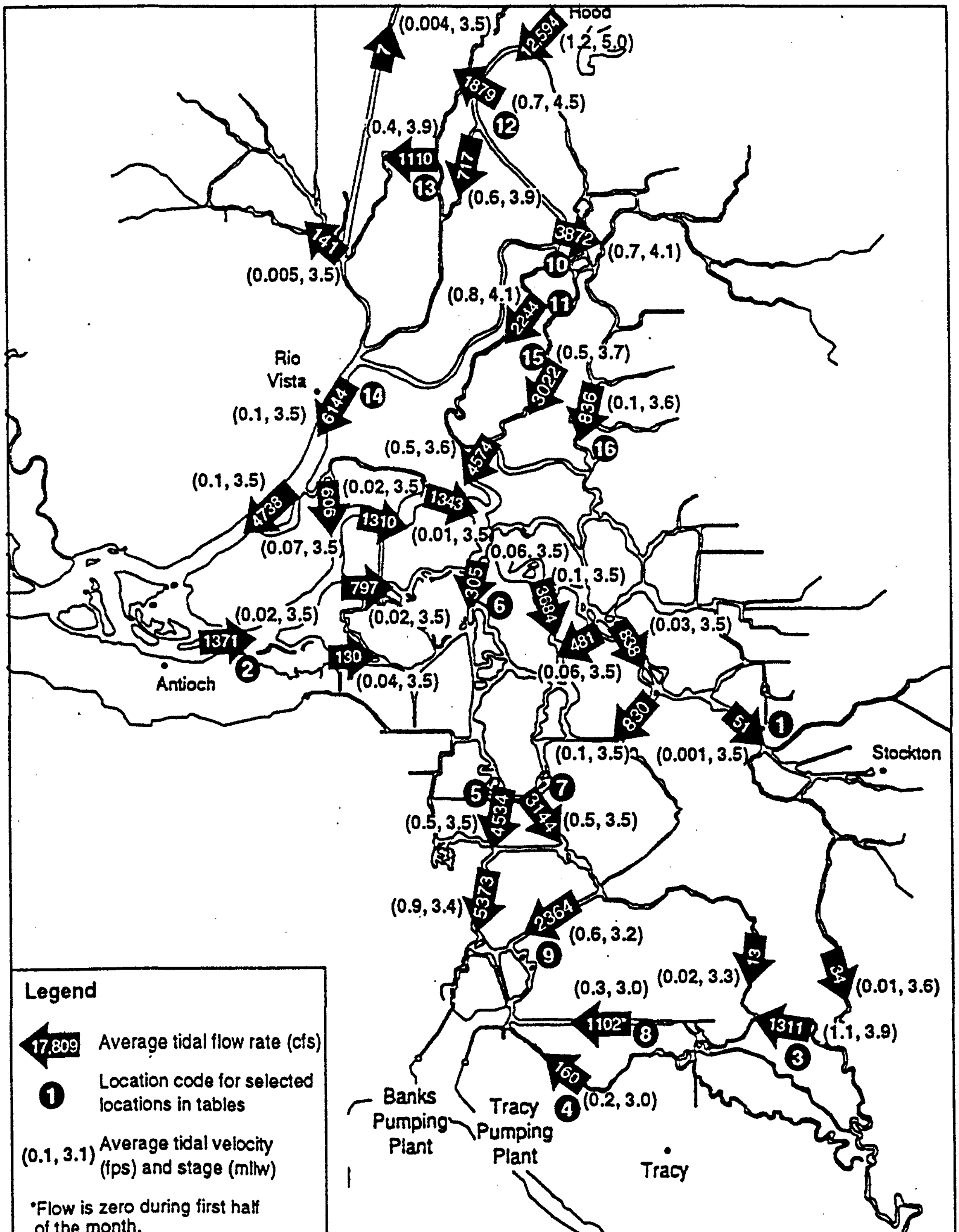


Figure 33. Average Tidal Flow Rates, Velocities, and Stages for Low-Flow/High-Pumping Conditions for Alternative 1A

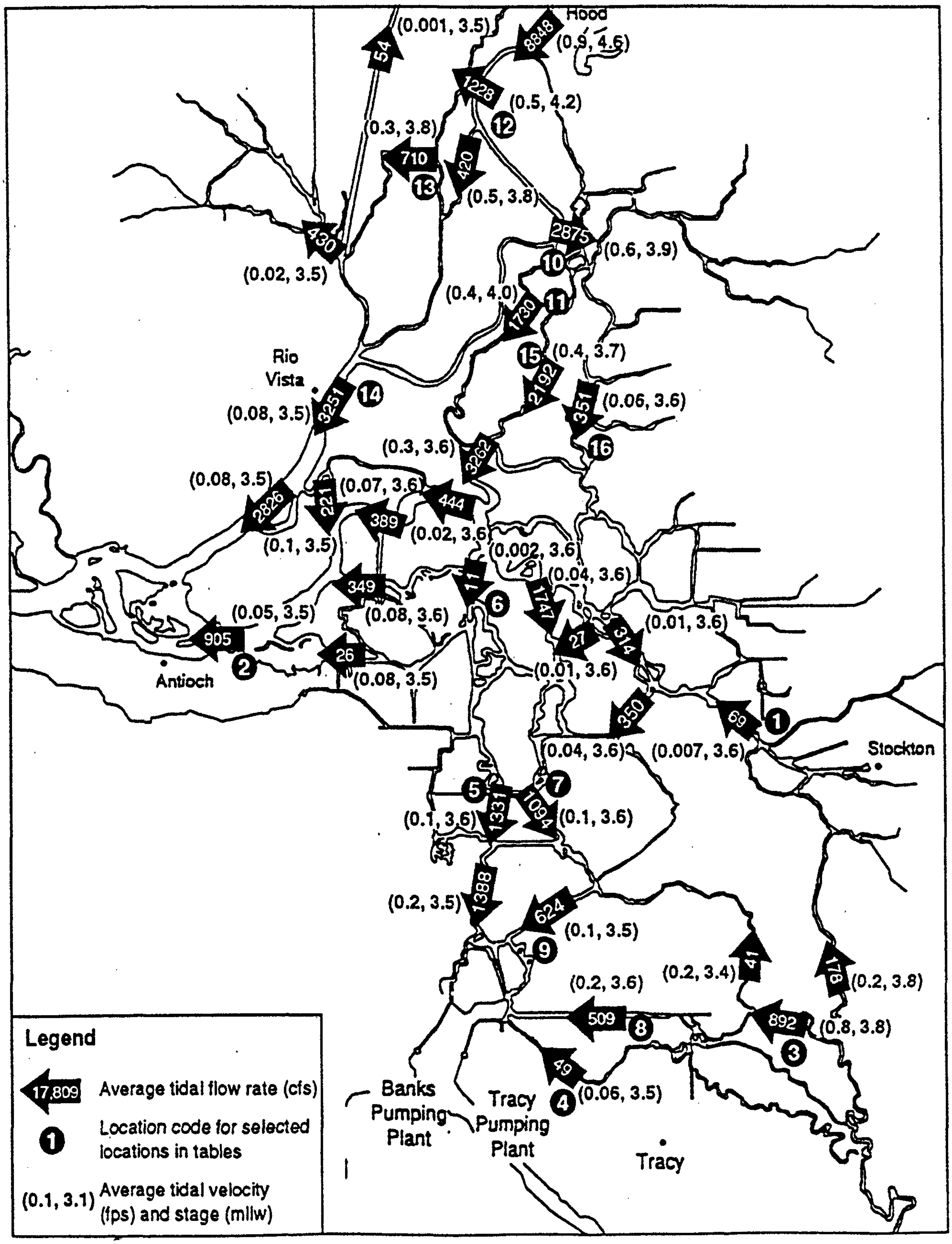


Figure 34. Average Tidal Flow Rates, Velocities, and Stages for Low-Flow/Low-Pumping Conditions for Alternative 1A

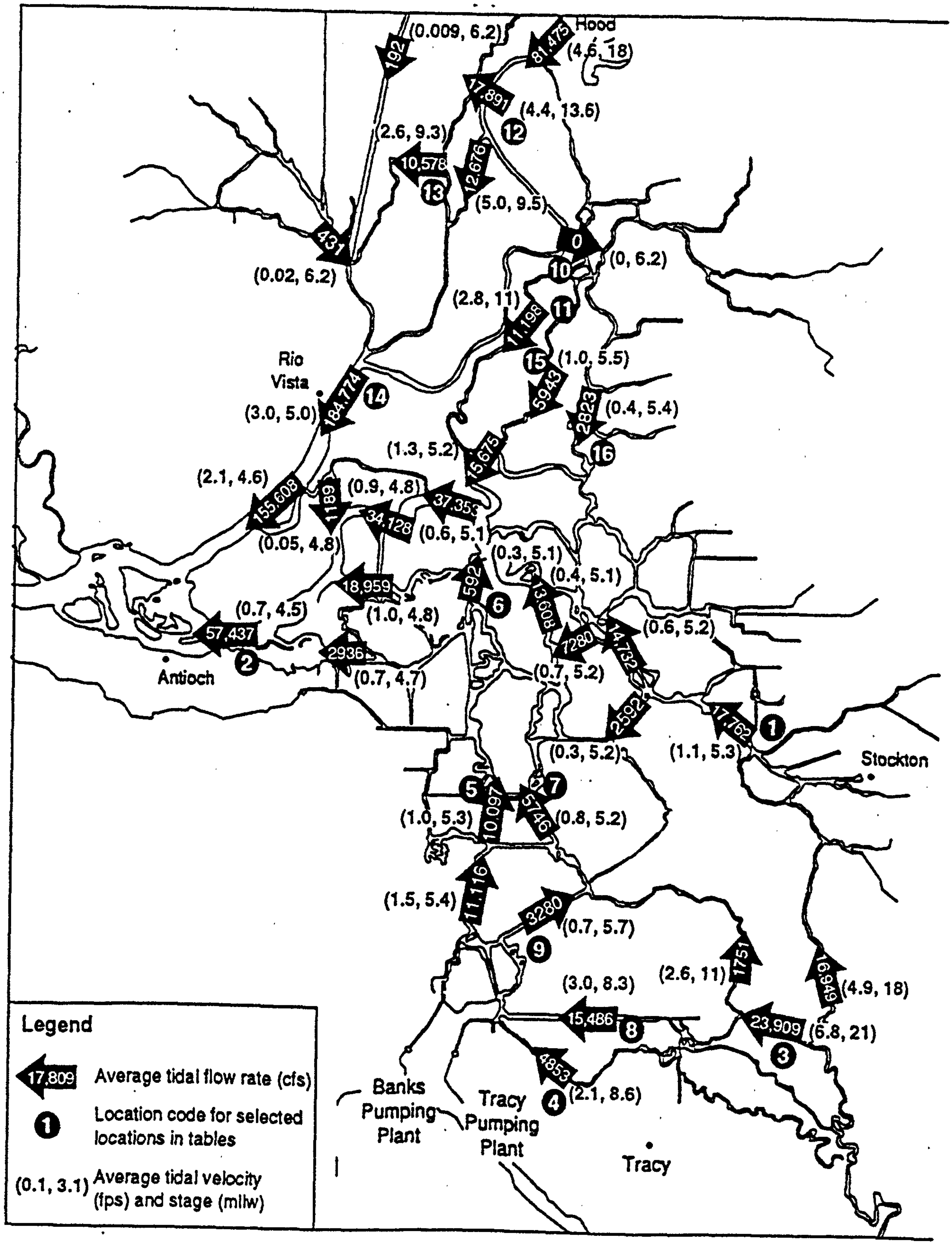


Figure 35. **Average Tidal Flow Rates, Velocities, and Stages for High-Flow Conditions for Alternative 1C**

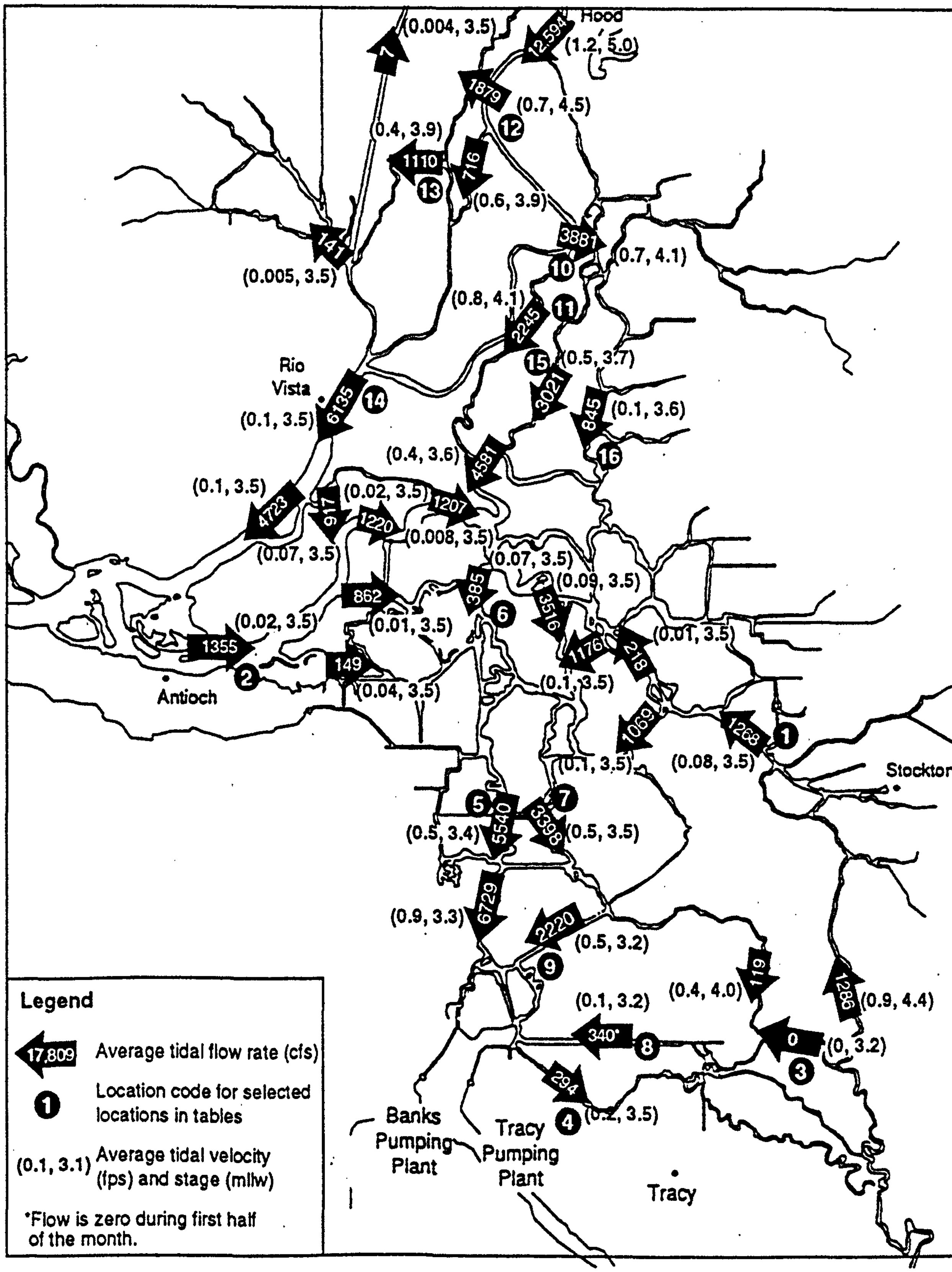


Figure 36. Average Tidal Flow Rates, Velocities, and Storage for Low-Flow/High-Pumping Conditions for Alternative 1C

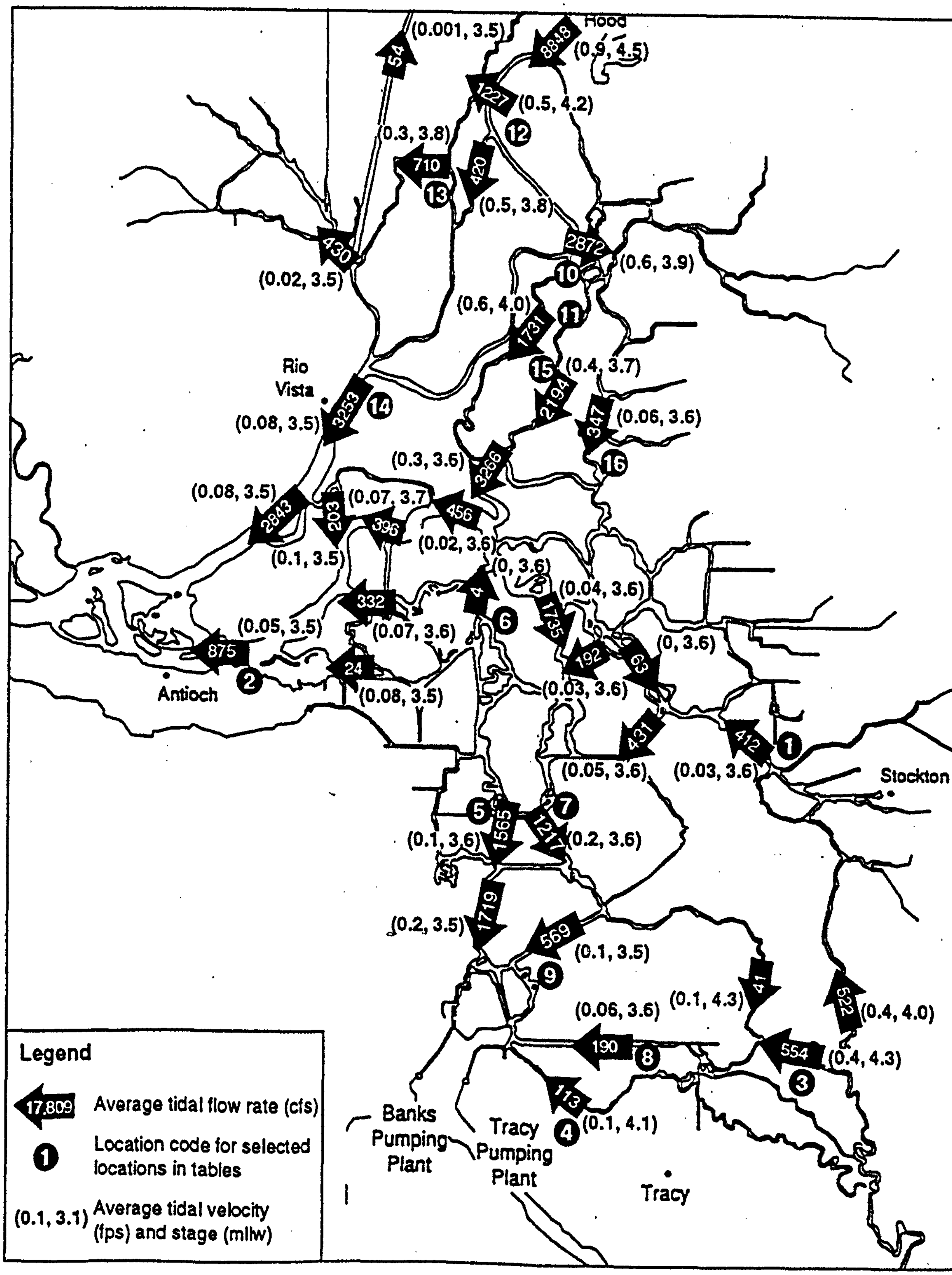
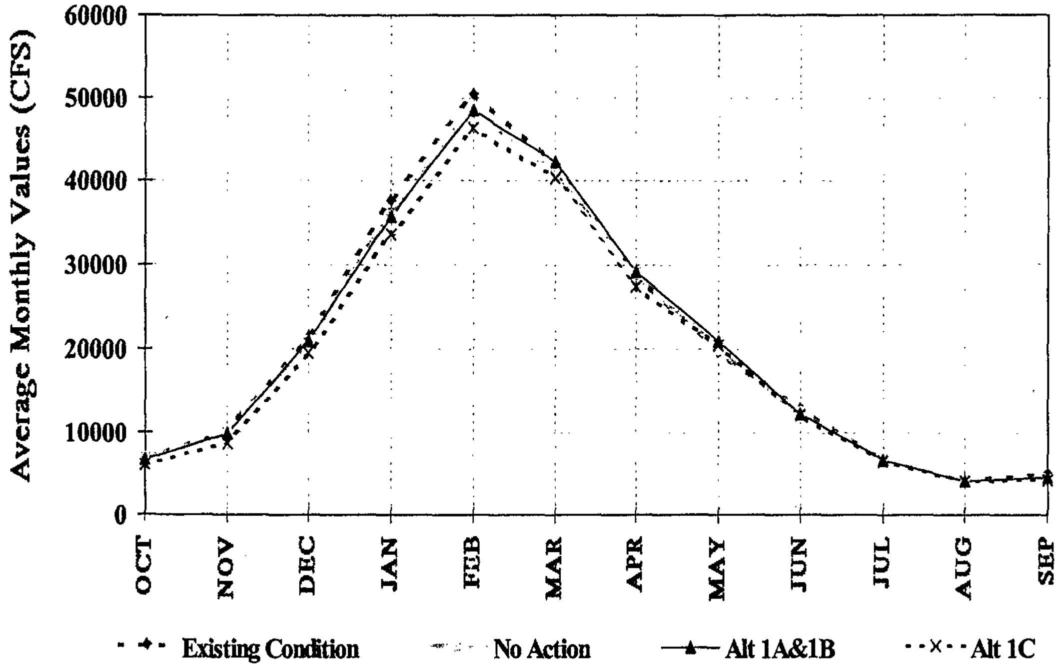


Figure 37. Average Tidal Flow Rates, Velocities, and Storage for Low-Flow/Low-Pumping Conditions for Alternative 1C

Comparison of Total Delta Outflow under Various Delta Alternatives Long Term(73 Year) Averages



Comparison of Total Delta Outflow under Various Delta Alternatives Critical Period Averages

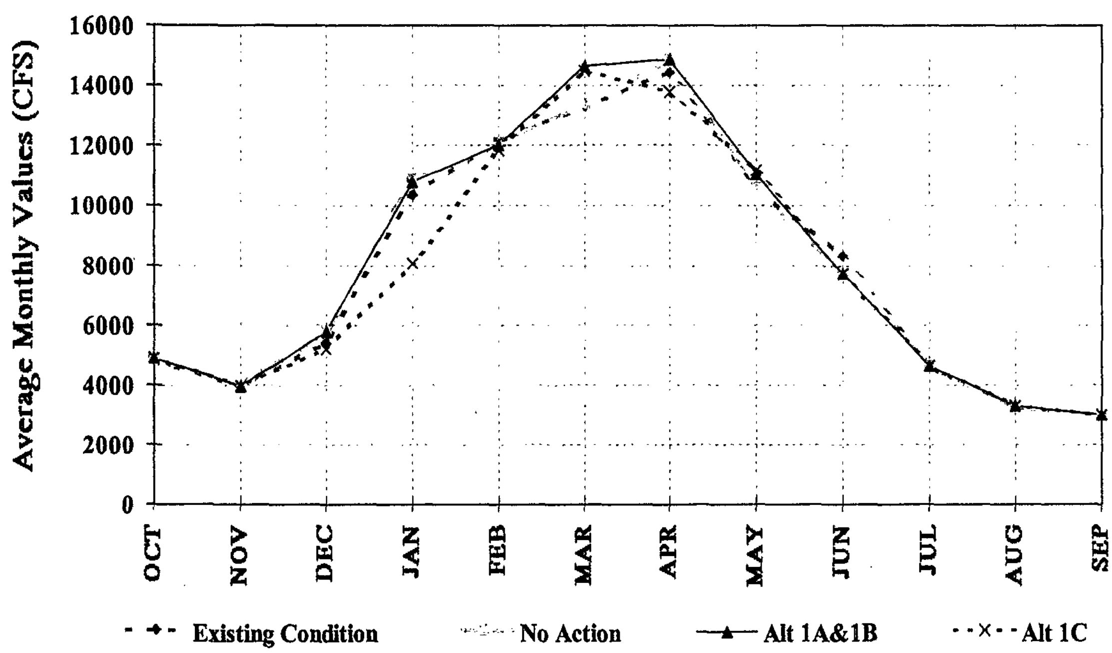
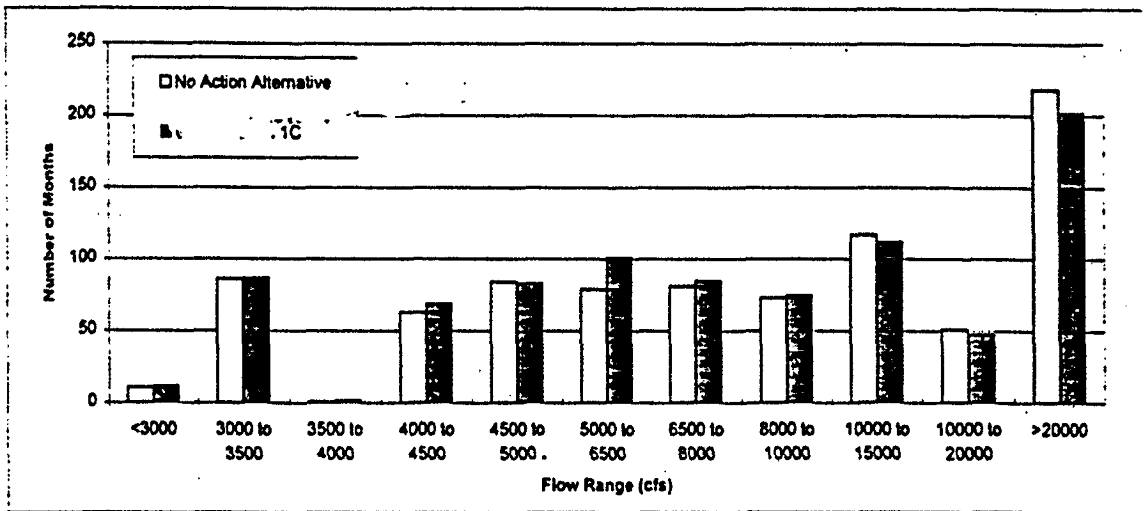
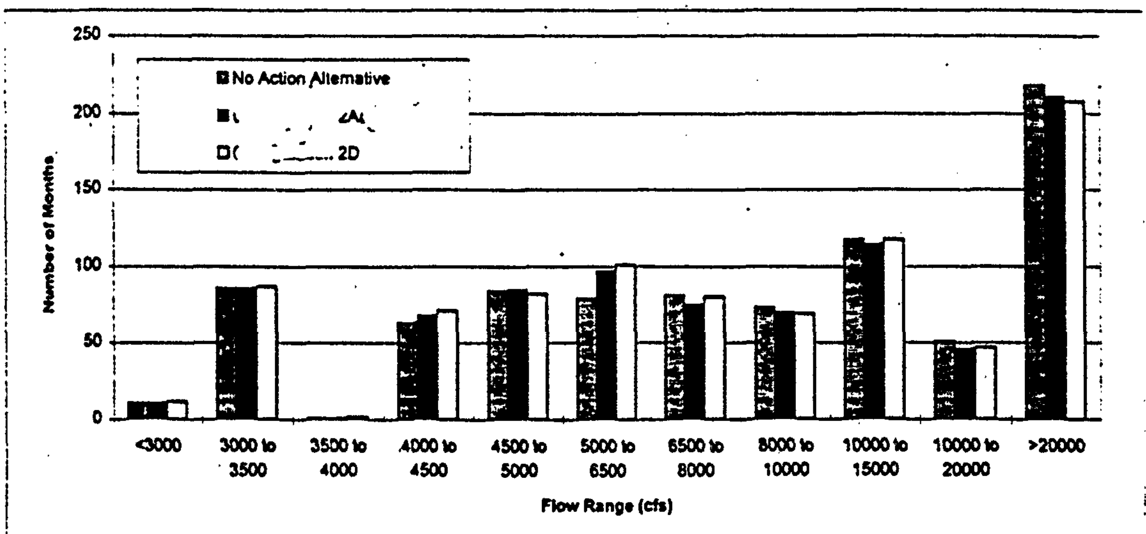


Figure 38. Average Monthly Instream Flows at Delta Outflow



-Alternative 1



Alternative 2

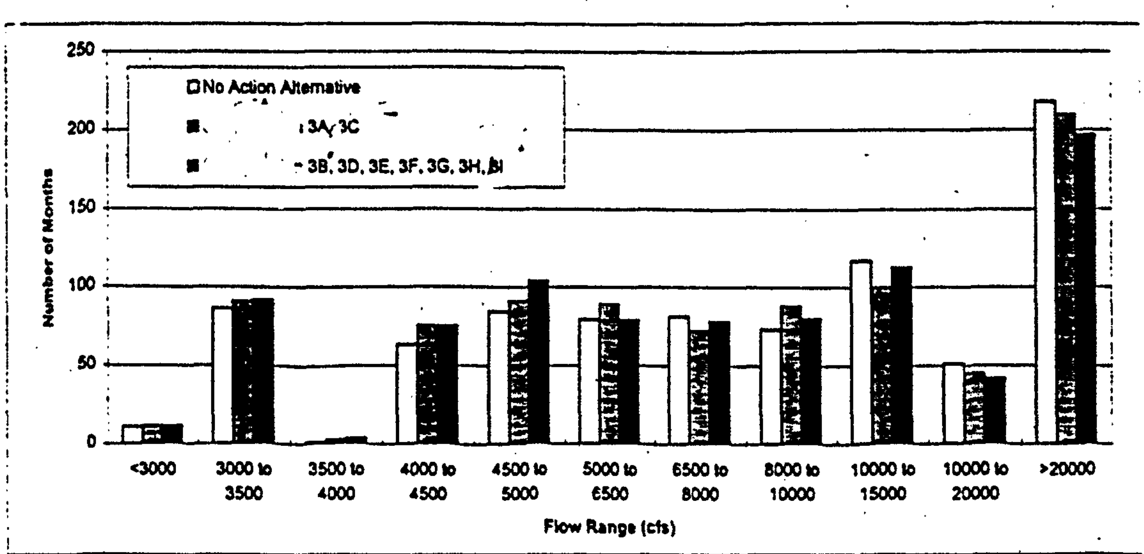
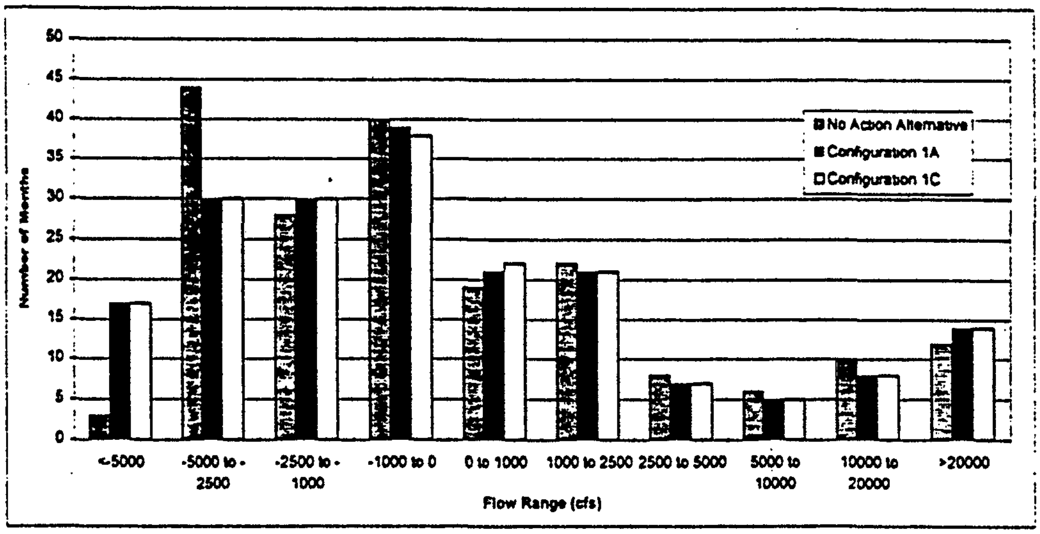
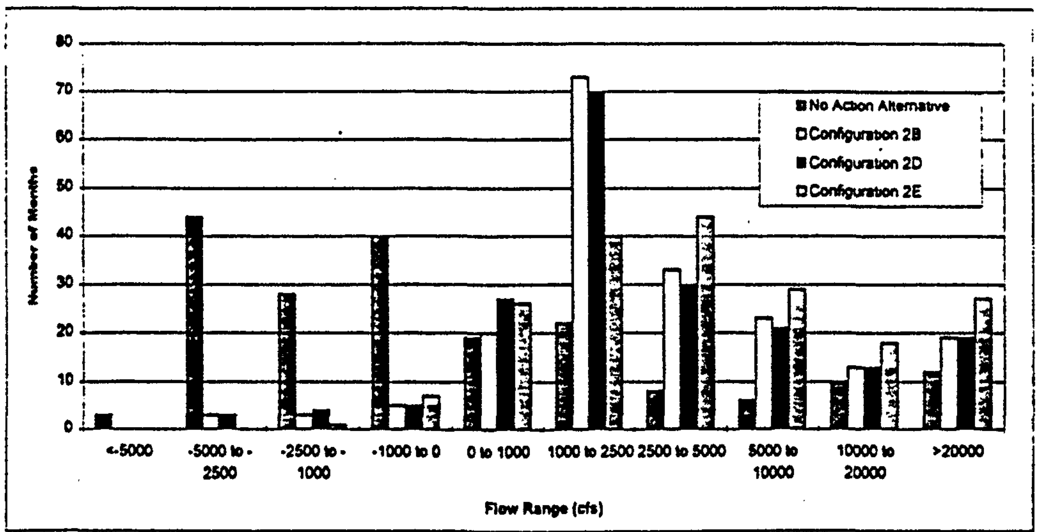


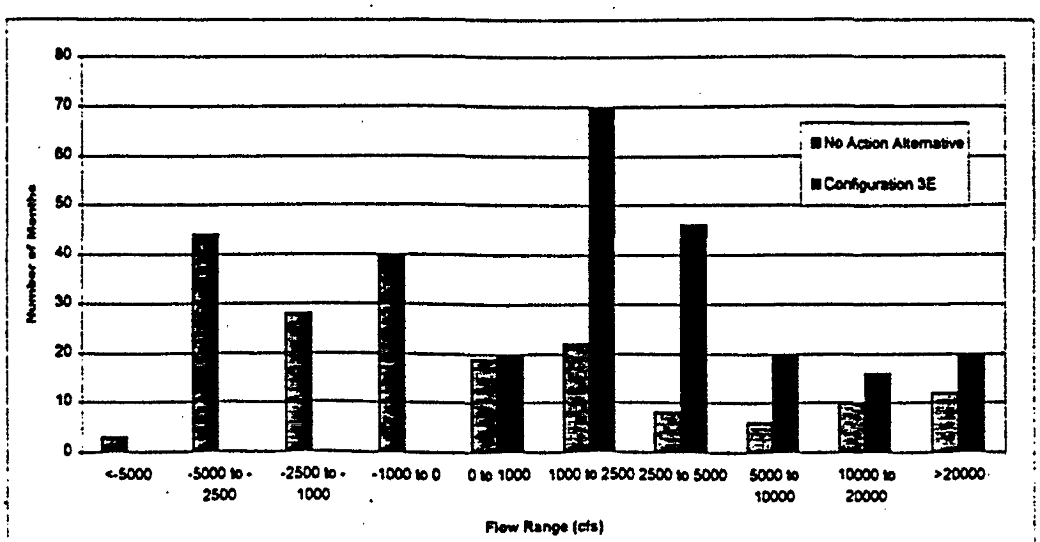
Figure 39. Frequency Distributions of Net Delta Outflow for All Alternatives



(a) Alternative 1

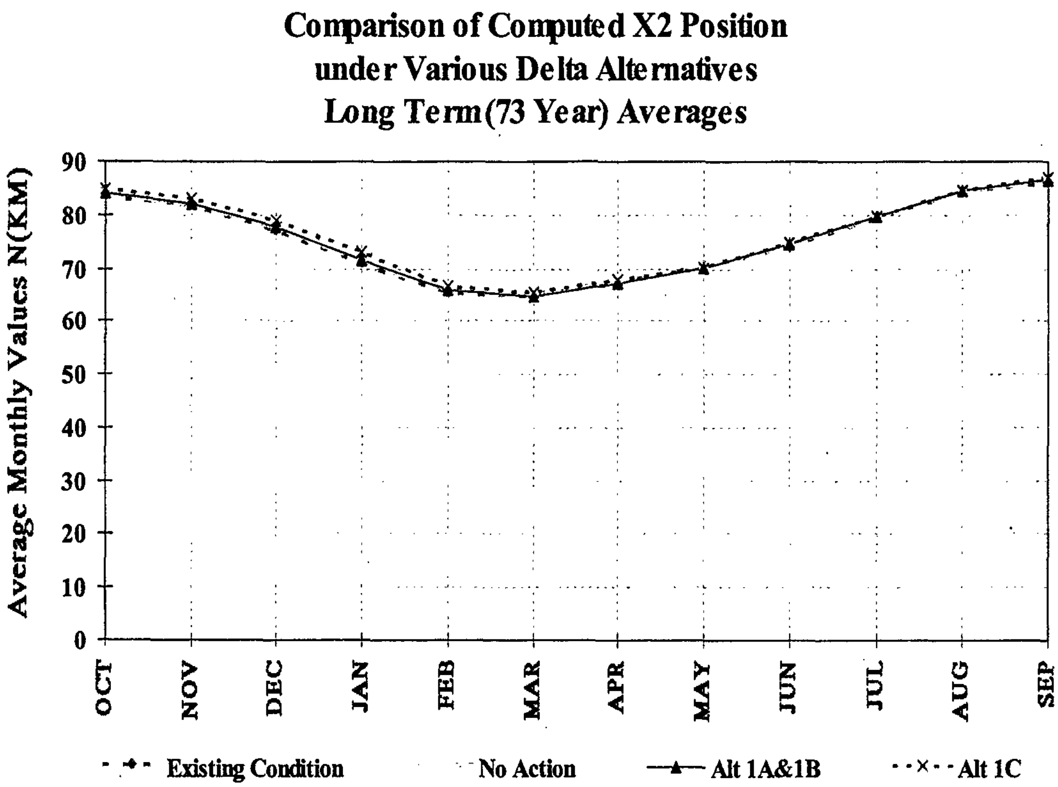


(b) Alternative 2



(c) Alternative 3

Figure 40. Frequency Distributions of Central Delta Outflow for All Alternatives



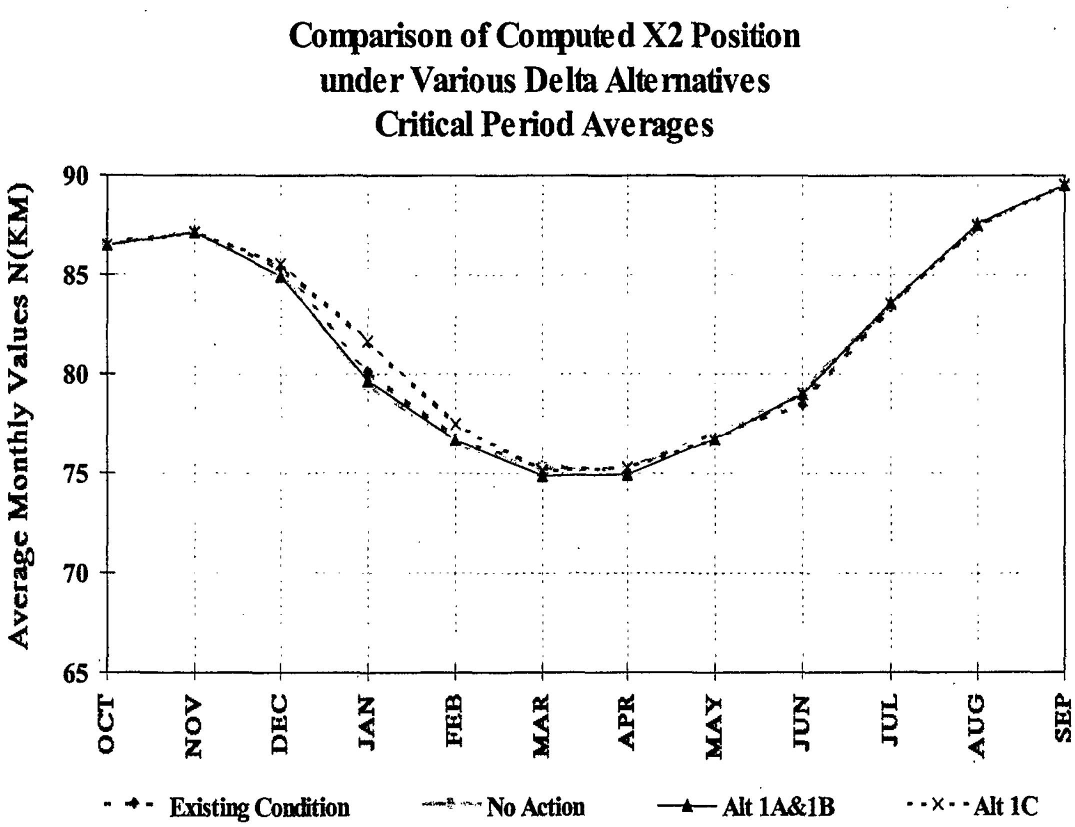
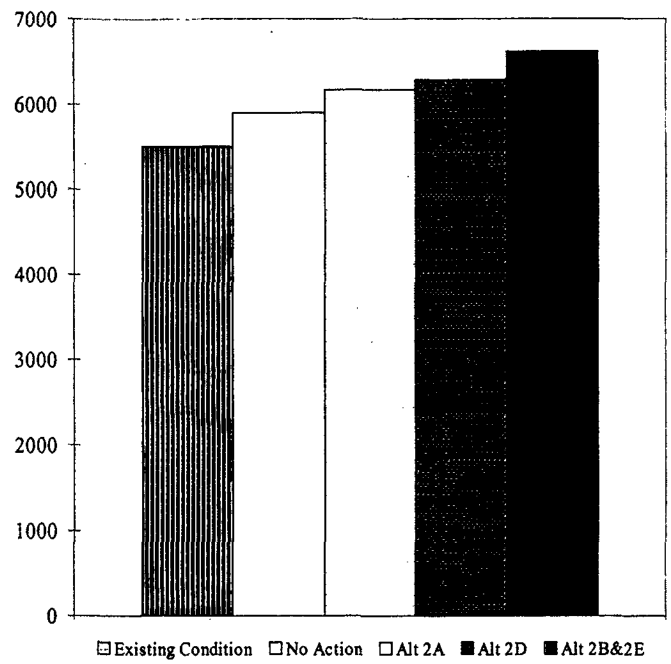
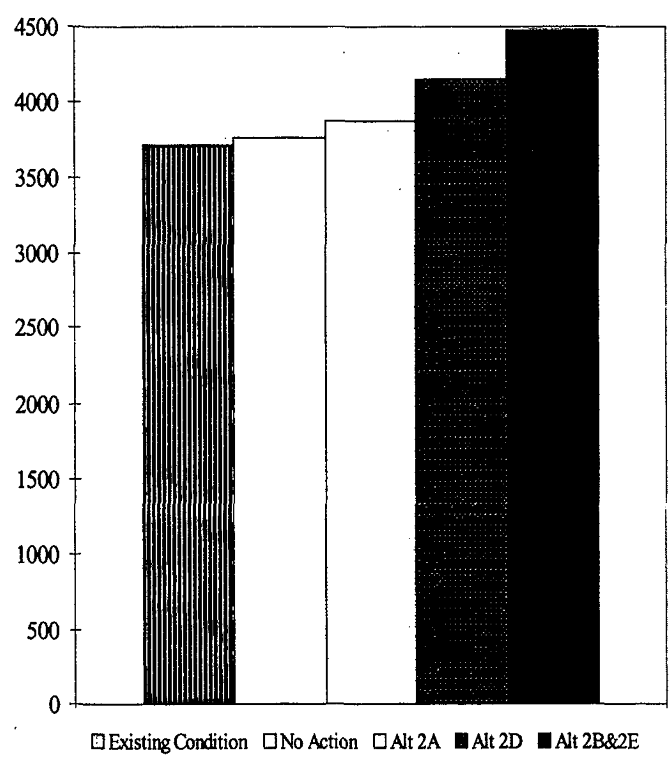


Figure 41. **Average Monthly X2 Position**

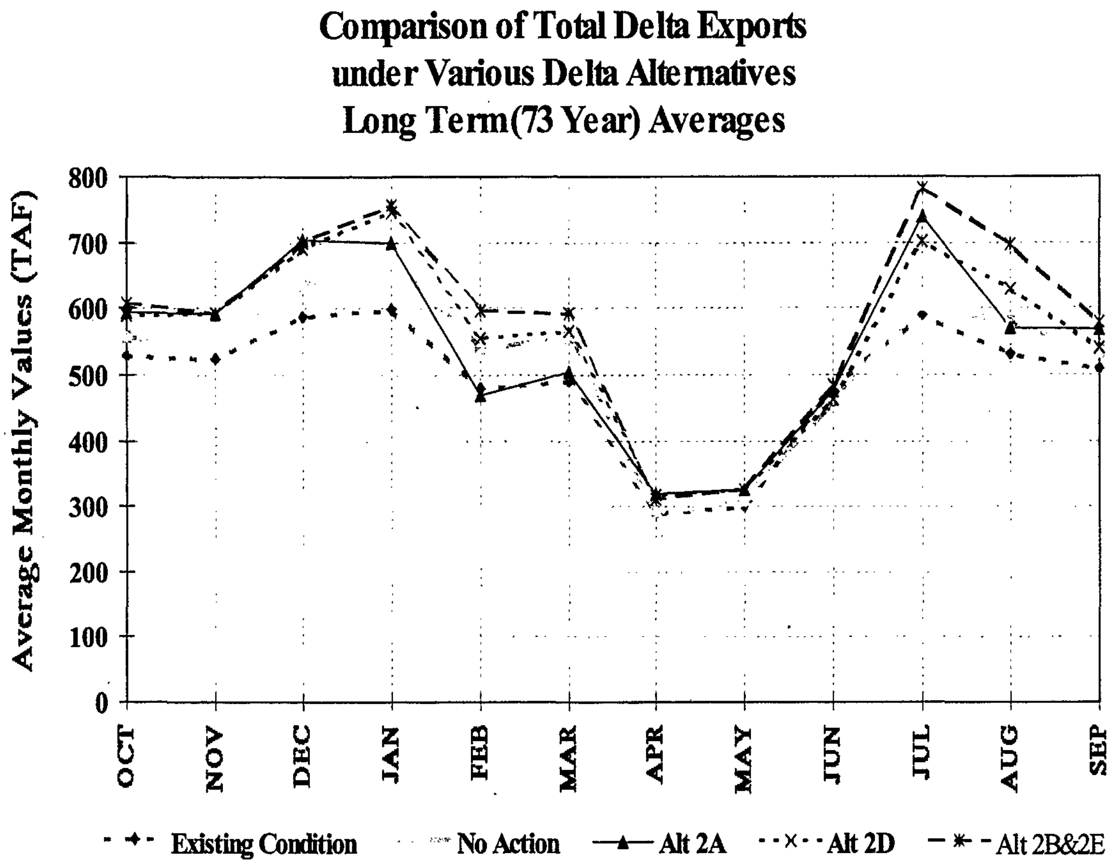


Average Annual CVP/SWP South of Delta Deliveries - Long Term (73 Year)



Average Annual CVP/SWP South of Delta Deliveries - Critical Period

Figure 42. Average Annual CVP/SWP South of Delta Deliveries



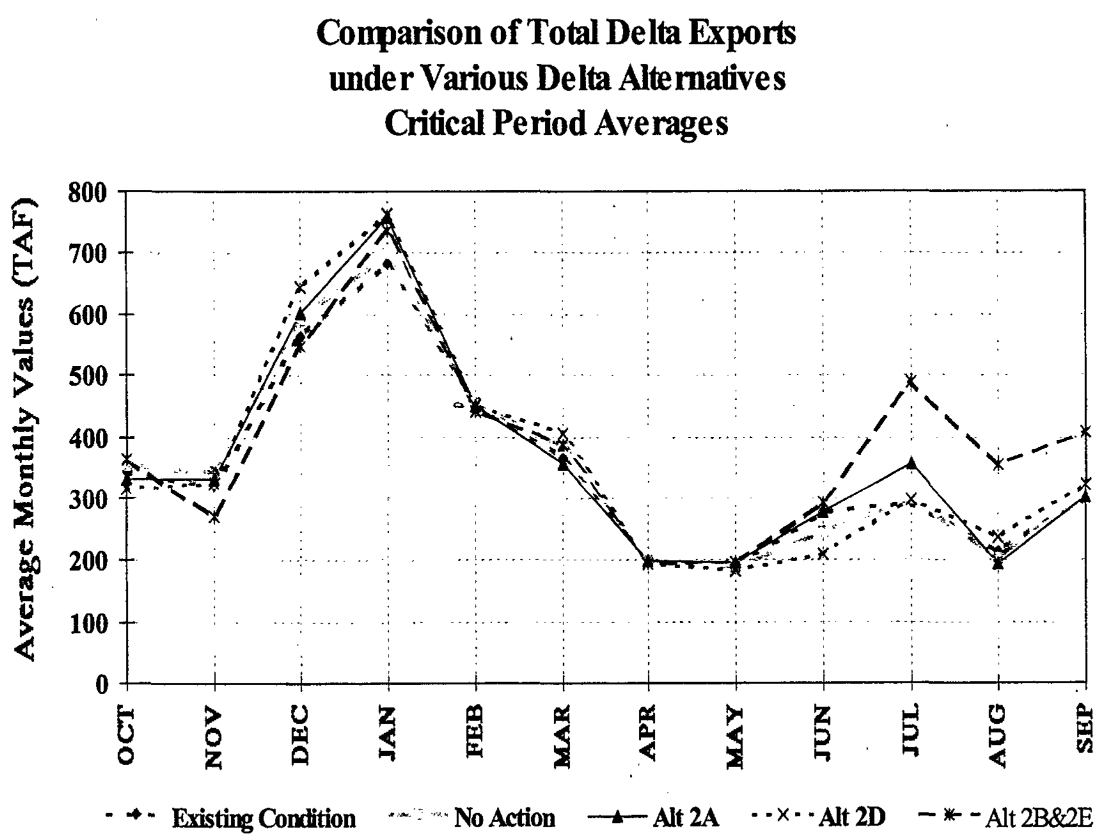
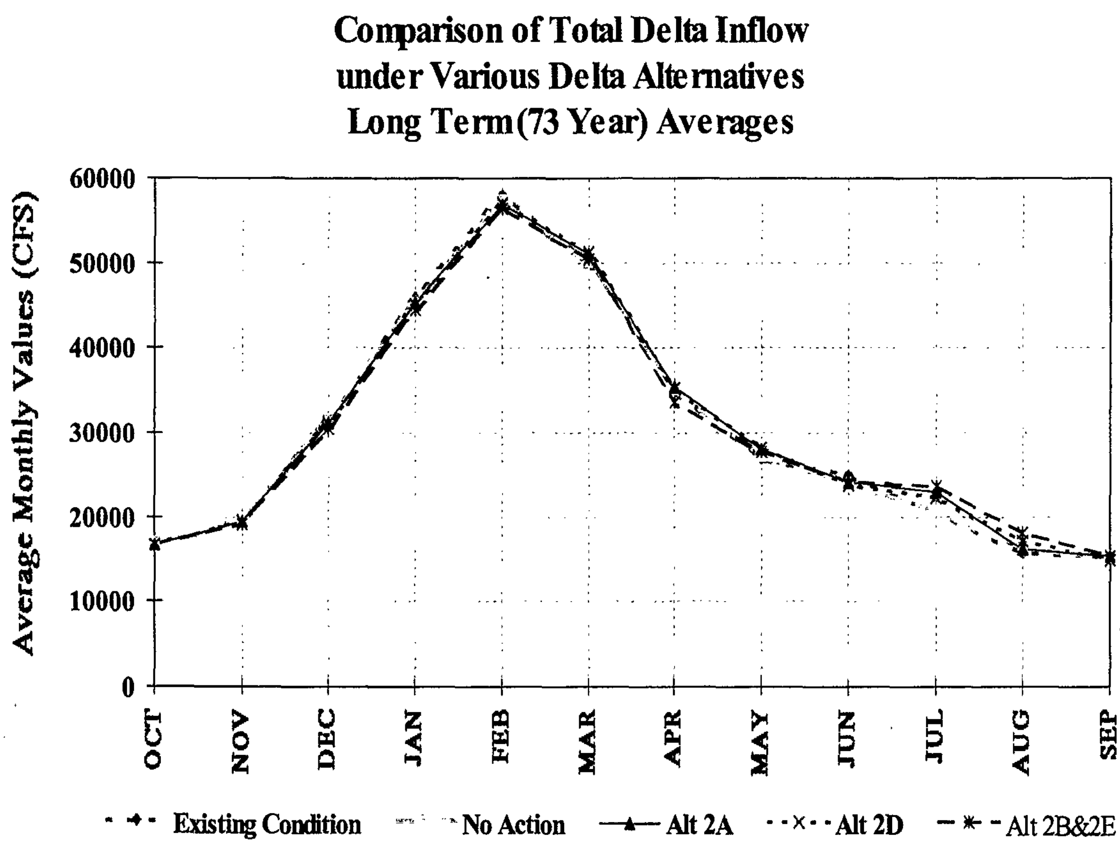


Figure 43. Average Monthly South of Delta Exports



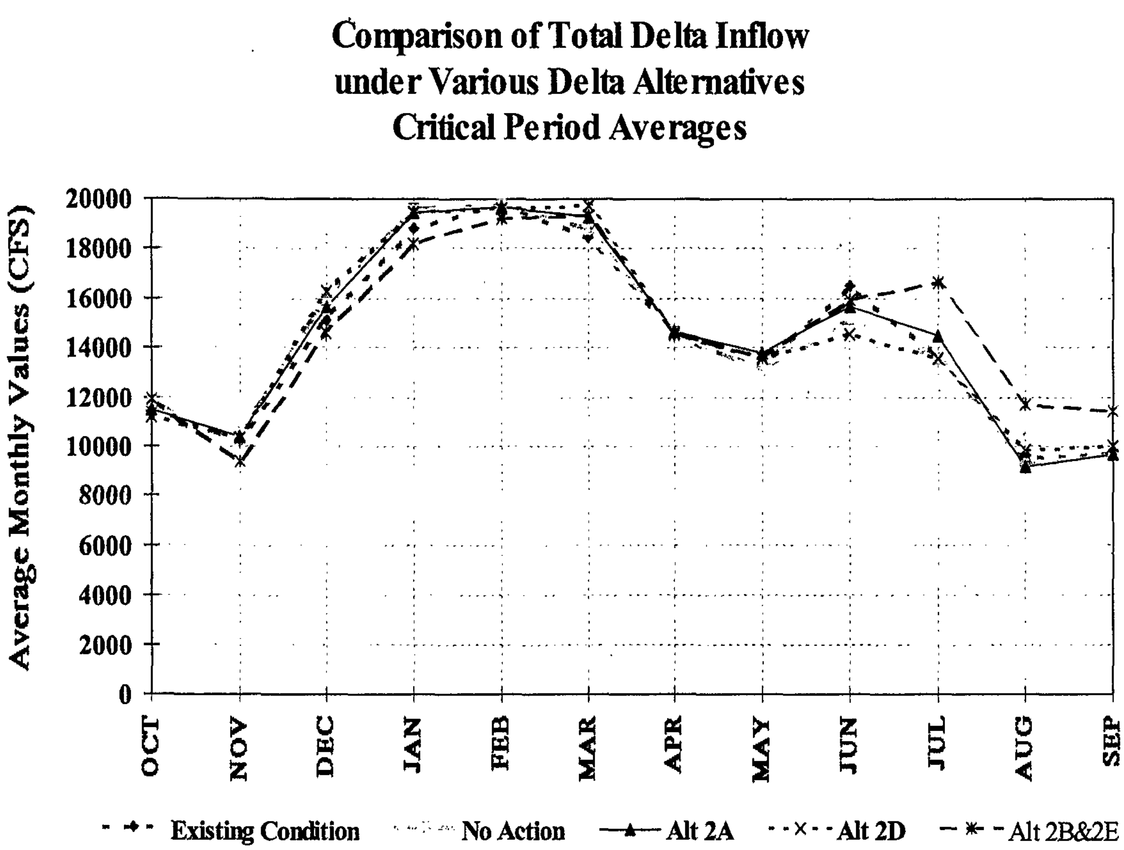


Figure 44. Average Monthly Delta Inflow

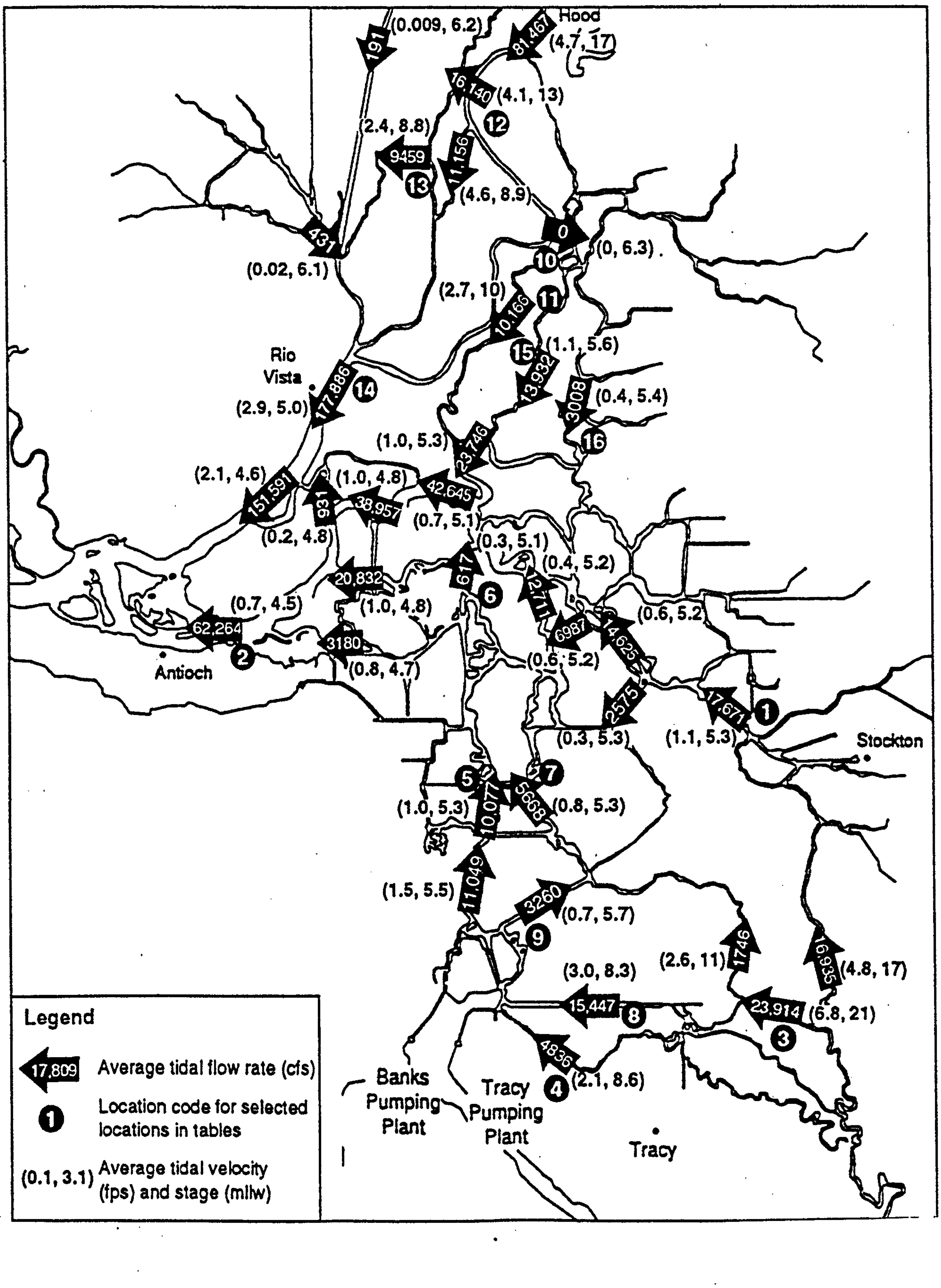


Figure 45. Average Tidal Flow Rates, Velocities, and Stages for High-Flow Conditions for Alternative 2B

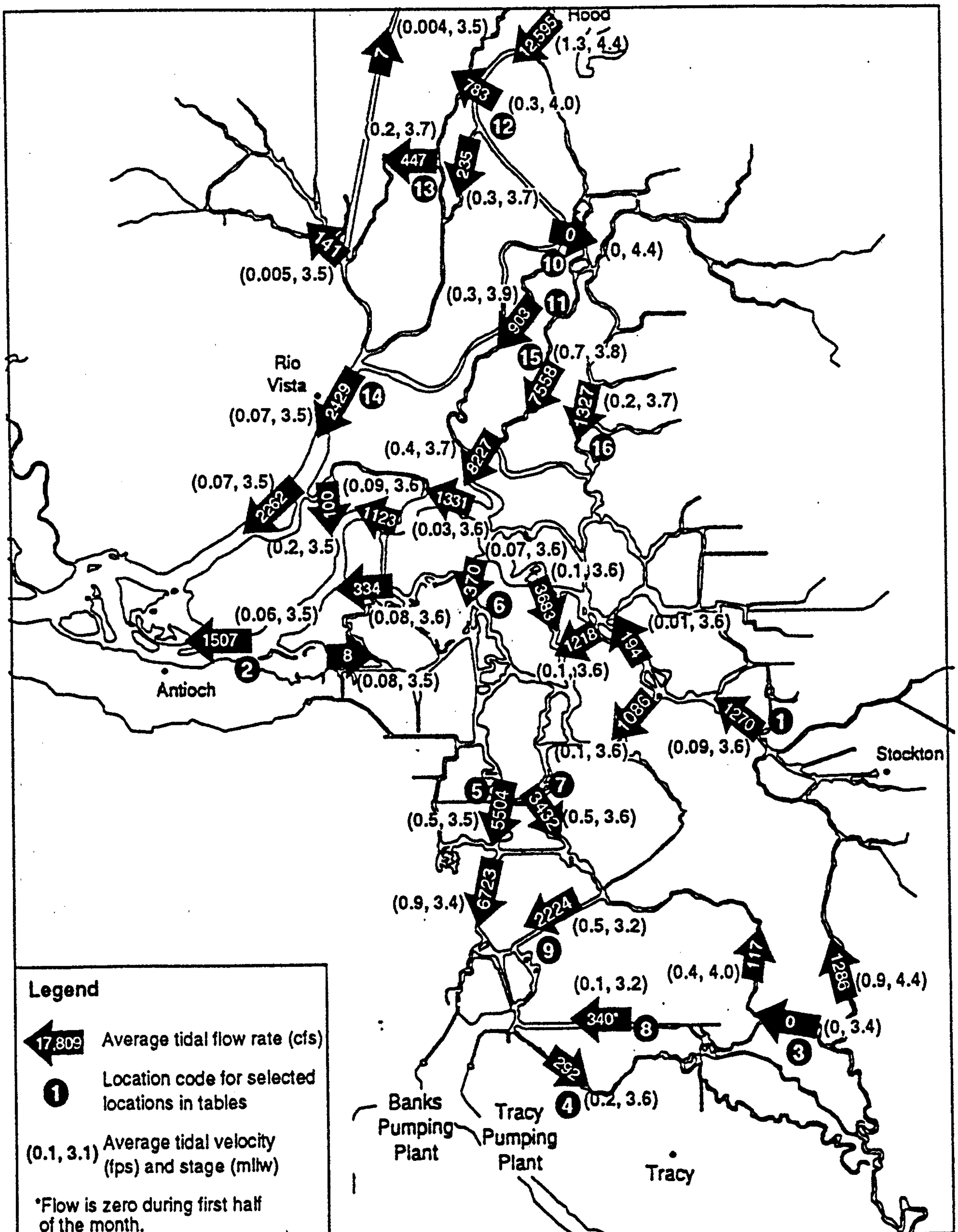


Figure 46. Average Tidal Flow Rates, Velocities, and Stages for Low-Flow/High-Pumping Conditions for Alternative 2B

C-008919

C-008919

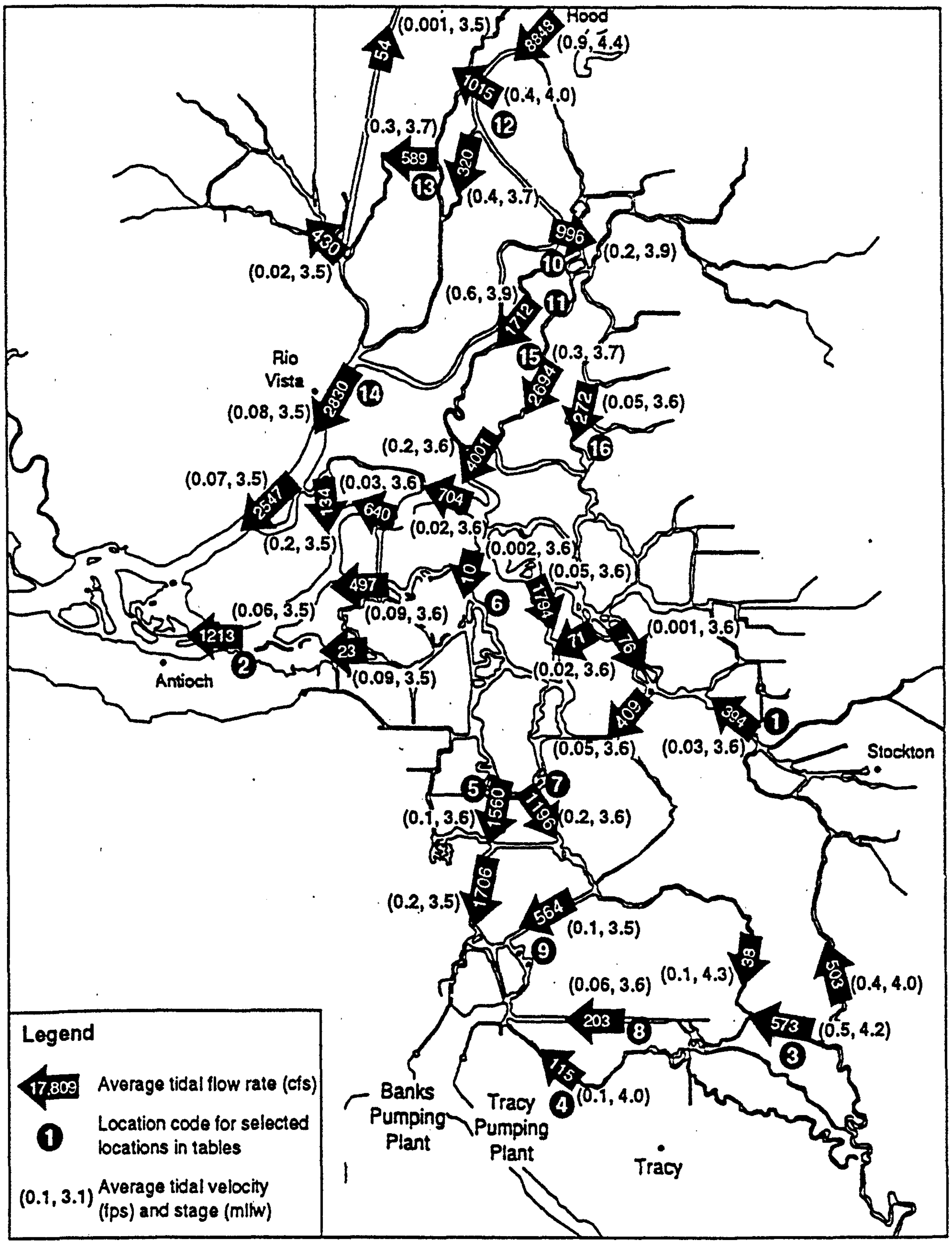


Figure 47. Average Tidal Flow Rates, Velocities, and Stages for Low-Flow/Low-Pumping Conditions for Alternative 2B

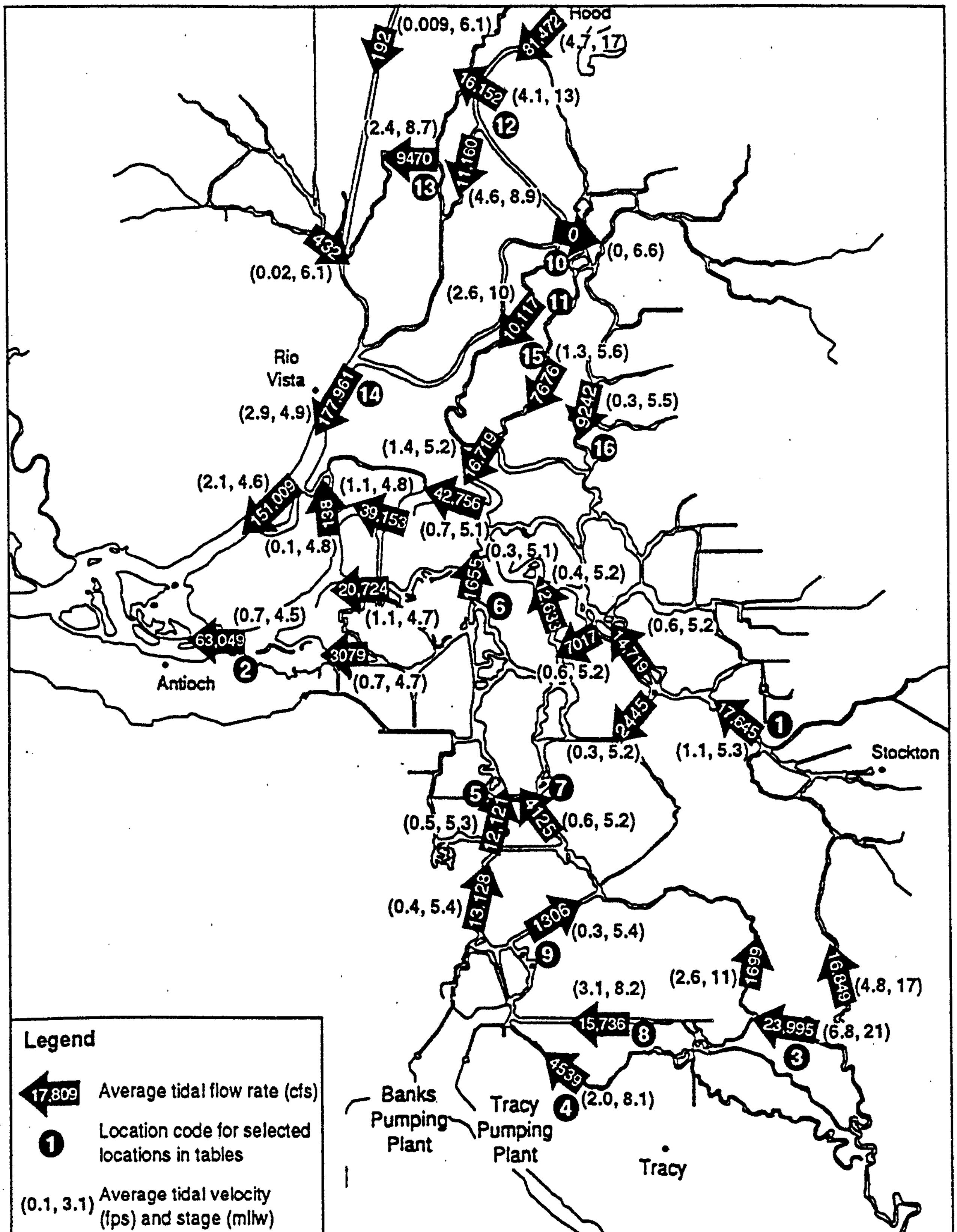


Figure 48. Average Tidal Flow Rates, Velocities, and Stages for High-Flow Conditions for Alternative 2D

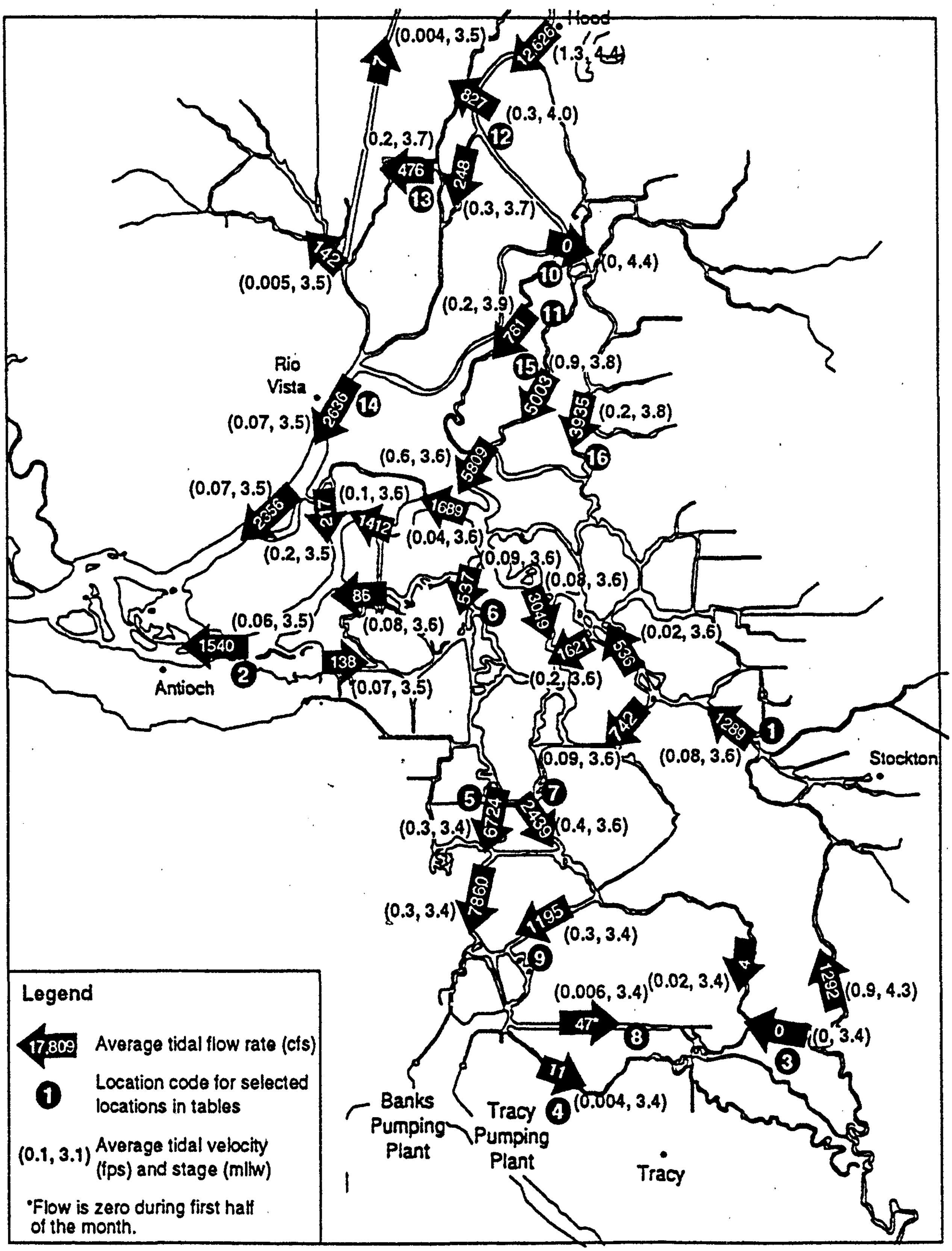


Figure 49. Average Tidal Flow Rates, Velocities, and Stages for Low-Flow/High-Pumping Conditions for Alternative 2D

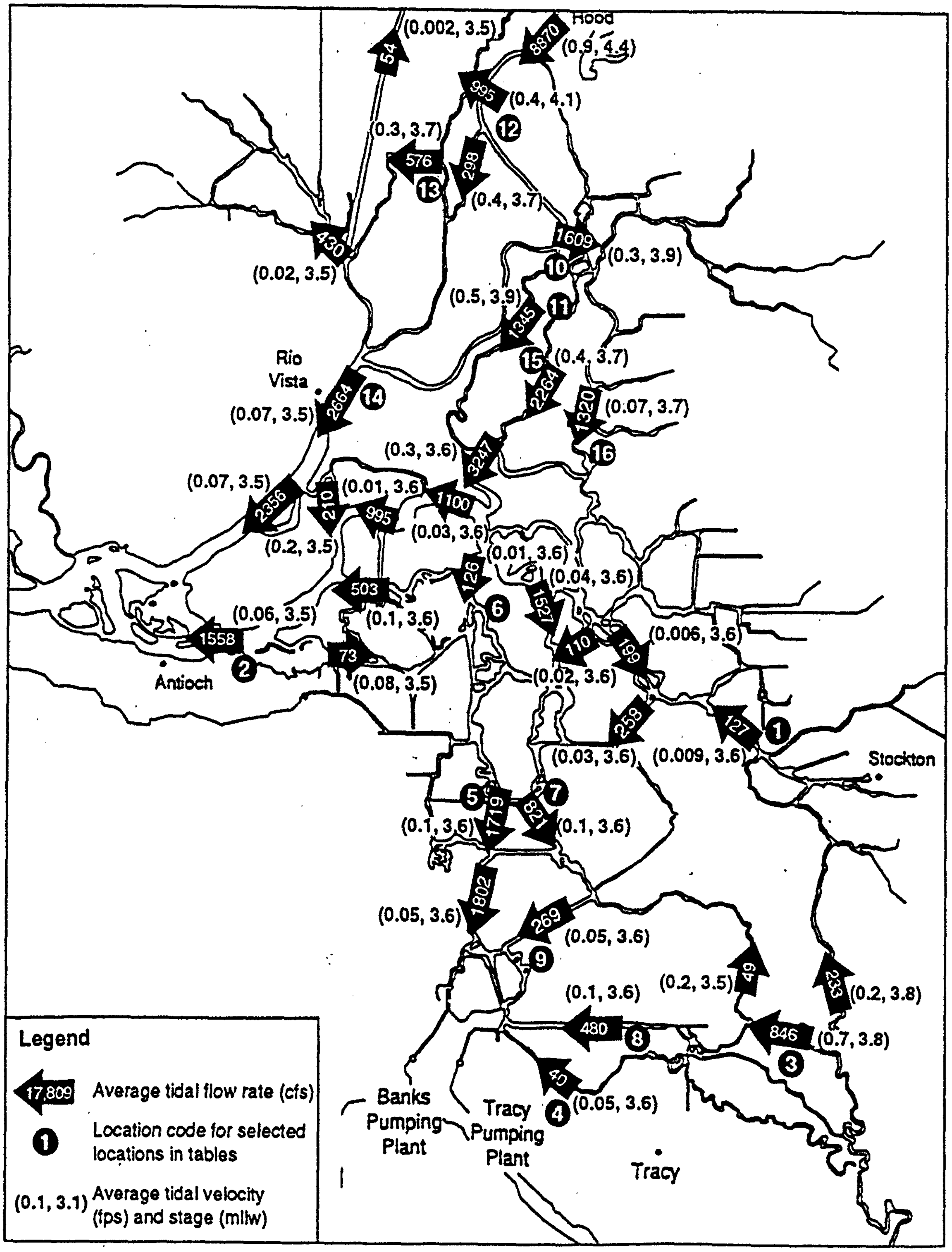


Figure 50. Average Tidal Flow Rates, Velocities, and Stages for Low-Flow/Low-Pumping Conditions for Alternative 2D

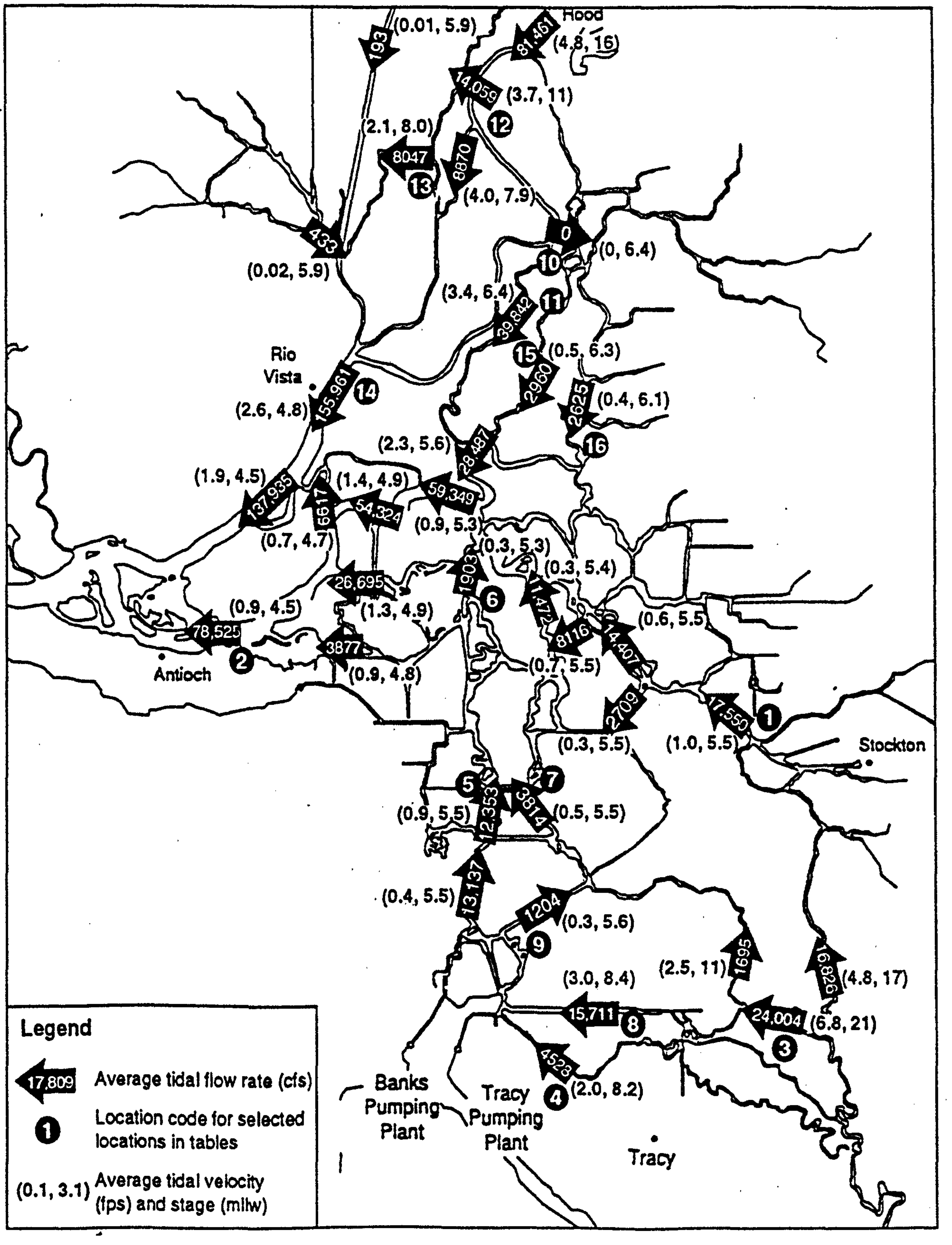


Figure 51. Average Tidal Flow Rates, Velocities, and Stages for High-Flow Conditions for Alternative 2E

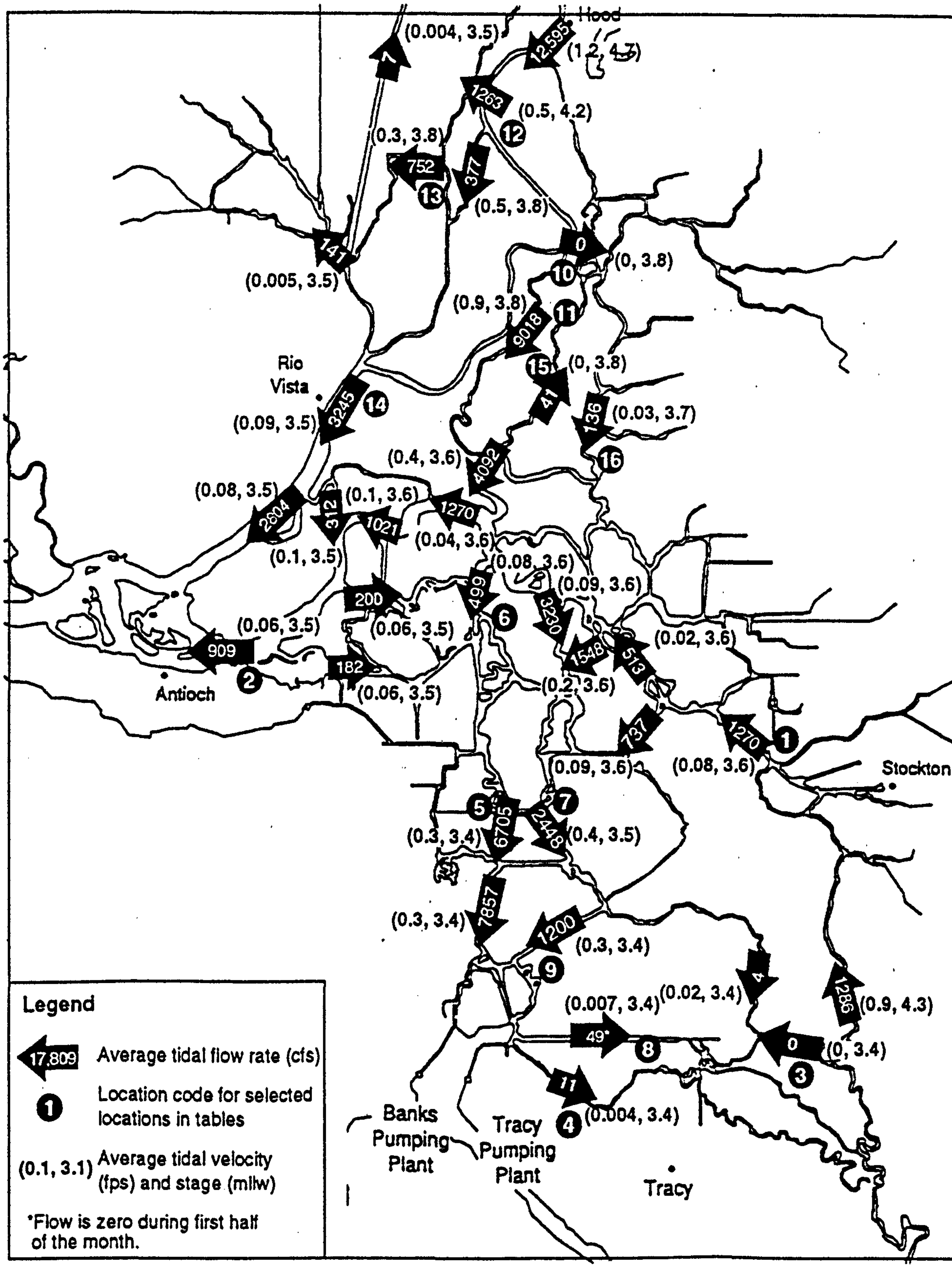


Figure 52. Average Tidal Flow Rates, Velocities, and Stages for Low-Flow/High-Pumping Conditions for Alternative 2E

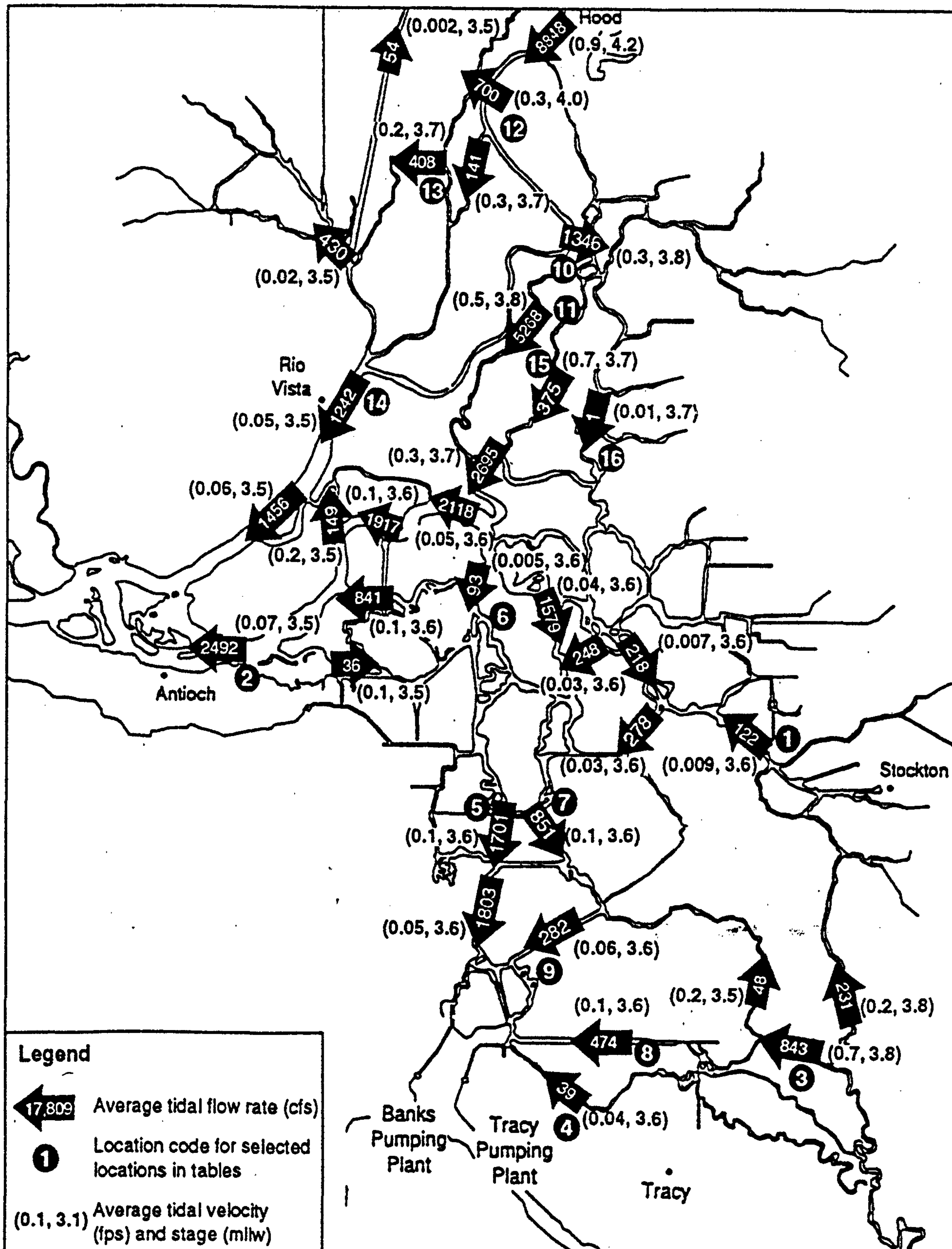
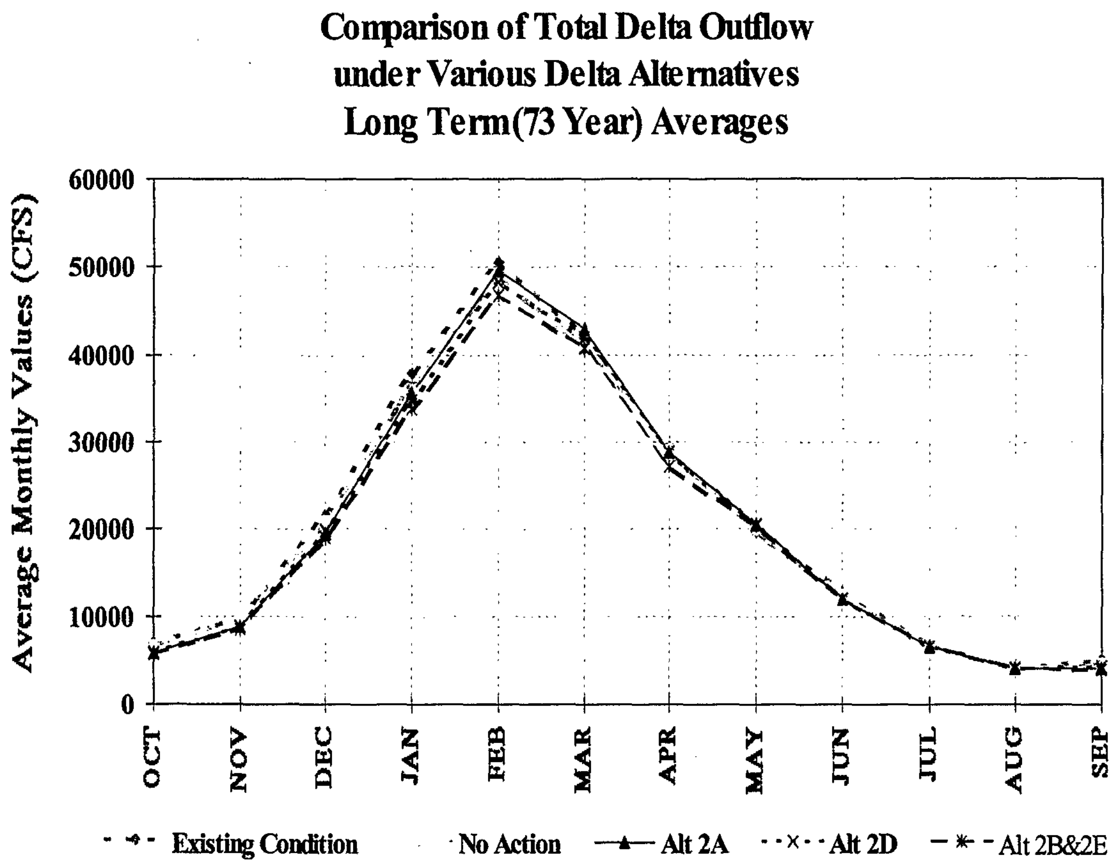


Figure 53. Average Tidal Flow Rates, Velocities, and Stages for Low-Flow/Low-Pumping Conditions for Alternative 2E



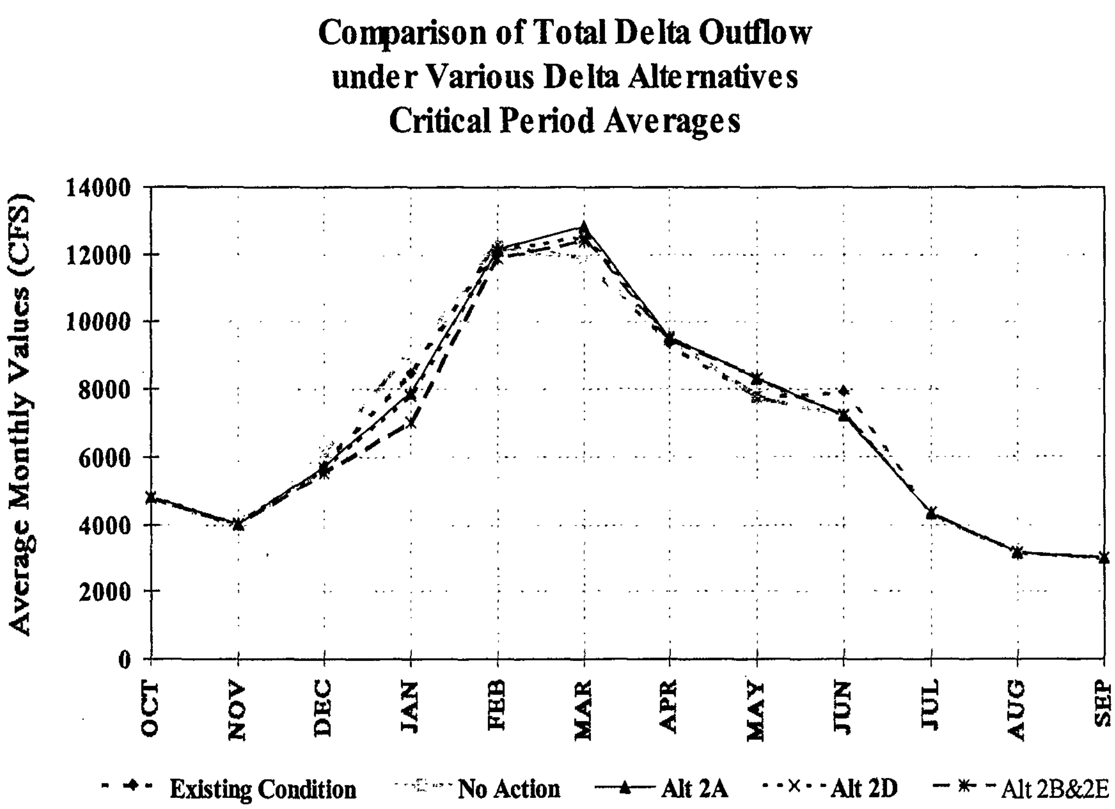
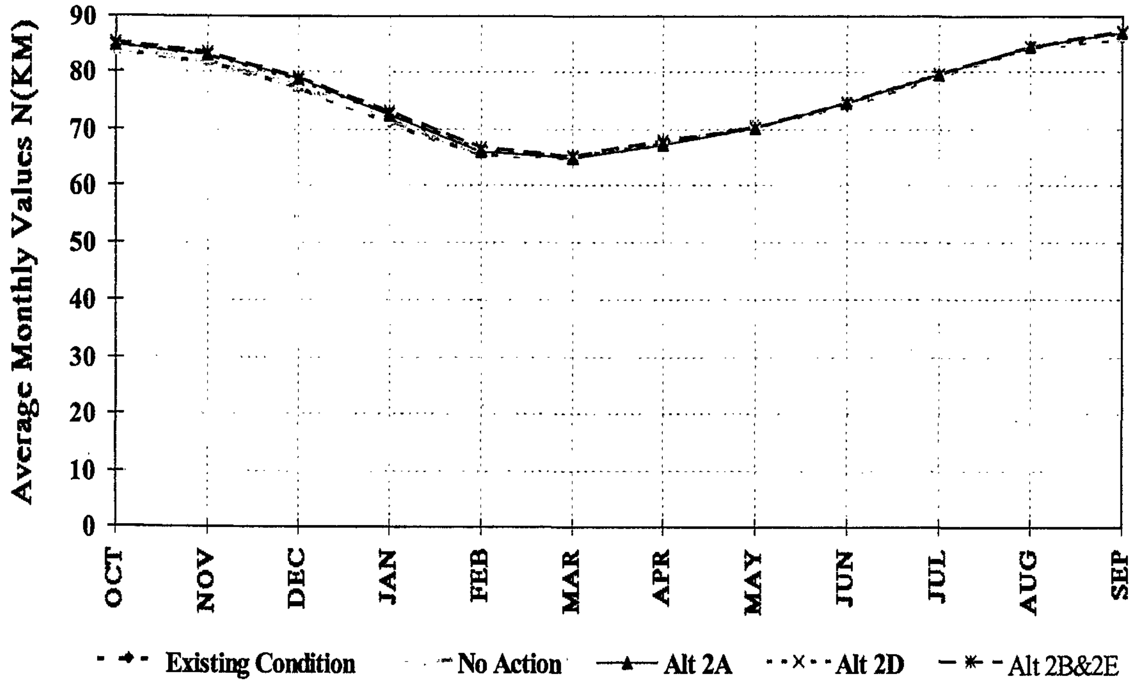


Figure 54. Average Monthly Instream Flows at Delta Outflow

Comparison of Computed X2 Position under Various Delta Alternatives Long Term (73 Year) Averages



Comparison of Computed X2 Position under Various Delta Alternatives Critical Period Averages

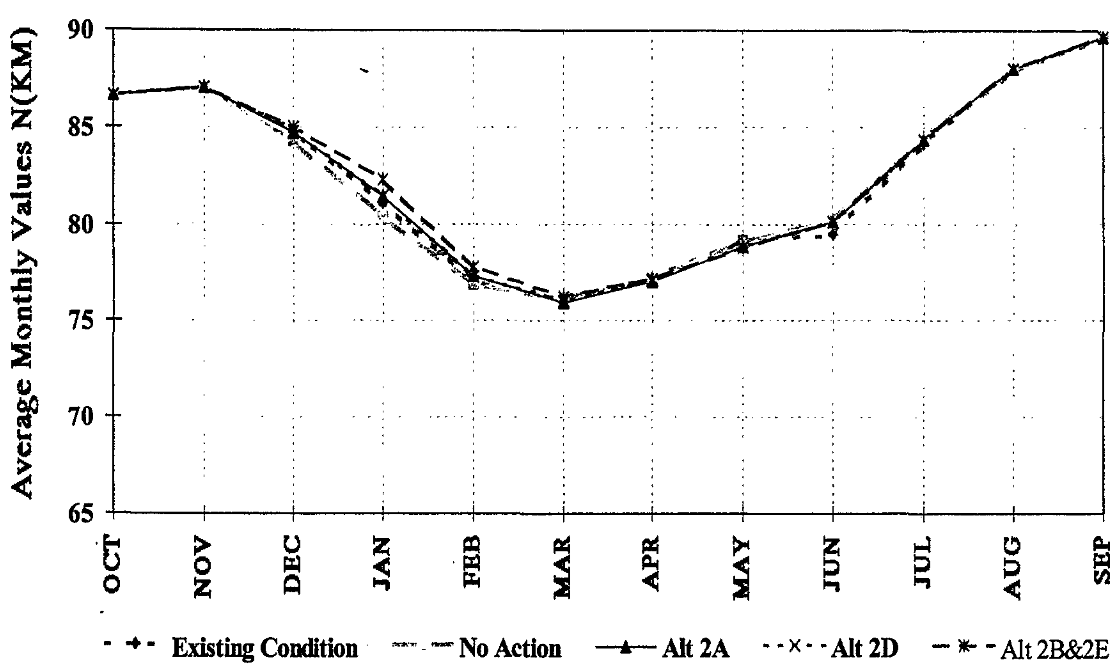
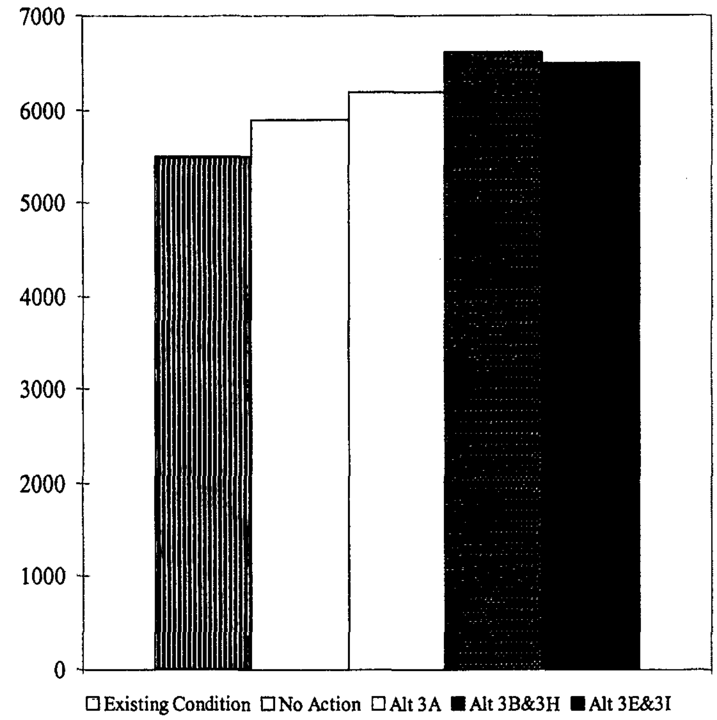
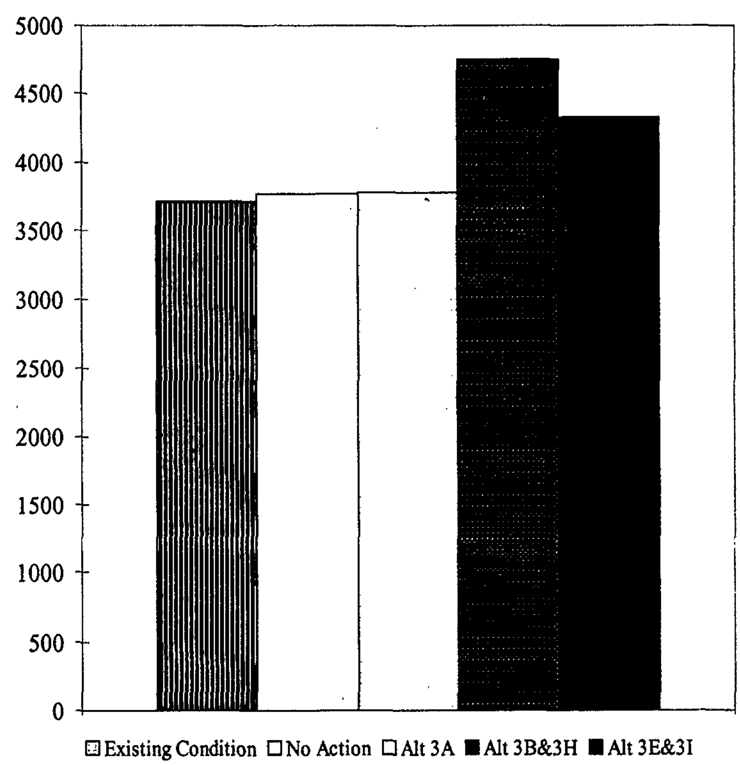


Figure 55. **Average Monthly X2 Position**

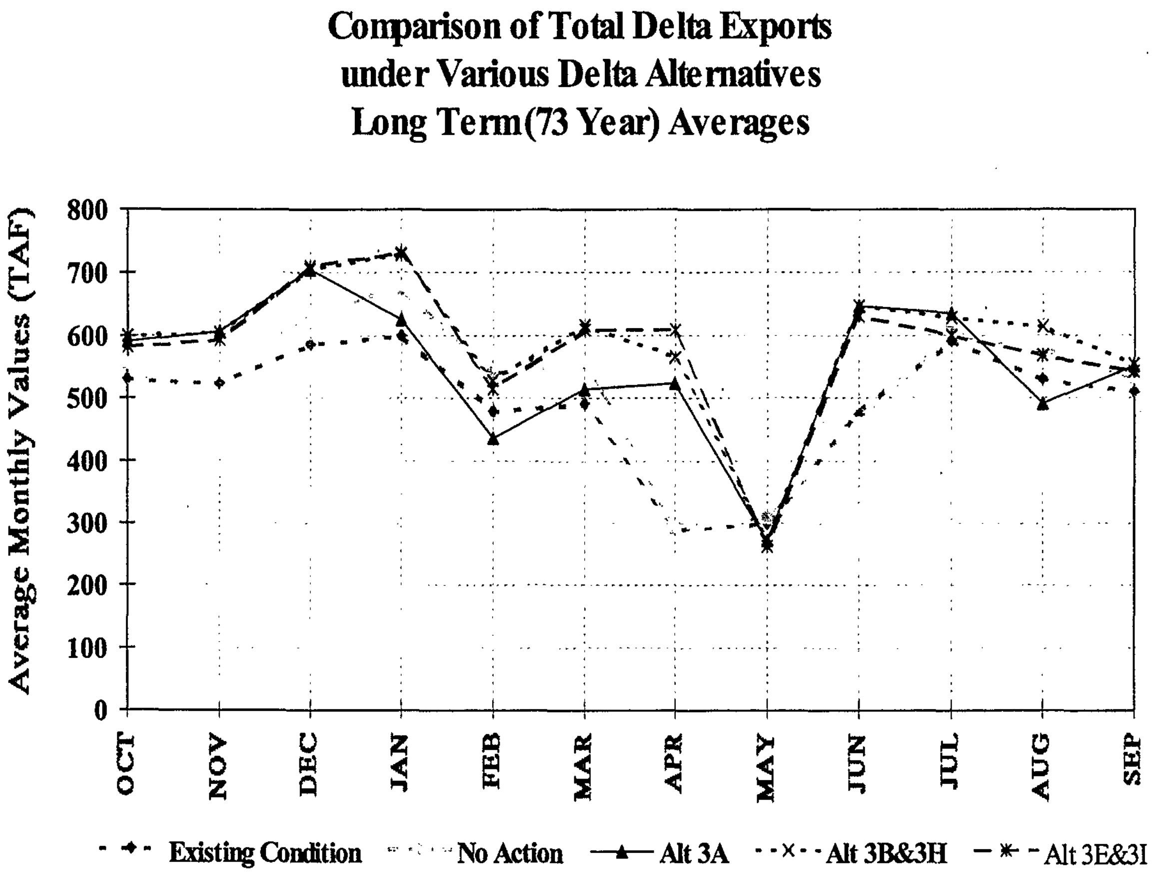


Average Annual CVP/SWP South of Delta Deliveries - Long Term (73 Year)



Average Annual CVP/SWP South of Delta Deliveries - Critical Period

Figure 56. Average Annual CVP/SWP South of Delta Deliveries



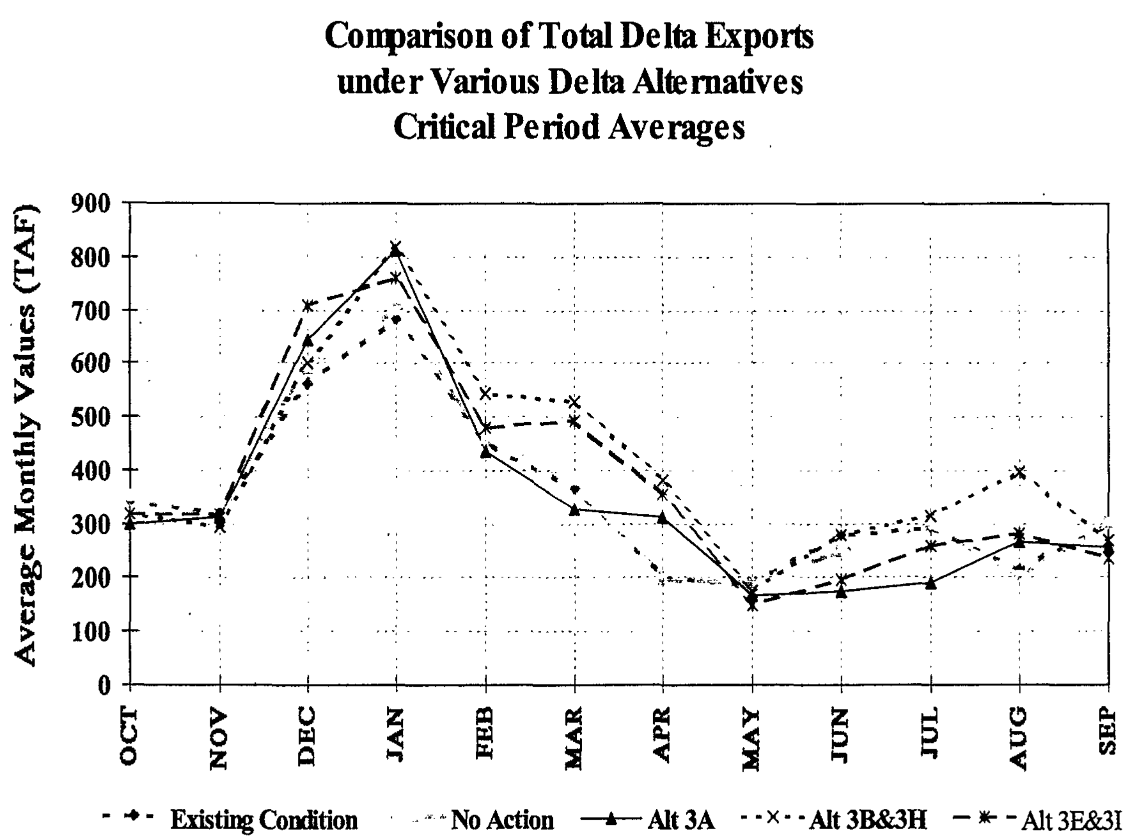
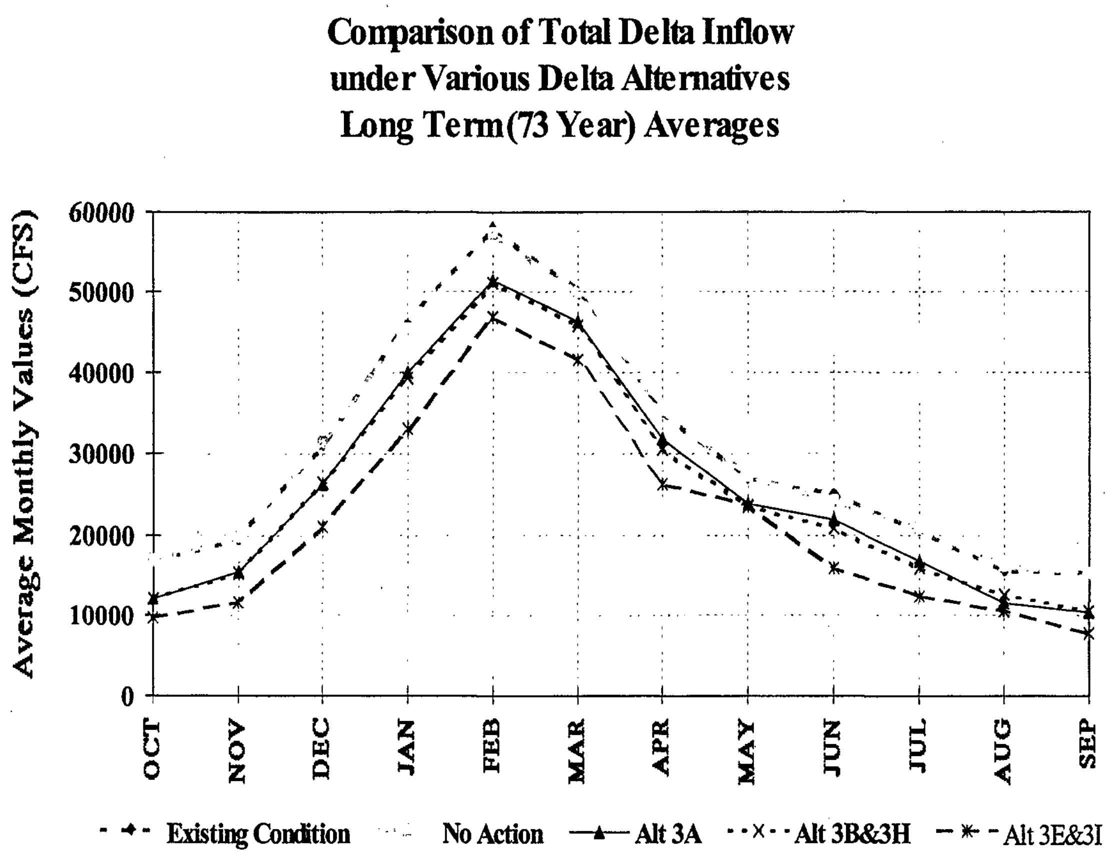


Figure 57. Average Monthly South of Delta Exports



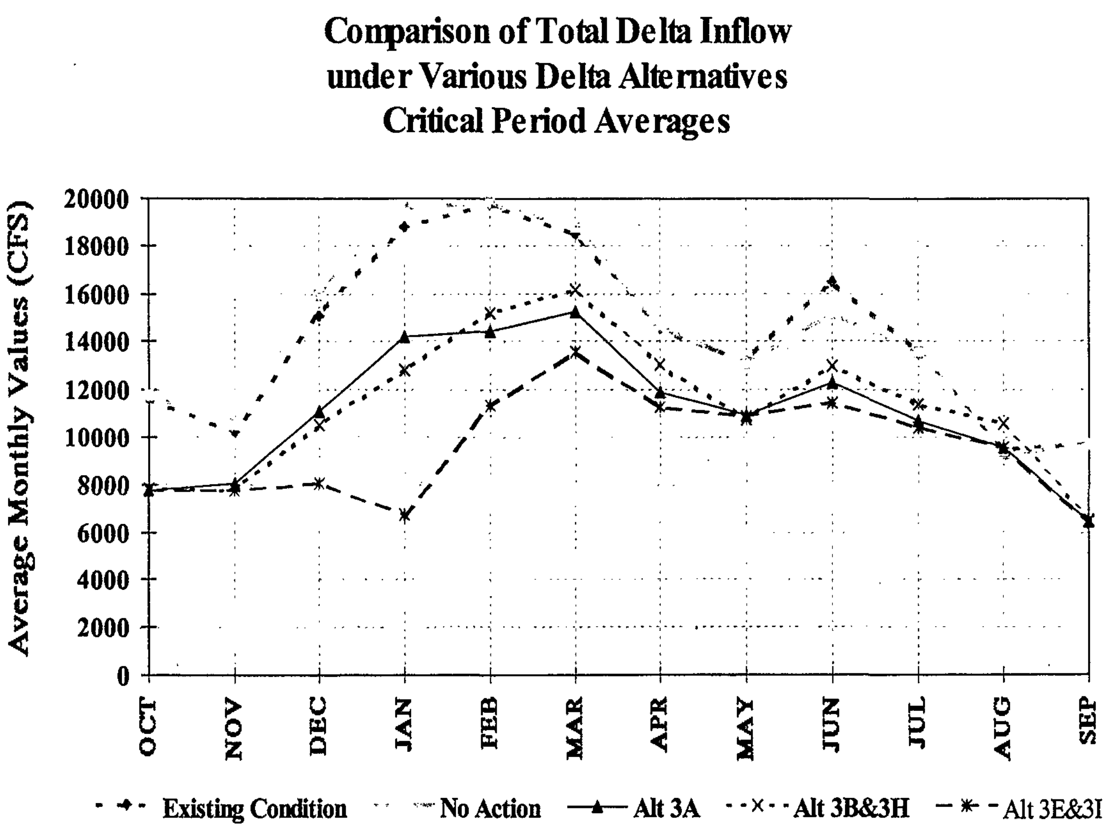


Figure 58. **Average Monthly Delta Inflow**

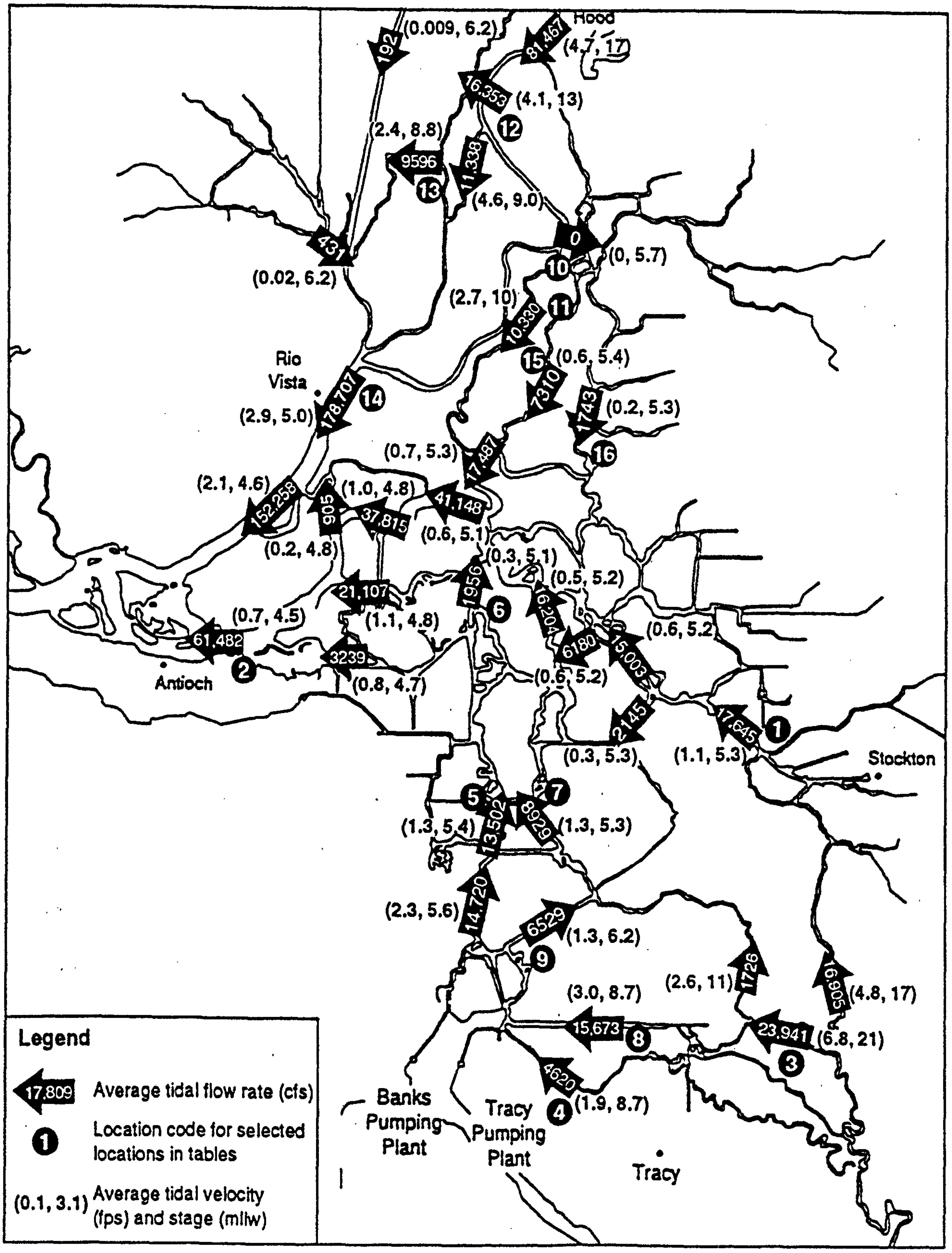


Figure 59. Average Tidal Flow Rates, Velocities, and Stages for High-Flow Conditions for Alternative 3E

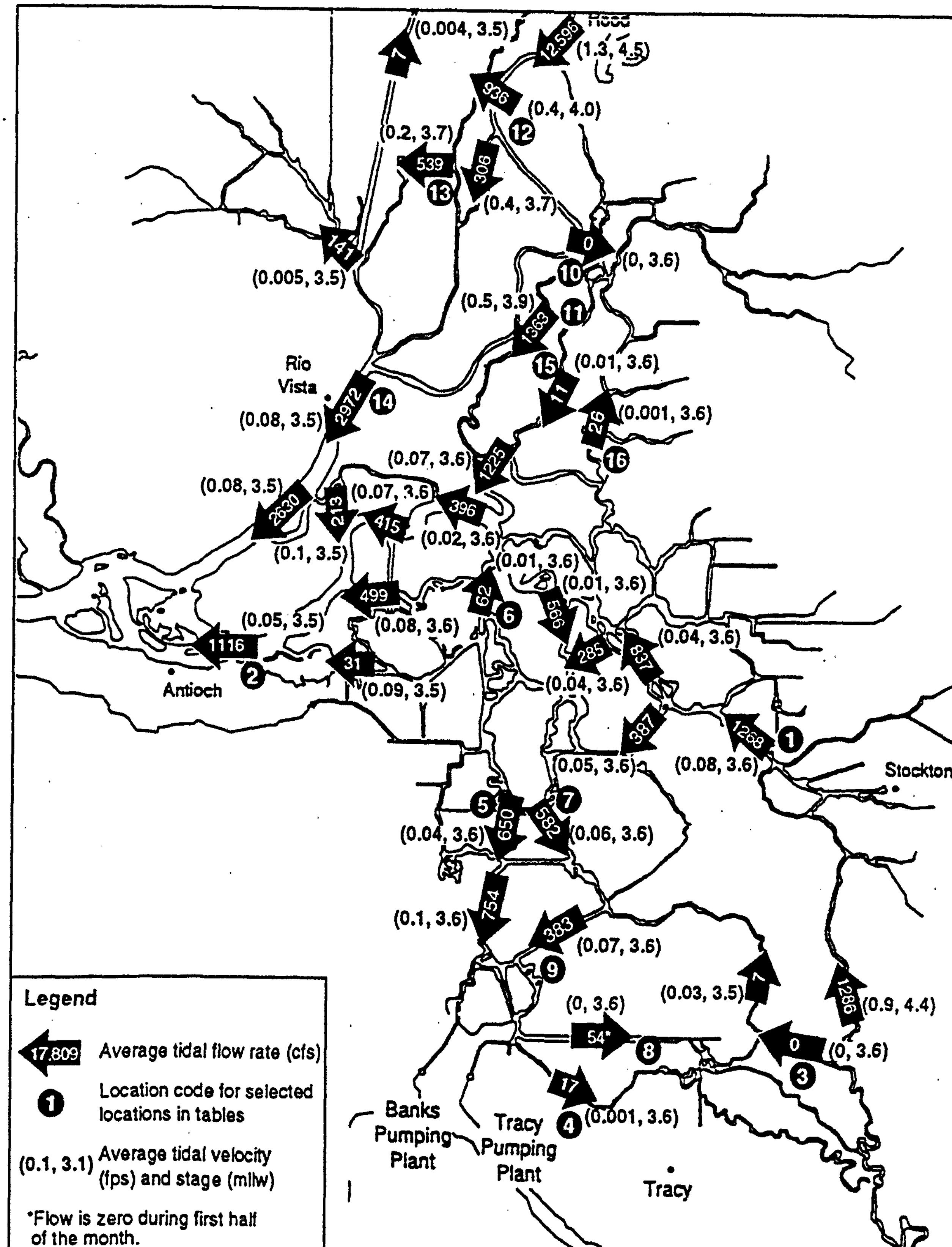


Figure 60. **Average Tidal Flow Rates, Velocities, and Stages for Low-Flow/Low-Pumping Conditions for Alternative 3E**

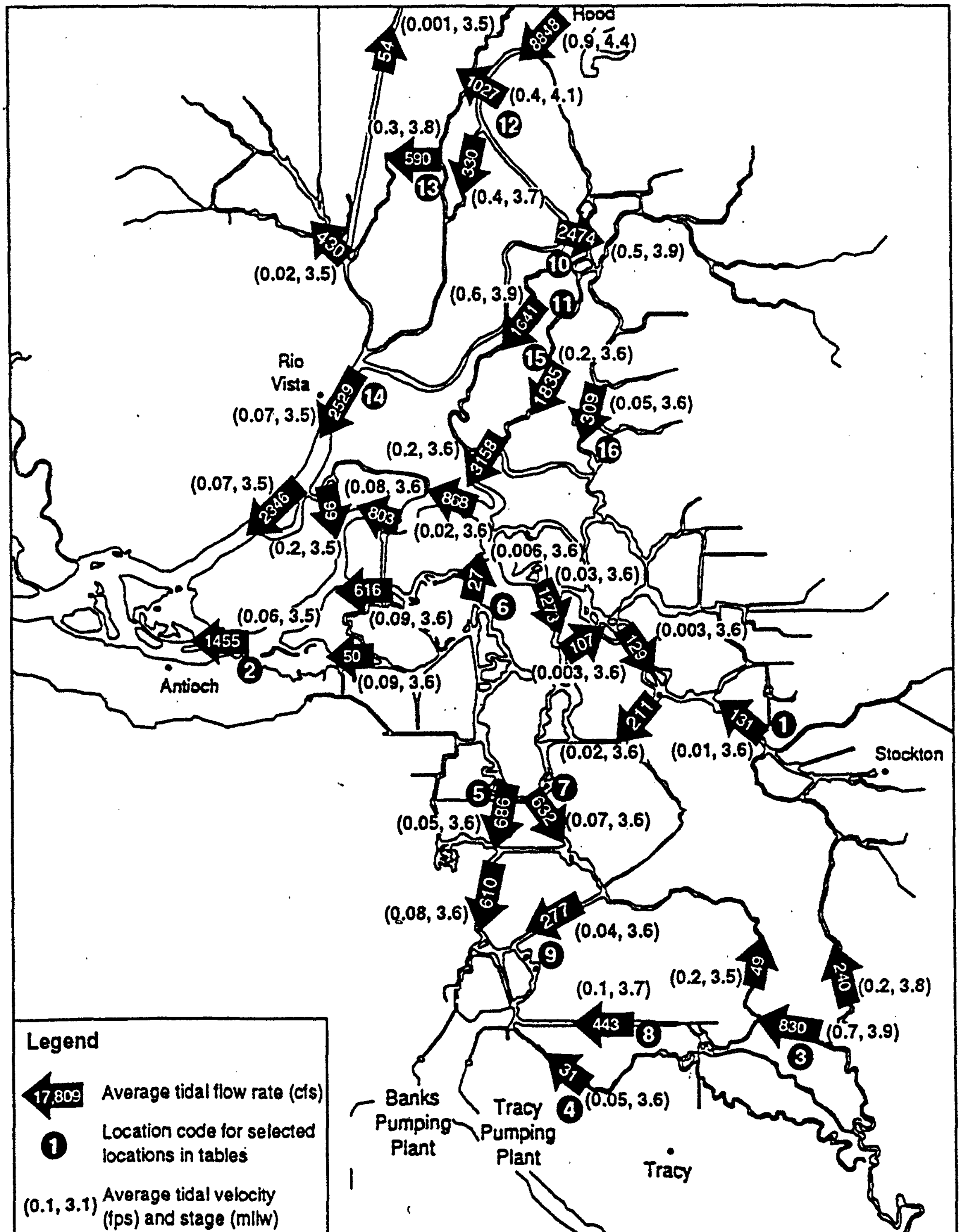
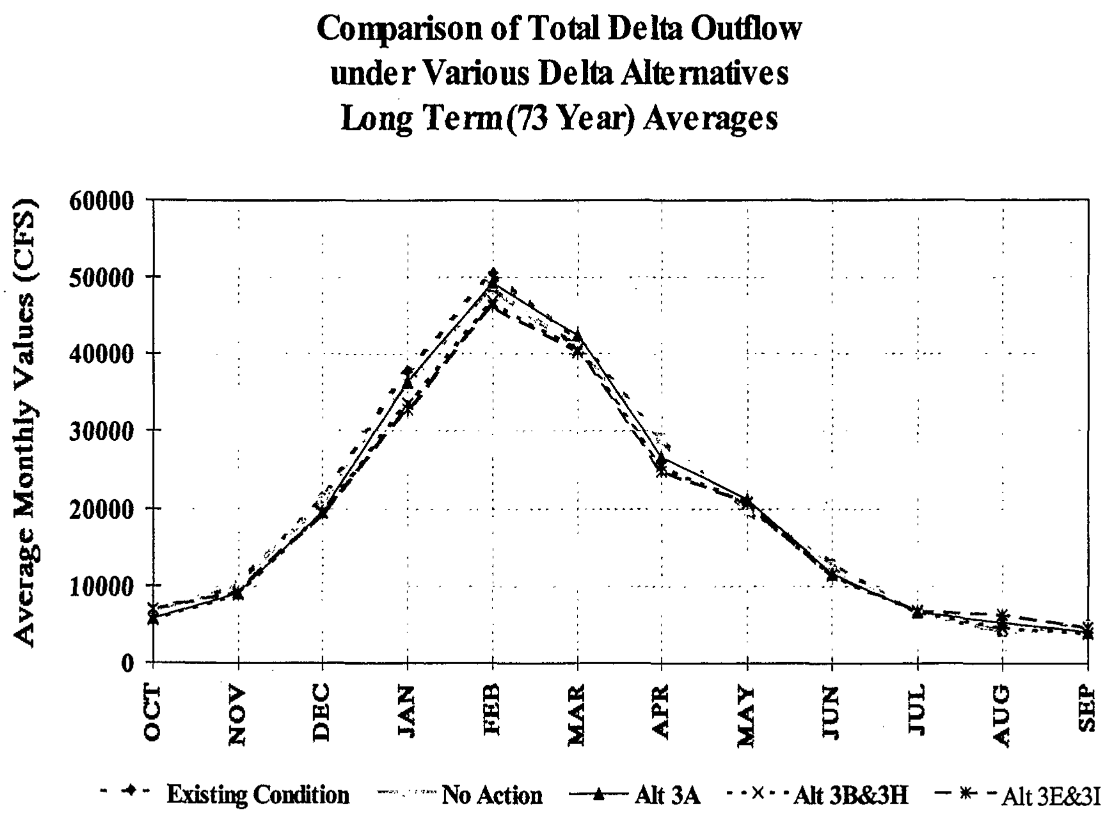


Figure 61. Average Tidal Flow Rates, Velocities, and Stages for Low-Flow/Low-Pumping Conditions for Alternative 3E



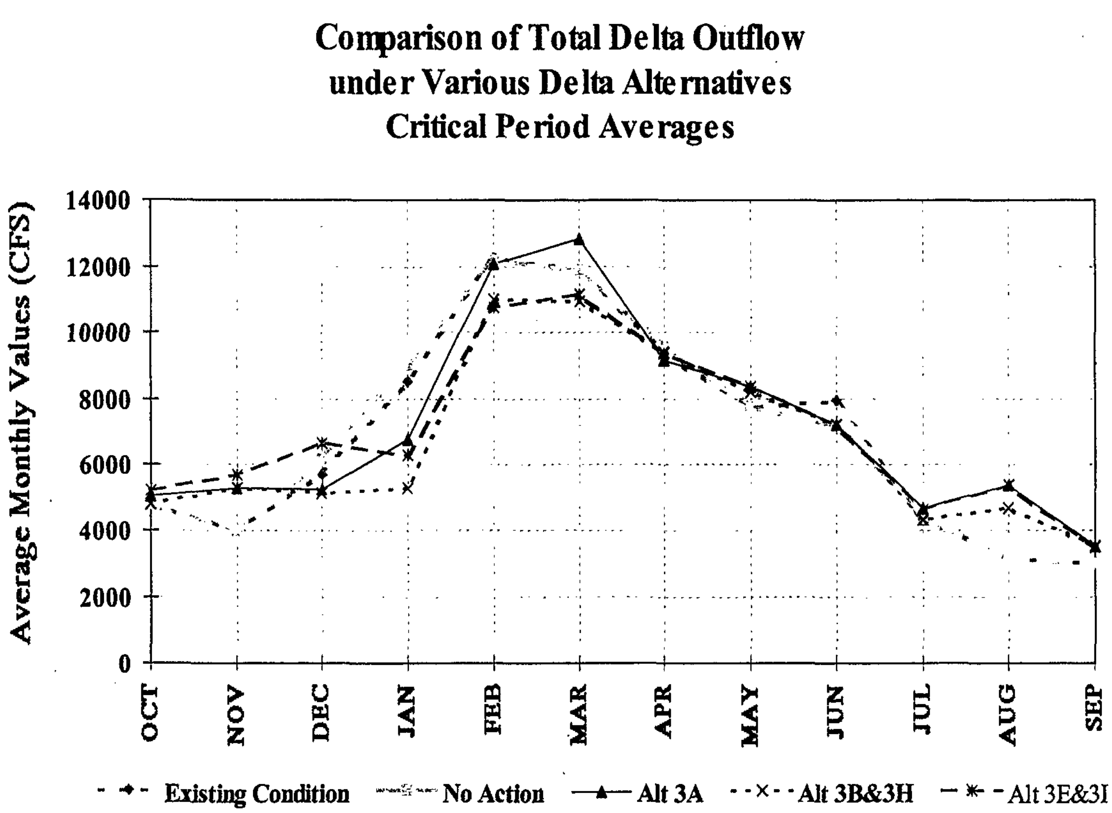
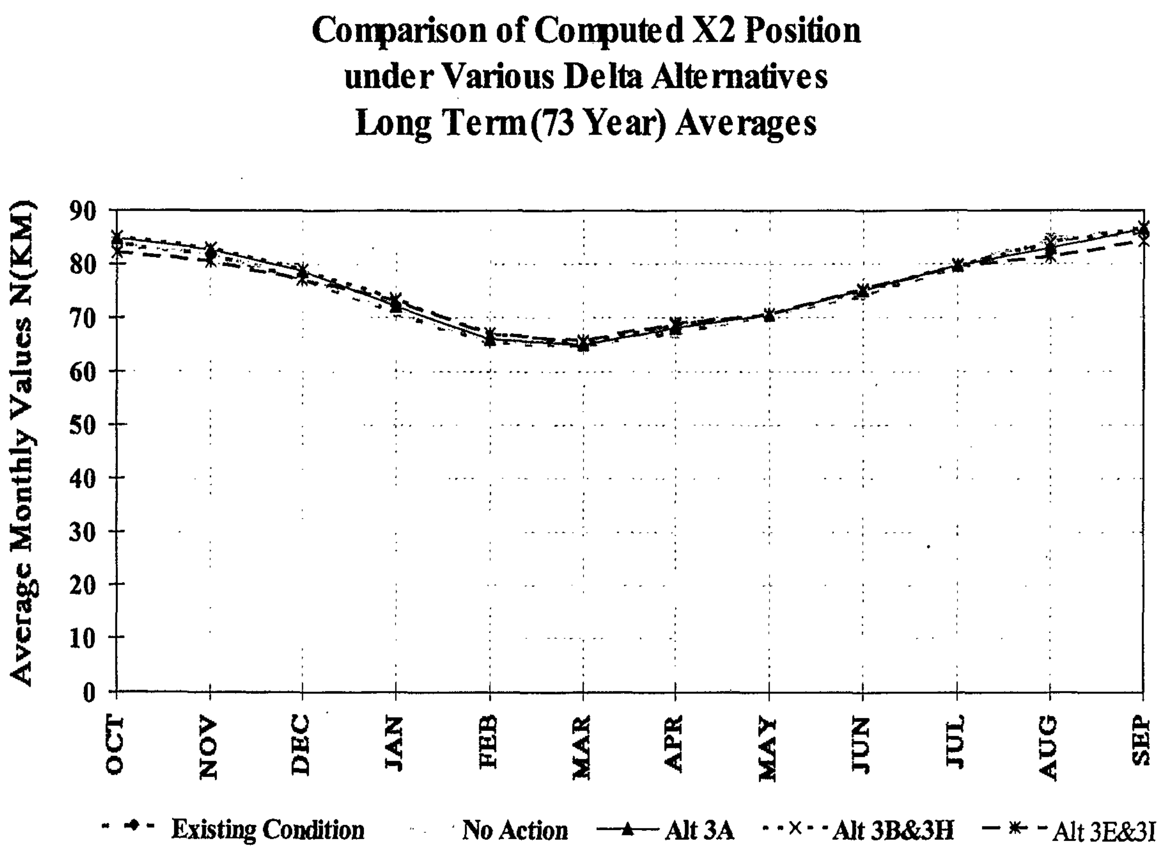


Figure 62. **Average Monthly Instream Flows at Delta Outflow**



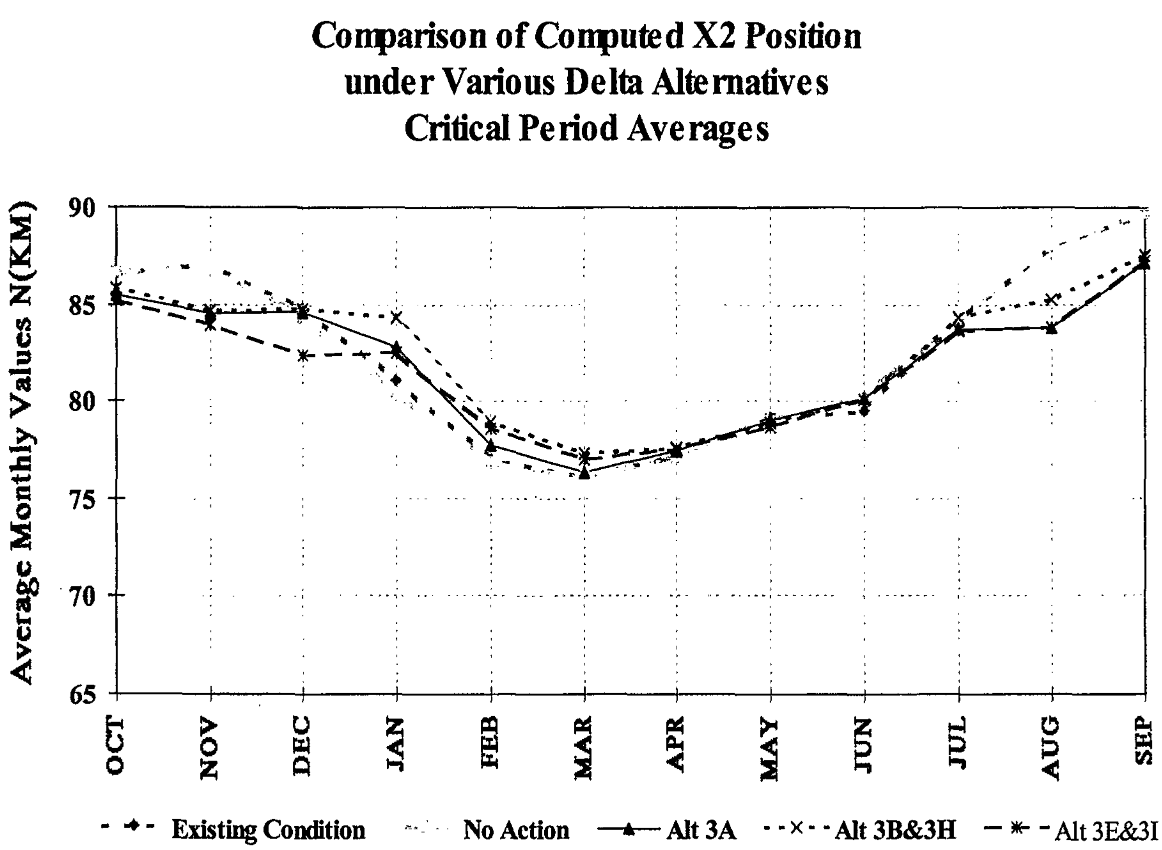
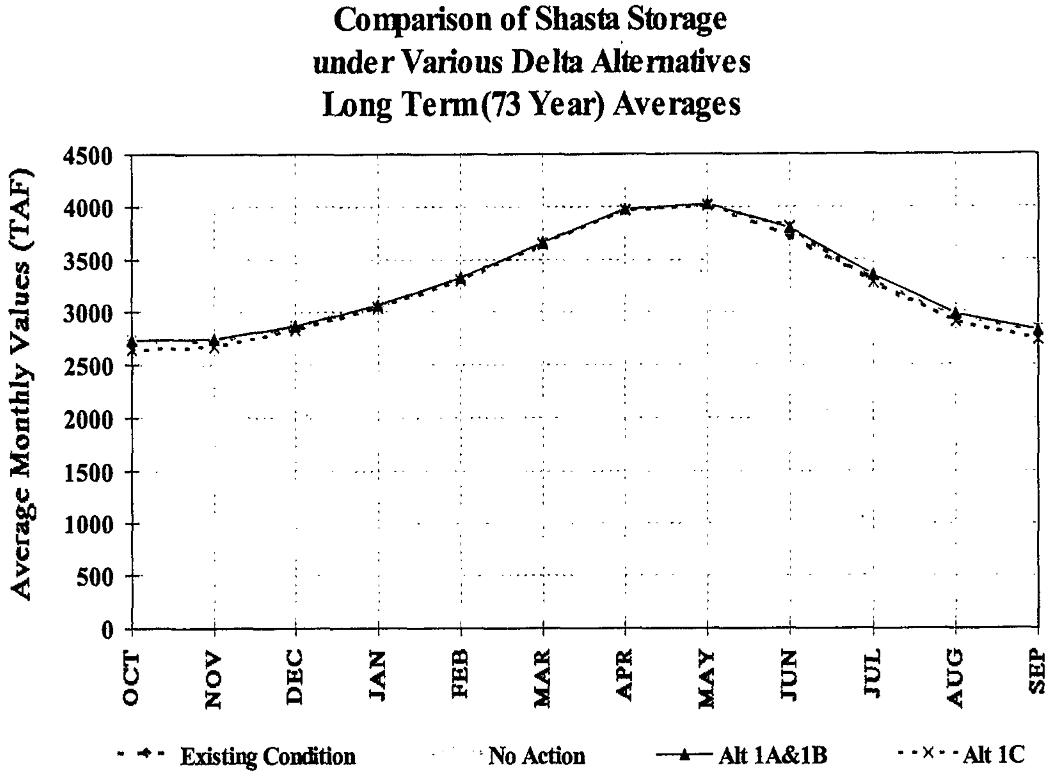


Figure 63. Average Monthly X2 Position



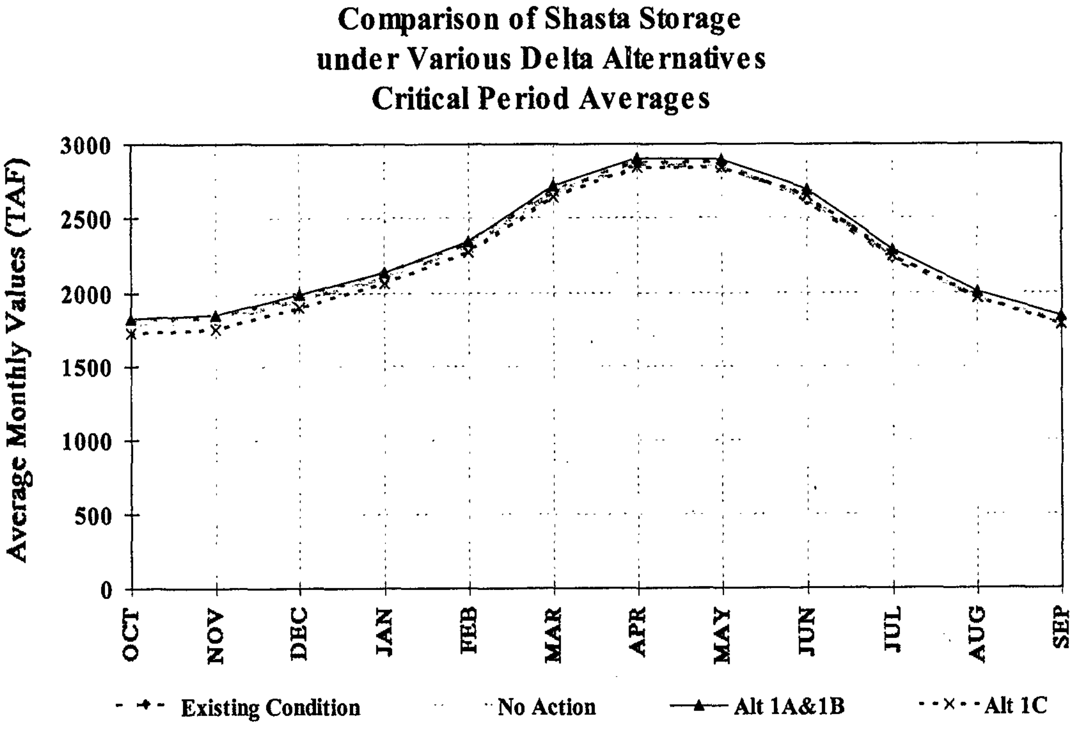
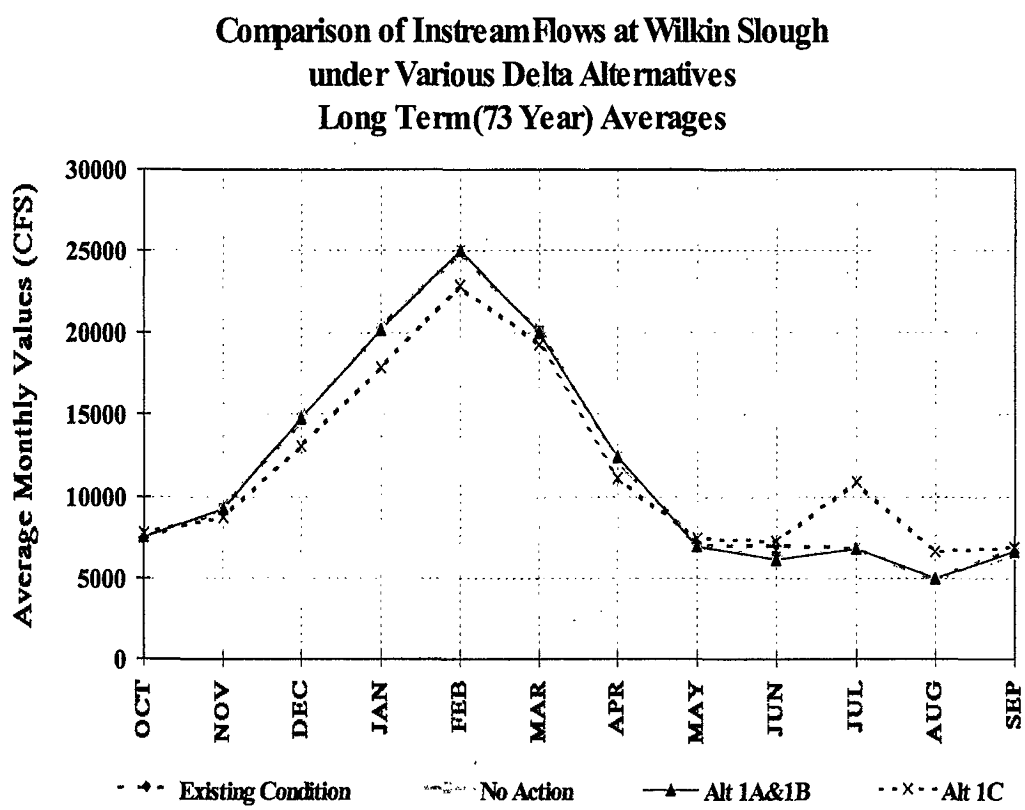


Figure 64. Average Monthly End of Month Storage at Shasta Lake



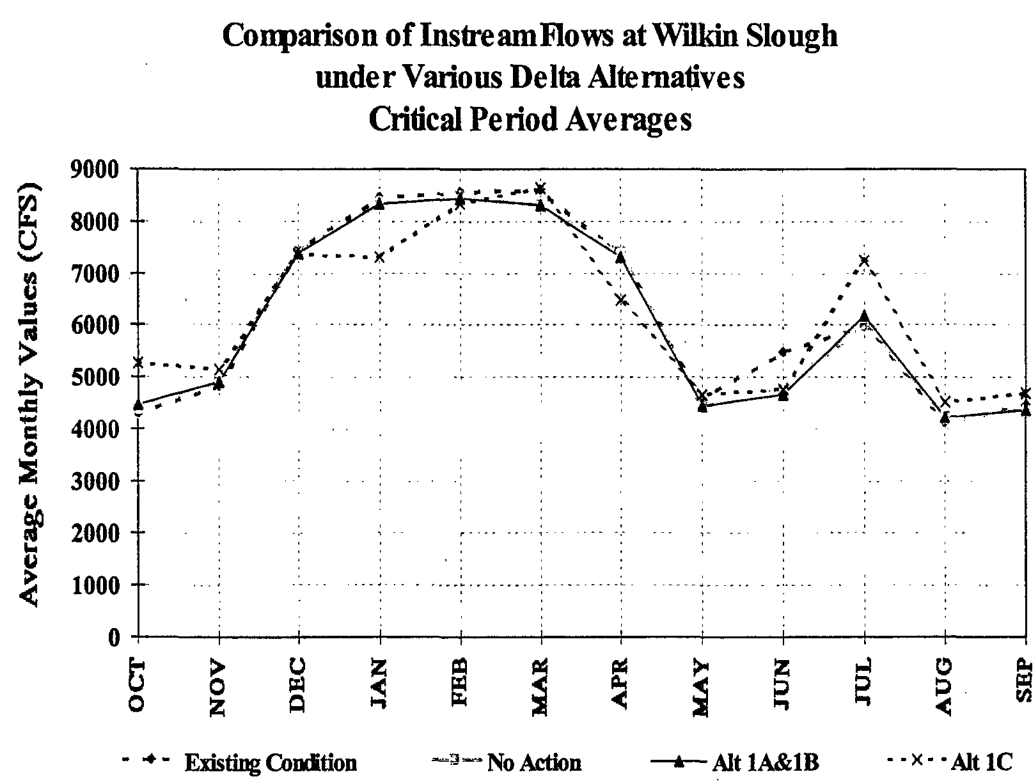
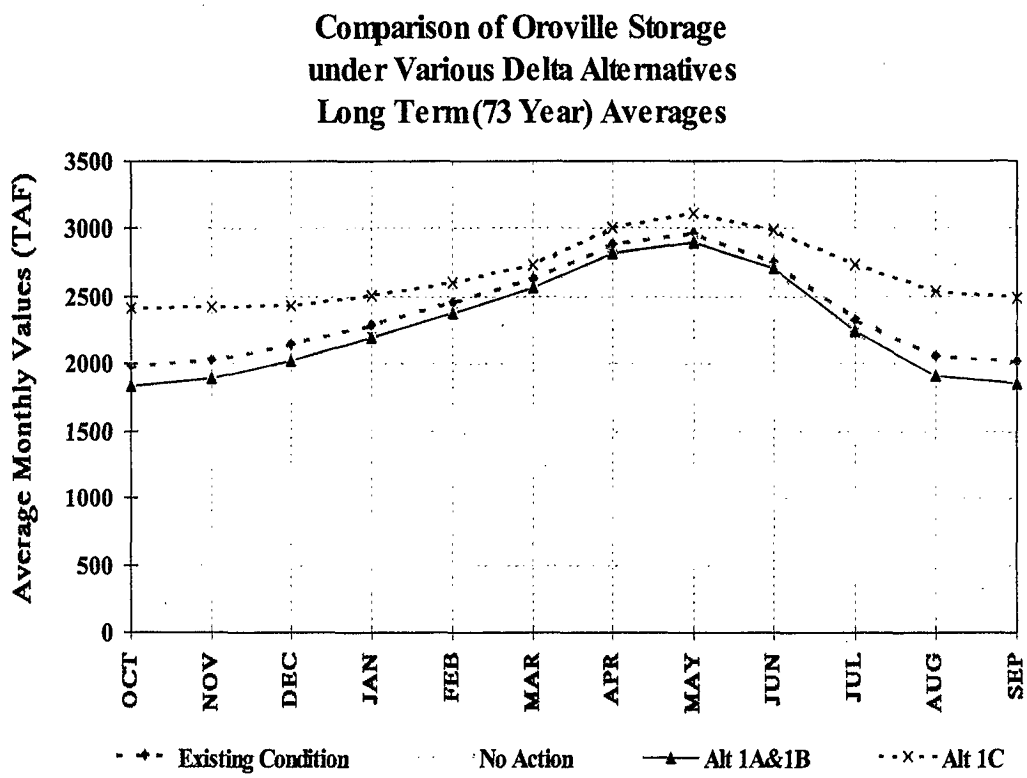


Figure 65. Average Monthly Instream Flows at Wilkins Slough



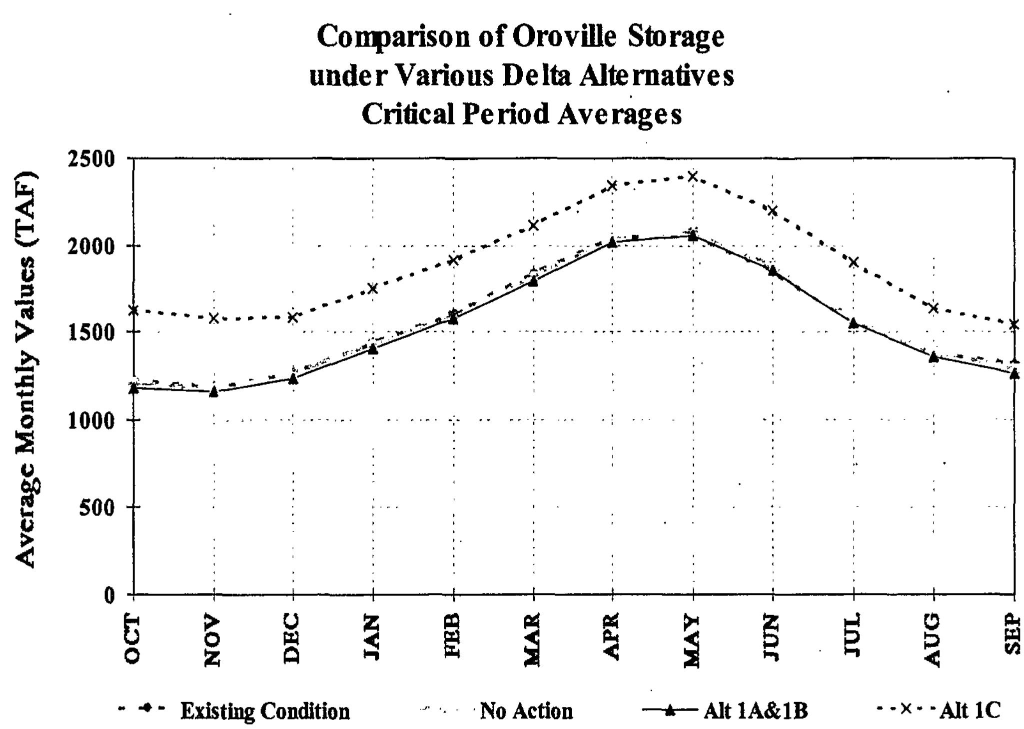
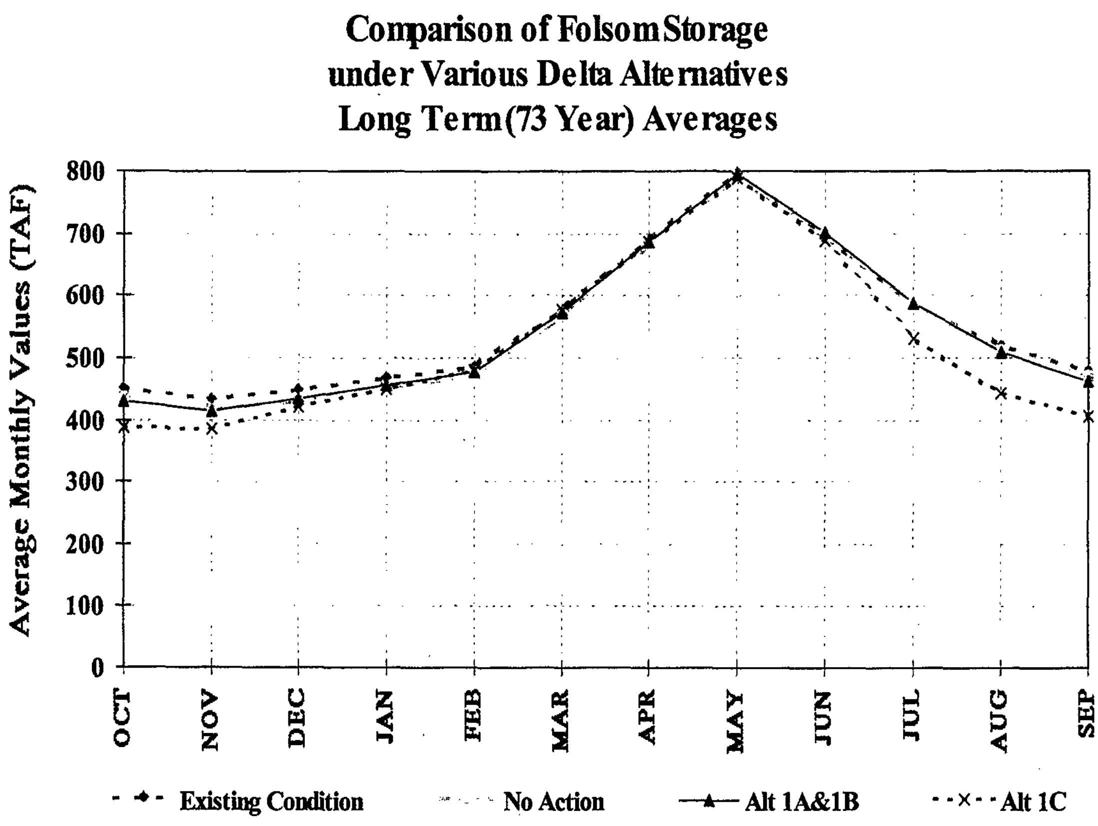


Figure 66. Average Monthly End of Month Storage at Lake Oroville



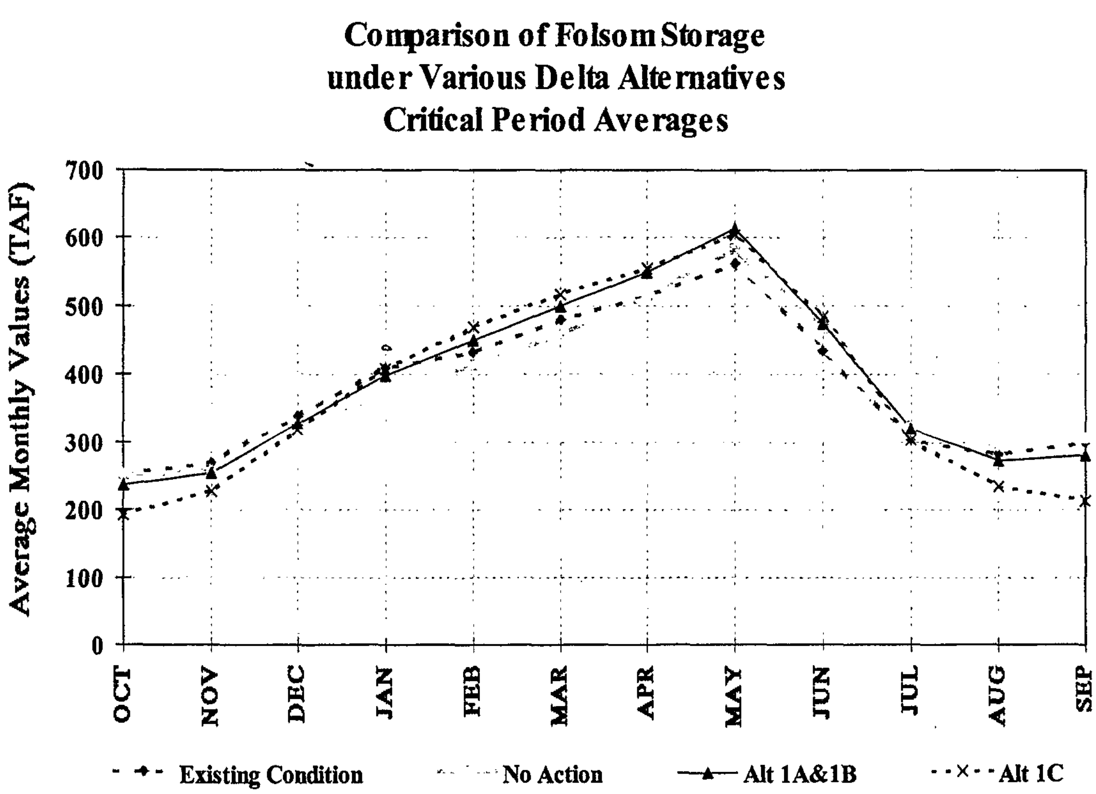
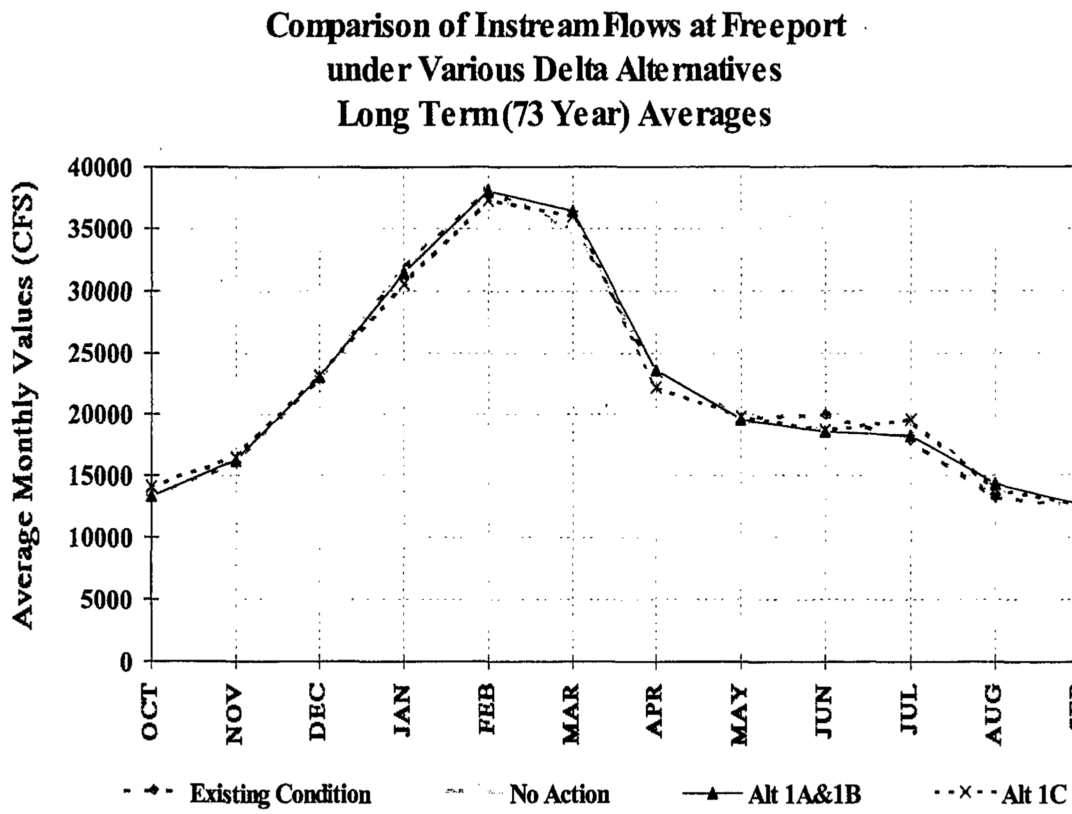


Figure 67. Average Monthly End of Month Storage at Folsom Lake



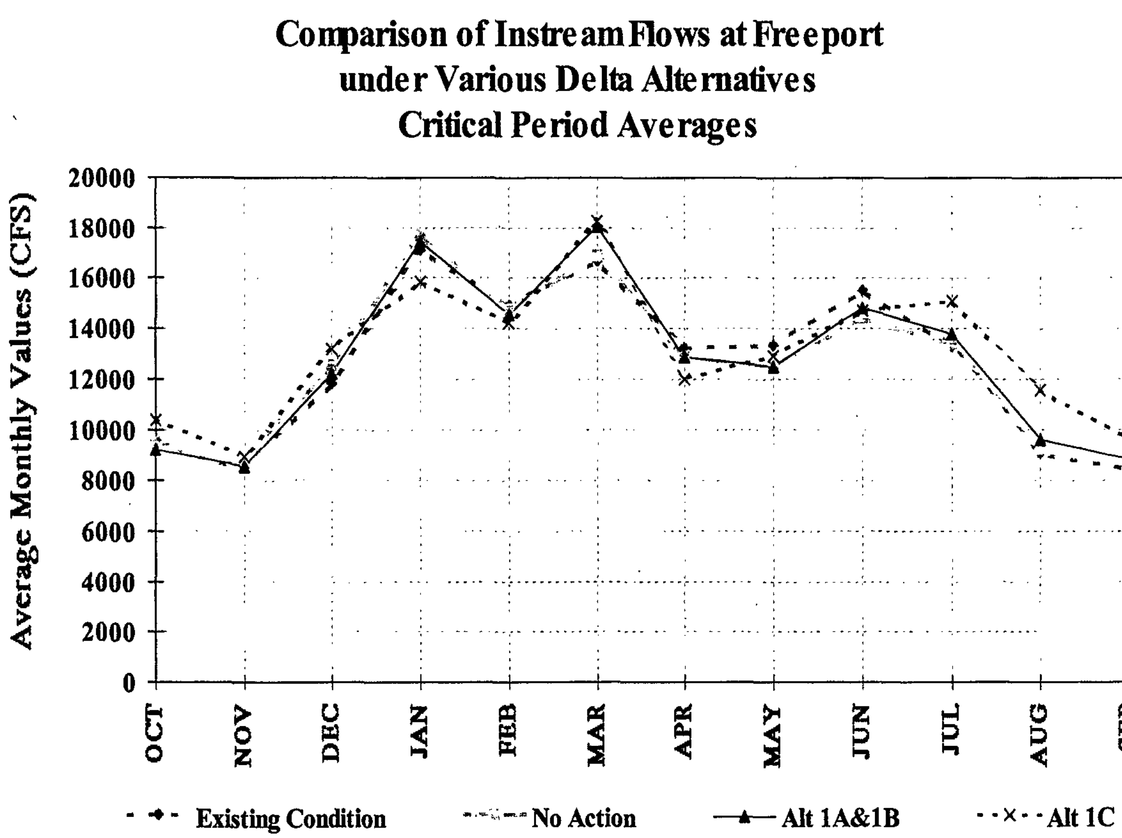
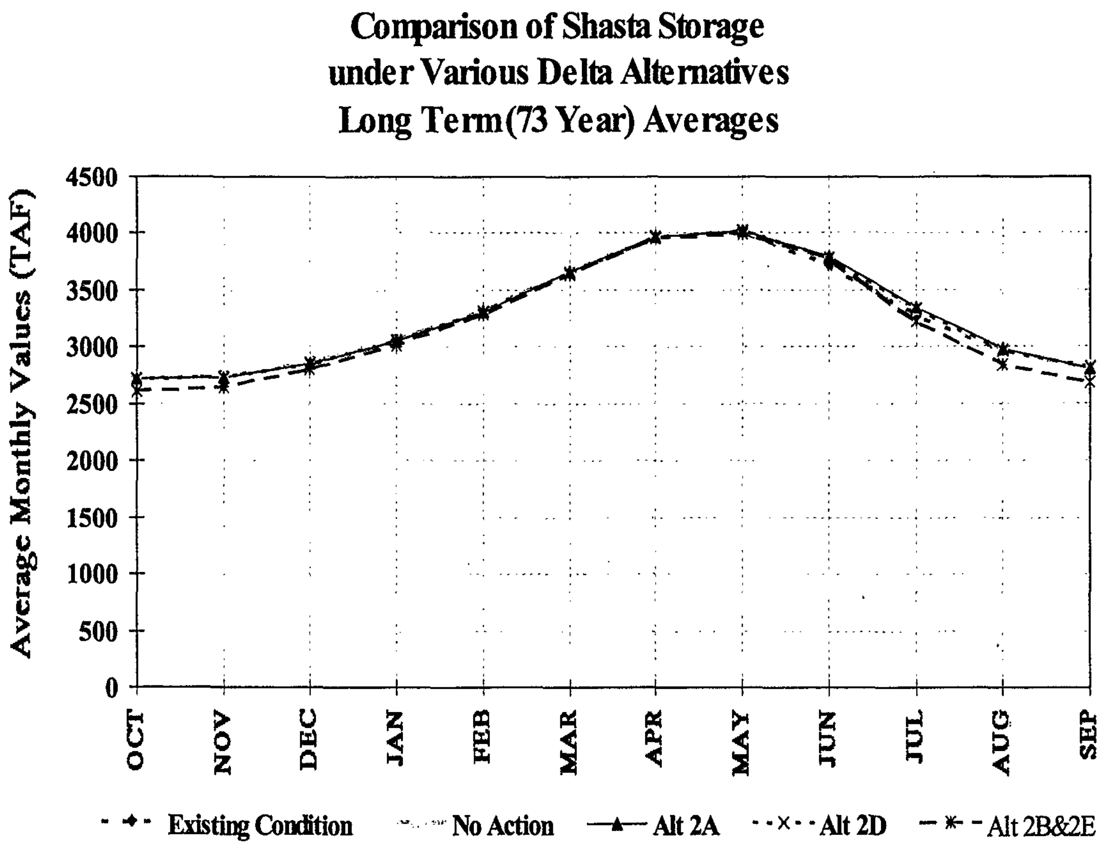


Figure 68. Average Monthly Instream Flows at Freeport



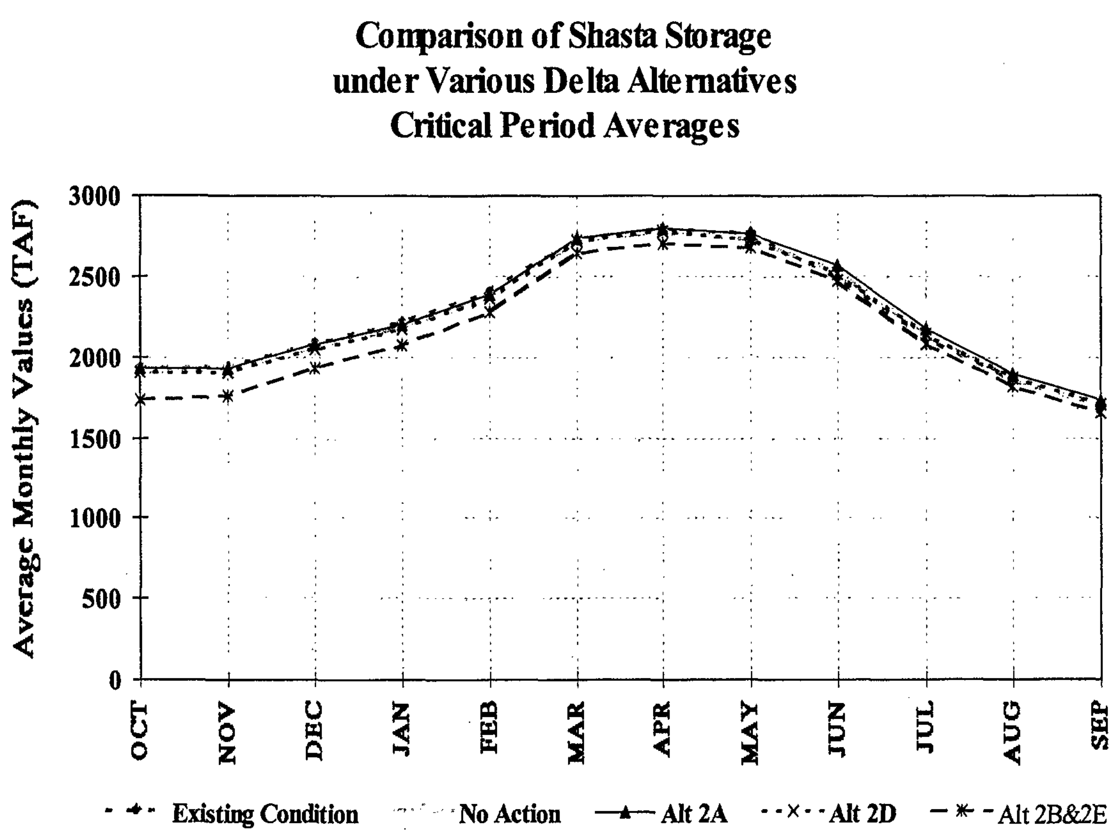
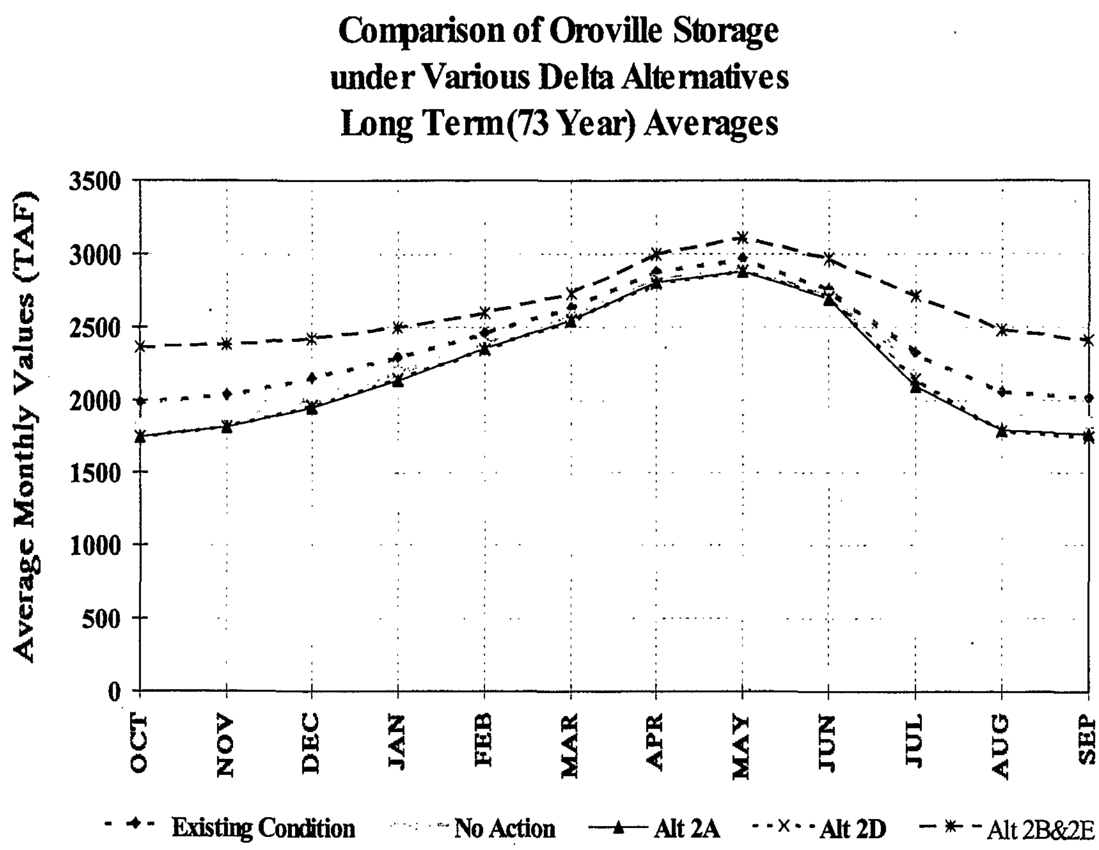


Figure 69. Average Monthly End of Month Storage at Shasta Lake



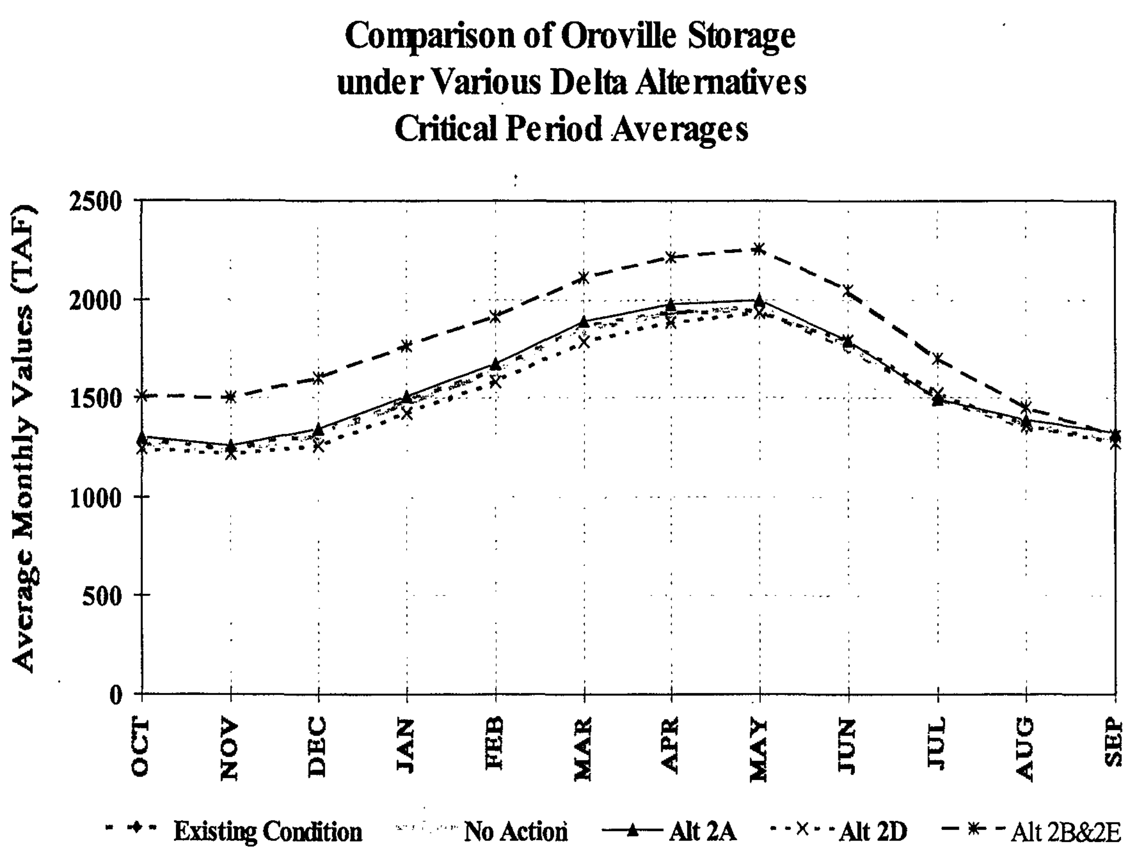
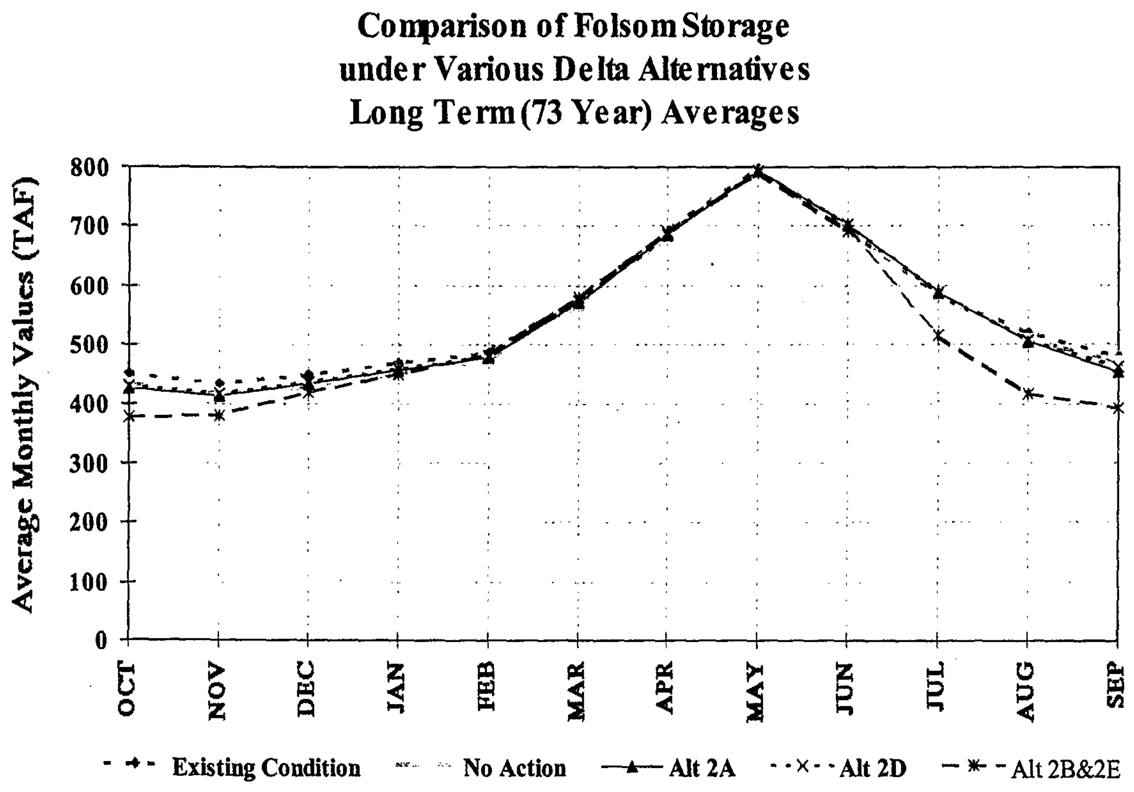


Figure 70. Average Monthly End of Month Storage at Lake Oroville



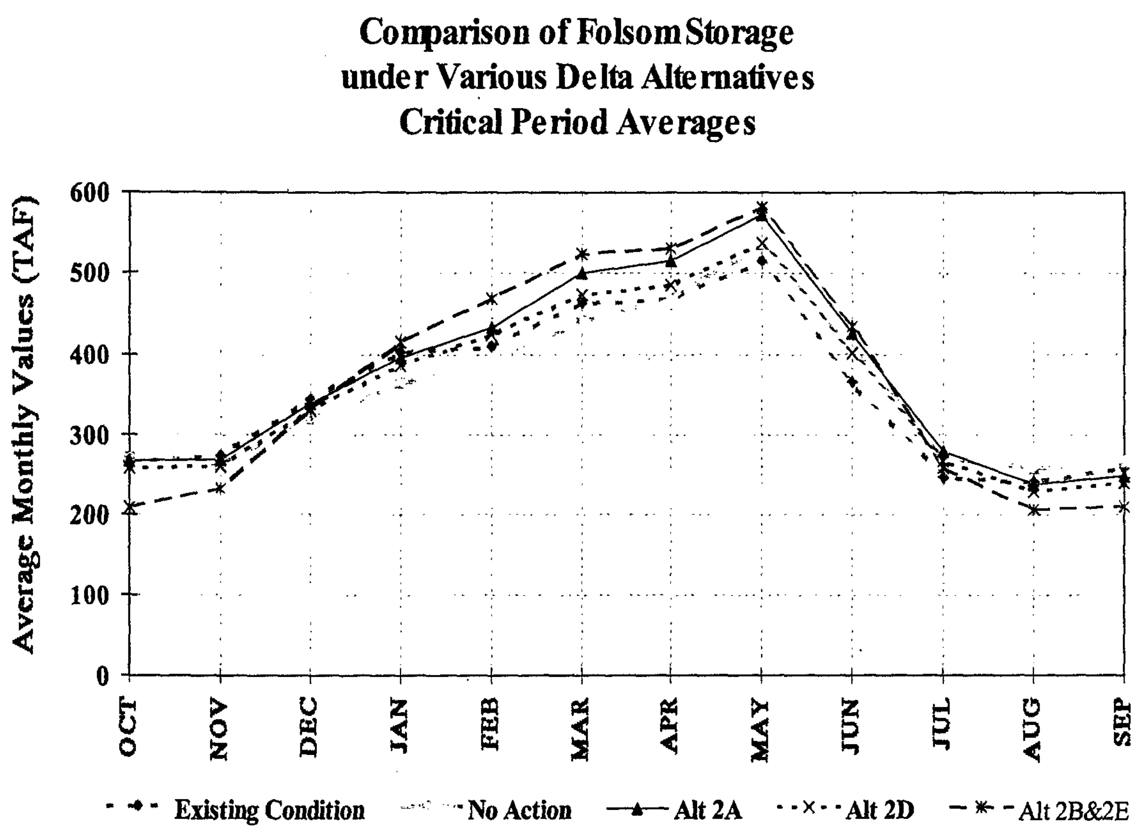
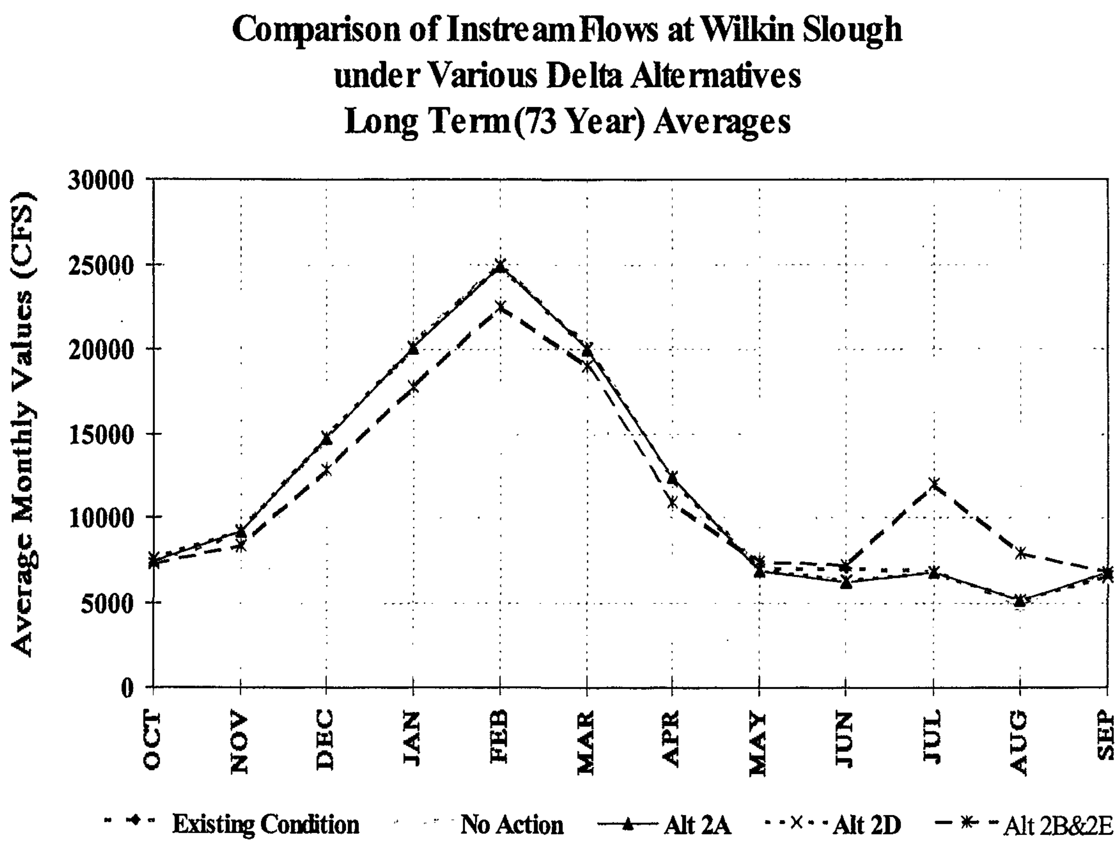


Figure 71. Average Monthly End of Month Storage at Folsom Lake



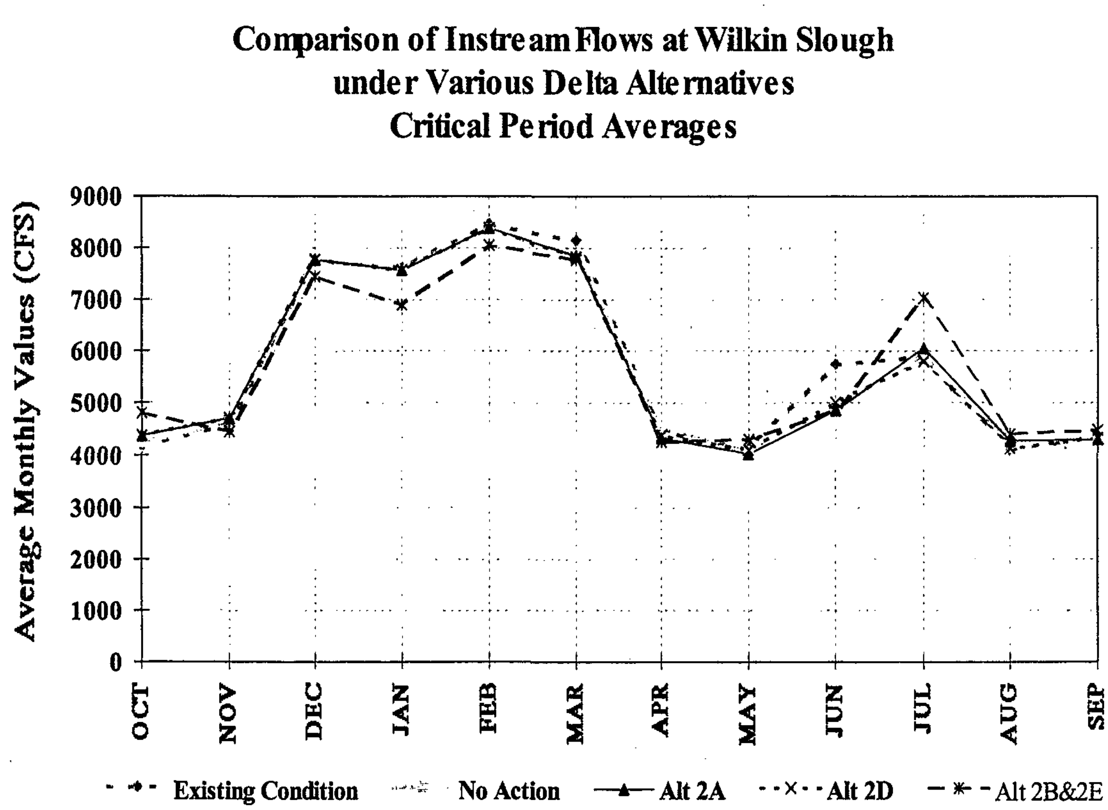
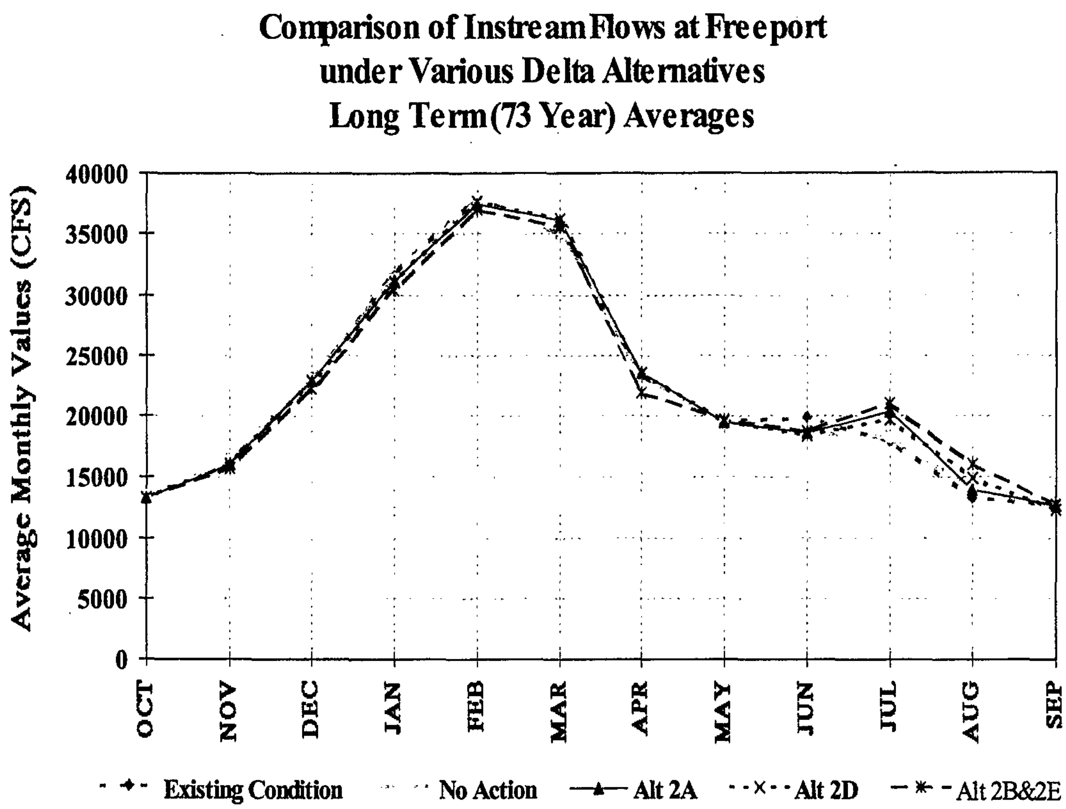


Figure 72. **Average Monthly Instream Flows at Wilkins Slough**



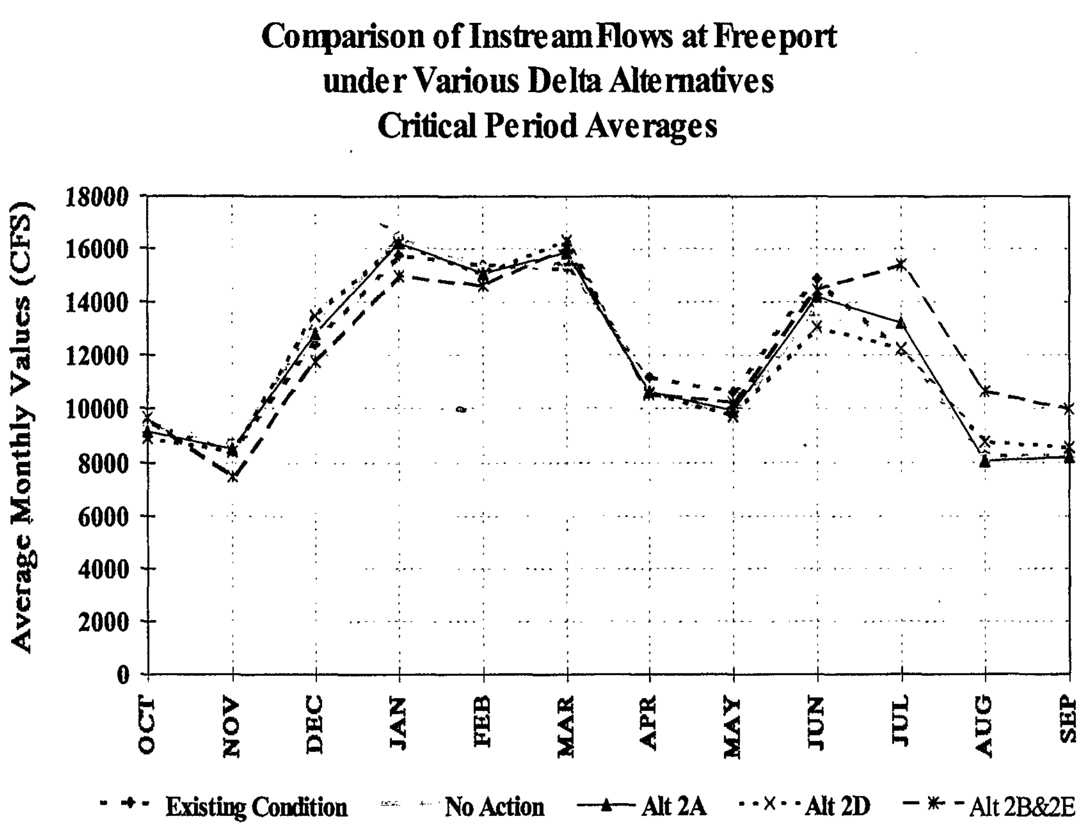
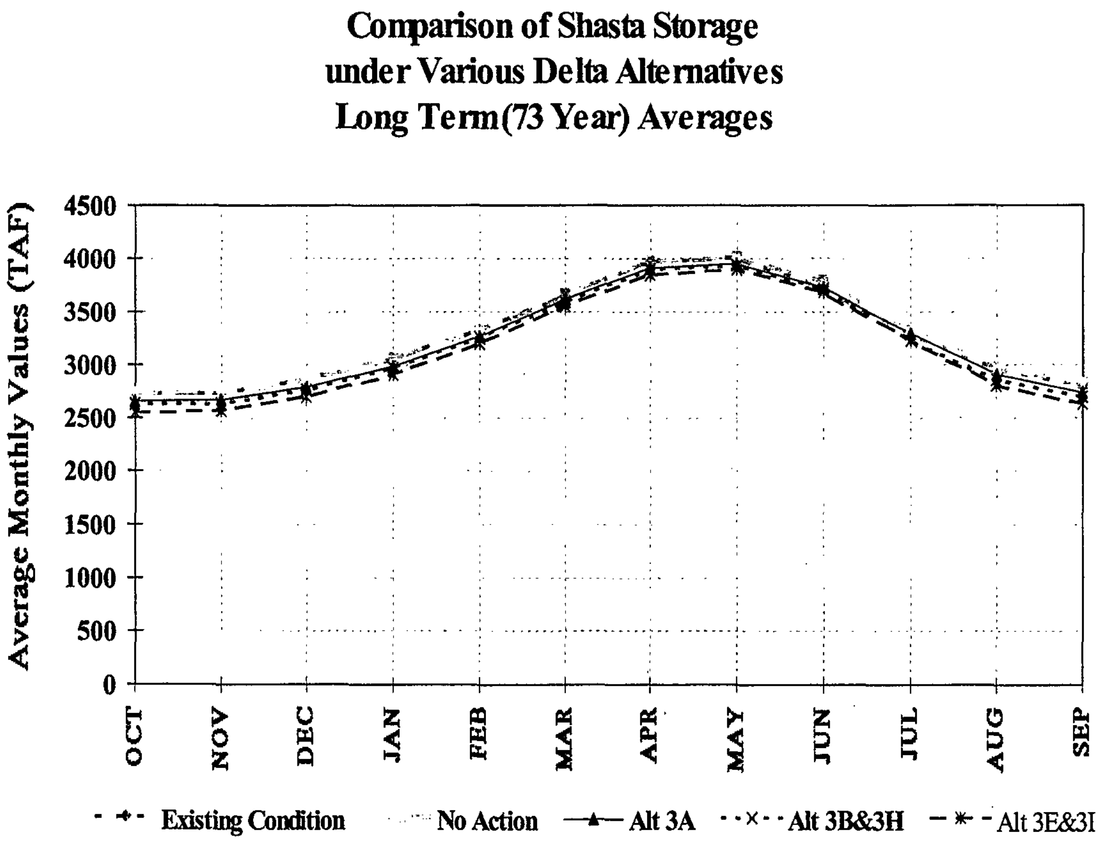


Figure 73. Average Monthly Instream Flows at Freeport



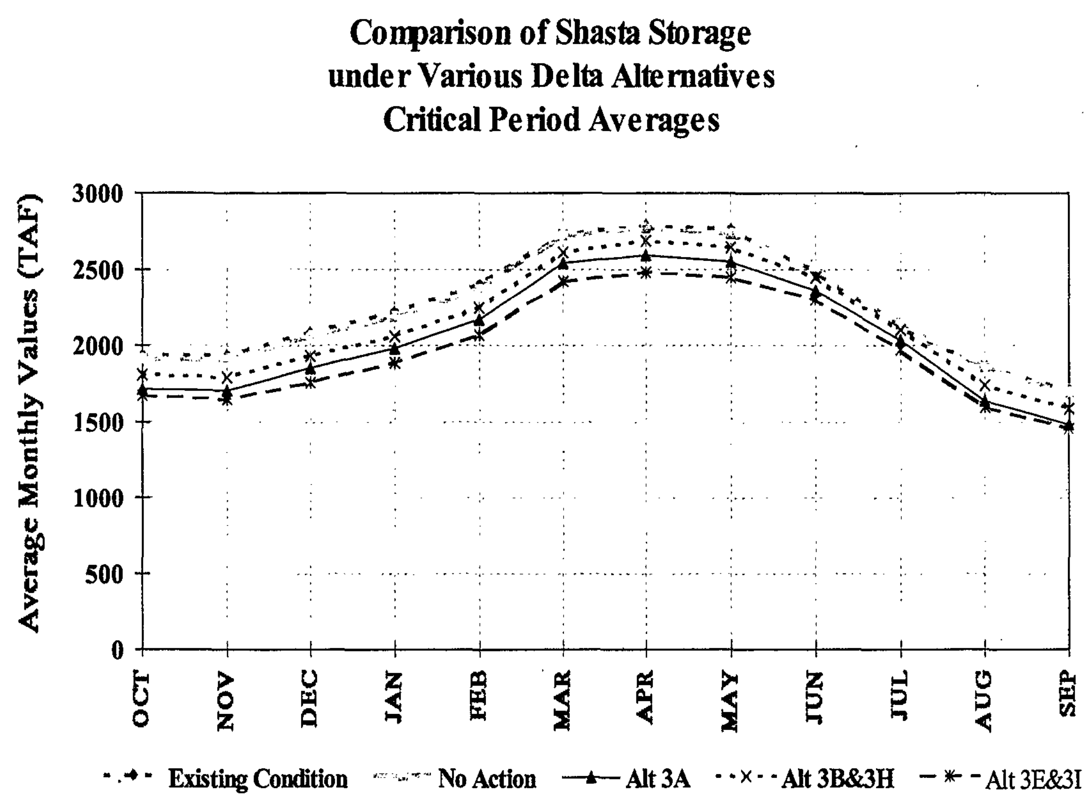
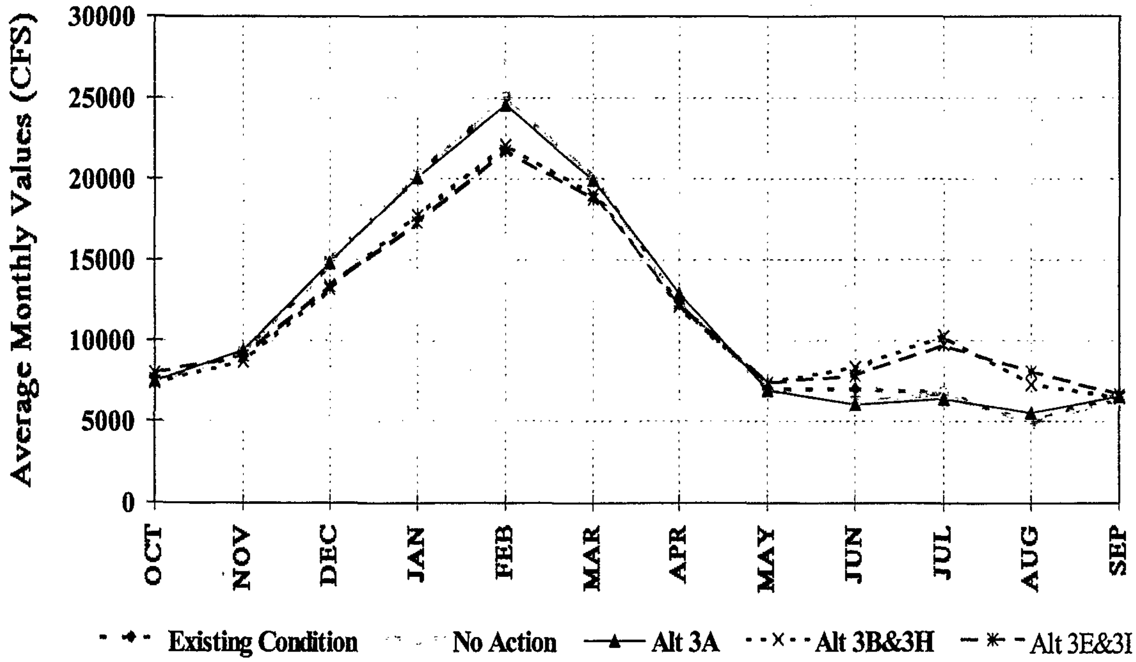


Figure 74. **Average Monthly End of Month Storage at Shasta Lake**

Comparison of Instream Flows at Wilkin Slough under Various Delta Alternatives Long Term (73 Year) Averages



Comparison of Instream Flows at Wilkin Slough under Various Delta Alternatives Critical Period Averages

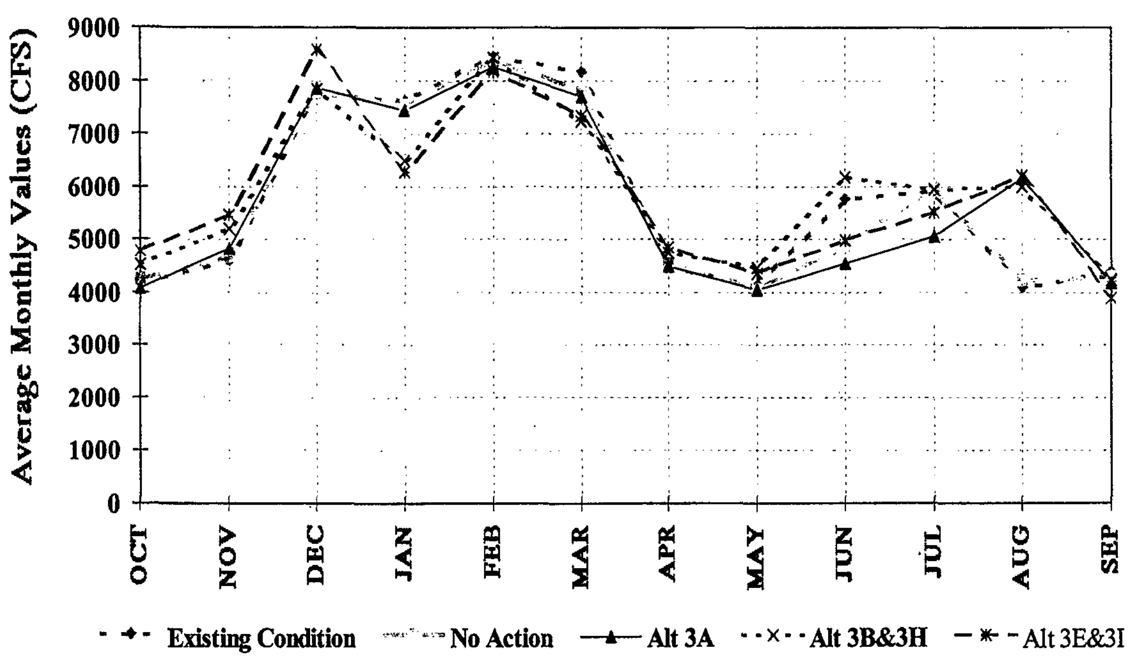
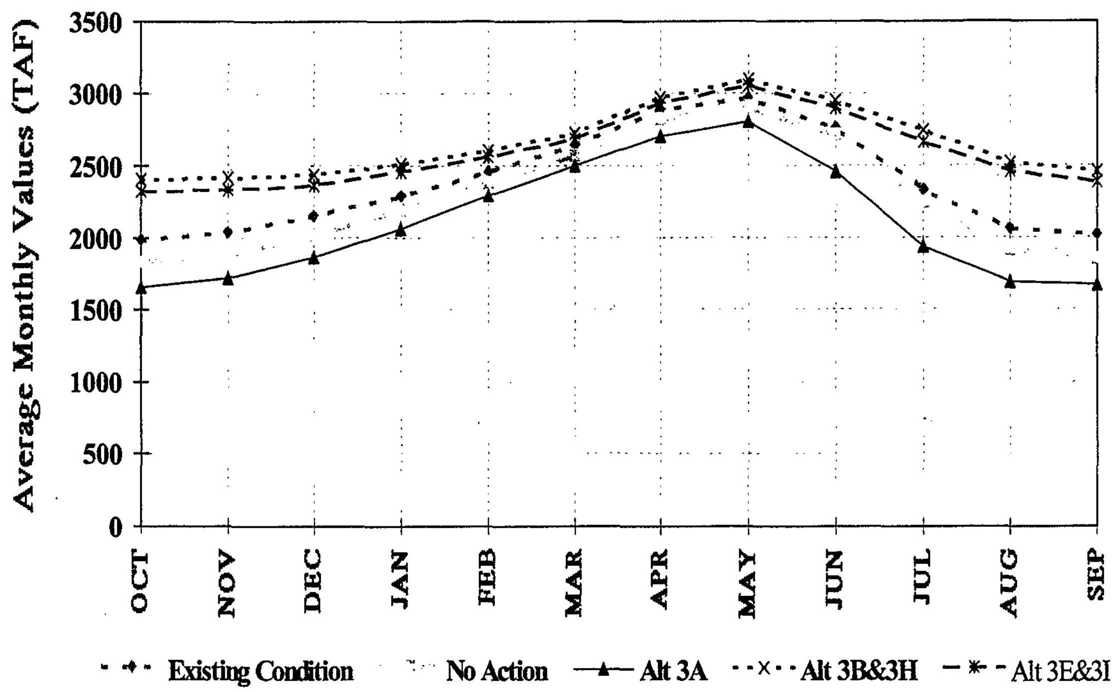


Figure 75. Average Monthly Instream Flows at Wilkins Slough

Comparison of Oroville Storage
under Various Delta Alternatives
Long Term(73 Year) Averages



Comparison of Oroville Storage
under Various Delta Alternatives
Critical Period Averages

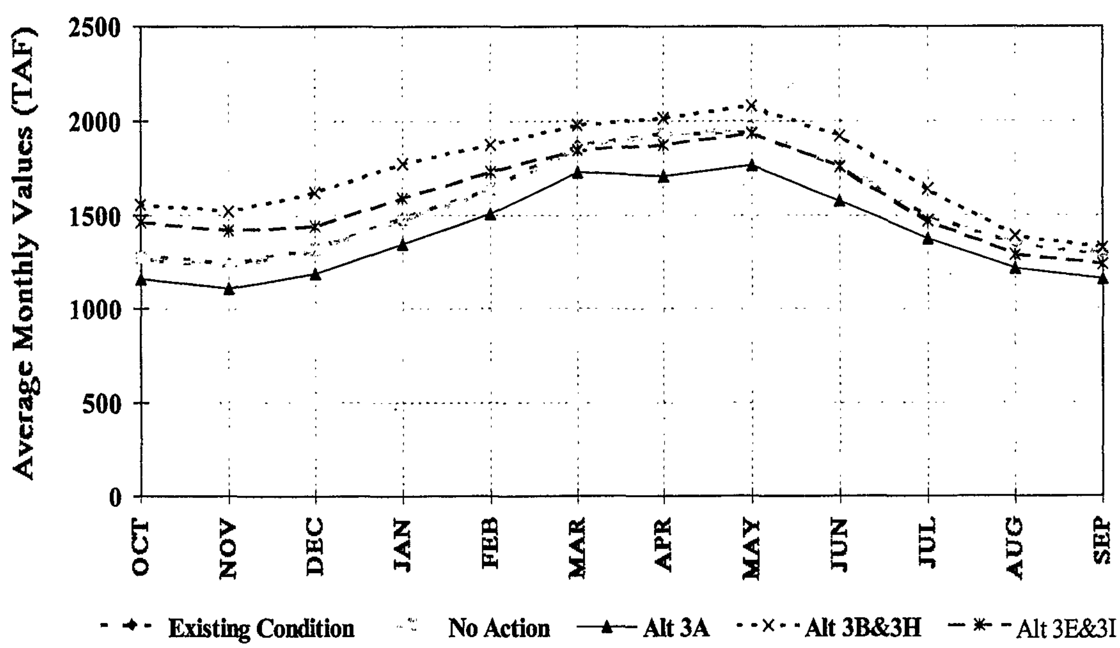
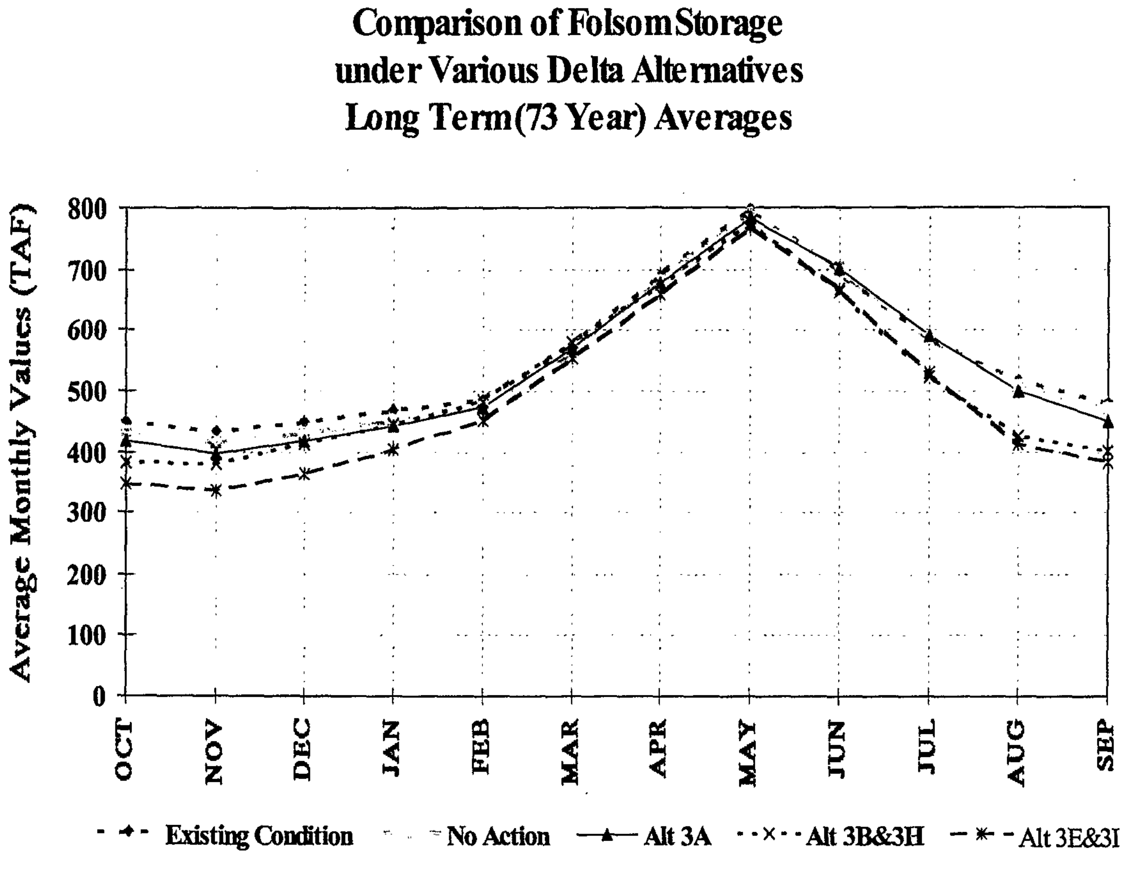


Figure 76. Average Monthly End of Month Storage at Lake Oroville



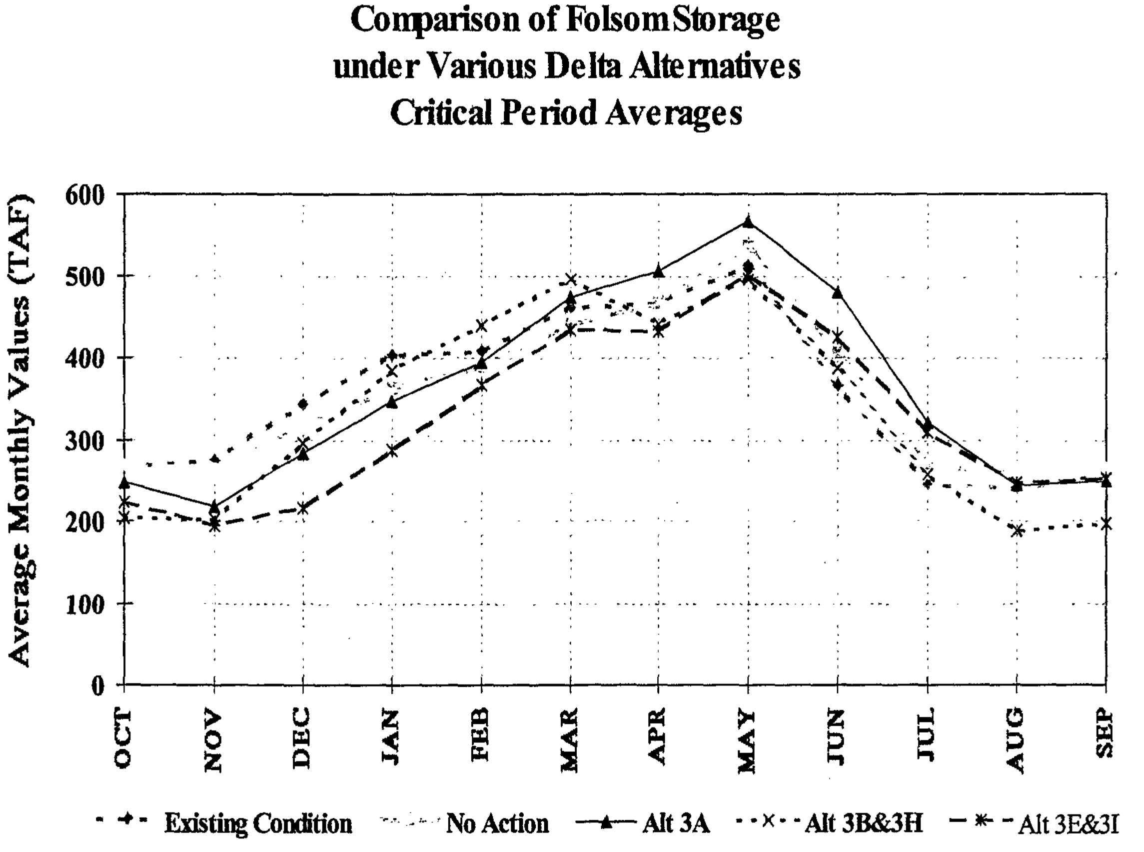
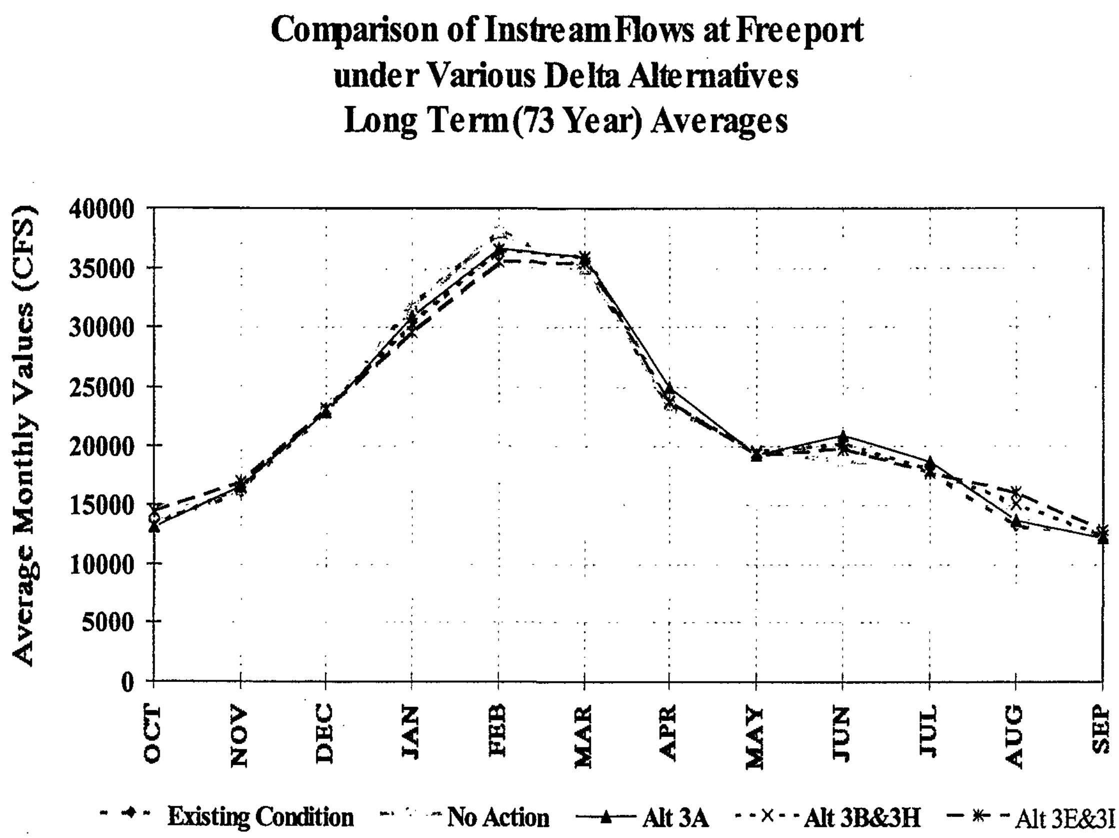


Figure 77. Average Monthly End of Month Storage at Folsom Lake



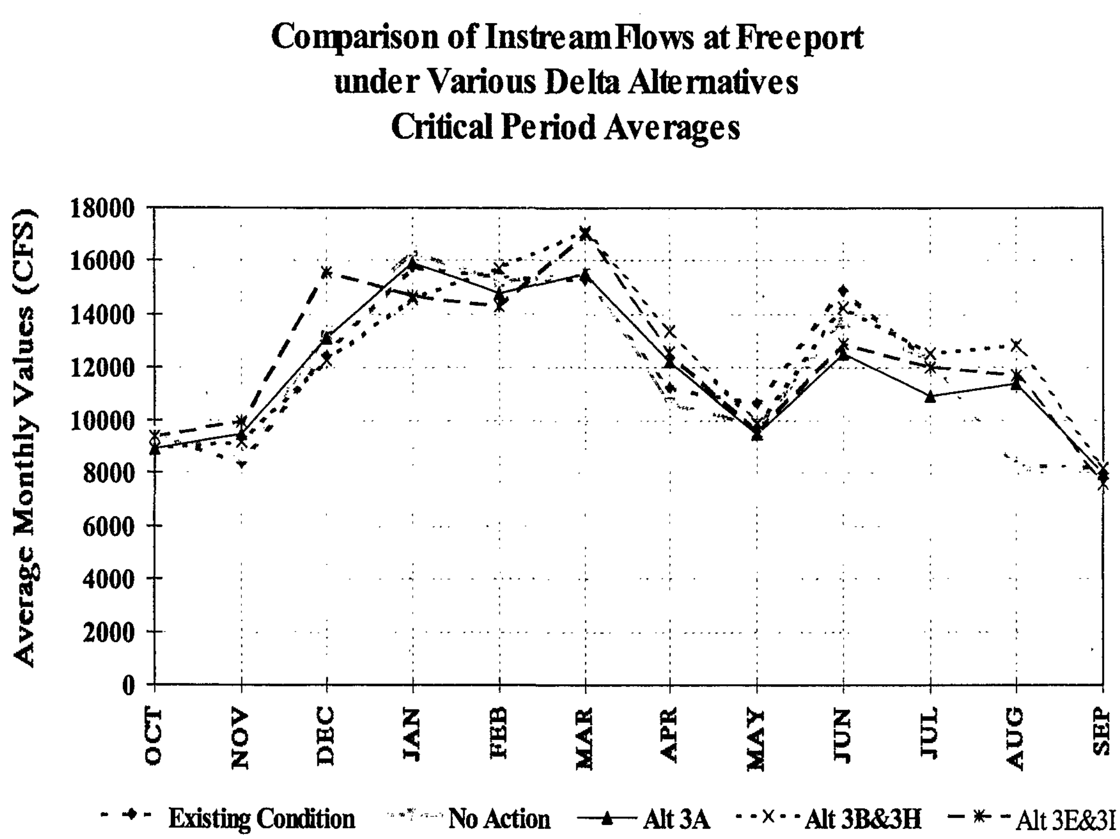
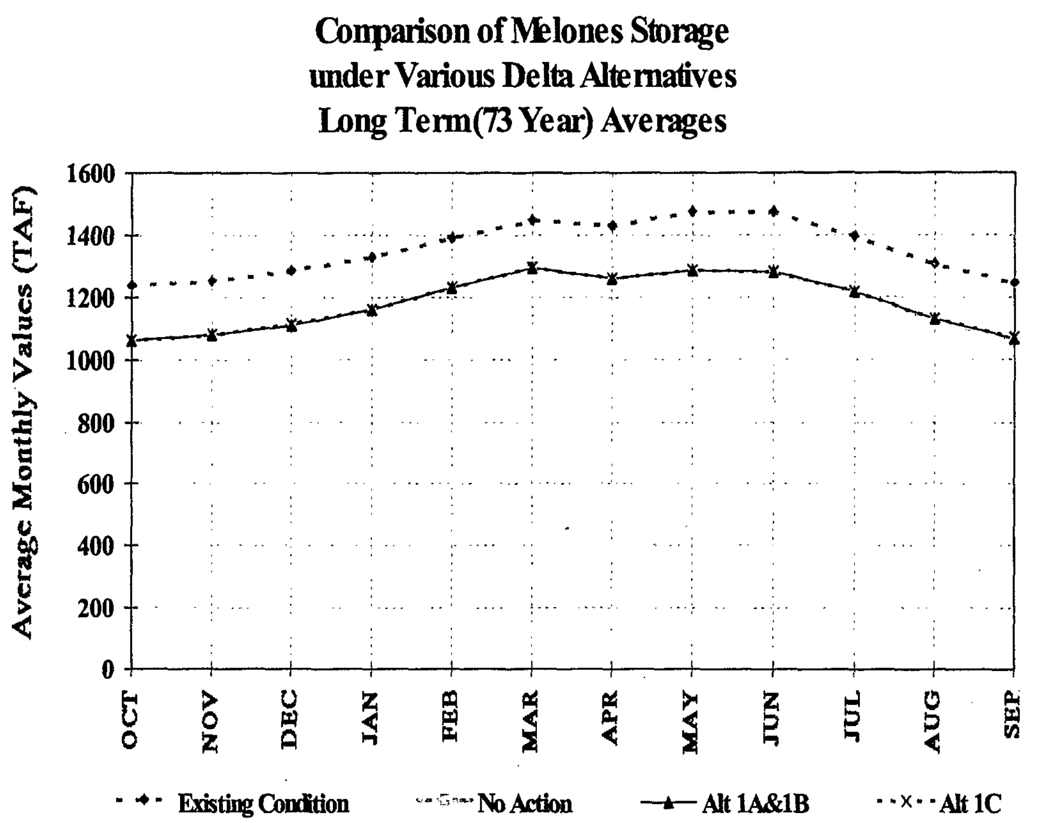


Figure 78. **Average Monthly Instream Flows at Freeport**



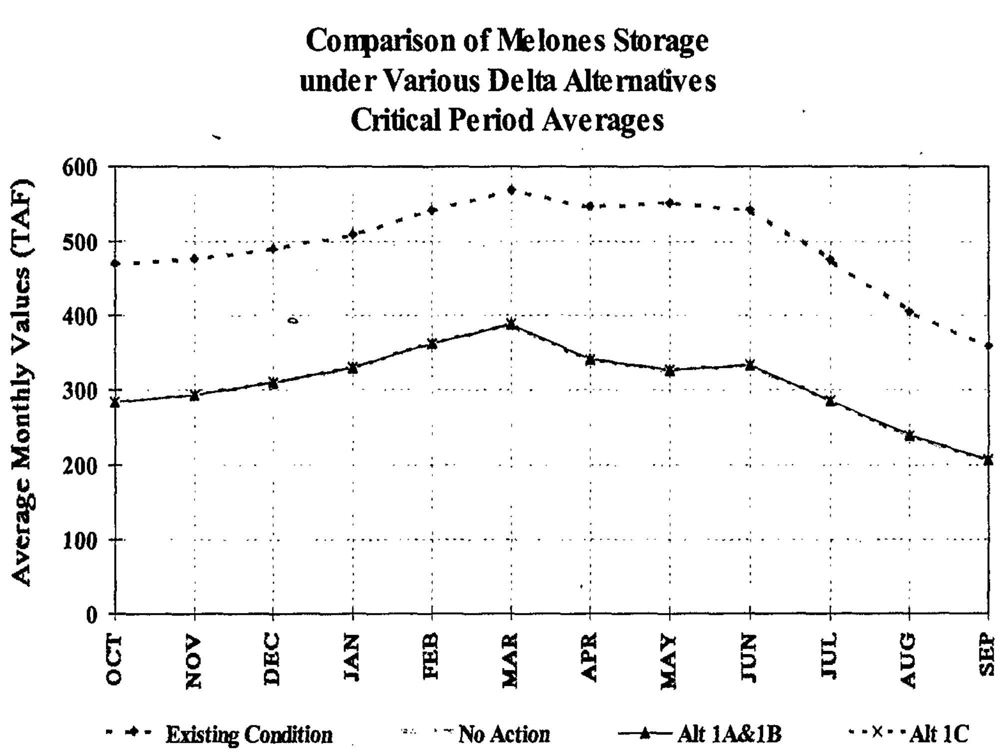
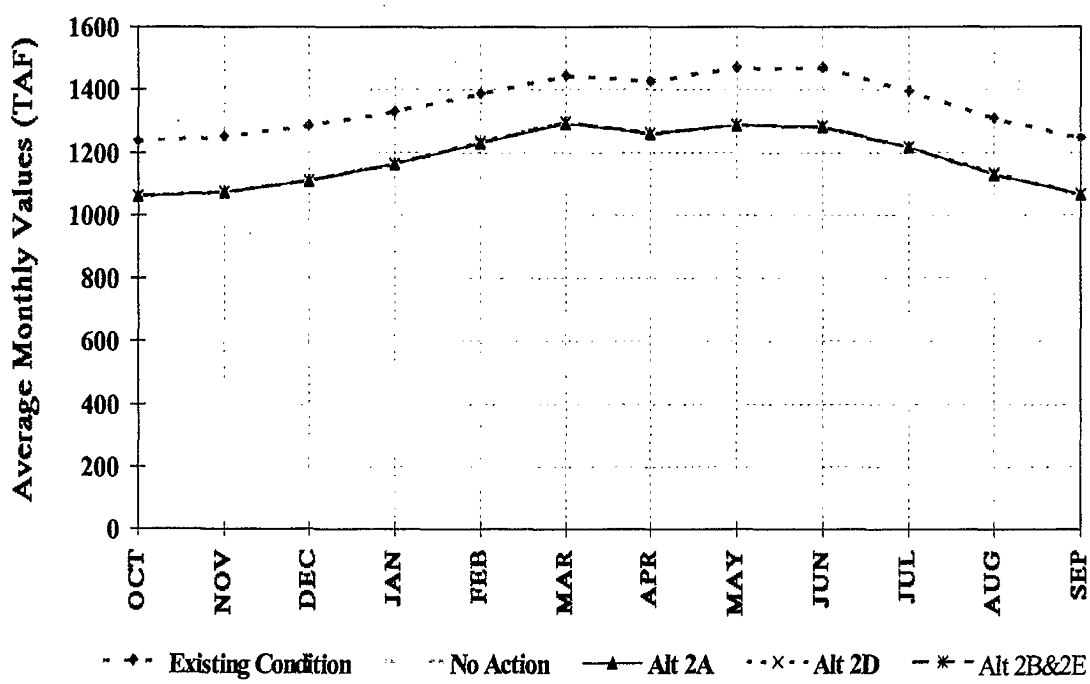


Figure 79. Average Monthly End of Month Storage at New Melones

Comparison of Melones Storage under Various Delta Alternatives Long Term(73 Year) Averages



Comparison of Melones Storage under Various Delta Alternatives Critical Period Averages

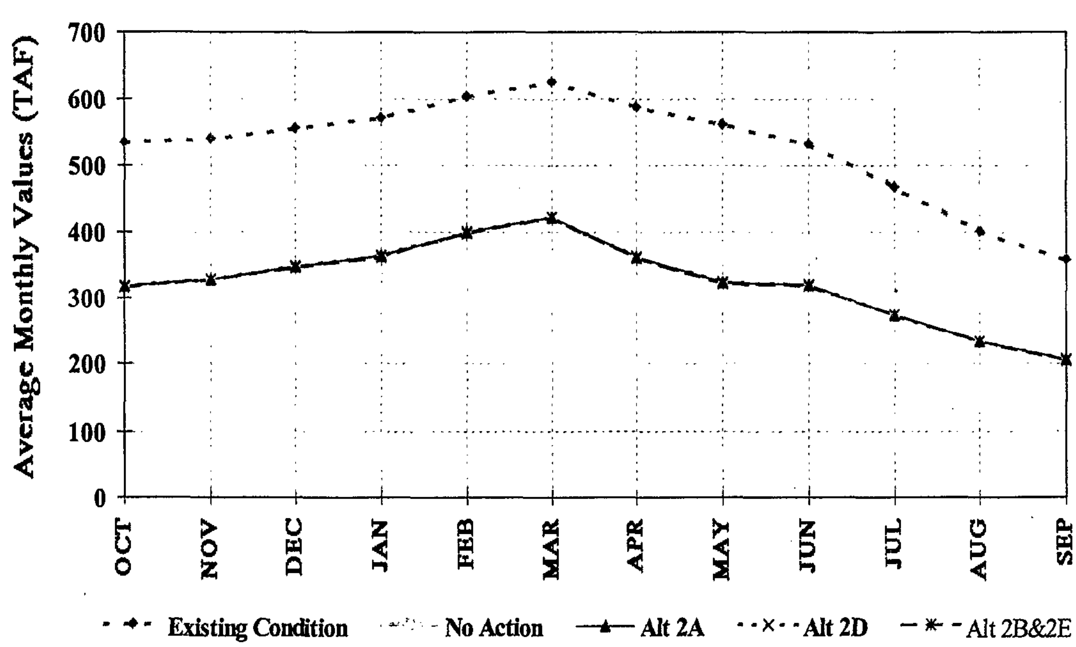
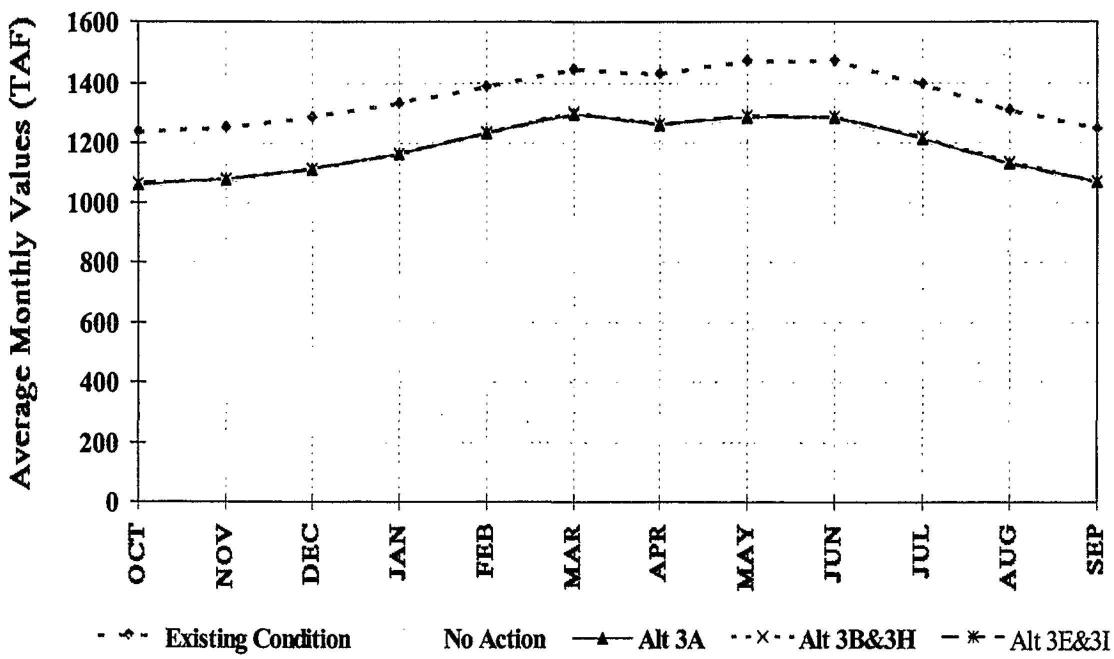


Figure 80. **Average Monthly End of Month Storage at New Melones**

Comparison of Melones Storage under Various Delta Alternatives Long Term (73 Year) Averages



Comparison of Melones Storage under Various Delta Alternatives Critical Period Averages

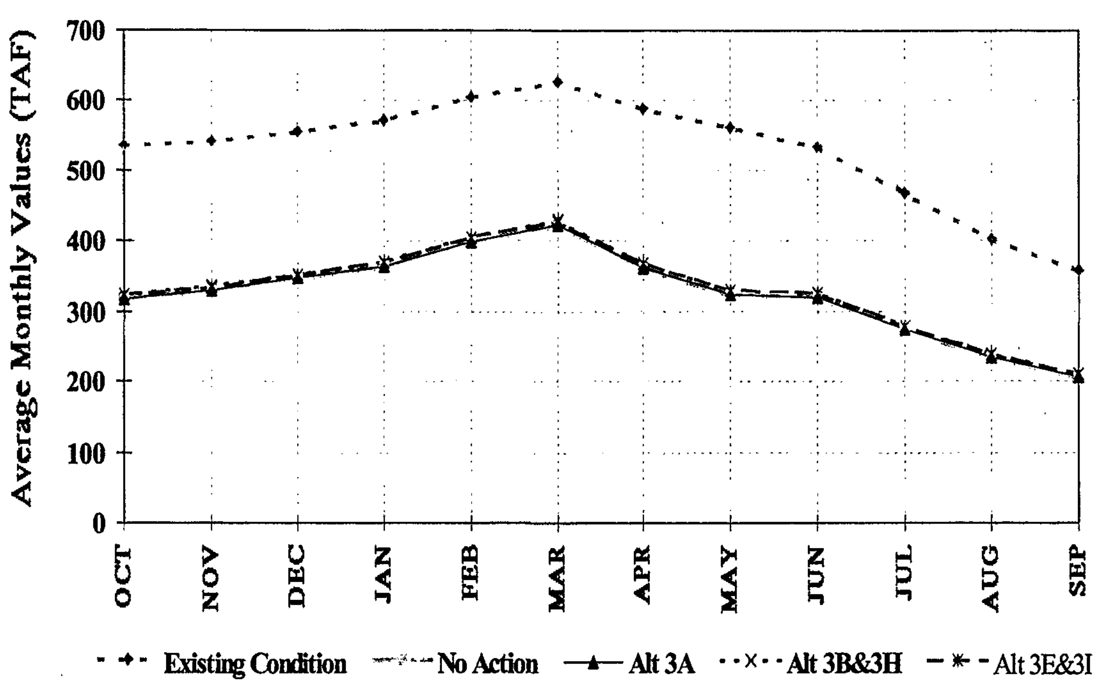
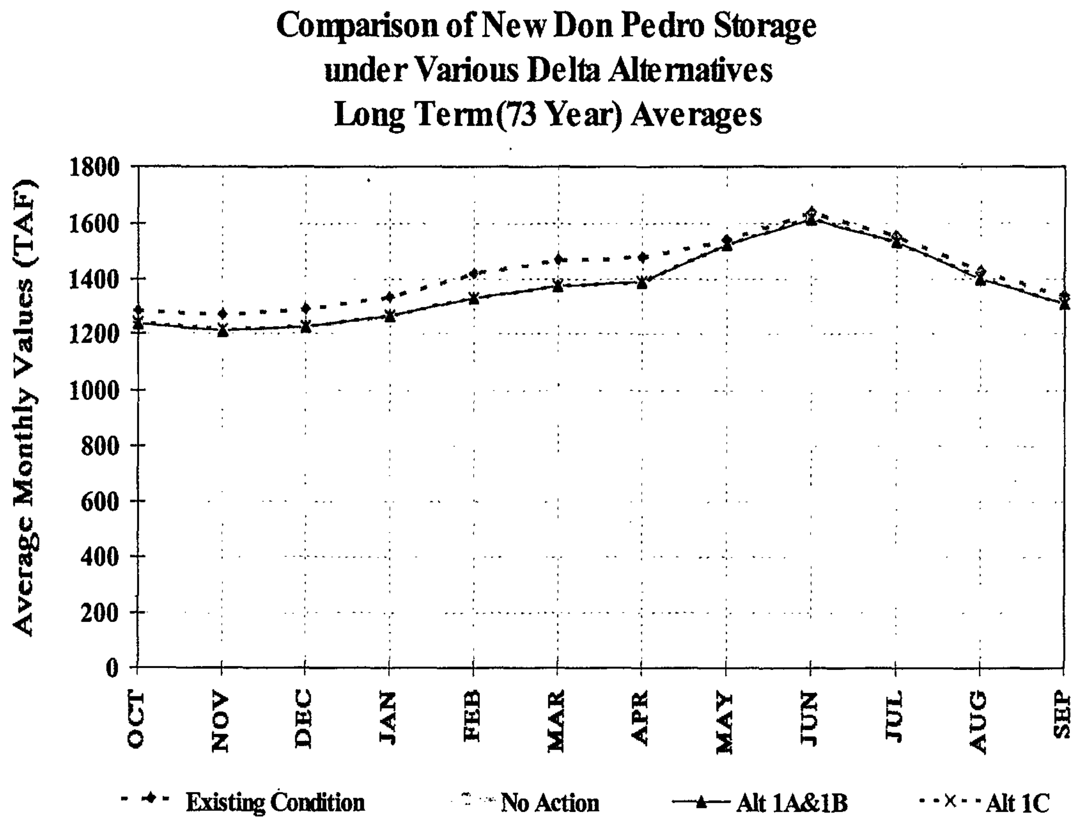


Figure 81. **Average Monthly End of Month Storage at New Melones**



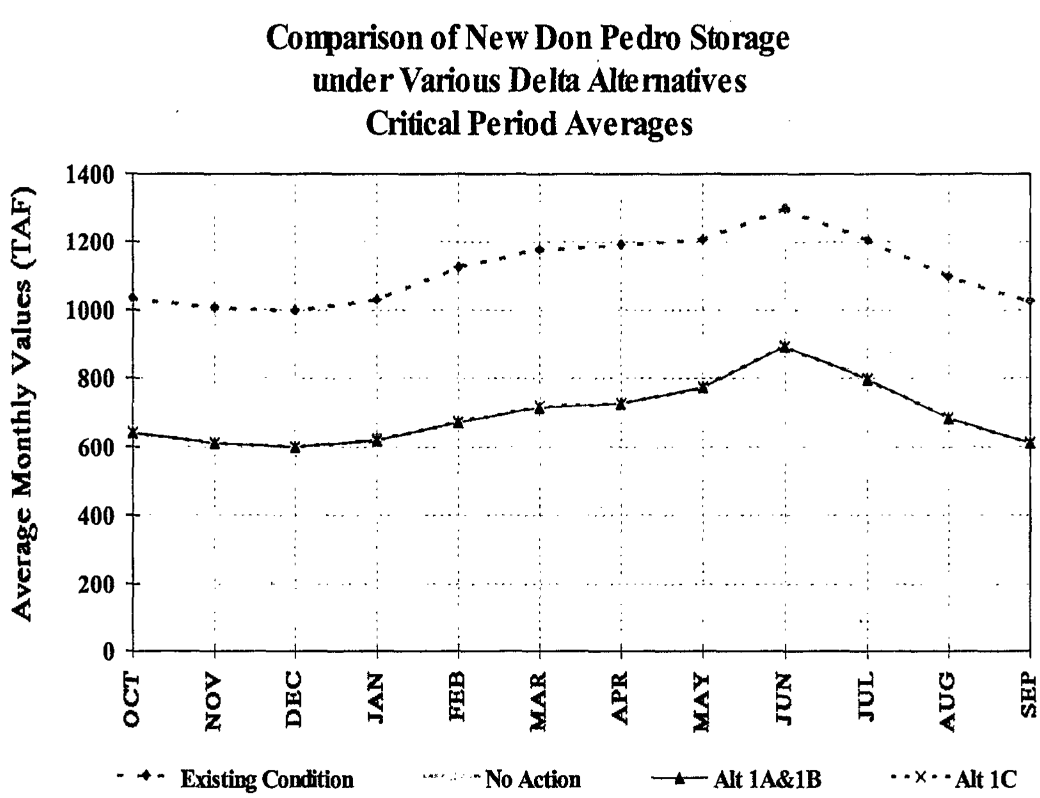
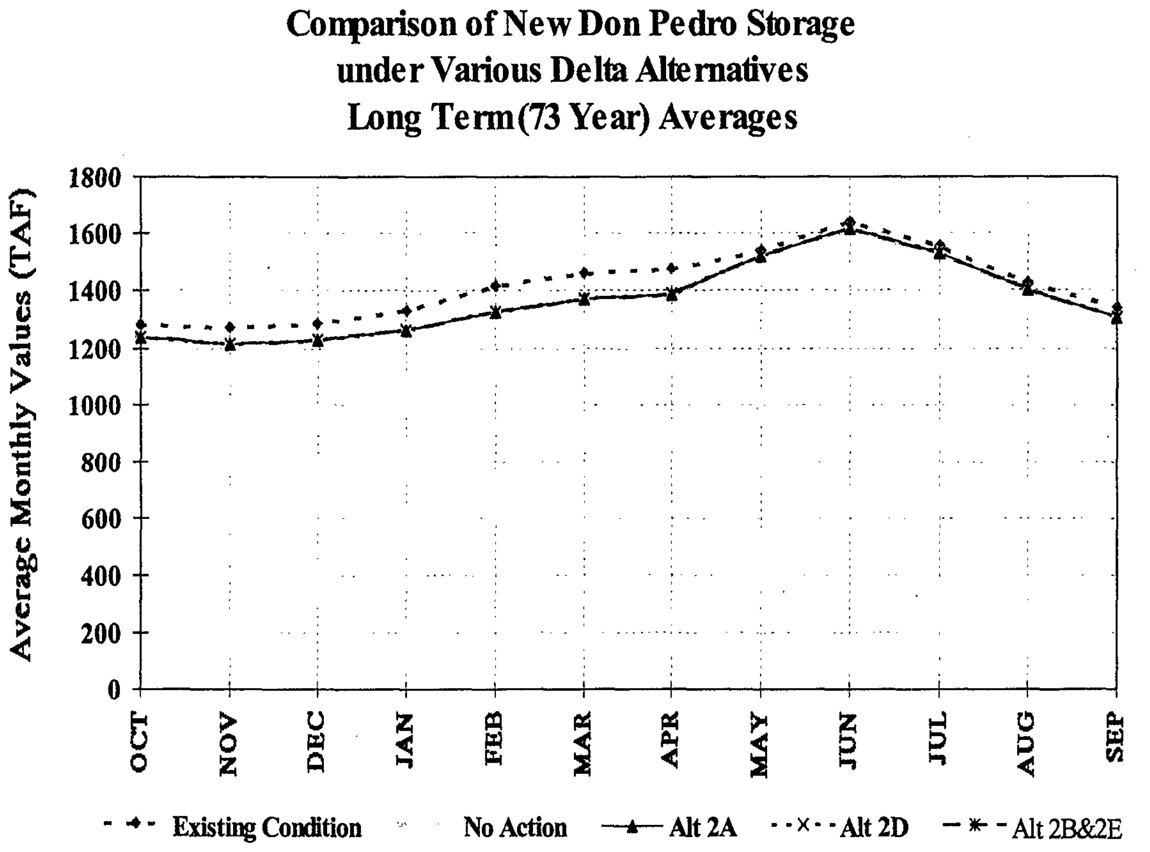


Figure 82. **Average Monthly End of Month Storage at New Don Pedro**



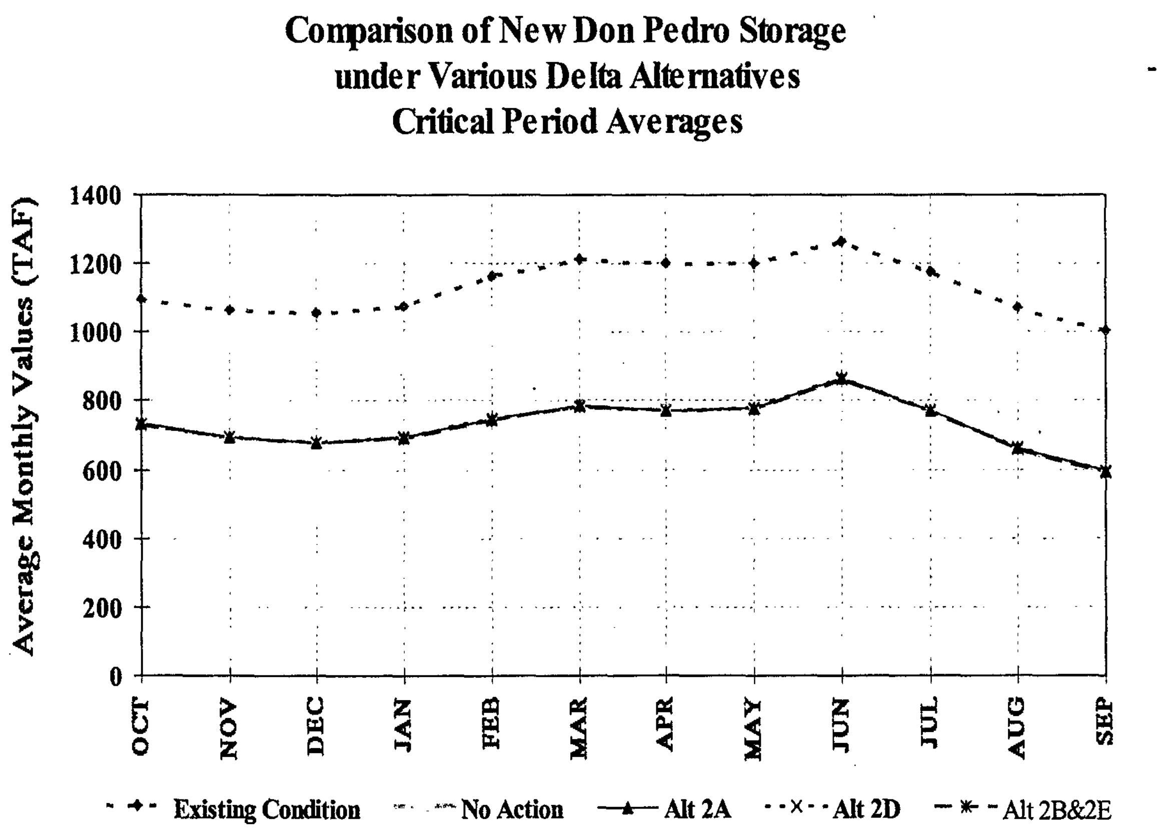
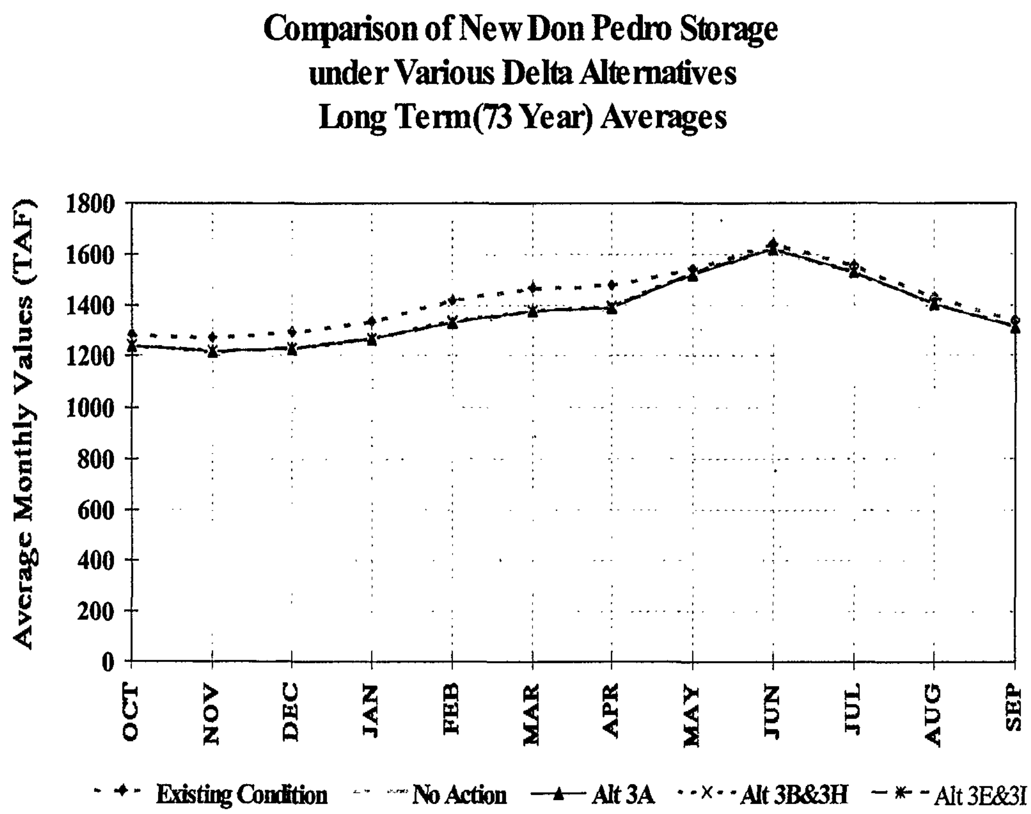


Figure 83. **Average Monthly End of Month Storage at New Don Pedro**



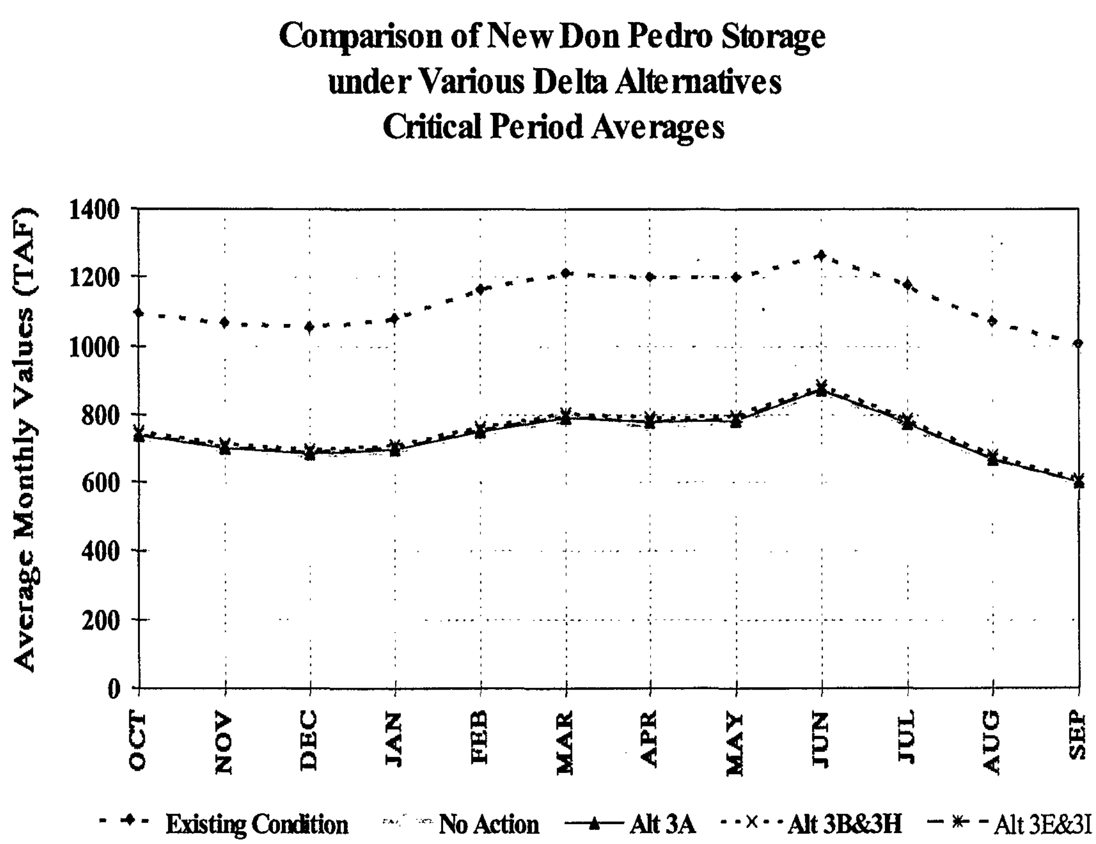
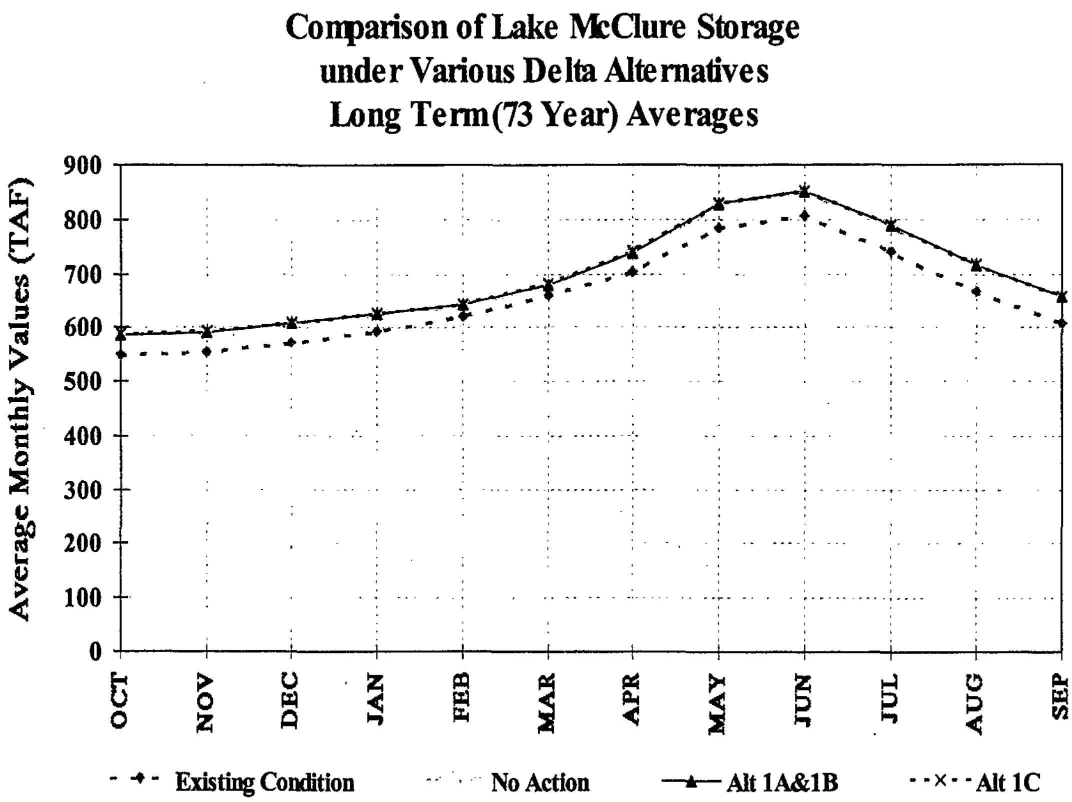


Figure 84. Average Monthly End of Month Storage at New Don Pedro



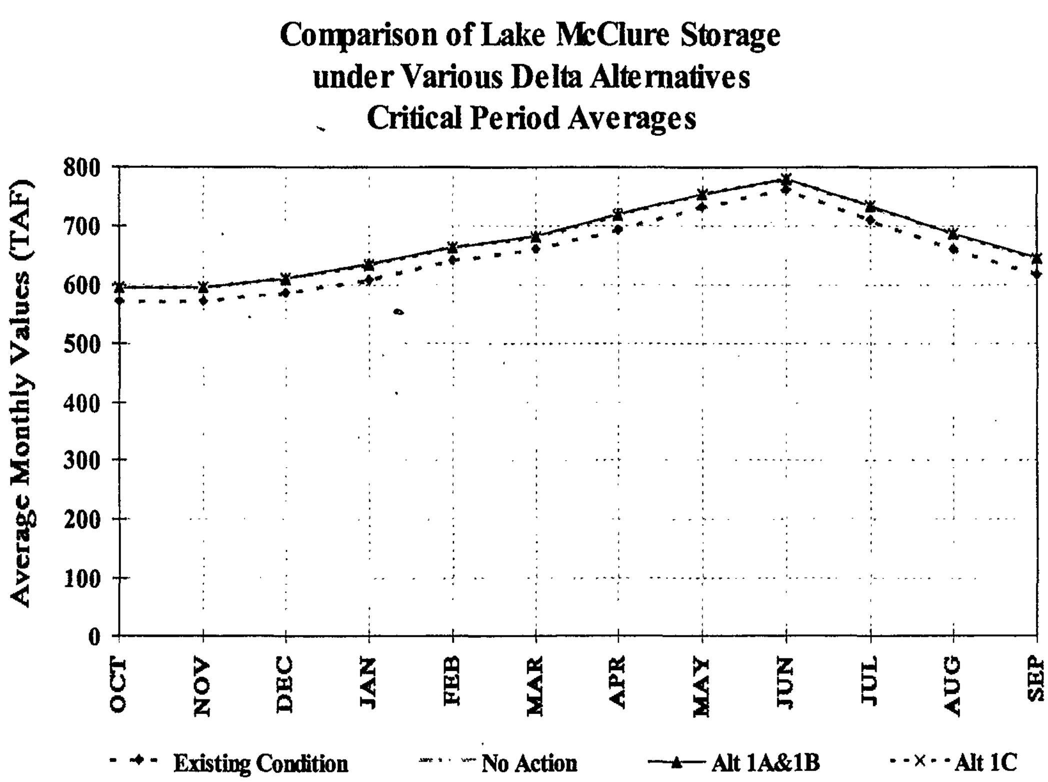
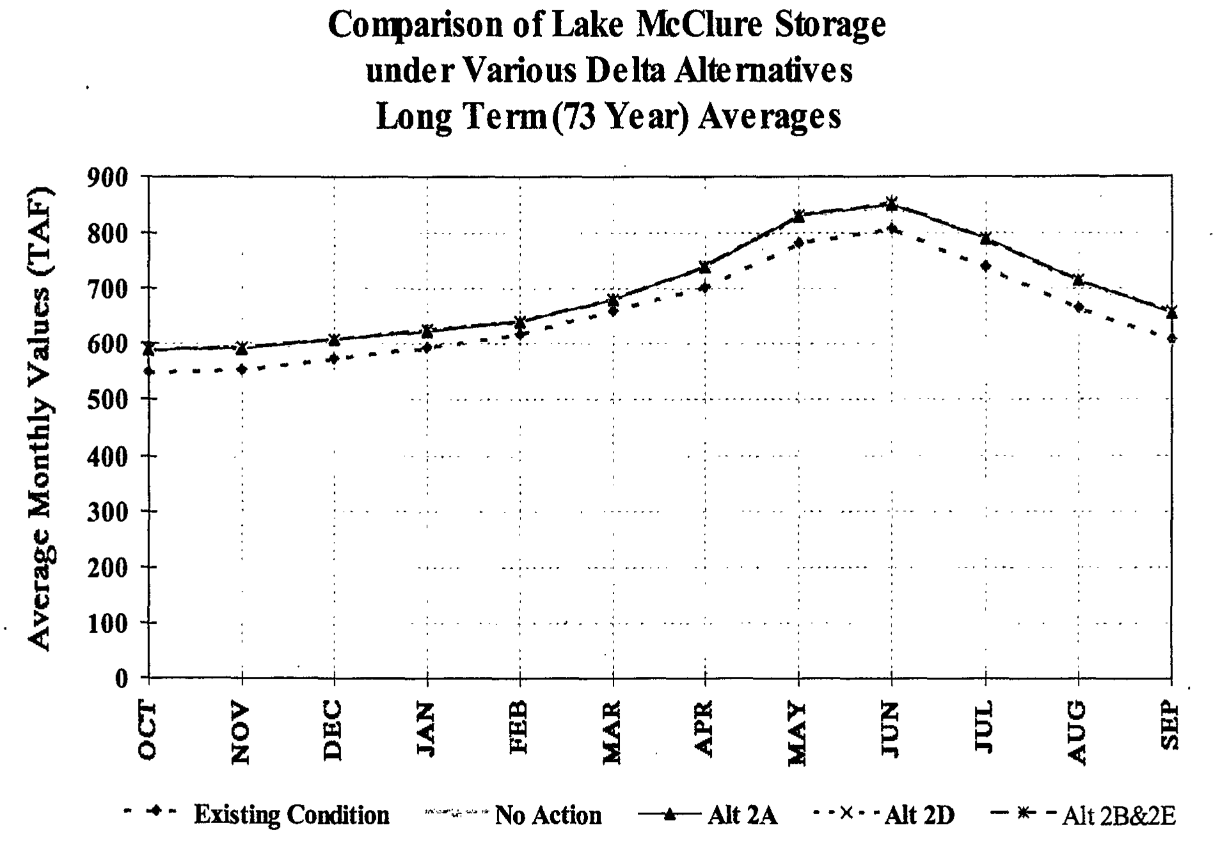


Figure 85. Average Monthly End of Month Storage at Lake McClure



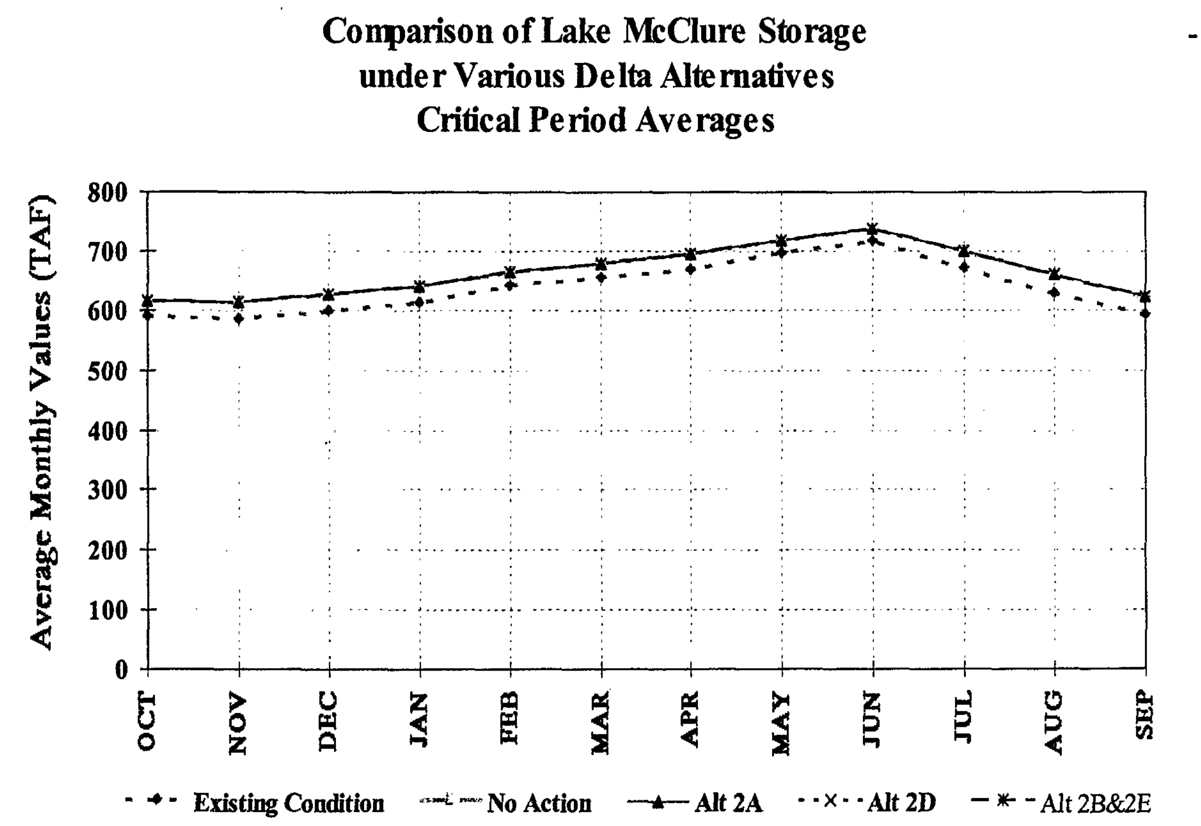
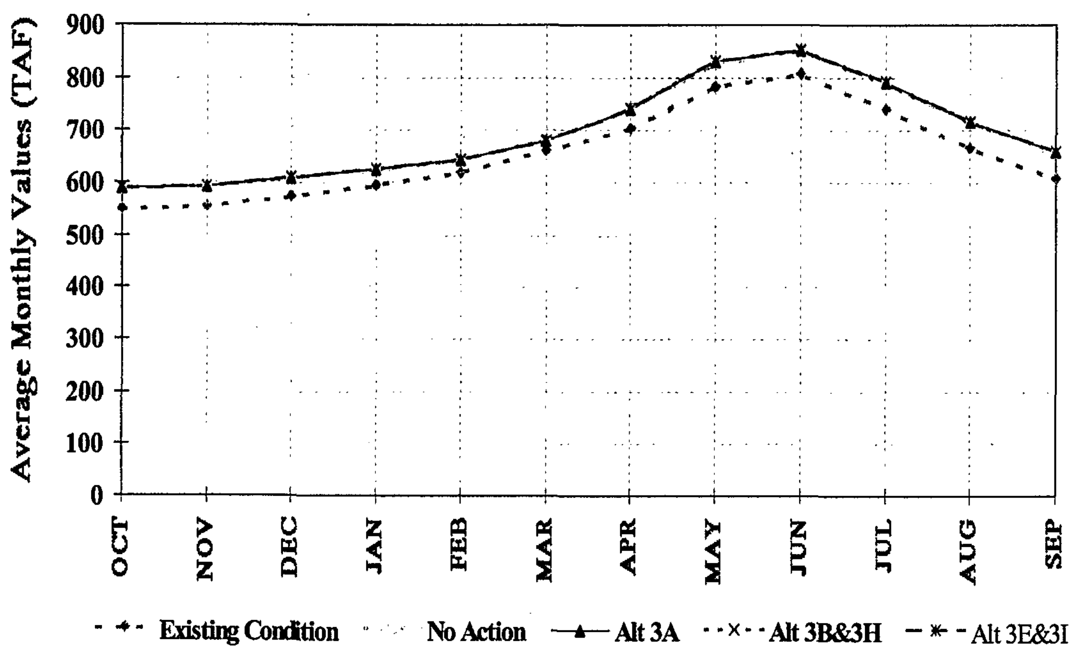


Figure 86. **Average Monthly End of Month Storage at Lake McClure**

Comparison of Lake McClure Storage under Various Delta Alternatives Long Term (73 Year) Averages



Comparison of Lake McClure Storage under Various Delta Alternatives Critical Period Averages

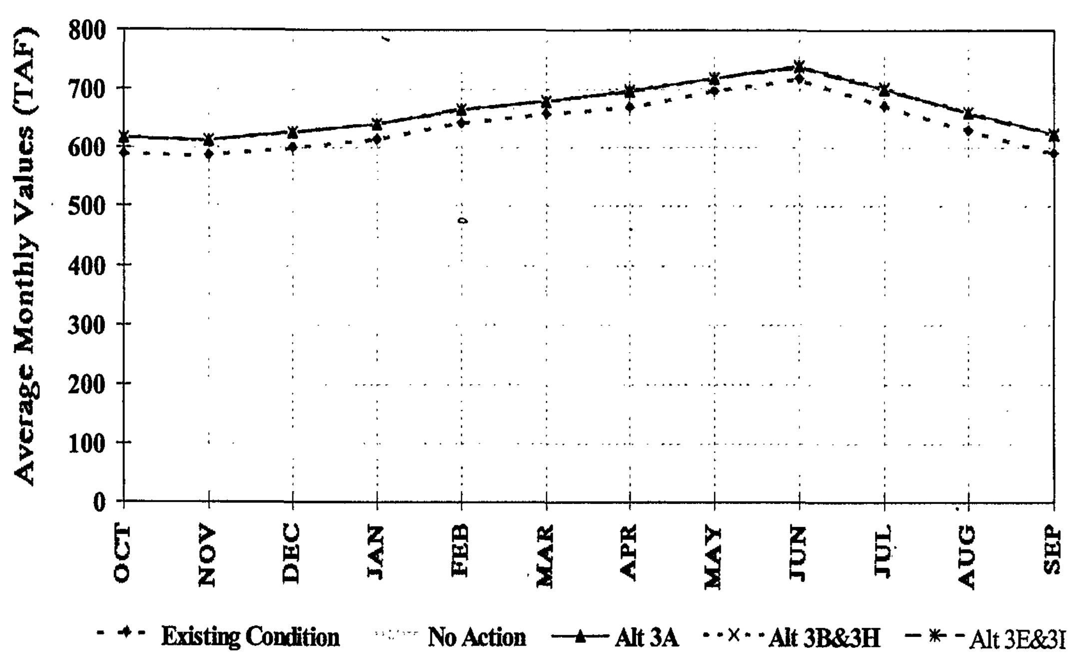
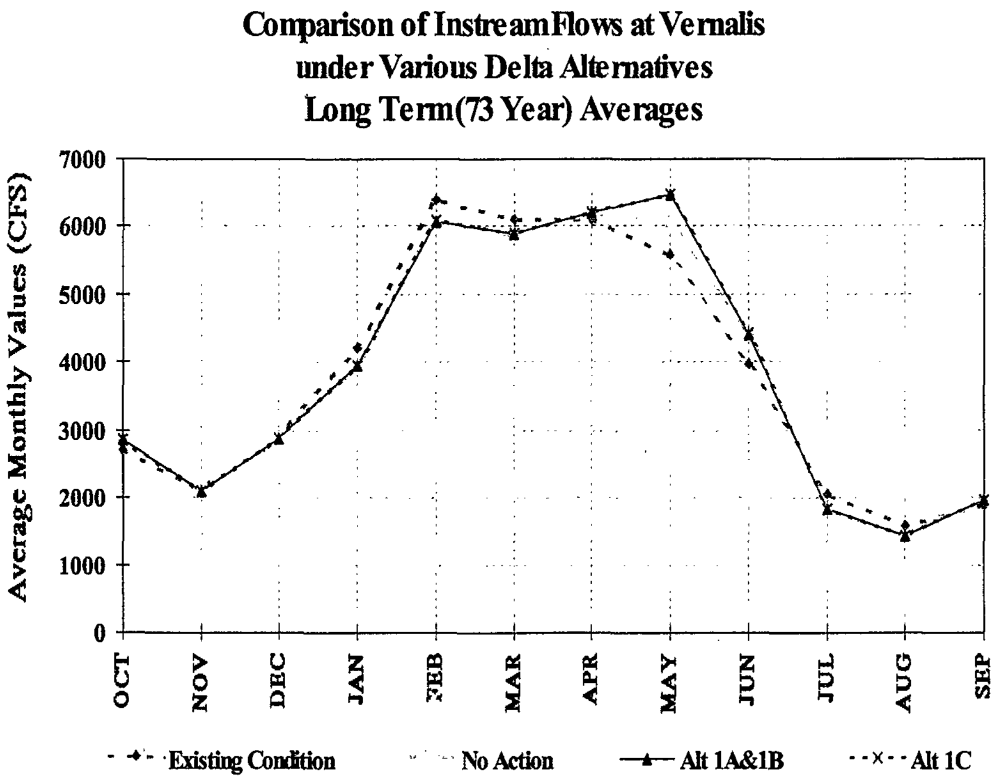


Figure 87. **Average Monthly End of Month Storage at Lake McClure**



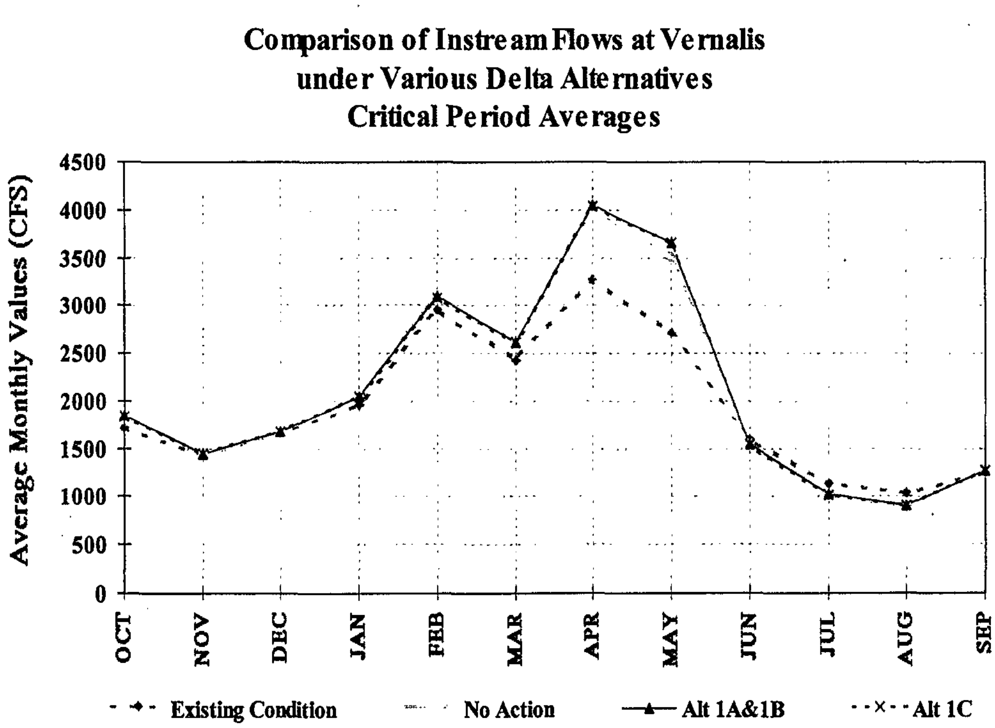
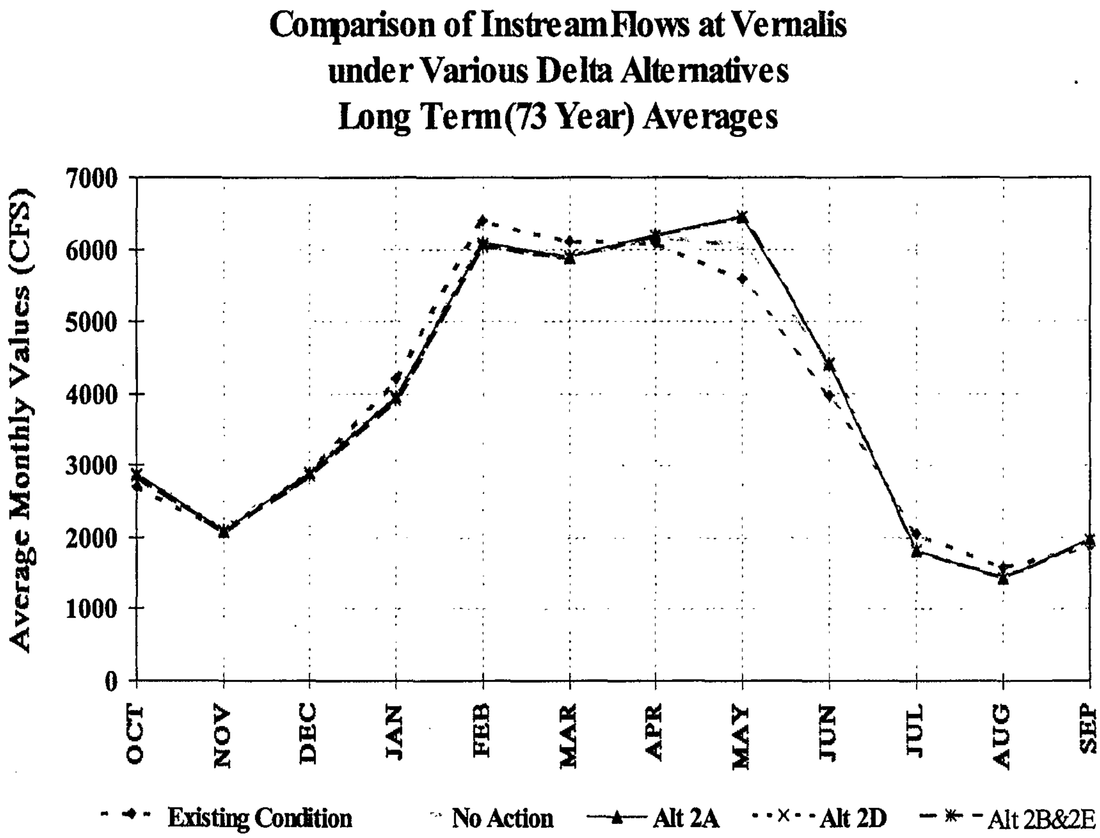


Figure 88. Average Monthly Instream Flows at Vernalis



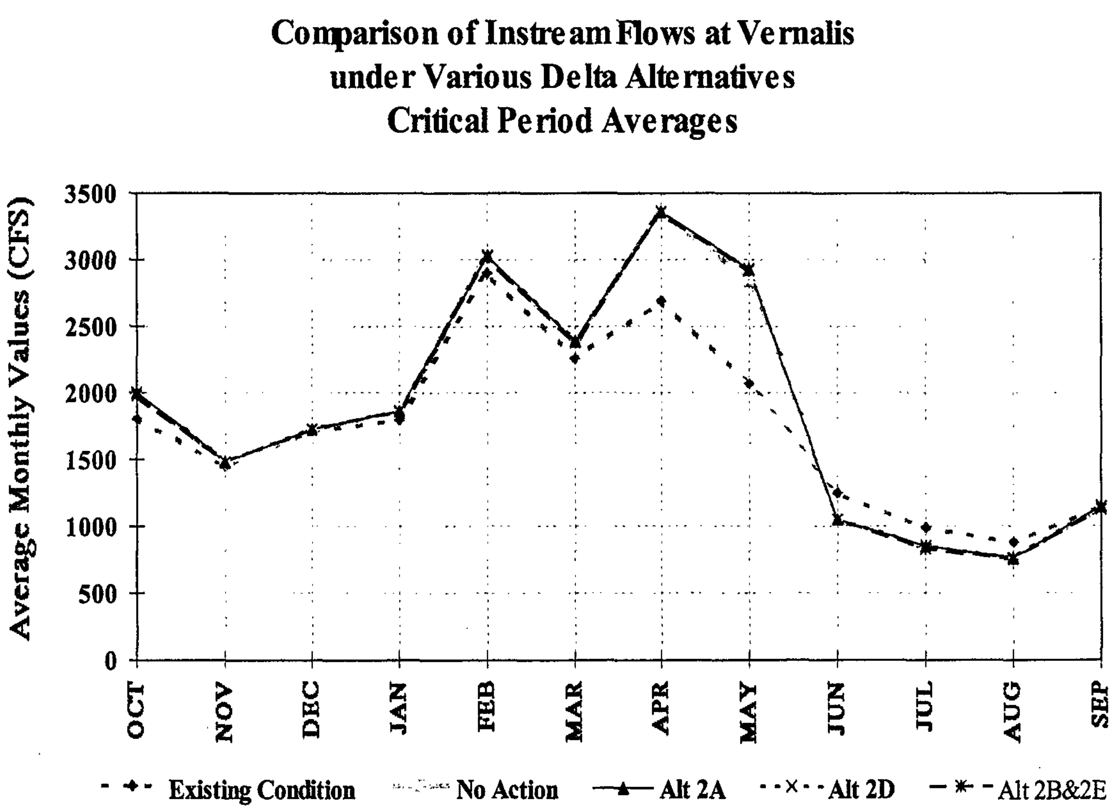
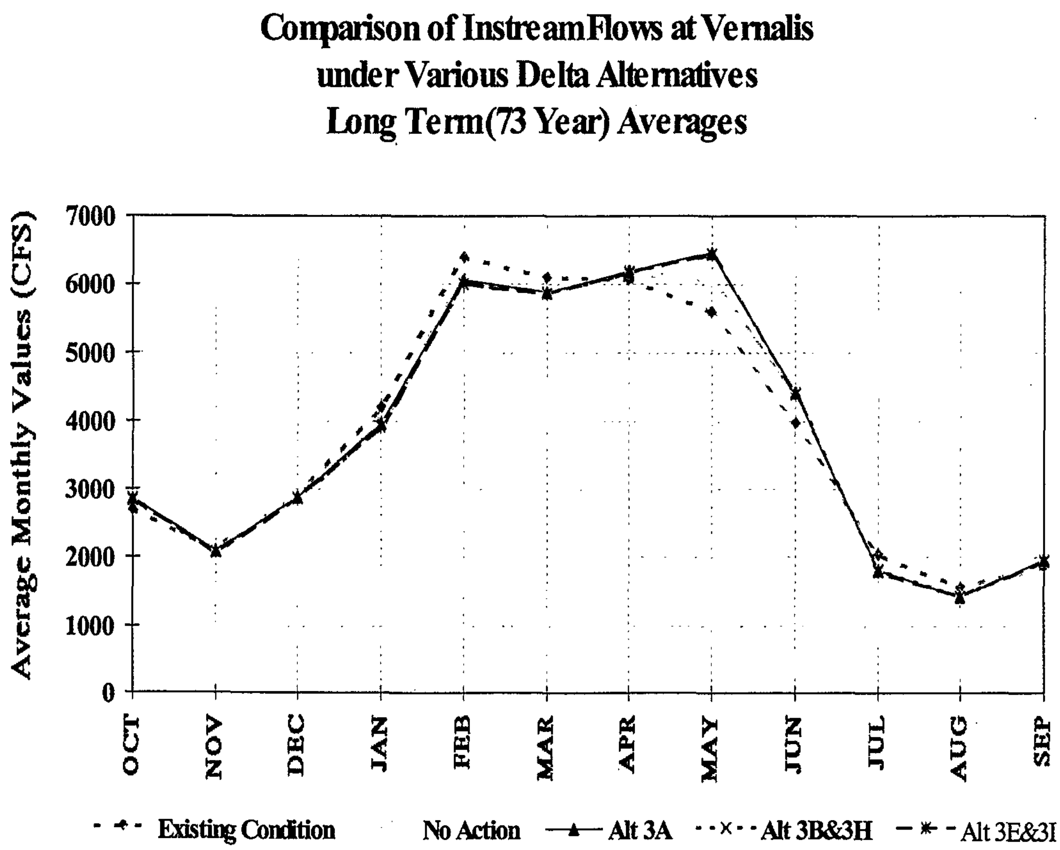


Figure 89. Average Monthly Instream Flows at Vernalis



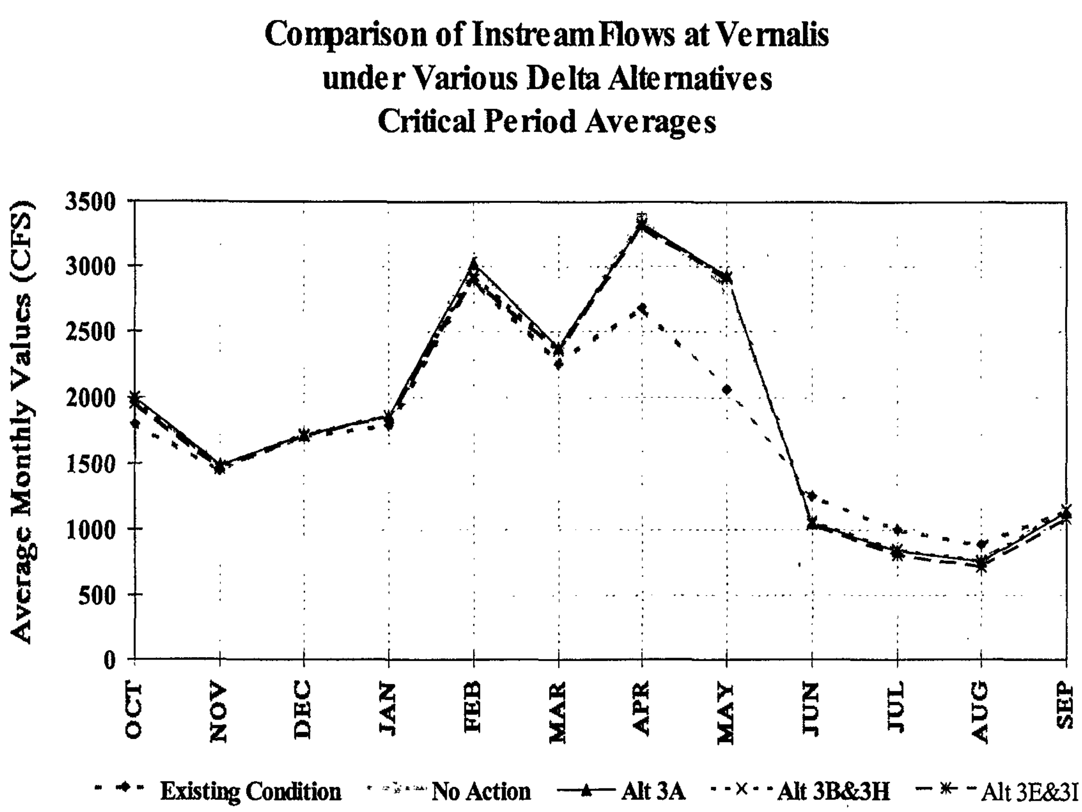
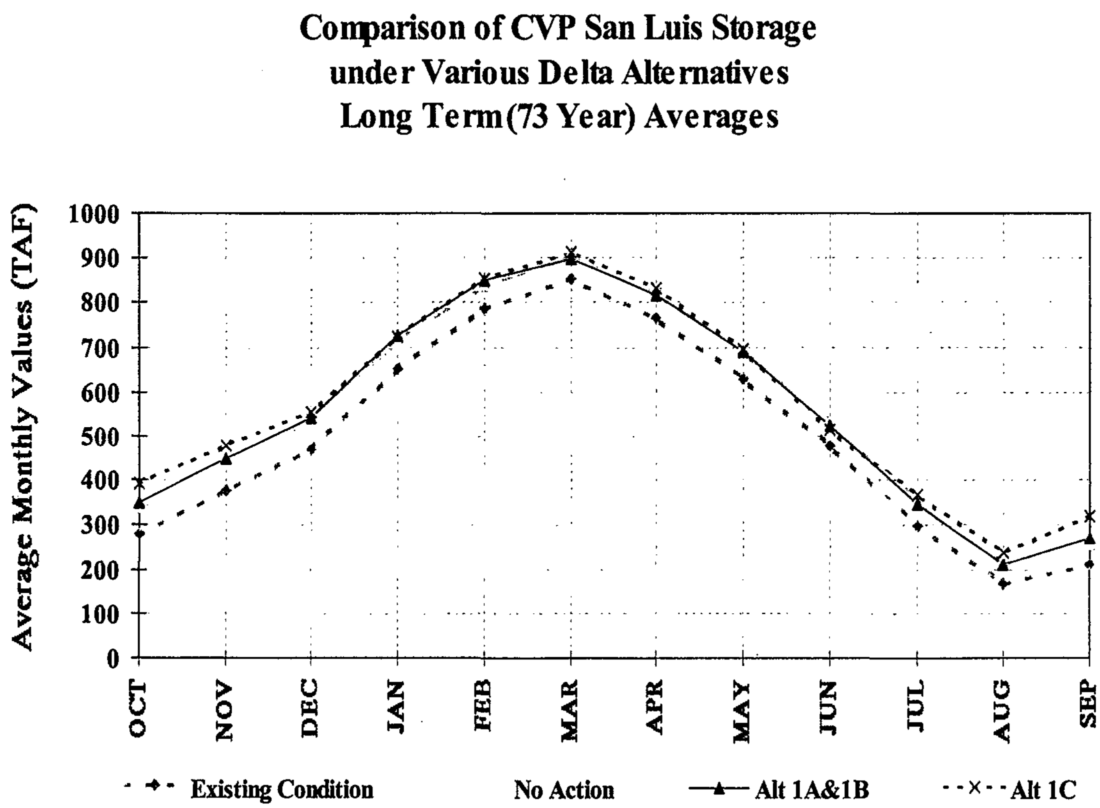


Figure 90. Average Monthly Instream Flows at Vernalis



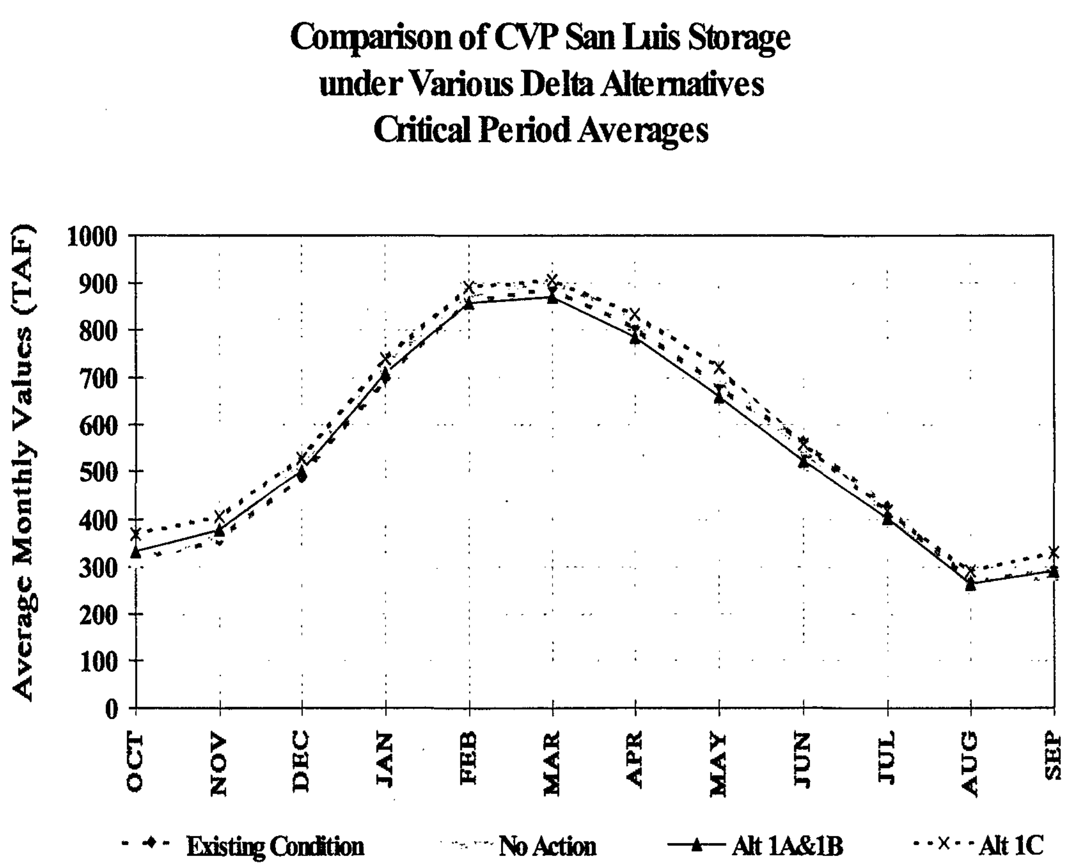
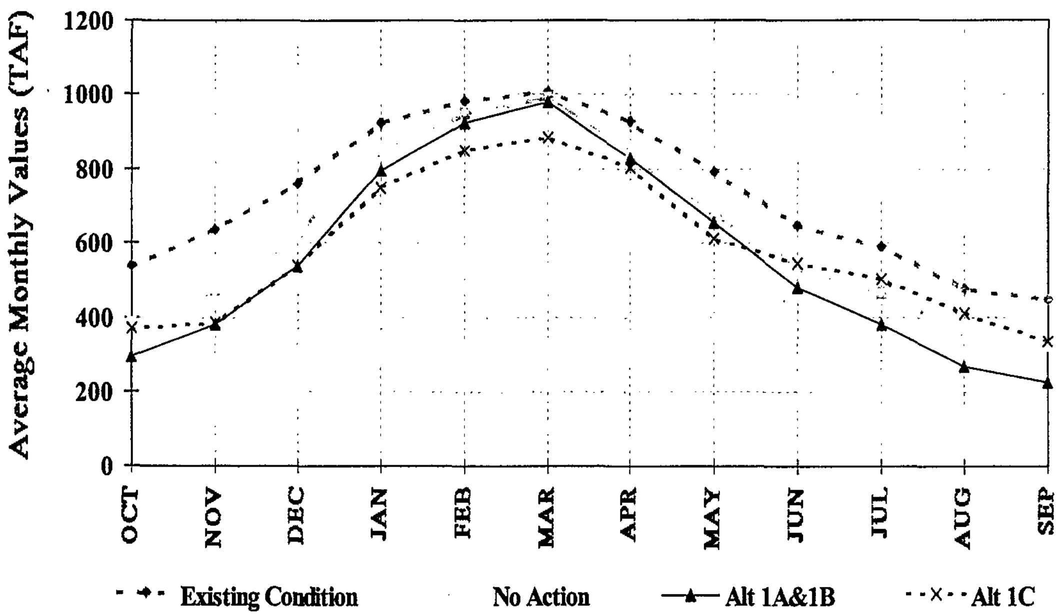


Figure 91. **Average Monthly End of Month Storage at CVP San Luis Reservoir**

Comparison of SWP San Luis Storage under Various Delta Alternatives Long Term(73 Year) Averages



Comparison of SWP San Luis Storage under Various Delta Alternatives Critical Period Averages

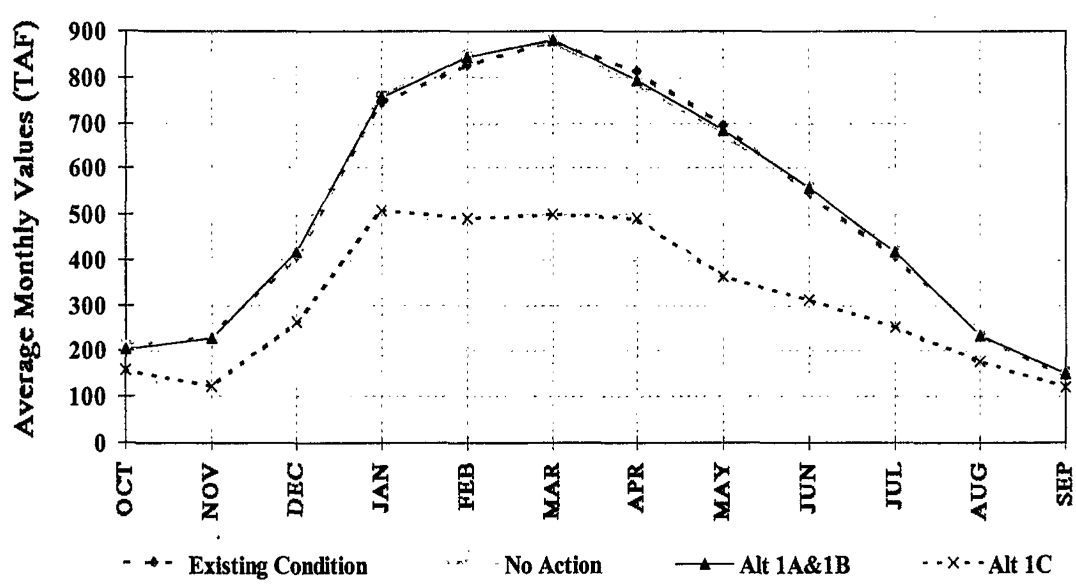
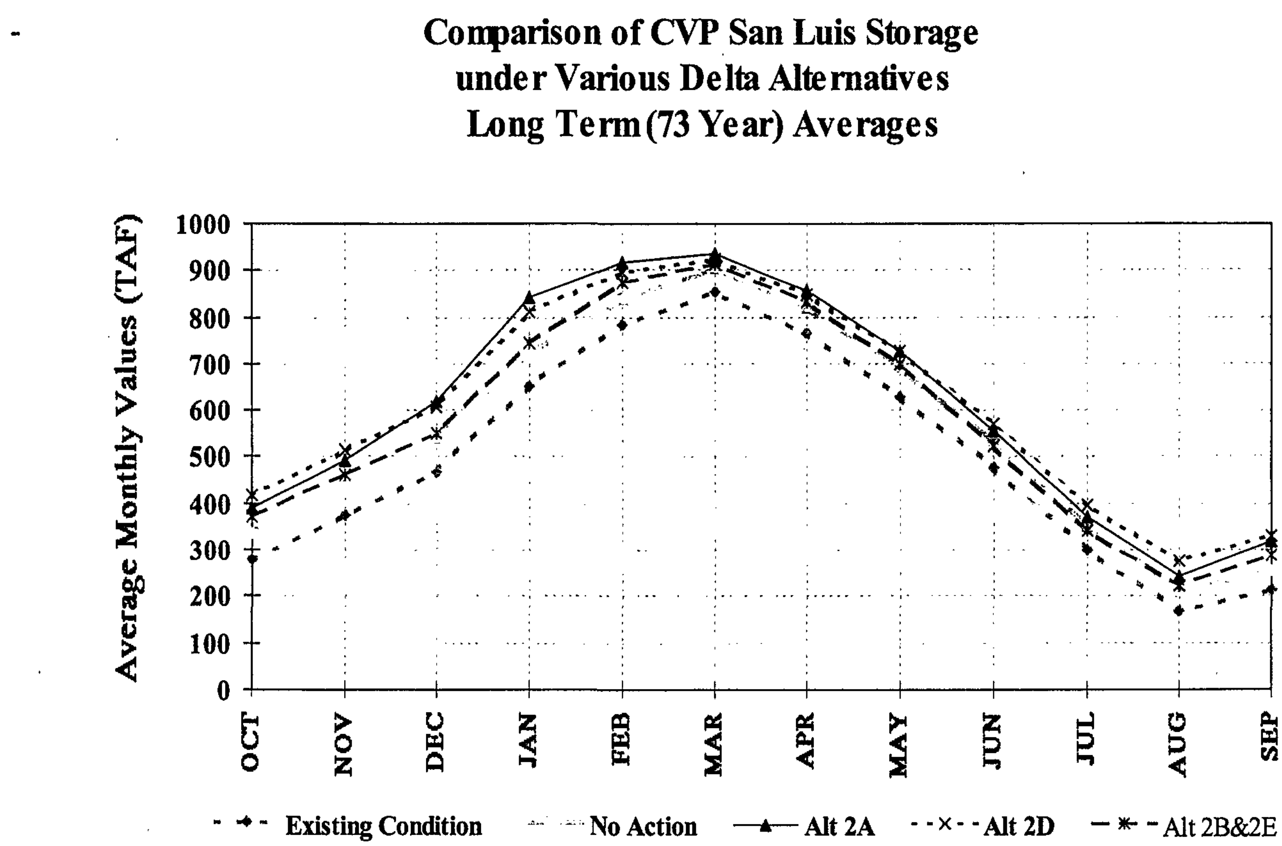


Figure 92. Average Monthly End of Month Storage at SWP San Luis Reservoir



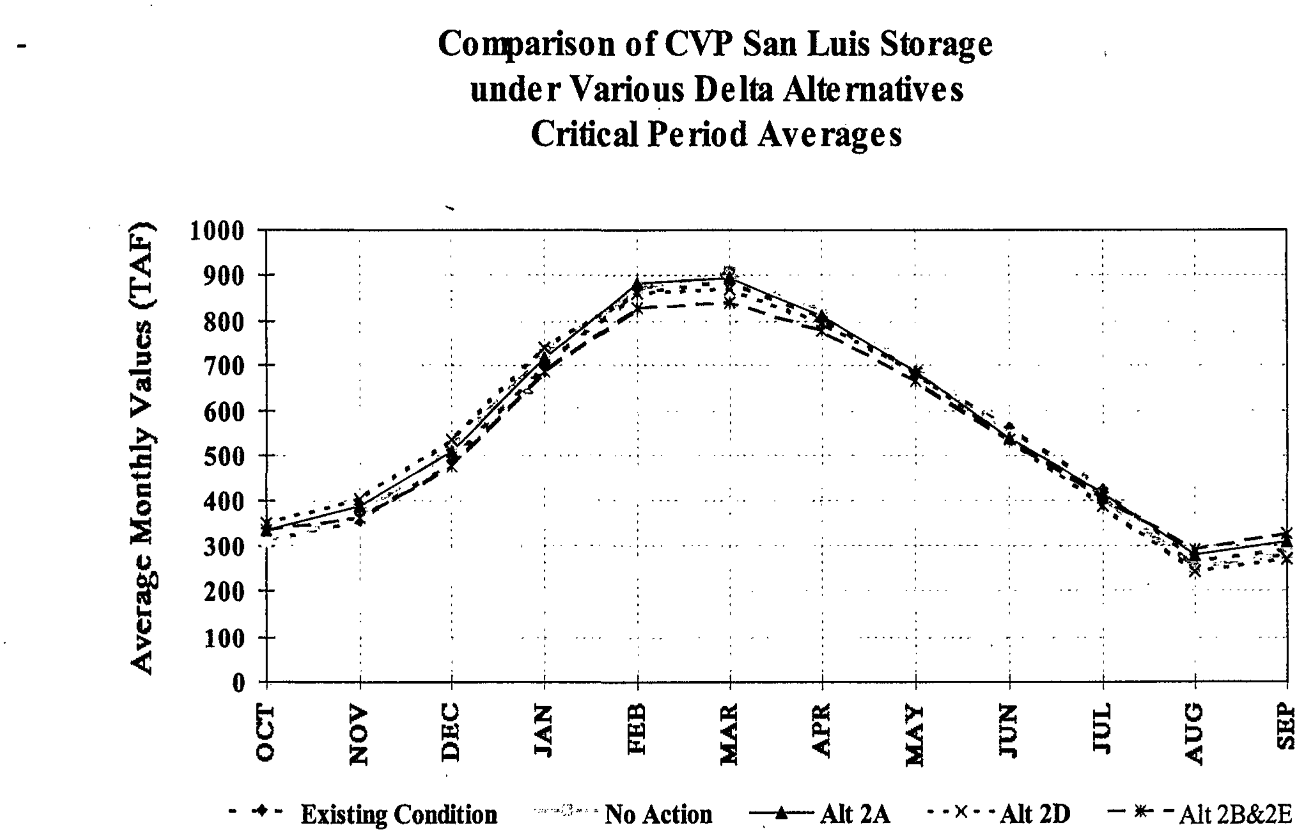
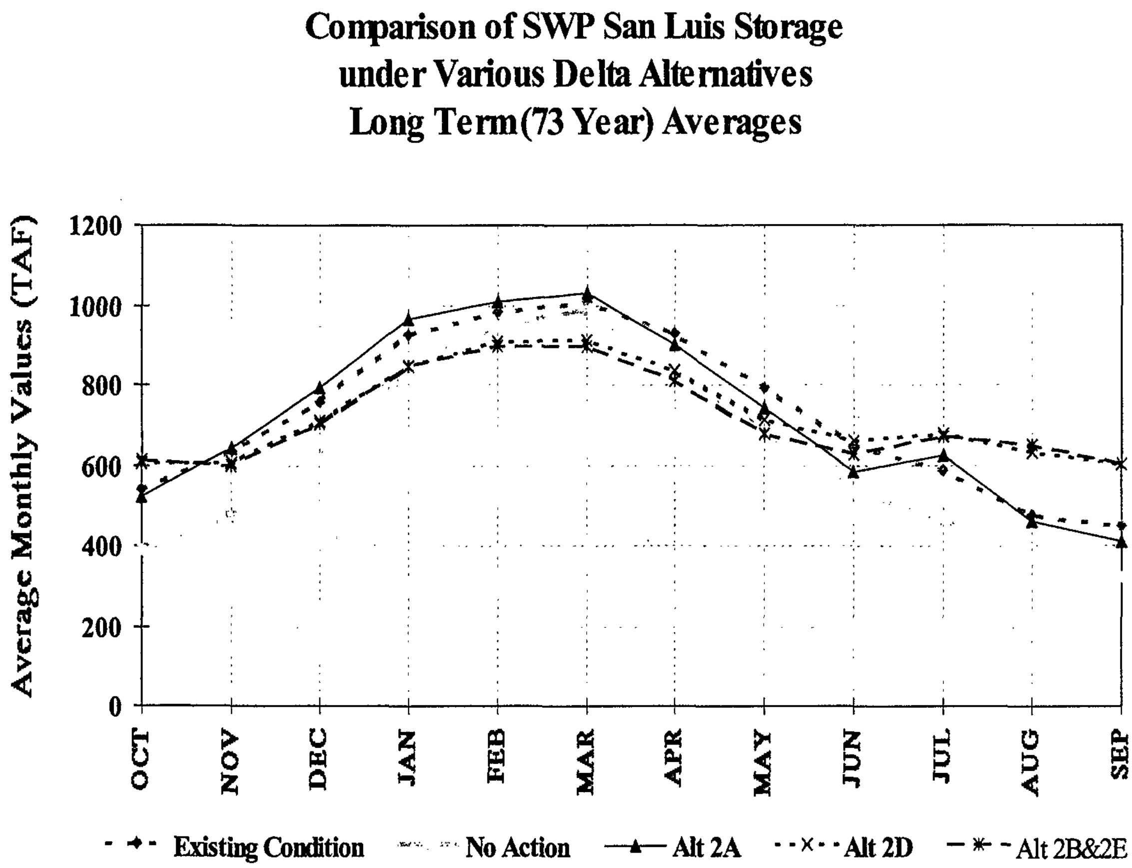


Figure 93. **Average Monthly End of Month Storage at CVP San Luis Reservoir**



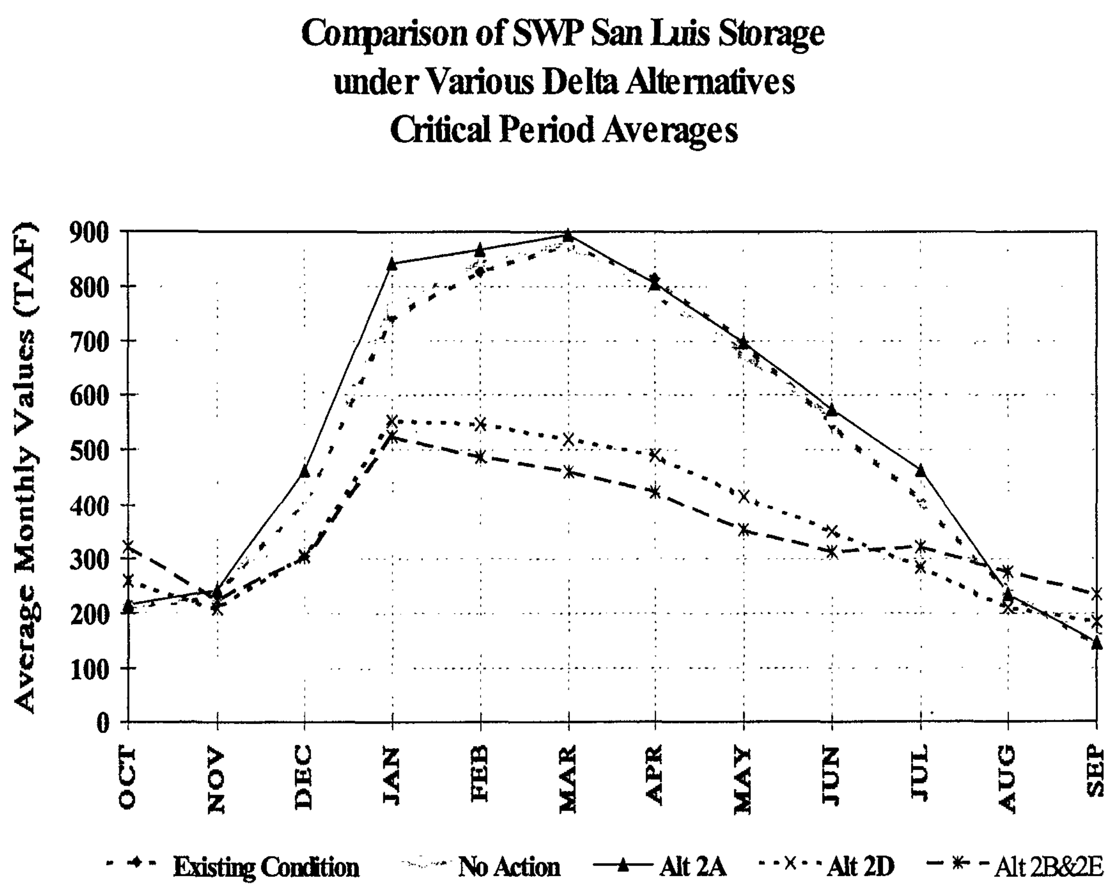
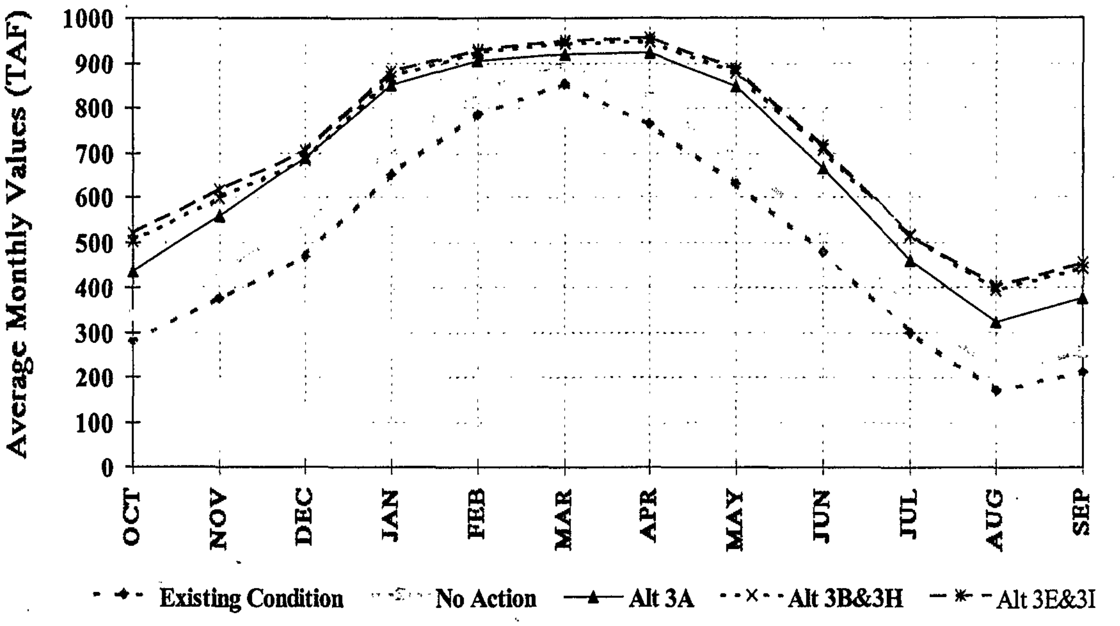


Figure 94. Average Monthly End of Month Storage at SWP San Luis Reservoir

Comparison of CVP San Luis Storage under Various Delta Alternatives Long Term (73 Year) Averages



Comparison of CVP San Luis Storage under Various Delta Alternatives Critical Period Averages

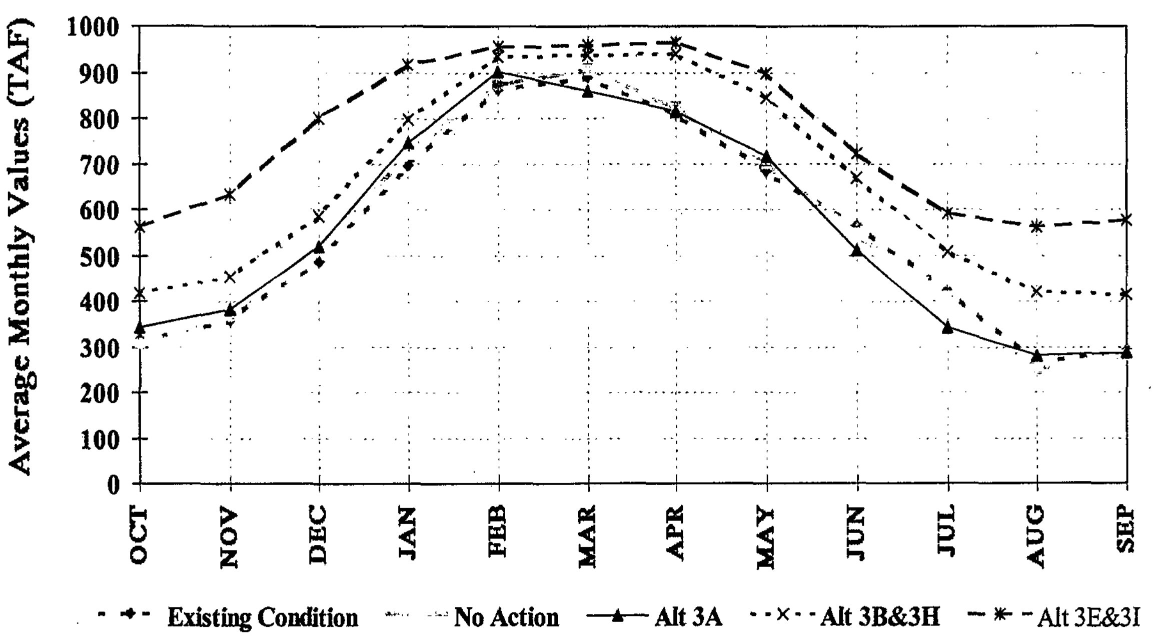
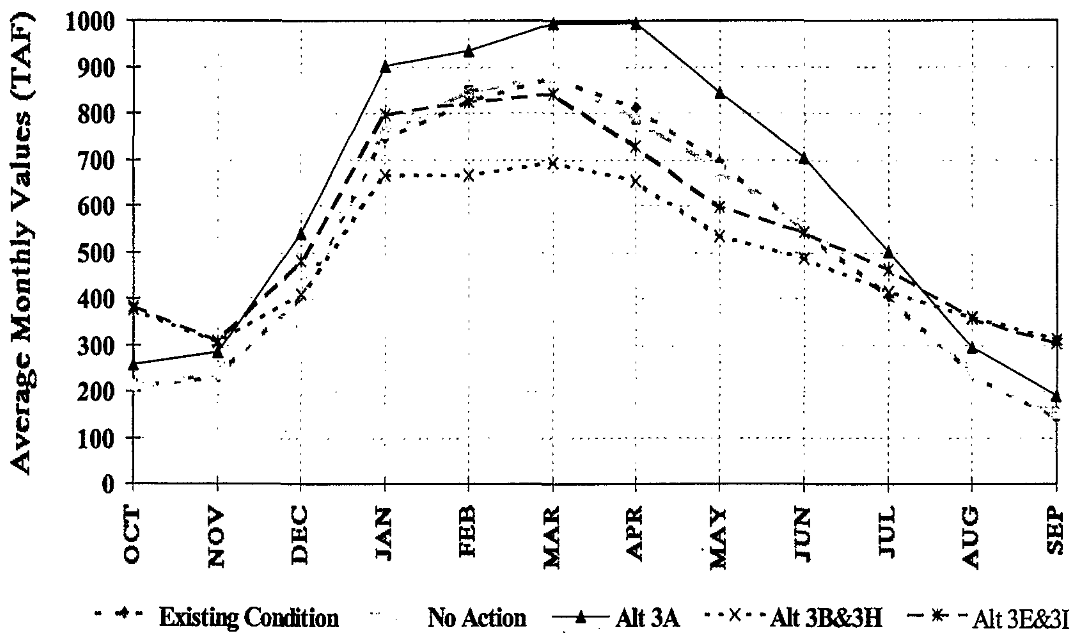


Figure 95. **Average Monthly End of Month Storage at CVP San Luis Reservoir**

Comparison of SWP San Luis Storage under Various Delta Alternatives Critical Period Averages



Comparison of SWP San Luis Storage under Various Delta Alternatives Long Term (73 Year) Averages

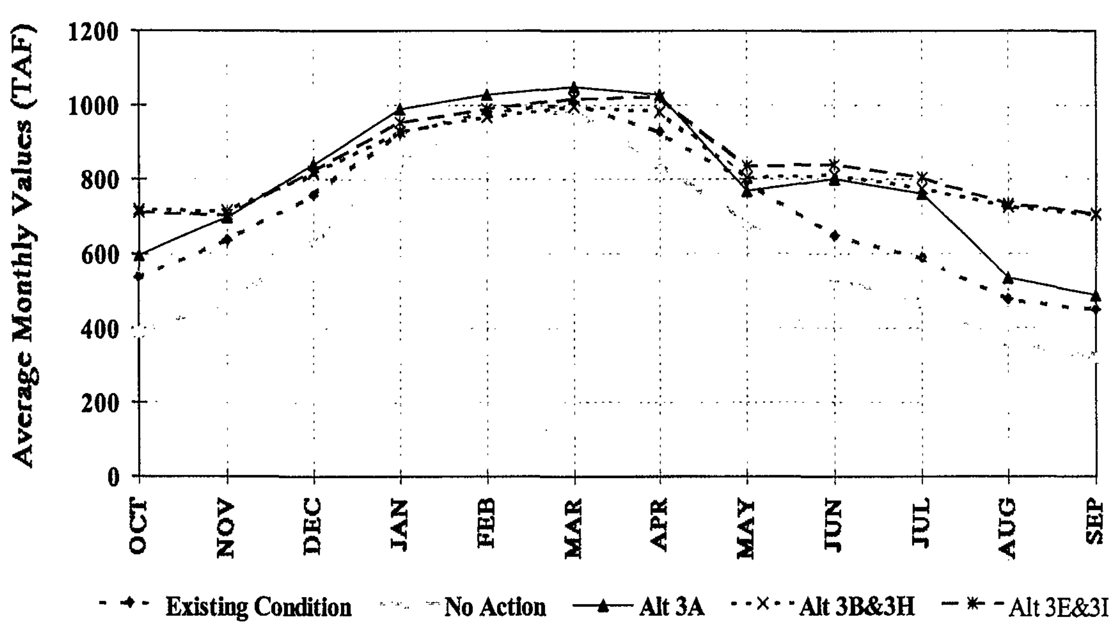


Figure 96. Average Monthly End of Month Storage at SWP San Luis Reservoir

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