Appendix B
Operation Analysis and Water Quality Modeling

CCWD Alternative Intake Project, California
Special Study Report

Prepared by

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ABBREVIATIONS AND ACRONYMS

AIP	Alternative Intake Project
CALFED	CALFED Bay-Delta Program
CCWD	Contra Costa Water District
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CVP	Central Valley Project
Delta	Sacramento-San Joaquin Delta
DWM2	Delta Simulation Model
DWR	California Department of Water Resources
E/I	export/import
EBMUD	East Bay Municipal Utility District
EC	electrical conductivity
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ESA	Federal Endangered Species Act
MAF	million acre-feet
mg/L	milligram per liter
mS/cm	micro Siemens per centimeter
NEPA	National Environmental Policy Act
OCAP	Operation Criteria and Plan
ppm	parts per million
Reclamation	United States Department of the Interior, Bureau of Reclamation
SDIP	South Delta Improvements Program
SWRCB	State Water Resources Control Board
SWP	California State Water Project
TAF	thousands acre-feet
TM	Technical Memorandum
TWSA	treated water service area
WTP	Water Treatment Plant

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Appendix B Operations Analysis and Water Quality Modeling

As part of the Alternative Intake Project (AIP) Environmental Impact Statement/Environmental Impact Report (EIR/EIS) (Contra Costa Water District and United States Department of the Interior, Bureau of Reclamation, 2006a), system operations, hydrodynamic, and water quality modeling were completed for multiple alternative plans. The AIP Special Study Report retained two plans from the AIP EIR/EIS and added a third alternative to be evaluated, in addition to the No-Action Alternative. This Appendix summarizes modeling assumptions, analysis, and results from the AIP EIR/EIS, and also presents model assumptions and results for the added third alternative. The purpose of this modeling effort is to evaluate and compare the potential for water supply reliability, fisheries, and water quality benefits for each of the project alternatives. This Appendix draws substantially from work already published by CCWD as part of the AIP EIR/EIS.

Alternative Plans

This section describes a set of four alternative plans that were formulated and retained for further development based on the screened resource management measures discussed in Chapter 3 of the AIP Special Study Report. These plans include the No-Action Plan (i.e., future-without-Project) and three alternative plans, 1 through 3. It should be noted that the order in which the plans appear, is not indicative of their performance or standing.

No-Action Plan

The No-Action Plan (i.e., future-without-Project) would entail Contra Costa Water District (CCWD) continuing to operate and maintain its existing facilities to maximize delivered water quality consistent with environmental regulations and permit conditions. As a result of projected future levels of demand, the No-Action Plan includes the expansion of the Old River pump station to 320 cubic feet per second (cfs) consistent with the CCWD Future Water Supply Implementation EIR (CCWD, 1998).

Alternative Plan 1

Plan 1 would preserve CCWD's existing intakes and add a new intake location on Victoria Canal. The new intake on Victoria Canal would protect and improve delivered water quality for CCWD customers by enabling CCWD to relocate some of its existing diversions at the Old River intake to Victoria Canal, a Delta location with better source water quality at certain times of the year than is currently available at Old River. Victoria Canal connects the Middle River and Old River.

Alternative Plan 2

Plan 2 would install desalination treatment processes to reduce salinity and improve the quality of supplies delivered from Bollman Water Treatment Plant (WTP). It would also reduce overall demands on the Rock Slough unscreened intake by increasing diversions through the screened Mallard Slough intake. The plan would require the expansion of the existing Mallard Slough intake and pump station, as well as treatment capacity expansion for the desalination plant. This expansion would serve the demands of the treated water service area (TWSA) customers currently served by the Bollman WTP. It would also reduce overall demands on the Contra Costa Canal, such that the canal would primarily serve CCWD's untreated-water customers.

Alternative Plan 3

Plan 3 would relocate the existing CCWD Rock Slough intake to a new location on Middle River, opposite Bacon Island, that provides better water quality. The plan would involve building a new screened intake and pump station on Middle River that would feed CCWD's exiting Pumping Plant No. 1 through a pipeline to the Contra Costa Canal entrance. To eliminate potential water quality deterioration in the Contra Costa Canal sections between Pumping Plant No. 1 and the canal entrance, this plan assumes that the Contra Costa Canal Encasement Project would be implemented and is part of the Future No-Action Plan. The new screened intake would contribute to overall reduction in fisheries mortality rates compared to the current unscreened intake on Rock Slough.

Modeling Methodology

Model Applications

Assessment of the project alternatives under consideration requires simulation of three key, interrelated systems: (1) the statewide operations of the Federal Central Valley Project (CVP) and California State Water Project (SWP); (2) the Sacramento-San Joaquin Delta (Delta); and (3) CCWD's local operations. Separate models are available for simulating each of these systems, and the information produced from each model can be integrated to assess the potential benefits of each alternative, and potential effects on CVP-SWP operations and the Delta environment.

For this study, statewide water resources operations are being simulated using CALSIM II, a model developed by United States Department of the Interior, Bureau of Reclamation (Reclamation) and California Department of Water Resources (DWR), for CVP and SWP planning studies. These operations influence and, at times, control flow in the Sacramento and San Joaquin river basins and the Delta. Average monthly river and channel flow output from CALSIM II is subsequently used as input to DWR's hydrodynamics/water quality model of the Delta, Delta Simulation Model (DSM2). Outputs from CALSIM II and DSM2 are used as inputs to the Solver model, which is a linear programming spreadsheet-based model developed by HDR/SWRI in

cooperation with CCWD. The Solver model simulates CCWD monthly operations, including CCWD diversions from the Delta and blending releases from Los Vaqueros Reservoir. The background and development of these three models are described briefly below. More detailed description of these models and their integrated use in simulation of CCWD operations is presented in the AIP Draft EIR/EIS: Water Resources Modeling Methodology Report (CCWD, 2006b).

CALSIM II

CALSIM II was jointly developed by Reclamation and DWR for planning studies related to CVP and SWP operations. The primary purpose of CALSIM II is to evaluate the water supply reliability of the CVP and SWP at current or future levels of development (e.g., 2001, 2020), with and without various assumed future facilities, and with different modes of facility operations. Geographically, the model covers the drainage basin of the Delta, and CVP/SWP exports to the San Francisco Bay Area, central coast, and Southern California.

CALSIM II typically simulates system operations for a 73-year period using a monthly time step. The model assumes that facilities, land use, water supply contracts, and regulatory requirements are constant over this period, representing a fixed level of development. The historical flow record of October 1921 to September 1994, adjusted for the influence of land use change and upstream flow regulation, is used to represent the possible range of water supply conditions. Major Central Valley rivers, reservoirs, and CVP/SWP facilities are represented by a network of arcs and nodes. Based on mass balance accounting, CALSIM II routes water through this network, according to a set of defined priorities.

CCWD Delta operations in CALSIM II are represented by a single arc, which aggregates total CCWD diversions that include CVP contract water from CCWD's Rock Slough and Old River intakes, and LV water rights diversions from Old Rover intake. Although all CCWD diversions are modeled as CVP contract diversions in CALSIM-II, this does not affect CVP/SWP system operations as LV water right diversions occurs only during Delta excess conditions (i.e., when this water would be Delta outflow).

DSM 2

DSM2 is a branched one-dimensional model for simulation of hydrodynamics, water quality, and particle tracking in a network of riverine or estuarine channels (DWR, 2002). The hydrodynamic module can simulate channel stage, flow and water velocity. The water quality module can simulate the movement of both conservative and nonconservative constituents. The model is used by DWR to perform operational and planning studies of the Delta. Details of the model, including source codes and model performance, are available from the DWR, Bay-Delta Office, Modeling Support Branch Web site (DWR, 2002). Documentation on model development is discussed in the annual reports to the

State Water Resources Control Board (SWRCB,), Methodology for Flow and Salinity Estimates in the Sacramento-San Joaquin Delta and Suisun Marsh, from the Delta Modeling Section of DWR.

Impact analysis for planning studies of the Delta is typically performed for a 16-year period, 1976 to 1991. In model simulations, electrical conductivity (EC) is typically used as a surrogate for salinity. Results from CALSIM II and the post-processing analysis are used to define Delta boundary inflows. CALSIM II derived boundary inflows include the Sacramento River flow at Hood, San Joaquin River flow at Vernalis, inflow from the Yolo Bypass, and inflow from the east-side streams. In addition, net Delta outflow from CALSIM II is used to calculate the DSM2 salinity boundary at Martinez.

Solver Model

The Solver Model was developed by SWRI (now HDR|SWRI) to simulate CCWD Delta operations, including the timing, amount, and location of CCWD diversions from the Delta, Los Vaqueros Reservoir blending operations, and water quality delivered to CCWD customers. The Solver Model is an Excel workbook that uses an external linear programming solver to make operational decisions according to a set of user-defined priorities, and physical and regulatory operational constraints.

Previous Analysis

System operations, hydrodynamic, and water quality modeling were completed in support of the AIP EIR/EIS, using the three-model package discussed above. The purpose of modeling conducted for the AIP EIR/EIS was to identify potential impacts of the project alternatives as determined by direct or indirect changes to surface water deliveries, water quality, and water surface elevation relative to existing and baseline conditions. The modeling for the AIP EIR/EIS is described in the Water Resources Modeling Methodology Report (CCWD, 2006b). Figure B 1 illustrates the model coordination process used during the AIP EIR/EIS study.

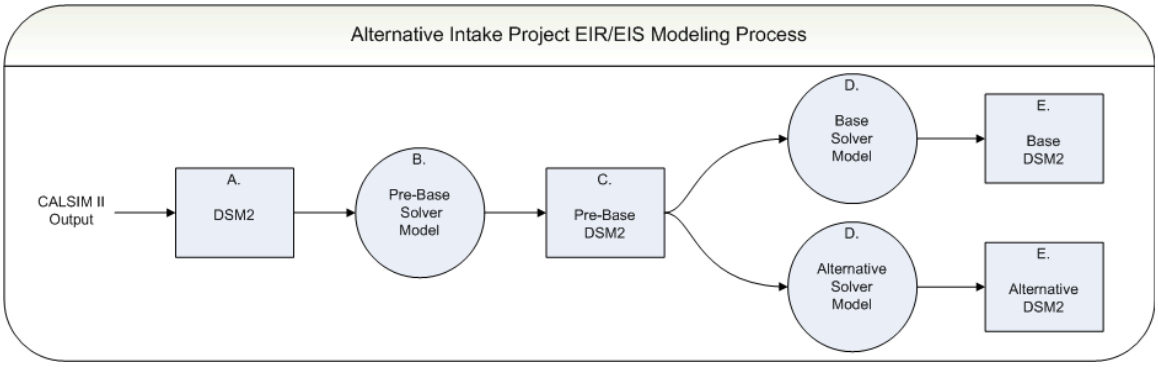

Figure B-1. Alternative Intake Project EIR/EIS Operations Modeling Process

Model Integration and Approach

Alternative Plan 3 was not included as part of the AIP EIR/EIS modeling effort. For the AIP Special Study Report, additional modeling was conducted by HDR|SWRI to evaluate Plan 3 and compare it to the alternatives presented in the AIP EIR/EIS. To provide consistency with previous analysis, this additional quantitative analysis used identical modeling approach and analytical process as for the AIP EIR/EIS.

Local and system-wide baseline conditions and operations were established for the AIP EIR/EIS using an iterative modeling procedure. These baseline conditions were used to simulate all project alternatives in the EIR/EIS model analysis, and were also used to conduct modeling for Plan 3, as follows:

1. DSM2 output for a 73-year simulation period provided monthly water quality (EC) data for (1) the proposed Middle River intake; and (2) the existing Old River intake (output from Step C in Figure B-1).

2. EC data from DSM2 were converted to chloride concentrations using one of two linear relationships, depending on Delta conditions.

3. The Solver Model used the above chloride Delta water quality data, together with data on Delta conditions (export/import (E/I) ratio, X2 [1] location, amount of Delta surplus) to simulate CCWD Delta diversions for direct delivery to CCWD and filling Los Vaqueros Reservoir (Step D in Figure B-1).

4. The CALSIM II postprocessor application used CCWD Delta diversions from the Solver Model to adjust baseline Delta boundary flows (Sacramento River inflow, Delta outflow), calculate revised Delta parameters (E/I ratio, X2 location, QWEST [2]), and calculate revised CVP operations (CVP/SWP delivery impacts, Lake Shasta storage). This is discussed in more detail in the Post-Processing Analysis section below.

5. DSM2 used the adjusted Delta boundary flow conditions described in Step 4 to simulate a 16-year period for impact analysis (Step E in Figure B-1).

Post-Processing Analysis

CALSIM II is an efficient tool for evaluating the complex network of California water supply projects, but it uses relatively coarse logic that can occasionally cause unrealistic operational decisions in response to relatively minor changes in inputs. The post-processing approach for determining revised Delta

[1] X2 is the distance from the Golden Gate to the point where daily average salinity is 2 parts per thousand at 1 meter off the bottom.
[2] QWEST is San Joaquin River flow past Jersey Point.

conditions and CVP operations was developed as a way to isolate the effects of relatively small localized changes in CCWD diversions between alternatives and avoid instances when CALSIM II does not appropriately model statewide operational responses to these small changes. A discussion comparing this post-processing approach with a CALSIM II re-run approach can be found in the AIP EIR/EIS Water Resources Modeling Methodology Report (CCWD, 2006b)

Baseline CALSIM II results for Delta conditions and CVP/SWP operations were adjusted to account for changes in CCWD's operations, as follows:

1. For changes in CCWD's total diversions under Delta balanced conditions, total Delta inflow and Sacramento River inflow were adjusted by an equal amount. These balanced condition adjustments were also reflected in upstream CVP storage (Shasta Reservoir) such that an increase in CCWD diversions resulted in an equal reduction in Shasta Reservoir storage, and visa versa. The E/I ratio was adjusted according to changes in the total Delta inflow and Delta exports. Exports at Banks and Tracy were assumed to be unaffected by CCWD operations.

2. When there was a change in CCWD's total diversions under Delta excess conditions, CALSIM II's net Delta outflow and Delta surplus were adjusted by the same amount. The location of X2 was recalculated according to the updated net Delta outflow. No change in releases from upstream storage was assumed under excess conditions.

3. QWEST was adjusted in Plan 3 to account for changes in Sacramento River inflow, and changes in flow through the Delta Cross Channel and Georgianna Slough.

CALSIM II post-processing analysis assumed that any changes (reduction or increase) in storage resulting from changes in the CCWD diversion pattern under balanced conditions resulted in an equal change (increase or reduction) in upstream storage at CVP's Shasta Reservoir. Annual changes in Shasta Reservoir storage were summed cumulatively for each year during periods when Shasta Reservoir was below the flood control release level, on the assumption that small changes in storage could accumulate and carryover from year to year until the reservoir spilled for flood management. This is both a reasonable operational scenario and a conservative approach given Shasta's storage and temperature requirements. The approach is conservative because the changes in storage would likely occur in Shasta, Oroville, and San Luis reservoirs. By assuming the total impact occurs only in Shasta Reservoir, the impact is cumulated at one site. More likely, the effects would be spread to all of the CVP and SWP storage reservoirs depending on operator decisions and would be much smaller than shown in this analysis.

Model Assumptions

Model assumptions for Plan 3 are consistent with the AIP EIR/EIS analysis. Additional analysis for Plan 3 was only conducted for the future condition (as opposed to an analysis of the Proposed Project and alternatives under existing and future conditions as required for California Environmental Quality Act (CEQA)/ National Environmental Policy Act (NEPA) compliance).

CALSIM II

The CALSIM II Operation Criteria and Plan (OCAP) studies completed by DWR and Reclamation for the CVP/SWP Delta smelt, winter and spring-run Chinook salmon, and steelhead trout Biological Opinions were used as operational representations of the base conditions for the AIP EIR/EIS. CALSIM II OCAP modeling assumptions used for this analysis are presented in Table D-1 of the AIP EIR/EIS Water Resources Modeling Methodology Report (CCWD, 2006b). The OCAP Study 5 Future EWA CALSIM II study was used as the Future No-Action baseline. Benefits and impacts of each alternative plan analyzed (Plans 1 through 3) were calculated against this baseline. CALSIM II modeling results from this baseline were used as inputs to the DSM2 and Solver Model.

DSM2

CALSIM II and the Solver Model use a 73-year hydrologic period, and therefore require a 73-year DSM2 analysis for the benefits evaluation. In this version of DSM2, used as input to the Solver Model, the downstream tidal boundary condition at Martinez is specified as the 19-year mean tide, repeated for each tidal cycle.

DSM2 runs with DWR's calculation of the modified astronomical tide at the Martinez boundary were used for water quality and water level impacts analysis. These runs were limited to water years 1976 through 1991 because that period is the extent of the available modified astronomical tide record. Use of 16-year DSM2 runs with this boundary condition is consistent with the modeling performed for other Delta projects.

DSM2 modeling of future conditions included the proposed the proposed South Delta Improvements Program (SDIP) permanent barriers in the south Delta. DWR and SDIP proposed four permanent operable gates at the head of Old River, Grant Line Canal, Old River at Tracy Road Bridge, and Middle River at Old River. These gates are intended to replace the existing temporary barriers to minimize the number of in- and out-migrating salmon moving towards export pumps, maintain adequate water levels for South Delta farmers to prevent cavitation from occurring in their irrigation pumps, and improve water quality in the South Delta channels by providing better circulation. DWR Delta Modeling Section developed three sets of operations for the gates: "Plan A", "Plan B", and "Plan C". "Plan A" focused on achieving higher water levels, but did not result in significant improvement in water quality. "Plan B" modified "Plan A" gate operations resulting in slight improvement in circulation and

water quality compared to "plan A". "Plan C" gate operations evolved to achieve the objective of improving water quality with better flow circulation in south Delta channels in addition to maintaining adequate water levels.

"Plan C" permanent barrier operations were used in the 16-year impacts evaluation, and "Plan B" permanent barrier operations were used for the 73-year benefits evaluation. Use of "Plan C" barrier operations for impacts analysis was consistent with other projects currently being developed and caused only minimal differences from the use of "Plan B" barrier operations.

DSM2 modeling includes the CALFED Bay-Delta Program (CALFED) Old River Water Quality Improvement Project and the CALFED Rock Slough Water Quality Improvement Project as part of the future No-Action condition.

Solver Model

The Solver Model was run for a 73-year period with the following assumptions:

- Los Vaqueros Biological-Opinion-Based Assumptions
  - No-fill period from March 15 through May 31, except when Los Vaqueros is below emergency storage levels
  - No-diversion period for the month of April, except when Los Vaqueros is at or below emergency storage
- Los Vaqueros Filling Criterion
  - Los Vaqueros filled with available water when Los Vaqueros chloride levels can be kept at or below 50 milligram per liter (mg/L)[3]
- Los Vaqueros Withdrawal Criteria (including dead storage)
  - No blending releases from Los Vaqueros Reservoir when storage is at or below emergency storage targets
  - Emergency storage target in wet, above normal, and below normal years = 70 thousands acre-feet (TAF)
  - Emergency storage target in dry and critical years = 44 TAF
- CCWD Delivery Goal
  - Delivered water quality goal = 65 parts per million (ppm) chloride

[3] A more stringent fill criterion of 40 mg/L was used in modeling runs with the alternative intake because the availability of higher quality water at intakes enabled more restrictive fill criteria and resulted in improved project performance. CCWD's delivered water quality goal of 65 mg/L chlorides was used in all cases.

- CCWD Facilities
  - Rock Slough maximum diversion = 320 cfs [4]
  - Old River maximum diversion = 250 cfs (existing condition) and 320 cfs (future condition [5])
  - Maximum Los Vaqueros Reservoir fill rate = 200 cfs
  - Maximum Los Vaqueros Reservoir withdrawal rate = 400 cfs
  - Maximum Los Vaqueros Reservoir storage = 100,000 acre-feet
  - Intertie with East Bay Municipal Utility District (EBMUD) Mokelumne Aqueduct = 3,200 acre-feet/yr (future condition)
- CCWD Demand Input
  - CCWD base future demands, from CCWD's 1996 Future Water Supply Study (CCWD, 1996) and Future Water Supply Update (CCWD, 2002), varied from 176,000 acre-feet in critical water years to 139,000 acre-feet in wet water years. Monthly distribution was based on historical data taking into account climate conditions. CCWD demands were reduced from the base demand to account for use of local supplies (City of Antioch, Mallard Slough, industrial diversions, recycled water, and rainfall in the service area for all water-year types). Adjusted demands were used in the Solver Model.

Summary of Model Results

This section discusses the effect of relocating CCWD's Rock Slough intake (Plan 3) on CCWD facility operations, and also describes and evaluates how each alternative plan (Plans 1 through 3) contributes to each of the planning objectives of the AIP Special Study Report. Evaluation is broken into three subsections, corresponding to the planning objectives: (1) maintaining and improving quality of delivered supplies to CCWD customers, (2) protecting and improving fisheries conditions around CCWD's intakes, and (3) improving reliability and maintaining quality of delivered supplies during emergencies.

[4] Permitted capacity of Rock Slough intake is 350 cfs; however, the intake is modeled at a capacity of 320 cfs consistent with the CCWD *Future Water Supply Study* (CCWD, 2002) because of physical capacity limitations in some reaches of the canal.

[5] Consistent with CCWD *Future Water Supply Implementation EIR* (CCWD, 1998).

Maintaining and Improving Delivered Water Quality

Plan 1 would allow CCWD to access better water quality from Victoria Canal during key periods (particularly late summer, early fall, and drought periods) and deliver it to Los Vaqueros Reservoir or the CCWD service area through the Old River conveyance system. Plan 2 would provide improved water quality through desalination of Mallard Slough water. Plan 3 would allow CCWD to access better water quality from Middle River compared to Rock Slough and deliver it to the CCWD service area through the Contra Costa Canal. Each of these plans would enable CCWD to protect and improve the quality of water it delivers to its customers. Table B-1 quantifies and compares the expected water quality improvements under each of the alternatives.

As shown in Table B-1, Plan 3 would provide the highest water quality benefits of all three alternatives, followed by Plan 1. Plan 2 would result in modest gains in water quality improvements, especially in reducing the maximum delivered chlorides and the number of consecutive months during which CCWD would not meet its water quality goal of 65 mg/L. This is because Plan 2 would only provide treated desalinated water to the Bollman WTP service area, which represents approximately 30 percent of all CCWD deliveries.

Table B-1. Contra Costa Water District Delivered Chloride Performance Under Alternative Plans

Alternative Plans	% of Time Chloride ≤ 65 mg/L		Average Delivered Chloride		Longest Duration Chloride > 65 mg/L		Maximum Delivered Chloride	
		Change** %	mg/L	Change %	Months	Change %	mg/L	Change %
No-Action Plan	86%	-	55	-	16	-	250	-
Plan 1	95%	+10%	46	-16%	10	-38%	125	-50%
Plan 2*	90%	+5%	53	-4%	15	-6%	250	0%
Plan 3	96%	+12%	43	-22%	6	-63%	119	-52%

Notes:

* Plan 2 would deliver treated water of 65 mg/L chlorides or better at all times to the Bollman WTP service area from the desalination treatment plant. Statistics shown in the table represent water deliveries to the Randall-Bold WTP treated water service area and untreated water customers (approximately 70 percent of all deliveries).

** Change compared to the No-Action Plan.

Key:

% = percent
≤ = less than or equal to
> = greater than
- = no change
mg/L = milligrams per liter

Protecting and Improving Fisheries Conditions

The greatest impacts to fisheries from operation of CCWD's intakes are associated with the operations of the unscreened Rock Slough intake. Significant improvements of fisheries conditions could result from reducing diversions from the unscreened intake, especially during critical fish periods. Therefore, in this section, diversions at Rock Slough are used as a metric of fisheries benefits.

Table B-2 summarizes the reductions in diversions from the unscreened Rock Slough intake based on the simulated 73-year hydrologic record. All three concept plans would reduce Rock Slough diversions compared to the Future No-Action Plan, both on an annual basis and during the spring. Plan 1 would relocate a portion of Rock Slough pumping to Old River or Victoria Canal. Plan 2 would shift some CVP water right diversions at Rock Slough to the Mallard Slough intake. Plan 3 would relocate the Rock Slough intake to Middle River. Table B-2 shows that Plan 3 would result in the largest expected fisheries improvement benefits as it would relocate 100 percent of the diversions at the unscreened Rock Slough intake to a new screened intake on Middle River. Plan 1 would outperform Plan 2 in terms of reducing diversions at the Rock Slough intake. Plan 1 would result in approximately 37 percent and 6 percent reductions in annual and spring Rock Slough pumping, respectively. Plan 2 would result in approximately 10 percent and 4 percent reductions in annual and spring Rock Slough pumping, respectively.

Table B-2. Rock Slough Diversions Under Alternative Plans

Alternative Plans	Average Annual Diversion		Average Spring* Diversions	
	TAF	Change** %	TAF	Change %
No-Action Plan	37.7	-	14.8	-
Plan 1	23.8	-37%	13.9	-6%
Plan 2	33.8	-10%	14.2	-4%
Plan 3	0.0	-100%	0.0	-100%

Notes:
* Spring (April through June) represents the critical period for endangered fisheries around Contra Costa Water District intakes
** Change compared to the No-Action Plan
Key:
% = percent
- = no change
TAF = thousand acre-feet

Improving Reliability and Maintaining Quality of Delivered Supplies during Emergencies

Improving the reliability of CCWD's system to deliver water supplies of adequate water quality during emergencies could be achieved through two primary mechanisms: (1) increasing operational flexibility of the system by providing additional intake locations on the Delta that would allow shifting of diversions in case of rapid deterioration in water quality at a certain intake, and (2) increasing carryover storage in Los Vaqueros Reservoir by reducing demand on reservoir releases for blending, such that more storage would be available during emergencies. Demands on Los Vaqueros Reservoir could be reduced if water supply of adequate water quality for direct delivery to CCWD customers was increased. Providing CCWD with better water quality at its intakes or through additional treatment (i.e., desalination) would require less blending

water to be released from Los Vaqueros Reservoir to meet the delivered water quality goal of 65 mg/L chloride.

Two metrics are used to measure how each alternative plan contribute to improving system reliability during emergencies: the number of CCWD's Delta intakes, which act as a surrogate for operational flexibility, and the increase in storage in Los Vaqueros Reservoir as a result of reduced demands on water for blending. Storage in Los Vaqueros is evaluated both over the 73-year hydrologic record representing a long-term average, and also during critical years (Sacramento Valley 40-30-30 index [6]). Table B-3 summarizes the reliability performance of the alternative plans measured against these metrics. Plans 1 and 3 resulted in the largest reliability improvement benefits over the Future No-Action Plan.

Table B-3. Performance of Contra Costa Water District System Reliability During Emergencies Under Alternative Plans

Alternative Plans	Number of Delta Intake Locations		Average Los Vaqueros Storage		Average Los Vaqueros Storage in Critical Years	
	No.	Change* %	TAF	Change * %	TAF	Change* %
Future No-Action Plan	3	-	77	-	49	-
Plan 1	4	+33%	86	+12%	56	+14%
Plan 2	3	-	80	+4%	52	+6%
Plan 3	4	+33%	89	+16%	60	+22%

Note:
* Change compared to the No-Action Plan
Key: % = percent - = no change TAF = thousand acre-feet

Model Output Data

This section contains model output in the form of charts and tables for: (1) the Future No-Action Plan, and (2) Alternative Plan 3, relocation of the existing Rock Slough intake to the Middle River. Model output for the Future No-Action Alternative is as presented in the AIP EIR/EIS, reproduced here for comparative purposes. Alternative Plan 3 model output is the product of additional modeling performed by SWRI|HDR for the AIP Special Study Report. Detailed model results for Alternative Plan 1 (Plans 1 and 2 in the EIR/EIS) and Alternative Plan 2 (Plan 4 in the EIR/EIS) can be found in the AIP EIR/EIS: Water Resources Modeling Methodology Report (CCWD, 2006b).

[6] The Sacramento Valley 40-30-30 Index is developed by SWRCB for the Sacramento hydrologic basins as part of SWRCB's Bay-Delta regulatory activities. The index defines five water year types: wet, above normal, below normal, dry and critical dry. The Sacramento Valley 40-30-30 Index is computed as a weighted average of the current water year's April-July unimpaired runoff forecast (40 percent), the current water year's October-March unimpaired runoff forecast (30 percent), and the previous water year's index (30 percent).

CALSIM II Model Results

This section contains tables derived from CALSIM II modeling used to establish baseline conditions in the Delta for the No-Action Plan (future without-project conditions) and results from the post-processing analysis conducted to determine the impact of CCWD's operations on CVP/SWP operations and conditions in the Delta. Results are reported as monthly values averaged over the 73-year period of simulation (Table B-4), and averaged by water year type (Table B-5). Results for Alternative Plan 3 (from the post-processing analysis) are compared to the No-Action Plan in terms of absolute difference in mean monthly values (Alternative Plan 3 minus No-Action Plan), and percentage change. Tables are presented for the following parameters:

- Total Delta inflow
- Sacramento River inflow
- Delta outflow
- SWP exports
- CVP exports
- X2 location
- QWEST flow
- E/I ratio
- Delta surplus
- Shasta Reservoir storage

Table B-4. Average Monthly Impacts of Contra Costa Water District Operations on Delta Conditions and Central Valley Project/ State Water Project Operations

Parameter		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
Total Inflow (cfs)	FNA	15,146	17,992	30,340	44,461	56,002	47,860	33,613	26,138	22,251	21,458	16,654	14,853	28,897
	Plan 3	15,185	18,026	30,351	44,461	55,984	47,840	33,604	26,136	22,234	21,431	16,700	14,965	28,910
	Difference	*39*	*34*	*11*	*0*	*-18*	*-20*	*-9*	*-2*	*-17*	*-27*	*46*	*112*	*12*
	% Difference	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*1%*	*0%*
Sacramento River Inflow (cfs)	FNA	11,994	15,340	24,689	32,734	39,313	34,103	24,595	19,098	17,248	18,835	14,616	12,543	22,092
	Plan 3	12,033	15,374	24,700	32,734	39,296	34,083	24,586	19,096	17,231	18,808	14,662	12,655	22,105
	Difference	*39*	*34*	*11*	*0*	*-18*	*-20*	*-9*	*-2*	*-17*	*-27*	*46*	*112*	*12*
	% Difference	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*1%*	*0%*
Net Delta Outflow (cfs)	FNA	5,335	9,303	20,458	35,880	47,344	38,637	27,474	20,679	11,679	7,233	4,574	4,026	19,385
	Plan 3	5,336	9,288	20,480	35,890	47,408	38,673	27,496	20,683	11,680	7,233	4,574	4,018	19,396
	Difference	*0*	*-14*	*22*	*9*	*64*	*36*	*23*	*3*	*1*	*0*	*0*	*-8*	*11*
	% Difference	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
CVP Exports (cfs)	FNA	3,787	3,686	3,513	3,623	3,667	3,284	2,172	1,381	2,410	3,489	3,422	3,948	3,198
	Plan 3	3,787	3,686	3,513	3,623	3,667	3,284	2,172	1,381	2,410	3,489	3,422	3,948	3,198
	Difference	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	% Difference	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
SWP Exports (cfs)	FNA	4,703	4,176	5,942	6,321	5,834	5,608	2,619	1,517	3,660	5,997	5,550	5,048	4,748
	Plan 3	4,703	4,176	5,942	6,321	5,834	5,608	2,619	1,517	3,660	5,997	5,550	5,048	4,748
	Difference	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	% Difference	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
X2 Location (km)	FNA	86.47	85.54	82.20	77.68	71.70	66.53	66.05	67.96	70.38	75.33	79.20	83.69	76.06
	Plan 3	86.48	85.54	82.20	77.69	71.71	66.52	66.04	67.94	70.37	75.33	79.20	83.69	76.06
	Difference	*0.01*	*0.00*	*0.01*	*0.01*	*0.01*	*-0.01*	*-0.01*	*-0.01*	*-0.01*	*0.00*	*0.00*	*0.00*	*0.00*
	% Difference	*0.01%*	*0.00%*	*0.01%*	*0.01%*	*0.01%*	*-0.01%*	*-0.02%*	*-0.02%*	*-0.01%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*
QWEST (cfs)	FNA	-796	-1,073	-387	2,627	5,135	4,137	6,010	5,637	1,625	-2,722	-2,825	-2,408	1,247
	Plan 3	-829	-1,122	-373	2,636	5,212	4,192	6,040	5,642	1,637	-2,705	-2,850	-2,492	1,249
	Difference	*-34*	*-49*	*14*	*9*	*77*	*55*	*31*	*5*	*11*	*17*	*-26*	*-84*	*2*
	% Difference	*-4%*	*-5%*	*4%*	*0%*	*2%*	*1%*	*1%*	*0%*	*1%*	*1%*	*-1%*	*-3%*	*0%*
E/I Ratio	FNA	0.56	0.47	0.44	0.37	0.26	0.24	0.17	0.12	0.28	0.43	0.51	0.60	0.37
	Plan 3	0.56	0.47	0.44	0.37	0.26	0.24	0.17	0.12	0.28	0.43	0.51	0.60	0.37
	Difference	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
	% Difference	*-0.27%*	*-0.26%*	*-0.10%*	*0.00%*	*0.11%*	*0.14%*	*0.05%*	*0.00%*	*0.06%*	*0.14%*	*-0.27%*	*-0.82%*	*-0.18%*
Delta Surplus (cfs)	FNA	825	2,571	14,721	26,936	27,886	20,736	14,447	9,315	2,417	238	59	470	10,052
	Plan 3	825	2,556	14,743	26,946	27,949	20,772	14,470	9,318	2,418	238	59	462	10,063
	Difference	*0*	*-14*	*22*	*9*	*64*	*36*	*23*	*3*	*1*	*0*	*0*	*-8*	*11*
	% Difference	*0%*	*-1%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*-2%*	*0%*
Shasta Storage (TAF)	FNA	2,493	2,549	2,701	2,939	3,194	3,537	3,807	3,789	3,494	3,011	2,637	2,514	3,056
	Plan 3	2,495	2,551	2,702	2,939	3,193	3,535	3,807	3,789	3,493	3,010	2,640	2,521	3,056
	Difference	*2*	*2*	*1*	*0*	*-1*	*-1*	*-1*	*0*	*-1*	*-2*	*3*	*7*	*1*
	% Difference	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*

Key:
% = percent
E/I = export/import ratio
TAF = thousand acre-feet
cfs = cubic feet per second
FNA = Future No-Action Plan
x2 = the location (in km from the Golden Gate Bridge) where Salinity is 2 parts per thousands
CVP = Central Valley Project
QWEST = San Joaquin River past Jersey Point
Delta = Sacramento-San Joaquin Delta
SWP = State Water Project

Table B-5. Year Type Impacts of Contra Costa Water District Operations on Delta Conditions and Central Valley Project/ State Water Project Operations

Parameter		Long-Term Average	Wet	Above Normal	Below Normal	Dry	Critical
Total Inflow (cfs)	FNA	28,897	48,047	33,176	23,284	17,889	13,047
	Plan 3	28,910	48,060	33,197	23,300	17,907	13,039
	Difference	*12*	*13*	*20*	*17*	*18*	*-7*
	% Difference	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Sacramento River Inflow (cfs)	FNA	22,092	33,535	26,405	19,042	15,238	11,171
	Plan 3	22,105	33,548	26,426	19,059	15,255	11,164
	Difference	*12*	*13*	*20*	*17*	*18*	*-7*
	% Difference	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Net Delta Outflow (cfs)	FNA	19,385	37,153	22,806	13,161	9,023	6,518
	Plan 3	19,396	37,172	22,827	13,180	9,021	6,516
	Difference	*11*	*20*	*21*	*19*	*-2*	*-2*
	% Difference	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Exports at Tracy (cfs)	FNA	3,198	3,665	3,572	3,412	2,993	2,095
	Plan 3	3,198	3,665	3,572	3,412	2,993	2,095
	Difference	*0*	*0*	*0*	*0*	*0*	*0*
	% Difference	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Exports at Banks (cfs)	FNA	4,748	5,975	5,431	5,024	4,113	2,556
	Plan 3	4,748	5,975	5,431	5,024	4,113	2,556
	Difference	*0*	*0*	*0*	*0*	*0*	*0*
	% Difference	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Total Pumping (cfs)	FNA	7,946	9,641	9,003	8,436	7,106	4,651
	Plan 3	7,946	9,641	9,003	8,436	7,106	4,651
	Difference	*0*	*0*	*0*	*0*	*0*	*0*
	% Difference	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
X2 Location (km)	FNA	76.06	69.55	73.81	77.27	80.01	82.67
	Plan 3	76.06	69.54	73.80	77.26	80.01	82.67
	Difference	*0.00*	*0.00*	*-0.01*	*0.00*	*0.00*	*0.01*
	% Difference	*0.00%*	*0.00%*	*-0.01%*	*0.00%*	*0.01%*	*0.01%*
QWEST (cfs)	FNA	1,247	5,026	1,443	-373	-1,201	-379
	Plan 3	1,249	5,033	1,448	-367	-1,214	-367
	Difference	*2*	*6*	*5*	*5*	*-14*	*12*
	% Difference	*0%*	*0%*	*0%*	*1%*	*-1%*	*3%*
E/I Ratio	FNA	0.37	0.33	0.38	0.41	0.41	0.34
	Plan 3	0.37	0.33	0.38	0.41	0.41	0.34
	Difference	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
	% Difference	*-0.18%*	*-0.17%*	*-0.22%*	*-0.23%*	*-0.21%*	*-0.03%*
Delta Surplus (cfs)	FNA	10,052	25,632	11,407	3,875	1,420	371
	Plan 3	10,063	25,652	11,428	3,894	1,418	369
	Difference	*11*	*20*	*21*	*19*	*-2*	*-2*
	% Difference	*0%*	*0%*	*0%*	*0%*	*0%*	*-1%*
Shasta Storage (TAF)	FNA	3,056	3,620	3,362	3,099	2,835	2,055
	Plan 3	3,056	3,621	3,363	3,101	2,836	2,055
	Difference	*1*	*1*	*1*	*1*	*1*	*0*
	% Difference	0%	0%	0%	0%	0%	0%

Key:
% = percent
FNA = Future No-Action Plan
TAF = thousand acre-feet
cfs = cubic feet per second
km = kilometers
x2 = the location (in km from the Golden Gate Bridge) where Salinity is 2 parts per thousands
Delta = Sacramento-San Joaquin Delta
QWEST = San Joaquin River past Jersey Point
E/I = export/import ratio

Changes to Delta inflow and CVP reservoir storage are the result of changes in CCWD operations during balanced conditions. Average monthly changes to Delta inflow (total and Sacramento River) are less than 1 percent in all months. The most significant increase in Delta inflows occurs in the late summer and fall, with the highest increase in September (112 cfs), correlating with the increase in CCWD diversions during this time. Increases in Sacramento River inflows result in additional releases from Shasta Reservoir, but due to the reservoir's large size, these additional releases are less than 1 percent of the total storage volume. Changes in CCWD operations are assumed to have no impact on project (CVP and SWP) exports.

Delta outflow is impacted when the amount of CCWD diversions changes during Delta excess conditions. Decreases in net Delta outflow and Delta surplus, which are less than 1 and 2 percent, respectively, are greatest in September and November. This is a result of increases in CCWD diversion of surplus supplies during those months.

Net Delta outflow, the location of X2, the E/I ratio, and net flow in the San Joaquin River at Jersey Point (QWEST) are all general indicators of ecosystem health within the Delta. Table B 4 and Table B-5 show that changes in net Delta outflow, X2 location, and E/I under Plan 3 are typically less than 1 percent. The largest Delta impacts are seen in QWEST which decreases between August and September as a result of increased CCWD diversions. The maximum average monthly decrease in QWEST is 5 percent.

Table B-6 represents adjustments to Shasta Reservoir storage based on changes in CCWD contract supply diversion under Plan 3, as discussed in the Post-Processing Analysis section above. The cumulative changes were then examined for two scenarios: (1) years when Shasta Reservoir storage was at or below 1.9 million acre-feet (MAF), and (2) years when Shasta Reservoir storage was at or below 1.0 MAF at the end of September in the Future No-Action Plan. The 1.9 MAF storage level at the end of September is an important indicator reservoir storage level related to the CVP's ability to maintain river water temperature for winter-run Chinook salmon (a Federal Endangered Species Act (ESA)-listed species) the following year, especially if the following year is dry. Storage at or below 1.0 MAF at the end of September represents a critical level for the CVP when significant changes in storage could impact project operations in the following year and future years. Evaluating the changes in CVP storage at these storage levels provides an assessment of how the project alternatives could affect water supply during periods when Shasta Reservoir and CVP and SWP supplies are most vulnerable to changes in the system. As shown in Table B-6, the number of years in which Alternative Plan 3 results in a decrease in Shasta storage during the 1.9 MAF and 1.0 MAF conditions is, 4 and 1, respectively.

Table B-6. Central Valley Project Contract Water Use Analyses: Simulated Accumulated Changes in Shasta Reservoir Storage

Water Year	Year Type	CCWD Div. Base (TAF)	CCWD Div. Plan 3 (TAF)	Annual Diversion Difference (TAF)	Accumulated End-of-September Storage Difference (TAF)	Base End-of-September Shasta Storage (TAF)	Water Year Flood Control Flag (TAF)	Accumulated Change in Shasta Reservoir Storage	
								1.9 MAF Criterion (TAF)	*1.0 MAF Criterion (TAF)*
1922	AN	160	163	4	-4	2,835	-	-	-
1923	BN	129	154	26	-29	2,203	-	-	-
1924	C	130	129	-1	-28	599	-	-28	-28
1925	D	191	183	-8	-21	1,924	-	-	-
1926	D	172	160	-12	-9	1,764	-	-9	-
1927	W	115	139	24	0	3,045	Flood Control	-	-
1928	AN	119	140	21	0	2,732	Flood Control	-	-
1929	C	135	137	2	-2	1,823	-	-2	-
1930	D	150	170	20	-22	2,054	-	-	-
1931	C	173	125	-48	26	612	-	26	26
1932	D	202	212	11	15	927	-	15	15
1933	C	125	131	6	9	681	-	9	9
1934	C	177	139	-38	47	561	-	47	47
1935	BN	175	185	10	38	1,612	-	38	-
1936	BN	139	139	0	38	2,218	-	-	-
1937	BN	136	153	16	22	2,404	-	-	-
1938	W	118	130	12	0	3,400	Flood Control	-	-
1939	D	127	145	18	0	2,101	Flood Control	-	-
1940	AN	143	151	7	0	2,602	Flood Control	-	-
1941	W	133	130	-3	0	3,400	Flood Control	-	-
1942	W	107	130	23	0	3,400	Flood Control	-	-
1943	W	108	131	23	0	3,090	Flood Control	-	-
1944	D	142	158	16	-16	2,397	-	-	-
1945	BN	141	154	13	-29	2,754	-	-	-
1946	BN	137	144	6	0	2,747	Flood Control	-	-
1947	D	145	166	22	-22	2,207	-	-	-
1948	BN	155	168	14	0	3,400	Flood Control	-	-
1949	D	137	145	8	0	2,707	Flood Control	-	-
1950	BN	172	153	-19	19	2,661	-	-	-
1951	AN	110	147	36	0	2,735	Flood Control	-	-
1952	W	117	134	16	0	3,400	Flood Control	-	-
1953	W	133	143	10	0	3,400	Flood Control	-	-
1954	AN	118	143	25	0	3,083	Flood Control	-	-
1955	D	151	159	8	0	2,499	Flood Control	-	-
1956	W	117	133	16	0	3,400	Flood Control	-	-
1957	AN	122	145	22	0	3,182	Flood Control	-	-
1958	W	114	135	21	0	3,400	Flood Control	-	-
1959	BN	127	143	16	0	2,326	Flood Control	-	-
1960	D	154	172	18	-18	2,464	-	-	-
1961	D	132	157	25	0	2,410	Flood Control	-	-
1962	BN	153	129	-24	0	2,737	Flood Control	-	-
1963	W	149	149	0	0	3,238	Flood Control	-	-
1964	D	110	132	22	0	2,362	Flood Control	-	-
1965	W	151	145	-6	0	3,153	Flood Control	-	-
1966	BN	115	140	26	0	2,777	Flood Control	-	-
1967	W	132	140	8	0	3,400	Flood Control	-	-
1968	BN	130	140	10	0	2,557	Flood Control	-	-
1969	W	130	136	6	0	3,400	Flood Control	-	-
1970	W	121	136	15	0	2,471	Flood Control	-	-
1971	W	128	137	9	0	3,400	Flood Control	-	-
1972	BN	120	140	20	0	2,730	Flood Control	-	-
1973	AN	140	141	0	0	3,041	Flood Control	-	-
1974	W	121	138	18	0	3,400	Flood Control	-	-
1975	W	112	129	17	0	3,400	Flood Control	-	-
1976	C	117	130	12	0	2,732	Flood Control	-	-
1977	C	177	155	-22	22	584	-	22	22
1978	AN	173	177	4	0	3,322	Flood Control	-	-
1979	BN	127	138	11	-11	2,736	-	-	-
1980	AN	136	150	14	0	3,002	Flood Control	-	-
1981	D	129	163	34	0	2,291	Flood Control	-	-
1982	W	128	130	2	0	3,400	Flood Control	-	-
1983	W	122	122	0	0	3,400	Flood Control	-	-
1984	W	131	142	11	0	3,138	Flood Control	-	-
1985	D	109	133	24	0	2,132	Flood Control	-	-
1986	W	146	137	-9	0	2,854	Flood Control	-	-
1987	D	117	143	26	-26	2,122	-	-	-
1988	C	158	146	-12	-14	1,587	-	-14	-
1989	D	157	150	-7	-7	2,341	-	-	-
1990	C	175	155	-20	13	1,744	-	13	-
1991	C	179	179	0	12	1,179	-	12	-
1992	C	176	175	-1	13	865	-	13	13
1993	AN	168	177	9	0	3,400	Flood Control	-	-
1994	C	109	158	49	0	1,470	Flood Control	0	-

Note:
Year Type: AN = above normal BN = below normal C = critical D = dry W = wet
Key:
MAF = million acre-feet TAF = thousand acre-feet CCWD = Contra Costa Water District - = N/A

DSM2 Delta Modeling Results

This section contains tables and charts derived from DSM2 modeling conducted to provide input data for the Solver Model and as part of the impact assessment. For the impact analysis, water quality results for the Future No-Action Plan and Alternative Plan 3 are reported as average monthly salinity (EC) for the 16-year period of analysis at the following key locations within the Delta:

- Water quality compliance locations at Collinsville, Chipps Island, Jersey Point, Emmaton, Old River at Tracy Road Bridge, Old River at Middle River, the San Joaquin River at Brandt Bridge, and Rock Slough (reported as Old River at Rock Slough).

- Locations near CVP/SWP intakes at Tracy Pumping Plant and Clifton Court Forebay, the proposed City of Stockton intake for the Delta Water Supply Project, and Middle River at Victoria Canal.

No water level (stage) data are reported. DSM2 analysis conducted for the AIP EIR/EIS showed that CCWD's operations have a minimal effect on water levels in the south Delta.

Although CCWD would typically not divert additional water under Alternative Plan 3, changes in the timing and location of CCWD diversions could potentially affect water quality conditions in the Delta. Changes in EC at Collinsville and Chipps are significant because they correspond to X2 requirements under SWRCB Water Right Decision 1641 (D-1641) from February through June. During this compliance period, average monthly increases in salinity at both Collinsville and Chipps are less than 0.1 percent (see Table B-7).

B-1641 sets agricultural water quality standards to be met between April and August at: (1) Jersey Point, (2) Emmaton, (3) Old River near Tracy Road Bridge, (4) Old River at Middle River, and (5) San Joaquin River at Brandt Bridge. The average monthly increase in EC during this compliance period is less than 1 percent at all five locations (see Table B-7).

CCWD's Rock Slough intake (reported as Old River at Rock Slough) is specified under D-1641 as a municipal and industrial (M&I) water quality compliance location. The largest increase in average monthly EC at the Rock Slough intake was 1.3 percent (Table B-7), which occurs during the months of September and October.

In addition to compliance with water quality standards, overall degradation of water quality that would adversely affect beneficial uses or the operations of Delta users, as a result of the proposed plan, must also be evaluated. Sites evaluated due to the potential for them to be affected by changes in water quality include (1) Tracy Pumping Plant (CVP exports), (2) Clifton Court

Forebay (SWP exports), (3) Empire Tract (proposed City of Stockton intake location), and (4) Middle River at Victoria Canal (an indicator of central Delta water quality and water quality reaching Victoria Island agricultural siphons). Average annual increases in salinity during the 16-year simulation period are less than 3 micro Siemens per centimeter (mS/cm) EC and less than 1 percent at all locations. The average monthly increase in salinity never exceeds 4 percent at all locations, with the maximum occurring at the Clifton Court Forebay in November (3.9 percent increase, 21 mS/cm EC). As was assumed in the AIP EIR/EIS, these changes are too small to affect CVP/SWP operations from a water quality perspective.

Table B-7. Average Monthly Impacts of Contra Costa Water District Operations on Water Quality (EC)

Parameter		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
Sacramento River at Collinsville (µS/cm)	FNA	7,311	5,919	4,952	2,983	1,958	1,139	1,321	1,989	3,219	3,974	5,316	7,070	3,929
	Plan 3	7,311	5,921	4,969	2,987	1,957	1,139	1,321	1,988	3,219	3,975	5,311	7,062	3,930
	%Difference	*0.0%*	*0.0%*	*0.3%*	*0.1%*	*-0.1%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*-0.1%*	*-0.1%*	*0.0%*
Sacramento River at Chipps Island (µS/cm)	FNA	10,659	8,954	7,801	5,062	3,483	2,160	2,517	3,616	5,418	6,772	8,567	10,468	6,290
	Plan 3	10,661	8,955	7,819	5,067	3,481	2,158	2,516	3,615	5,418	6,772	8,564	10,462	6,291
	%Difference	*0.0%*	*0.0%*	*0.2%*	*0.1%*	*-0.1%*	*-0.1%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*-0.1%*	*0.0%*
San Joaquin River at Jersey Point (µS/cm)	FNA	2,045	1,566	1,503	977	615	388	311	380	617	1,036	1,399	2,142	1,082
	Plan 3	2,056	1,571	1,517	982	614	387	311	380	617	1,035	1,404	2,151	1,085
	%Difference	*0.5%*	*0.4%*	*0.9%*	*0.5%*	*-0.2%*	*-0.2%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.4%*	*0.4%*	*0.4%*
Sacramento River at Emmaton (µS/cm)	FNA	2,366	1,766	1,319	791	515	331	357	535	919	1,005	1,440	2,269	1,134
	Plan 3	2,366	1,768	1,325	793	516	331	357	535	920	1,005	1,435	2,262	1,134
	%Difference	*0.0%*	*0.1%*	*0.5%*	*0.2%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.2%*	*0.0%*	*-0.3%*	*-0.3%*	*0.0%*
Old River near Tracy Road Bridge (µS/cm)	FNA	627	580	534	529	447	490	442	430	457	522	524	586	514
	Plan 3	635	587	537	533	448	490	442	430	457	523	527	592	517
	%Difference	*1.3%*	*1.1%*	*0.7%*	*0.8%*	*0.1%*	*0.1%*	*0.0%*	*0.0%*	*0.0%*	*0.2%*	*0.5%*	*1.0%*	*0.5%*
Old River at Middle River (µS/cm)	FNA	481	480	455	453	412	424	385	409	493	491	388	459	444
	Plan 3	486	484	458	457	413	424	385	409	494	493	392	465	447
	%Difference	*1.2%*	*0.8%*	*0.7%*	*0.8%*	*0.3%*	*0.1%*	*0.0%*	*0.0%*	*0.0%*	*0.3%*	*0.9%*	*1.2%*	*0.5%*
San Joaquin River at Brandt Bridge (µS/cm)	FNA	619	647	567	499	524	562	451	433	545	641	736	935	597
	Plan 3	619	647	567	499	524	562	451	433	545	641	737	935	597
	%Difference	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.1%*	*0.0%*	*0.0%*
Old River at Highway 4 (µS/cm)	FNA	689	600	551	531	450	364	327	352	343	381	454	596	470
	Plan 3	698	607	557	538	452	365	327	352	343	384	459	603	474
	%Difference	*1.3%*	*1.1%*	*1.0%*	*1.2%*	*0.5%*	*0.3%*	*0.0%*	*0.0%*	*-0.1%*	*0.8%*	*1.0%*	*1.3%*	*0.8%*
Delta Mendota Canal at Tracy Pumping Plant (µS/cm)	FNA	610	560	526	503	449	451	383	394	419	442	501	631	489
	Plan 3	618	566	530	508	450	451	383	394	418	444	505	636	492
	%Difference	*1.3%*	*1.1%*	*0.7%*	*0.8%*	*0.2%*	*0.1%*	*0.0%*	*0.0%*	*0.0%*	*0.6%*	*0.7%*	*0.9%*	*0.6%*
West Canal at mouth of Clifton Court Forebay Intake (µS/cm)	FNA	608	552	500	491	419	399	357	387	386	385	434	540	455
	Plan 3	617	573	516	509	432	373	340	361	366	372	421	521	450
	%Difference	*1.6%*	*3.9%*	*3.1%*	*3.7%*	*3.1%*	*-6.5%*	*-4.9%*	*-6.6%*	*-5.3%*	*-3.2%*	*-3.0%*	*-3.5%*	*-1.0%*
City of Stockton Proposed Intake Location (µS/cm)	FNA	407	385	361	367	335	309	325	346	283	277	299	362	338
	Plan 3	409	386	364	369	335	309	325	346	283	278	300	365	339
	%Difference	*0.4%*	*0.3%*	*0.7%*	*0.7%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.4%*	*0.5%*	*0.7%*	*0.3%*
Middle River at Victoria Canal(µS/cm)	FNA	475	466	425	440	401	377	359	383	361	328	341	400	396
	Plan 3	480	470	428	444	403	378	359	383	361	331	346	406	399
	%Difference	*1.2%*	*0.9%*	*0.9%*	*1.1%*	*0.4%*	*0.1%*	*0.0%*	*0.0%*	*-0.1%*	*1.0%*	*1.3%*	*1.7%*	*0.7%*

Key:
% = percent µS/cm = microsiems per centimeter EC = Electrical Conductivity FNA = Future No-Action Plan

CCWD Operations Modeling

Figure B-2 displays the average simulated monthly water quality at CCWD's two existing intakes (Rock Slough and Old River) and the proposed intake under Alternative Plan 3 (Middle River), output from the DSM2 full-period analysis. As the figure shows, water quality at Rock Slough is quite poor, significantly worse than at either the Old River or Middle River locations during the majority of the year.

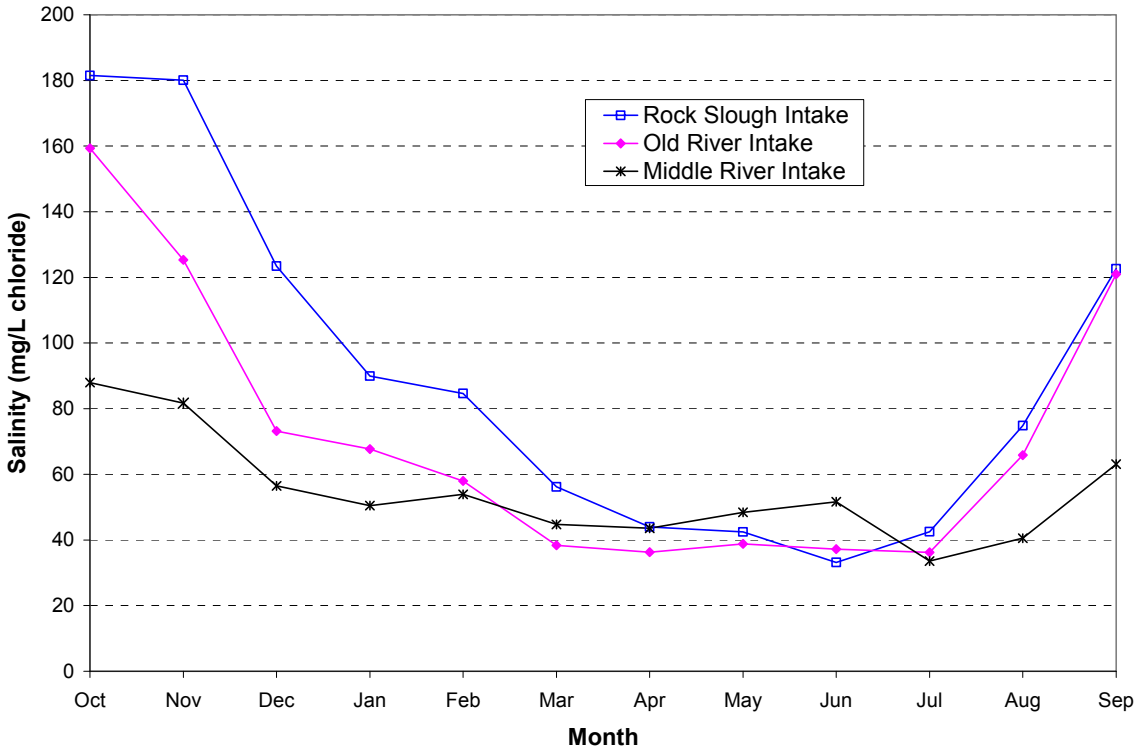

Figure B-2. Average Simulated Monthly Salinity at CCWD Intakes

Shifting diversions to the better quality Middle River source, although it does not change CCWD's overall annual diversions from the Delta, does change the timing pattern and location of diversions (see Figures B-3 and B-4). Rock Slough diversions are reduced to zero. Old River diversions are reduced in all months, particularly from July through February, when CCWD is instead capturing significantly better quality water provided at the Middle River intake site.

Under the No-Action Plan (future without-project conditions), during the late summer and fall, diverted water quality at CCWD's existing intakes is above the 65 mg/L target, requiring blending releases from the reservoir to meet the chloride goal. Access to better quality water during the late summer and early fall periods allows for more Delta diversions, less requirements for blending,

and improvement of the quality of water CCWD delivers to its customers. The shifting down and flattening of the CCWD delivered water quality exceedence curve (see Figure B-5) outlines the impact of the better quality Middle River intake. The 10 percent and 50 percent exceedence salinities are reduced by 27 mg/L and 8 mg/L chloride, respectively.

Decreasing the demand of reservoir supplies for blending shifts CCWD's total diversion timing from the spring to the fall and improves overall reservoir storage, allowing CCWD to enter critically dry periods with comparatively more storage in Los Vaqueros Reservoir, eliminating or postponing the exhaustion of stored blending water supply during these periods. The exceedence plot of monthly Los Vaqueros Reservoir storage (see Figure B-6) displays how improving water quality allows the reservoir to maintain higher storage levels for more months during the 73-year period of analysis. Under Alternative Plan 3, the 50 percent exceedence storage is 98 TAF, as compared to the 82 TAF for the Future No-Action Alternative. The 10 percent exceedence is 100 TAF for both alternatives.

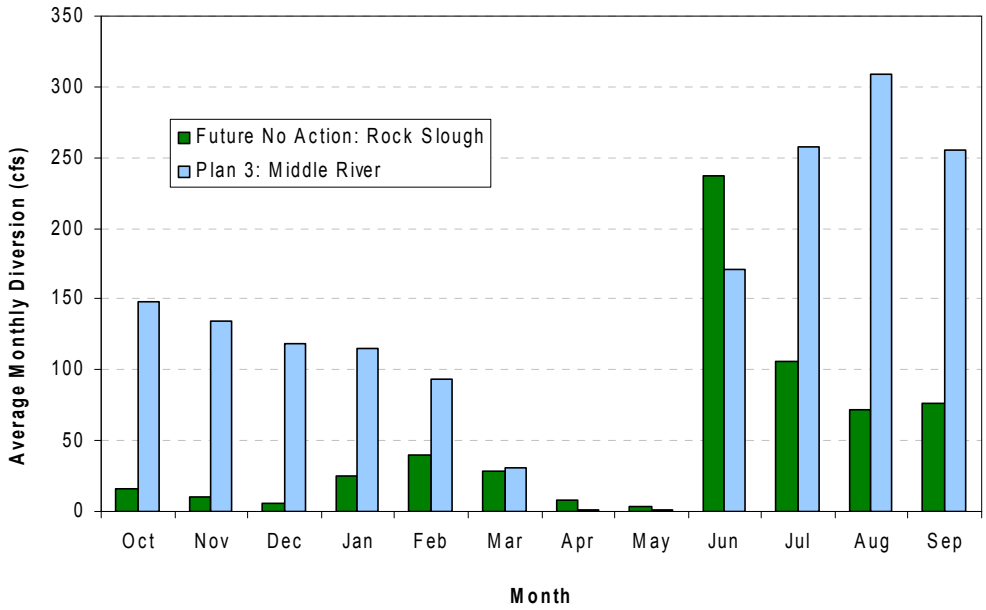

Figure B-3. Average Simulated Monthly Rock Slough (FNA) and Middle River (Plan 3) Diversions

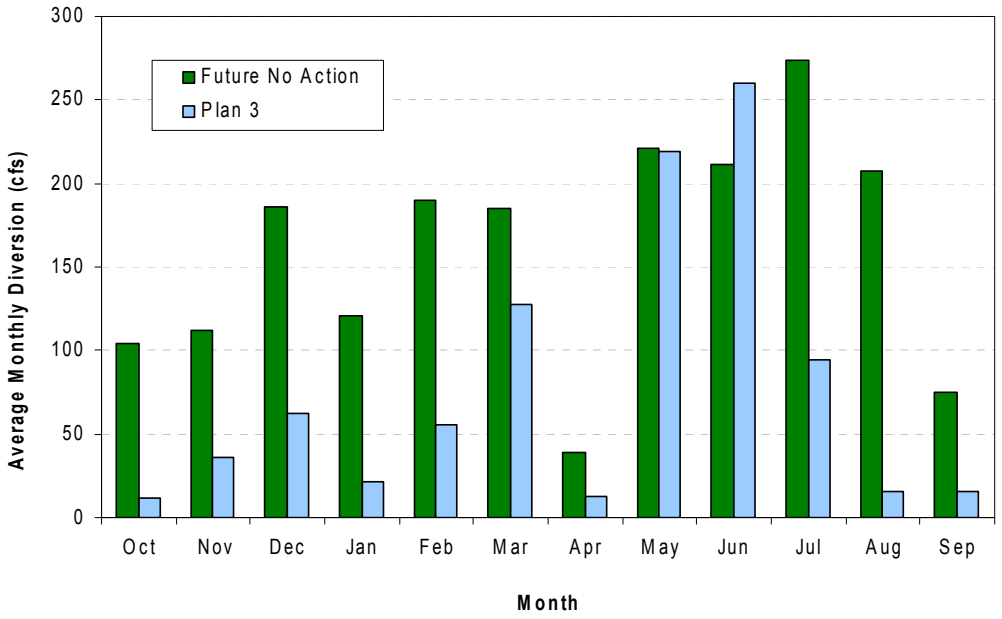

Figure B-4. Average Simulated Monthly Old River Diversions

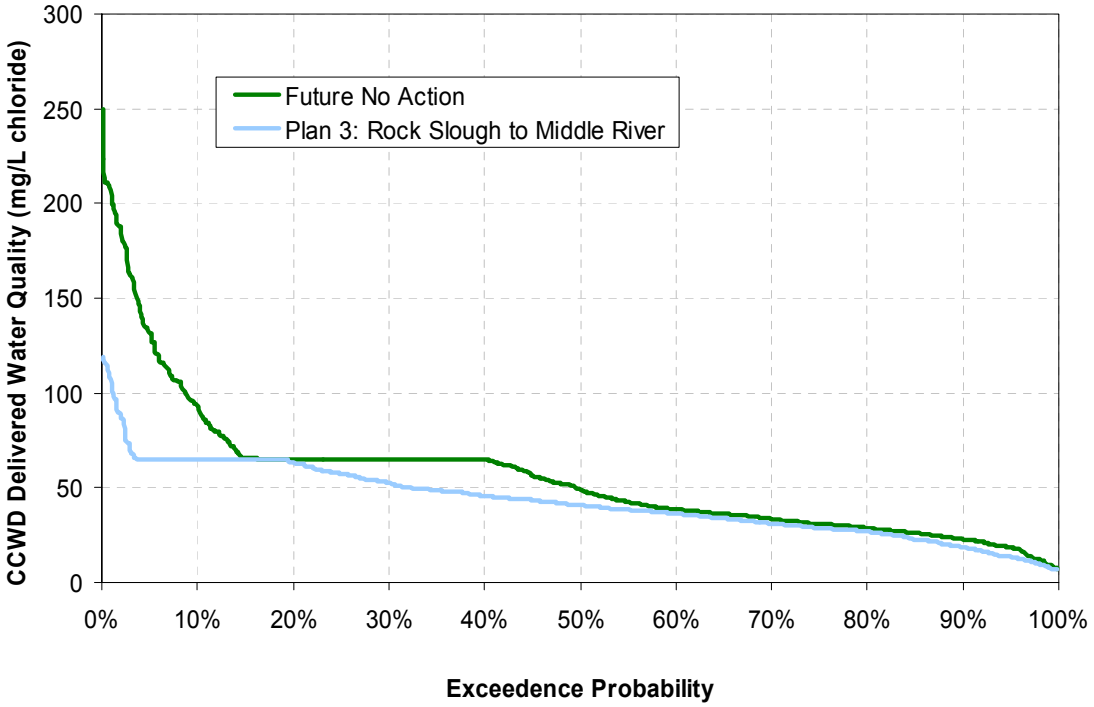

Figure B-5. Exceedence Plot of CCWD Delivered Monthly Average Water Quality (mg/L)

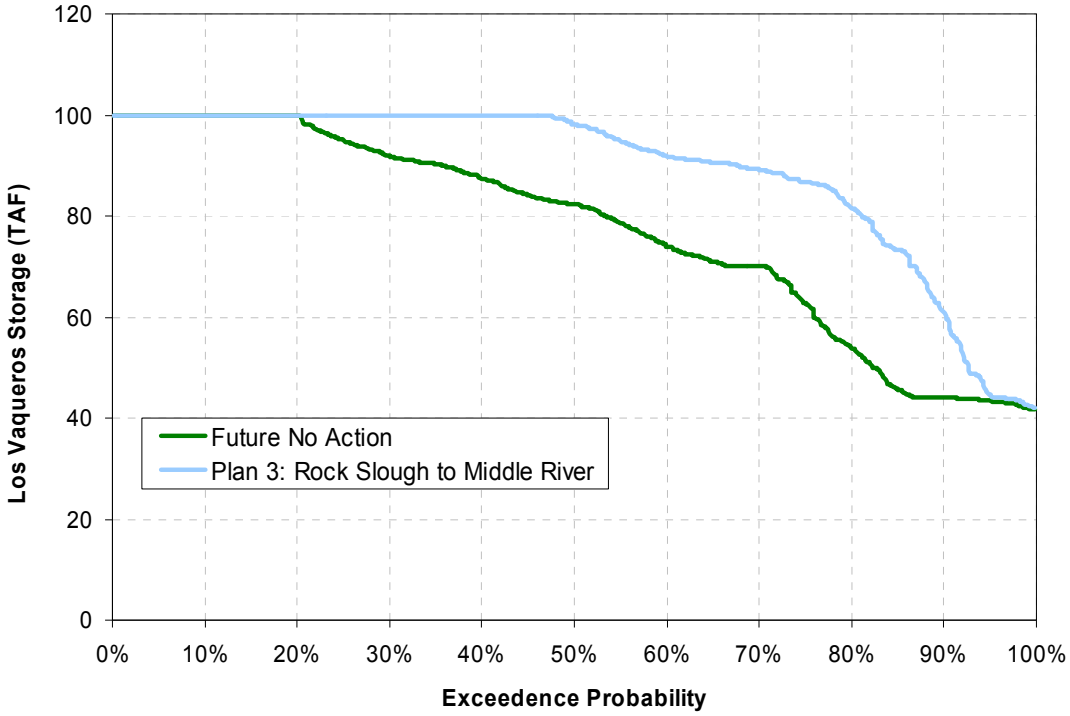

Figure B-6. Exceedence Plot of Los Vaqueros Reservoir Average Monthly Storage (TAF)

Results of CCWD Operations Modeling

This section presents tables derived from the Solver Model for CCWD's operations under the No-Action Plan (future without-project) and Alternative Plan 3.The results are presented as follows:

- Tables of mean monthly CCWD diversions averaged over the 73-year period of simulation, and also average by water year type (Sacramento valley 40-30-30 index) (Tables B-8 and B-9). Diversions are reported for (1) each CCWD Delta intake, (2) CCWD Los Vaqueros water right, (3) CVP contract water, and (4) total CCWD water deliveries.

- Tables of average monthly simulated diversions at CCWD's existing and proposed intakes (Rock Slough, Old River, and the relocated Rock Slough intake to the Middle River) and total diversions over the 73-year simulation period (Tables B-10 through B-17).

- Tables of monthly storage in Los Vaqueros Reservoir over the 73-year simulation period (Tables B-18 and B-19).

- Tables of average monthly CCWD delivered water quality (mg/L chloride) over the 73-year simulation period (Table B-20 and B-21).

Table B-8. Mean Monthly Contra Costa Water District Operations

Parameter		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
Rock Slough Diversions (cfs)	FNA	16	10	5	25	40	29	8	3	238	106	71	77	52
	Plan 3	0	0	0	0	0	0	0	0	0	0	0	0	0
	Difference	-16	-10	-5	-25	-40	-29	-8	-3	-238	-106	-71	-77	-52
	% Difference	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%
Old River Diversions (cfs)	FNA	105	112	186	121	190	185	39	221	211	274	207	75	161
	Plan 3	12	36	62	21	55	127	13	219	260	95	16	16	78
	Difference	-93	-76	-124	-99	-135	-58	-26	-2	49	-179	-191	-59	-83
	% Difference	-89%	-68%	-67%	-82%	-71%	-31%	-67%	-1%	23%	-65%	-92%	-79%	-52%
Middle River Diversions (cfs)	FNA	0	0	0	0	0	0	0	0	0	0	0	0	0
	Plan 3	148	135	118	115	93	31	2	1	171	258	309	255	136
	Difference	148	135	118	115	93	31	2	1	171	258	309	255	136
	% Difference	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total CCWD Diversions (cfs)	FNA	121	123	243	146	230	214	47	225	449	380	279	151	217
	Plan 3	160	171	231	136	148	158	15	220	431	353	325	271	218
	Difference	39	48	-11	-9	-81	-56	-32	-5	-18	-27	46	120	1
	% Difference	32%	39%	-5%	-6%	-35%	-26%	-69%	-2%	-4%	-7%	17%	79%	0%
Los Vaqueros Water Right Diversions (cfs)	FNA	0	1	41	27	86	51	11	3	42	0	0	0	22
	Plan 3	0	6	22	15	32	17	1	0	41	0	0	0	11
	Difference	0	5	-20	-12	-54	-34	-10	-2	-1	0	0	0	-11
	% Difference	0%	648%	-47%	-43%	-62%	-67%	-89%	-89%	-2%	0%	0%	0%	-48%
CVP Contract Water Diversions (cfs)	FNA	119	122	153	119	144	163	36	222	407	380	279	151	191
	Plan 3	159	165	164	121	116	141	13	219	390	353	325	270	203
	Difference	40	43	10	2	-28	-22	-22	-3	-17	-27	46	119	12
	% Difference	34%	35%	7%	2%	-19%	-13%	-62%	-1%	-4%	-7%	17%	79%	6%
Los Vaqueros Storage (TAF)	FNA	69	66	72	73	78	84	76	75	85	88	85	77	77
	Plan 3	86	85	90	91	92	93	84	83	91	93	92	91	89
	Difference	16	19	18	18	13	10	8	8	6	5	8	15	12
	% Difference	23%	29%	26%	25%	17%	12%	11%	10%	8%	5%	9%	19%	16%
Total CCWD Deliveries (cfs)	FNA	240	179	152	139	142	128	178	223	282	315	317	282	215
	Plan 3	240	179	152	139	142	128	178	223	282	315	317	282	215
	Difference	0	0	0	0	0	0	0	0	0	0	0	0	0
	% Difference	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Delivered Water Quality (mg/L)	FNA	93	91	55	59	55	40	39	38	32	35	53	74	55
	Plan 3	64	62	39	42	43	36	45	38	37	22	32	52	43
	Difference	-29	-29	-16	-16	-12	-3	6	0	5	-13	-21	-23	-13
	% Difference	-31%	-32%	-29%	-28%	-21%	-8%	15%	0%	16%	-38%	-40%	-31%	-23%

Key: % = percent; CCWD = Contra Costa Water District; cfs = cubic feet per second; CVP = Central Valley Project; FNA = Future No-Action Plan; mg/L =milligrams per liter; N/A= not applicable; TAF = thousand acre-feet

Table B-9. Contra Costa Water District Operations Averaged by Year Type

Parameter		Long-Term Average	Wet	Above Normal	Below Normal	Dry	Critical
Rock Slough Diversions (cfs)	FNA	52	45	54	52	57	57
	Plan 3	0	0	0	0	0	0
	Difference	-52	-45	-54	-52	-57	-57
	% Difference	-100%	-100%	-100%	-100%	-100%	-100%
Old River Diversions (cfs)	FNA	161	163	174	164	152	154
	Plan 3	78	90	86	76	84	44
	Difference	-83	-73	-88	-88	-68	-110
	% Difference	-52%	-45%	-51%	-54%	-45%	-72%
Middle River Diversions (cfs)	FNA	0	0	0	0	0	0
	Plan 3	136	111	142	138	145	162
	Difference	136	111	142	138	145	162
	% Difference	N/A	N/A	N/A	N/A	N/A	N/A
CVP Contract Water Diversions (cfs)	FNA	191	173	191	192	200	210
	Plan 3	203	187	211	205	219	201
	Difference	12	14	20	12	19	-9
	% Difference	6%	8%	10%	6%	9%	-4%
Los Vaqueros Water Right Diversions (cfs)	FNA	22	33	37	24	10	4
	Plan 3	11	15	18	10	9	5
	Difference	-11	-18	-19	-14	-1	1
	% Difference	-48%	-55%	-52%	-59%	-8%	21%
Los Vaqueros Storage (TAF)	FNA	77	90	84	81	71	53
	Plan 3	89	97	91	94	88	70
	Difference	12	7	7	14	17	16
	% Difference	16%	8%	8%	17%	24%	30%
Total CCWD Deliveries (cfs)	FNA	215	201	207	212	224	237
	Plan 3	215	201	207	212	224	237
	Difference	0	0	0	0	0	0
	% Difference	0%	0%	0%	0%	0%	0%
Delivered Water Quality (mg/L)	FNA	55	38	50	51	61	87
	Plan 3	43	32	39	41	48	58
	Difference	-13	-6	-11	-10	-13	-28
	% Difference	-23%	-15%	-22%	-20%	-22%	-33%

Key:
% = percent
cfs = cubic feet per second
CVP = Central Valley Project
FNA = Future No-Action Plan
mg/L = milligrams per liter
N/A = not applicable
TAF = thousand acre-feet

Table B-10. Future No-Action: Rock Slough Monthly Diversions (cfs)

Water Year	Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
1922	AN	240	170	0	0	0	0	0	0	144	1	10	227	66
1923	BN	0	0	0	0	0	0	0	0	282	8	0	0	24
1924	C	0	0	0	135	124	0	0	0	295	320	318	290	124
1925	D	0	0	0	0	56	70	0	0	293	208	199	153	82
1926	D	0	0	0	0	46	31	0	0	293	208	199	269	87
1927	W	51	0	2	49	46	0	0	0	105	0	314	83	54
1928	AN	0	0	0	0	0	0	0	0	279	1	10	130	35
1929	C	0	0	0	0	115	32	0	0	314	195	0	0	55
1930	D	0	0	0	0	78	70	0	0	293	102	0	77	52
1931	C	0	0	0	0	166	87	42	57	314	8	0	0	56
1932	D	0	0	0	0	0	31	0	0	293	208	199	183	76
1933	C	0	0	0	0	46	87	0	0	314	8	0	0	38
1934	C	245	0	0	180	0	0	0	0	314	320	0	0	88
1935	BN	245	0	0	0	0	1	171	38	282	194	87	0	85
1936	BN	0	0	0	0	5	60	0	0	162	119	10	0	30
1937	BN	0	0	0	0	6	60	0	0	162	111	10	172	43
1938	W	0	0	0	136	0	0	0	0	106	0	7	250	42
1939	D	0	0	59	41	54	31	0	0	293	0	0	0	40
1940	AN	0	0	0	0	40	0	37	0	279	187	0	82	52
1941	W	0	0	0	0	0	0	0	0	83	0	7	207	25
1942	W	0	0	0	0	121	0	0	0	100	0	314	114	54
1943	W	0	0	0	0	1	0	0	0	257	0	314	81	54
1944	D	0	0	0	51	0	31	0	0	293	208	0	0	49
1945	BN	0	0	2	0	46	60	0	0	282	194	0	104	57
1946	BN	0	0	0	136	129	29	0	0	282	314	0	0	74
1947	D	0	0	0	65	0	31	0	0	293	320	0	0	59
1948	BN	0	0	0	94	160	121	146	51	282	194	0	0	87
1949	D	0	0	0	0	0	70	0	0	293	208	0	0	48
1950	BN	0	0	0	142	46	57	45	0	282	194	11	0	65
1951	AN	76	0	0	136	126	0	0	0	279	1	318	0	78
1952	W	0	0	0	0	111	0	0	0	105	0	7	0	19
1953	W	0	0	49	103	121	53	0	0	257	0	6	109	58
1954	AN	0	0	0	0	1	54	0	0	279	1	10	86	36
1955	D	0	0	0	0	0	13	0	0	293	52	0	150	42
1956	W	0	0	2	0	40	3	0	0	105	0	314	116	48
1957	AN	0	0	0	0	1	54	0	0	279	102	318	0	63
1958	W	0	0	0	0	0	0	0	0	47	0	6	0	4
1959	BN	0	116	0	0	0	60	0	0	282	11	0	0	39
1960	D	0	0	0	99	116	31	0	0	293	142	0	0	57
1961	D	0	0	2	55	0	31	0	0	293	301	0	0	57
1962	BN	0	0	2	0	46	23	0	0	282	194	0	0	46
1963	W	0	59	159	0	0	0	0	0	95	0	7	135	38
1964	D	0	22	0	0	0	0	0	0	293	320	0	0	53
1965	W	0	0	2	0	46	18	0	0	137	183	120	0	42
1966	BN	0	0	0	0	0	16	0	0	282	11	0	0	26
1967	W	0	0	0	0	9	0	0	0	89	0	7	0	9
1968	BN	0	156	0	0	114	60	0	0	282	11	235	0	71
1969	W	0	0	0	0	9	0	0	0	106	0	7	273	33
1970	W	0	156	54	0	0	0	0	0	257	303	314	93	98
1971	W	0	0	0	0	121	53	0	0	257	0	7	111	46
1972	BN	0	0	0	39	0	60	0	0	282	194	0	68	54
1973	AN	0	0	0	16	129	0	0	0	279	1	10	111	45
1974	W	0	0	0	123	115	0	0	0	105	0	314	0	55
1975	W	0	78	0	0	1	0	0	0	104	0	314	0	41
1976	C	0	0	63	0	0	47	0	0	171	0	0	0	23
1977	C	0	0	0	0	0	87	43	57	314	8	0	290	67
1978	AN	0	0	0	0	78	0	36	0	159	187	97	196	63
1979	BN	0	0	0	0	0	60	0	0	162	60	10	88	32
1980	AN	0	0	0	0	5	0	0	0	279	0	10	281	48
1981	D	0	0	0	0	0	29	0	0	293	241	0	0	47
1982	W	0	0	2	49	46	53	0	0	137	25	7	273	49
1983	W	0	0	0	0	0	0	0	0	90	0	6	273	31
1984	W	0	0	0	0	0	0	0	0	257	0	314	95	55
1985	D	0	0	0	0	0	0	0	0	293	275	0	0	47
1986	W	0	0	0	0	0	0	22	42	257	183	314	273	91
1987	D	73	0	0	0	53	70	0	0	293	208	0	0	58
1988	C	0	0	0	0	40	47	0	0	314	208	0	0	51
1989	D	0	0	0	0	198	70	0	0	293	208	0	0	64
1990	C	0	0	0	169	0	47	0	0	314	0	0	0	44
1991	C	0	0	0	0	0	0	37	0	314	0	0	0	29
1992	C	245	0	0	0	0	47	0	0	314	320	0	0	77
1993	AN	0	0	0	0	78	21	0	0	159	187	124	140	59
1994	C	0	0	0	0	0	47	0	0	314	0	0	0	30

Note: * Water year type defined by Sacramento Valley index: AN = above normal BN =below normal C = critical D = dry W =wet
Key: cfs = cubic feet per second

Table B-11. Plan 3: Rock Slough Monthly Diversions (cfs)

Water Year	Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
1922	AN	0	0	0	0	0	0	0	0	0	0	0	0	0
1923	BN	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	C	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	D	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	D	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1928	AN	0	0	0	0	0	0	0	0	0	0	0	0	0
1929	C	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	D	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	C	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	D	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	C	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	C	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	BN	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	BN	0	0	0	0	0	0	0	0	0	0	0	0	0
1937	BN	0	0	0	0	0	0	0	0	0	0	0	0	0
1938	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1939	D	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	AN	0	0	0	0	0	0	0	0	0	0	0	0	0
1941	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1942	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	D	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	BN	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	BN	0	0	0	0	0	0	0	0	0	0	0	0	0
1947	D	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	BN	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	D	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	BN	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	AN	0	0	0	0	0	0	0	0	0	0	0	0	0
1952	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	AN	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	D	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	AN	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	BN	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	D	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	D	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	BN	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	D	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	BN	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	BN	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	BN	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	AN	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	C	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	C	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	AN	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	BN	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	AN	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	D	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	D	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	D	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	C	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	D	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	C	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	C	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	C	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	AN	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	C	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: * Water year type defined by Sacramento Valley index: AN = above normal BN =below normal C = critical D = dry W =wet
Key: cfs = cubic feet per second

Table B-12. Future No-Action: Old River Monthly Diversions (cfs)

Water Year	Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
1922	AN	200	200	281	118	91	109	0	193	320	320	320	0	179
1923	BN	76	71	303	123	229	125	0	214	199	320	235	98	166
1924	C	55	161	107	0	0	129	0	151	0	8	0	0	51
1925	D	245	202	133	180	320	56	74	254	200	320	320	0	192
1926	D	44	40	61	156	320	230	0	250	200	320	320	0	162
1927	W	0	60	320	320	320	121	0	193	320	316	12	0	165
1928	AN	45	46	259	105	317	205	0	193	185	320	320	0	166
1929	C	52	51	123	75	0	247	0	273	200	320	126	62	128
1930	D	23	199	139	169	320	230	0	250	200	320	142	0	166
1931	C	240	199	122	168	0	87	182	217	0	320	318	290	179
1932	D	245	202	133	180	191	230	85	255	200	320	320	0	197
1933	C	44	36	68	124	320	247	0	273	200	320	203	124	163
1934	C	0	202	133	0	197	209	194	274	0	8	318	290	152
1935	BN	0	202	133	180	191	320	204	281	200	320	320	66	201
1936	BN	47	102	111	136	320	220	0	214	320	320	320	135	187
1937	BN	52	46	163	64	320	220	0	214	320	320	320	0	170
1938	W	48	74	307	200	100	91	0	193	320	316	320	0	164
1939	D	127	303	0	0	0	230	0	250	200	303	109	51	131
1940	AN	41	70	82	158	320	308	183	193	200	320	279	0	180
1941	W	94	170	303	123	315	124	0	193	320	316	320	0	190
1942	W	62	54	259	105	87	105	0	193	320	316	12	0	126
1943	W	90	75	136	105	320	196	0	193	169	316	12	0	134
1944	D	55	49	259	0	95	230	0	250	200	320	139	102	142
1945	BN	43	59	320	162	320	220	0	214	200	320	291	0	179
1946	BN	43	169	307	0	198	198	0	214	200	16	139	62	129
1947	D	166	178	307	0	127	230	0	250	200	208	90	71	152
1948	BN	37	50	184	0	0	200	230	253	200	320	202	68	145
1949	D	161	179	143	98	0	230	0	250	200	320	186	94	155
1950	BN	49	107	146	0	320	263	224	214	200	320	320	171	195
1951	AN	0	142	307	174	0	110	0	193	185	320	12	71	126
1952	W	57	77	303	123	200	184	0	193	320	316	320	211	192
1953	W	307	156	0	0	3	57	0	193	168	316	320	0	127
1954	AN	54	55	212	105	320	171	0	193	184	320	320	0	161
1955	D	62	62	303	123	315	230	0	250	200	320	286	0	179
1956	W	46	54	320	169	320	213	0	193	320	316	12	0	164
1957	AN	70	55	82	45	320	214	0	193	200	320	12	66	131
1958	W	46	96	303	123	315	152	0	193	320	316	320	153	195
1959	BN	210	0	105	105	268	63	0	214	200	320	225	59	147
1960	D	81	179	143	0	0	230	0	250	200	320	153	258	151
1961	D	55	48	320	0	79	230	0	250	200	0	169	289	137
1962	BN	246	199	320	169	320	220	80	222	200	320	115	123	211
1963	W	234	320	148	136	200	105	0	193	320	316	320	0	191
1964	D	45	0	259	305	176	144	0	250	200	54	58	46	128
1965	W	28	44	320	169	320	213	2	201	320	320	320	83	195
1966	BN	58	89	259	305	19	220	0	214	200	320	170	71	161
1967	W	127	176	307	136	320	150	0	193	320	316	320	249	218
1968	BN	270	1	59	95	0	60	0	214	200	320	0	51	106
1969	W	80	178	307	136	320	141	0	193	320	316	320	9	193
1970	W	178	61	0	82	116	107	0	193	171	14	12	0	78
1971	W	57	50	259	105	200	112	0	193	169	316	320	0	149
1972	BN	72	51	94	0	89	220	19	222	200	320	198	0	124
1973	AN	211	169	307	320	35	99	0	193	185	320	320	0	180
1974	W	41	66	303	200	53	107	0	193	320	316	12	126	145
1975	W	170	0	111	60	320	198	0	193	320	316	12	108	151
1976	C	156	112	0	36	47	247	0	211	0	221	318	249	133
1977	C	245	202	133	180	198	87	181	216	0	320	318	0	173
1978	AN	245	202	133	180	320	308	182	193	320	320	320	0	227
1979	BN	68	53	101	87	315	220	0	214	320	320	320	0	168
1980	AN	48	78	307	136	320	138	0	193	182	320	320	9	171
1981	D	88	58	113	77	315	230	0	250	200	0	97	116	129
1982	W	53	47	320	320	320	213	0	193	320	320	320	7	203
1983	W	235	147	40	65	81	53	0	193	320	316	320	8	148
1984	W	237	147	48	103	115	109	0	193	171	316	12	0	121
1985	D	52	41	259	305	197	141	0	250	200	0	77	68	132
1986	W	59	68	198	108	120	307	320	209	200	320	85	9	167
1987	D	0	47	83	44	0	230	0	250	200	320	126	52	113
1988	C	38	59	107	169	320	247	0	273	200	320	146	68	162
1989	D	135	202	132	180	0	230	47	256	200	320	79	157	161
1990	C	246	199	122	0	166	247	107	277	92	252	318	290	193
1991	C	245	202	133	180	175	174	262	273	0	311	318	290	214
1992	C	0	202	133	180	191	247	118	279	48	8	291	290	165
1993	AN	245	202	133	180	320	287	139	199	320	320	320	0	222
1994	C	47	40	303	58	76	247	0	273	200	90	51	202	132

Note: * Water year type defined by Sacramento Valley index: AN = above normal BN =below normal C = critical D = dry W =wet
Key: cfs = cubic feet per second

Table B-13. Plan 3: Old River Monthly Diversions (cfs)

Water Year	Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
1922	AN	320	320	281	0	91	109	0	193	320	320	12	9	165
1923	BN	0	43	0	119	115	125	0	214	320	14	12	8	81
1924	C	0	0	95	0	0	78	0	144	0	8	0	0	27
1925	D	0	0	148	0	200	199	0	250	320	208	0	133	121
1926	D	0	0	0	0	200	230	0	250	320	166	0	22	99
1927	W	0	20	51	0	0	109	0	193	320	14	12	9	61
1928	AN	0	0	59	0	0	108	0	193	320	14	12	9	60
1929	C	0	0	72	0	0	150	0	273	0	8	0	0	42
1930	D	0	0	127	16	200	230	0	250	320	129	0	0	106
1931	C	0	0	0	0	0	0	0	224	0	8	0	0	19
1932	D	0	0	36	200	200	230	0	250	320	208	0	169	135
1933	C	0	0	135	0	1	176	0	273	0	8	0	0	49
1934	C	0	0	21	0	18	87	0	273	0	8	0	0	34
1935	BN	0	0	17	0	115	320	222	214	320	200	92	9	126
1936	BN	0	0	103	0	0	122	0	214	320	14	12	9	66
1937	BN	0	0	138	0	0	38	0	214	200	14	12	9	52
1938	W	0	122	99	133	97	91	0	193	169	14	12	9	78
1939	D	4	2	0	0	0	179	0	250	320	8	0	0	64
1940	AN	0	0	0	0	320	214	0	193	320	54	12	9	94
1941	W	0	0	140	96	0	95	0	193	320	316	12	9	98
1942	W	0	58	0	0	0	105	0	193	320	316	12	9	84
1943	W	5	0	0	0	0	49	0	193	320	316	12	9	75
1944	D	0	0	118	0	0	144	0	250	320	53	0	22	76
1945	BN	0	0	110	0	0	121	0	214	320	17	12	9	67
1946	BN	0	0	254	135	130	123	0	214	320	16	12	0	100
1947	D	0	194	0	0	0	156	0	250	320	10	0	0	78
1948	BN	0	0	42	0	0	220	0	214	320	163	12	9	82
1949	D	0	82	0	0	0	187	0	250	320	56	0	22	76
1950	BN	0	0	142	0	75	63	0	214	320	16	12	9	71
1951	AN	3	0	94	0	0	110	0	193	320	14	12	0	62
1952	W	0	53	52	106	110	52	0	193	169	316	12	9	89
1953	W	6	156	49	103	124	111	0	193	320	14	12	9	91
1954	AN	0	111	0	0	0	56	0	193	320	14	12	9	60
1955	D	0	21	15	0	1	75	0	250	320	52	0	22	63
1956	W	0	0	148	4	0	110	0	193	320	316	12	8	93
1957	AN	4	3	0	0	0	110	0	193	320	14	12	0	55
1958	W	0	137	0	0	79	86	0	193	320	316	12	9	96
1959	BN	5	3	0	0	110	123	0	214	320	17	12	0	67
1960	D	0	0	148	0	0	230	0	250	320	133	0	22	92
1961	D	0	0	115	0	0	108	0	250	320	55	0	0	71
1962	BN	0	0	148	0	20	120	0	214	320	17	12	0	71
1963	W	0	200	100	0	0	105	0	193	320	316	12	9	105
1964	D	0	0	120	0	2	74	0	250	320	54	0	0	68
1965	W	0	0	148	200	186	109	0	193	320	14	12	9	99
1966	BN	0	88	0	0	119	125	0	214	320	17	12	0	75
1967	W	0	192	0	0	124	97	0	193	152	316	12	9	91
1968	BN	238	1	0	0	114	121	0	214	320	16	11	0	86
1969	W	0	138	101	0	94	44	0	193	320	316	12	9	102
1970	W	4	1	54	82	0	107	0	193	320	14	12	9	66
1971	W	0	92	0	0	122	109	0	193	320	14	12	9	73
1972	BN	5	2	0	0	0	129	0	214	320	16	12	0	58
1973	AN	0	0	148	56	0	99	0	193	320	14	12	9	71
1974	W	0	132	0	117	115	107	0	193	320	13	12	9	85
1975	W	4	2	0	0	0	97	0	193	320	316	12	9	80
1976	C	2	2	0	0	0	125	0	188	0	8	0	0	27
1977	C	0	0	0	0	0	87	182	217	0	8	0	0	41
1978	AN	0	0	59	0	200	217	102	200	200	200	126	9	109
1979	BN	6	0	0	0	0	119	0	214	320	16	12	9	58
1980	AN	0	124	0	0	0	46	0	193	320	13	12	9	60
1981	D	6	3	0	0	0	192	0	250	320	55	0	49	73
1982	W	0	0	148	0	0	45	0	193	320	316	12	7	87
1983	W	3	147	40	65	81	53	0	193	320	316	320	281	152
1984	W	237	147	48	103	0	109	0	193	320	14	12	9	99
1985	D	0	0	114	0	0	71	0	250	320	55	0	0	67
1986	W	0	0	148	0	196	98	0	193	320	14	12	9	82
1987	D	0	0	51	0	0	87	0	250	320	56	0	0	64
1988	C	0	0	148	26	154	92	0	273	0	8	0	0	58
1989	D	0	0	31	0	0	230	0	250	320	208	0	0	87
1990	C	0	50	40	0	0	247	0	273	0	8	0	0	51
1991	C	0	0	0	0	0	87	231	273	0	8	0	0	50
1992	C	0	0	0	0	0	247	105	279	0	8	0	0	53
1993	AN	0	0	18	0	320	235	104	199	320	200	126	9	128
1994	C	0	0	59	0	0	225	0	273	200	8	0	84	71

Note: * Water year type defined by Sacramento Valley index: AN = above normal BN =below normal C = critical D = dry W =wet
Key: cfs = cubic feet per second

Table B-14. Future No-Action: Middle River Monthly Diversions (cfs)

Water Year	Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
1922	AN	0	0	0	0	0	0	0	0	0	0	0	0	0
1923	BN	0	0	0	0	0	0	0	0	0	0	0	0	0
1924	C	0	0	0	0	0	0	0	0	0	0	0	0	0
1925	D	0	0	0	0	0	0	0	0	0	0	0	0	0
1926	D	0	0	0	0	0	0	0	0	0	0	0	0	0
1927	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1928	AN	0	0	0	0	0	0	0	0	0	0	0	0	0
1929	C	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	D	0	0	0	0	0	0	0	0	0	0	0	0	0
1931	C	0	0	0	0	0	0	0	0	0	0	0	0	0
1932	D	0	0	0	0	0	0	0	0	0	0	0	0	0
1933	C	0	0	0	0	0	0	0	0	0	0	0	0	0
1934	C	0	0	0	0	0	0	0	0	0	0	0	0	0
1935	BN	0	0	0	0	0	0	0	0	0	0	0	0	0
1936	BN	0	0	0	0	0	0	0	0	0	0	0	0	0
1937	BN	0	0	0	0	0	0	0	0	0	0	0	0	0
1938	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1939	D	0	0	0	0	0	0	0	0	0	0	0	0	0
1940	AN	0	0	0	0	0	0	0	0	0	0	0	0	0
1941	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1942	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1943	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1944	D	0	0	0	0	0	0	0	0	0	0	0	0	0
1945	BN	0	0	0	0	0	0	0	0	0	0	0	0	0
1946	BN	0	0	0	0	0	0	0	0	0	0	0	0	0
1947	D	0	0	0	0	0	0	0	0	0	0	0	0	0
1948	BN	0	0	0	0	0	0	0	0	0	0	0	0	0
1949	D	0	0	0	0	0	0	0	0	0	0	0	0	0
1950	BN	0	0	0	0	0	0	0	0	0	0	0	0	0
1951	AN	0	0	0	0	0	0	0	0	0	0	0	0	0
1952	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1953	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1954	AN	0	0	0	0	0	0	0	0	0	0	0	0	0
1955	D	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1957	AN	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	BN	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	D	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	D	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	BN	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	D	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	BN	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	BN	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	BN	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	AN	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	C	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	C	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	AN	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	BN	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	AN	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	D	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	D	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	W	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	D	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	C	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	D	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	C	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	C	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	C	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	AN	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	C	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: * Water year type defined by Sacramento Valley index: AN = above normal BN =below normal C = critical D = dry W =wet
Key: cfs = cubic feet per second

Table B-15. Plan 3: Middle River Monthly Diversions (cfs)

Water Year	Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
1922	AN	120	50	0	118	0	0	0	0	144	1	318	281	86
1923	BN	201	170	86	0	0	0	0	0	161	314	318	279	127
1924	C	166	113	159	129	58	87	0	0	176	320	318	210	145
1925	D	78	145	185	180	198	40	0	0	173	320	319	289	161
1926	D	91	65	141	169	166	31	0	0	173	320	319	289	147
1927	W	124	199	174	167	155	0	0	0	105	303	314	273	151
1928	AN	149	127	111	104	116	0	0	0	143	307	318	281	138
1929	C	135	152	155	123	56	81	0	0	225	320	318	253	152
1930	D	70	53	185	180	198	70	0	0	173	320	319	289	155
1931	C	70	53	131	160	64	71	0	0	314	320	318	290	149
1932	D	245	202	185	180	191	31	0	0	173	320	319	289	178
1933	C	160	100	174	163	166	0	0	0	314	320	318	290	167
1934	C	87	50	185	180	198	87	0	0	215	320	318	290	161
1935	BN	180	201	185	180	198	1	44	0	162	314	318	279	172
1936	BN	152	116	159	131	104	0	0	0	162	314	318	279	144
1937	BN	139	91	159	132	107	60	0	0	282	314	318	279	157
1938	W	127	179	0	0	0	0	0	0	257	303	314	273	121
1939	D	232	156	59	104	81	0	0	0	173	320	319	137	132
1940	AN	77	103	170	169	40	54	0	0	159	307	318	281	140
1941	W	101	94	155	0	86	0	0	0	83	0	314	273	92
1942	W	181	156	40	67	108	0	0	0	100	0	314	273	103
1943	W	232	152	56	77	118	53	0	0	106	0	314	273	115
1944	D	134	88	111	103	110	0	0	0	173	320	319	289	137
1945	BN	117	165	174	169	163	0	0	0	162	314	318	279	155
1946	BN	129	140	0	0	0	0	0	0	162	314	318	206	106
1947	D	137	179	105	136	55	53	0	0	173	320	319	289	147
1948	BN	88	107	174	169	105	23	0	0	162	314	318	279	145
1949	D	168	179	103	135	0	70	0	0	173	320	319	289	146
1950	BN	107	115	174	127	166	60	0	0	162	314	318	279	152
1951	AN	241	175	0	129	126	0	0	0	143	307	318	232	139
1952	W	138	170	155	0	0	53	0	0	257	0	314	273	113
1953	W	232	0	0	0	0	0	0	0	105	303	314	273	102
1954	AN	132	156	60	104	121	54	0	0	143	307	318	281	140
1955	D	155	170	155	120	115	70	0	0	173	320	319	289	157
1956	W	101	104	174	169	157	0	0	0	105	0	314	273	116
1957	AN	232	156	60	104	118	0	0	0	140	307	318	252	141
1958	W	133	170	117	114	0	0	0	0	47	0	314	273	97
1959	BN	232	156	60	100	0	0	0	0	162	314	318	168	126
1960	D	92	71	159	136	86	31	0	0	173	320	319	289	140
1961	D	135	120	174	169	151	68	0	0	173	320	319	289	160
1962	BN	121	103	174	169	166	0	0	0	162	314	318	113	137
1963	W	58	179	159	118	115	0	0	0	95	0	314	273	109
1964	D	170	44	111	99	117	70	0	0	173	320	198	175	123
1965	W	86	159	174	169	0	0	0	0	104	303	314	273	132
1966	BN	149	156	49	101	0	0	0	0	162	314	318	214	122
1967	W	129	179	100	92	0	0	0	0	257	0	314	273	112
1968	BN	0	156	59	95	0	0	0	0	162	314	318	129	103
1969	W	110	179	159	105	0	53	0	0	106	0	314	273	108
1970	W	232	156	0	0	116	0	0	0	108	303	314	273	125
1971	W	138	156	43	100	0	0	0	0	106	303	314	273	119
1972	BN	232	156	55	92	63	60	0	0	162	314	318	169	135
1973	AN	71	166	159	136	101	0	0	0	143	307	318	281	140
1974	W	105	170	91	0	0	0	0	0	105	303	314	273	113
1975	W	232	156	57	105	115	0	0	0	104	0	314	273	113
1976	C	232	156	60	105	83	87	0	0	226	320	318	170	146
1977	C	75	132	163	114	112	87	41	57	314	320	318	290	169
1978	AN	245	202	185	180	198	54	0	0	279	307	318	281	187
1979	BN	240	169	97	114	103	0	0	0	162	314	318	279	150
1980	AN	125	179	102	115	82	54	0	0	141	307	318	281	142
1981	D	240	170	102	117	59	0	0	0	173	320	292	289	147
1982	W	127	94	174	128	159	53	0	0	96	0	314	273	118
1983	W	232	0	0	0	0	0	0	0	90	0	6	0	27
1984	W	0	0	0	0	115	0	0	0	108	303	314	273	93
1985	D	132	84	111	105	119	70	0	0	173	320	194	189	125
1986	W	149	135	174	169	166	0	0	0	106	303	314	273	149
1987	D	188	103	111	104	100	70	0	0	173	320	319	170	138
1988	C	81	128	174	169	160	87	0	0	171	320	318	277	157
1989	D	64	58	185	180	104	70	0	0	173	320	319	150	135
1990	C	120	199	174	57	100	47	0	0	260	320	318	290	157
1991	C	245	202	133	180	198	87	32	0	314	320	318	290	193
1992	C	245	202	133	180	191	47	0	0	314	320	318	290	187
1993	AN	245	202	185	180	78	54	0	0	159	307	318	281	167
1994	C	160	143	155	123	0	55	0	0	314	320	318	290	157

Note: * Water year type defined by Sacramento Valley index: AN = above normal BN =below normal C = critical D = dry W =wet
Key: cfs = cubic feet per second

Table B-16. Future No-Action: Total Contra Costa Water District Monthly Diversions (cfs)

Water Year	Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
1922	AN	440	370	281	118	91	109	0	193	464	321	330	227	245
1923	BN	76	71	355	123	229	125	0	214	481	328	235	98	195
1924	C	55	161	159	135	124	129	0	151	295	328	318	290	179
1925	D	245	202	185	180	376	126	74	254	493	528	519	153	278
1926	D	44	40	113	156	366	261	0	250	493	528	519	269	253
1927	W	51	60	374	369	366	121	0	193	425	316	327	83	224
1928	AN	45	46	311	105	317	205	0	193	463	321	330	130	206
1929	C	52	51	175	75	115	279	0	273	514	515	126	62	187
1930	D	23	199	191	169	398	300	0	250	493	422	142	77	222
1931	C	240	199	174	168	166	174	224	274	314	328	318	290	239
1932	D	245	202	185	180	191	261	85	255	493	528	519	183	277
1933	C	44	36	120	124	366	334	0	273	514	328	203	124	205
1934	C	245	202	185	180	197	209	194	274	314	328	318	290	245
1935	BN	245	202	185	180	191	321	375	319	482	514	407	66	291
1936	BN	47	102	163	136	325	281	0	214	482	439	330	135	221
1937	BN	52	46	215	64	326	281	0	214	482	431	330	172	218
1938	W	48	74	359	336	100	91	0	193	426	316	327	250	210
1939	D	127	303	111	41	54	261	0	250	493	303	109	51	175
1940	AN	41	70	134	158	360	308	220	193	479	507	279	82	236
1941	W	94	170	355	123	315	124	0	193	403	316	327	207	219
1942	W	62	54	311	105	208	105	0	193	420	316	327	114	185
1943	W	90	75	188	105	321	196	0	193	426	316	327	81	193
1944	D	55	49	311	51	95	261	0	250	493	528	139	102	195
1945	BN	43	59	374	162	366	281	0	214	482	514	291	104	241
1946	BN	43	169	359	136	327	227	0	214	482	331	139	62	207
1947	D	166	178	359	65	127	261	0	250	493	528	90	71	216
1948	BN	37	50	236	94	160	321	375	303	482	514	202	68	237
1949	D	161	179	195	98	0	300	0	250	493	528	186	94	207
1950	BN	49	107	198	142	366	321	269	214	482	514	331	171	264
1951	AN	76	142	359	310	126	110	0	193	463	321	330	71	208
1952	W	57	77	355	123	311	184	0	193	425	316	327	211	215
1953	W	307	156	101	103	124	111	0	193	425	316	326	109	189
1954	AN	54	55	264	105	321	225	0	193	463	321	330	86	201
1955	D	62	62	355	123	315	243	0	250	493	372	286	150	226
1956	W	46	54	374	169	360	217	0	193	425	316	327	116	216
1957	AN	70	55	134	45	321	268	0	193	479	422	330	66	198
1958	W	46	96	355	123	315	152	0	193	367	316	326	153	204
1959	BN	210	116	157	105	268	123	0	214	482	331	225	59	191
1960	D	81	179	195	99	116	261	0	250	493	462	153	258	212
1961	D	55	48	374	55	79	261	0	250	493	301	169	289	198
1962	BN	246	199	374	169	366	243	80	222	482	514	115	123	261
1963	W	234	379	359	136	200	105	0	193	415	316	327	135	233
1964	D	45	22	311	305	176	144	0	250	493	374	58	46	186
1965	W	28	44	374	169	366	231	2	201	457	503	440	83	241
1966	BN	58	89	311	305	19	236	0	214	482	331	170	71	191
1967	W	127	176	359	136	329	150	0	193	409	316	327	249	231
1968	BN	270	157	111	95	114	121	0	214	482	331	235	51	182
1969	W	80	178	359	136	329	141	0	193	426	316	327	282	231
1970	W	178	217	106	82	116	107	0	193	428	316	327	93	180
1971	W	57	50	311	105	321	165	0	193	426	316	327	111	199
1972	BN	72	51	146	39	89	281	19	222	482	514	198	68	182
1973	AN	211	169	359	336	164	99	0	193	463	321	330	111	230
1974	W	41	66	355	323	168	107	0	193	425	316	327	126	204
1975	W	170	78	163	60	321	198	0	193	424	316	326	108	197
1976	C	156	112	115	36	47	294	0	211	171	221	318	249	161
1977	C	245	202	185	180	198	174	224	274	314	328	318	290	244
1978	AN	245	202	185	180	398	308	219	193	479	507	417	196	294
1979	BN	68	53	153	87	315	281	0	214	482	380	330	88	204
1980	AN	48	78	359	136	325	138	0	193	461	320	330	290	223
1981	D	88	58	165	77	315	259	0	250	493	241	97	116	180
1982	W	53	47	374	369	366	267	0	193	457	345	327	280	256
1983	W	235	147	92	65	81	53	0	193	410	316	326	281	183
1984	W	237	147	100	103	115	109	0	193	428	316	327	95	181
1985	D	52	41	311	305	197	141	0	250	493	275	77	68	184
1986	W	59	68	250	108	120	307	342	251	457	503	400	282	262
1987	D	73	47	135	44	53	300	0	250	493	528	126	52	175
1988	C	38	59	159	169	360	294	0	273	514	528	146	68	217
1989	D	135	202	184	180	198	300	47	256	493	528	79	157	230
1990	C	246	199	174	169	166	294	107	277	406	252	318	290	242
1991	C	245	202	185	180	175	174	299	273	314	311	318	290	247
1992	C	245	202	185	180	191	294	118	279	362	328	291	290	247
1993	AN	245	202	185	180	398	308	139	199	479	507	444	140	285
1994	C	47	40	355	58	76	294	0	273	514	90	51	202	167

Note: * Water year type defined by Sacramento Valley index: AN = above normal BN =below normal C = critical D = dry W =wet
Key: cfs = cubic feet per second

Table B-17. Plan 3: Total Contra Costa Water District Monthly Diversions (cfs)

Water Year	Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
1922	AN	440	370	281	118	91	109	0	193	464	321	330	290	251
1923	BN	201	213	138	119	115	125	0	214	481	328	330	288	213
1924	C	166	113	305	129	58	165	0	144	176	328	318	210	176
1925	D	78	145	385	180	398	240	0	250	493	528	319	421	286
1926	D	91	65	193	169	366	261	0	250	493	486	319	311	250
1927	W	124	219	278	167	155	109	0	193	425	316	327	282	216
1928	AN	149	127	222	104	116	108	0	193	463	321	330	290	202
1929	C	135	152	279	123	56	232	0	273	225	328	318	253	198
1930	D	70	53	364	196	398	300	0	250	493	449	319	289	265
1931	C	70	53	183	160	64	71	0	224	314	328	318	290	173
1932	D	245	202	273	380	391	261	0	250	493	528	319	458	317
1933	C	160	100	362	163	167	176	0	273	314	328	318	290	221
1934	C	87	50	258	180	216	174	0	273	215	328	318	290	199
1935	BN	180	201	254	180	313	321	267	214	482	514	409	289	302
1936	BN	152	116	313	131	104	122	0	214	482	328	330	288	215
1937	BN	139	91	349	132	107	98	0	214	482	329	330	289	213
1938	W	127	301	151	133	97	91	0	193	426	316	327	282	204
1939	D	236	158	111	104	81	179	0	250	493	328	319	137	200
1940	AN	77	103	222	169	360	268	0	193	479	361	330	290	238
1941	W	101	94	347	96	86	95	0	193	403	316	327	282	195
1942	W	181	214	92	67	108	105	0	193	420	316	327	282	192
1943	W	237	152	109	77	118	102	0	193	426	316	327	282	195
1944	D	134	88	282	103	110	144	0	250	493	373	319	311	217
1945	BN	117	165	336	169	163	121	0	214	482	331	330	289	226
1946	BN	129	140	306	135	130	123	0	214	482	331	330	206	210
1947	D	137	373	157	136	55	209	0	250	493	330	319	289	229
1948	BN	88	107	269	169	105	243	0	214	482	477	330	289	231
1949	D	168	261	155	135	0	257	0	250	493	376	319	310	227
1950	BN	107	115	369	127	241	123	0	214	482	331	330	288	227
1951	AN	244	175	146	129	126	110	0	193	463	321	330	232	206
1952	W	138	223	260	106	110	105	0	193	425	316	327	282	207
1953	W	238	156	101	103	124	111	0	193	425	316	326	282	198
1954	AN	132	266	112	104	121	110	0	193	463	321	330	290	203
1955	D	155	191	222	120	116	145	0	250	493	372	319	310	224
1956	W	101	104	374	173	157	110	0	193	425	316	327	281	213
1957	AN	236	158	112	104	118	110	0	193	460	321	330	252	199
1958	W	133	307	169	114	79	86	0	193	367	316	326	282	198
1959	BN	238	158	112	100	110	123	0	214	482	331	330	168	197
1960	D	92	71	359	136	86	261	0	250	493	453	319	311	236
1961	D	135	120	341	169	151	176	0	250	493	375	319	289	235
1962	BN	121	103	374	169	186	120	0	214	482	331	330	113	212
1963	W	58	379	311	118	115	105	0	193	415	316	327	282	218
1964	D	170	44	283	99	119	144	0	250	493	374	198	175	196
1965	W	86	159	374	369	186	109	0	193	424	316	326	282	235
1966	BN	149	244	102	101	119	125	0	214	482	331	330	214	201
1967	W	129	371	152	92	124	97	0	193	409	316	327	282	208
1968	BN	238	157	111	95	114	121	0	214	482	331	328	129	193
1969	W	110	317	312	105	94	97	0	193	426	316	327	282	215
1970	W	236	157	106	82	116	107	0	193	428	316	327	282	196
1971	W	138	248	95	100	122	109	0	193	426	316	327	282	196
1972	BN	238	157	107	92	63	190	0	214	482	330	330	169	198
1973	AN	71	166	359	192	101	99	0	193	463	321	330	290	215
1974	W	105	302	143	117	115	107	0	193	425	316	327	282	203
1975	W	236	158	109	105	115	97	0	193	424	316	326	282	197
1976	C	235	158	112	105	83	212	0	188	226	328	318	170	178
1977	C	75	132	215	114	112	174	224	274	314	328	318	290	214
1978	AN	245	202	296	180	398	271	102	200	479	507	444	290	301
1979	BN	246	169	149	114	103	119	0	214	482	330	330	288	212
1980	AN	125	303	154	115	82	100	0	193	461	320	330	290	206
1981	D	246	173	154	117	59	192	0	250	493	375	292	338	224
1982	W	127	94	374	128	159	99	0	193	416	316	327	280	209
1983	W	235	147	92	65	81	53	0	193	410	316	326	281	183
1984	W	237	147	100	103	115	109	0	193	428	316	327	282	197
1985	D	132	84	277	105	119	141	0	250	493	375	194	189	197
1986	W	149	135	374	169	362	98	0	193	426	316	327	282	236
1987	D	188	103	214	104	100	157	0	250	493	376	319	170	206
1988	C	81	128	374	195	314	178	0	273	171	328	318	277	220
1989	D	64	58	268	180	104	300	0	250	493	528	319	150	226
1990	C	120	249	266	57	100	294	0	273	260	328	318	290	213
1991	C	245	202	185	180	198	174	263	273	314	328	318	290	247
1992	C	245	202	185	180	191	294	105	279	314	328	318	290	244
1993	AN	245	202	255	180	398	290	104	199	479	507	444	290	299
1994	C	160	143	266	123	0	280	0	273	514	328	318	374	232

Note: * Water year type defined by Sacramento Valley index: AN = above normal BN =below normal C = critical D = dry W =wet
Key: cfs = cubic feet per second

Table B-18. Future No-Action: Los Vaqueros Reservoir Average Monthly Storage (TAF)

Water Year	Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
1922	AN	80	92	100	100	100	100	90	90	100	100	100	96	96
1923	BN	86	80	93	94	100	100	89	89	100	100	94	83	92
1924	C	71	70	70	70	70	67	53	46	44	44	43	43	58
1925	D	43	43	43	43	53	52	44	44	56	67	79	71	53
1926	D	58	48	45	44	55	63	50	50	61	73	85	83	60
1927	W	71	63	75	88	99	100	91	91	100	100	100	88	89
1928	AN	76	70	82	82	94	100	90	90	100	100	100	91	90
1929	C	79	72	73	70	70	76	63	62	74	85	72	58	71
1930	D	44	44	44	44	55	65	53	52	64	69	57	44	53
1931	C	44	44	44	44	44	44	44	43	43	43	42	42	43
1932	D	42	42	43	43	44	51	44	44	56	67	79	72	52
1933	C	60	50	47	44	55	65	51	51	62	62	54	44	54
1934	C	44	44	44	44	44	46	44	44	43	43	43	42	44
1935	BN	42	42	42	43	42	54	66	72	84	95	100	87	64
1936	BN	75	70	70	71	83	93	82	82	93	100	100	91	84
1937	BN	79	71	75	70	82	94	83	82	94	100	100	93	85
1938	W	81	75	87	100	100	100	91	91	100	100	100	98	94
1939	D	91	100	100	96	92	100	87	86	98	95	82	67	91
1940	AN	54	46	44	44	56	69	72	72	83	95	92	79	67
1941	W	70	70	84	85	98	100	93	92	100	100	100	96	91
1942	W	85	79	92	94	100	100	92	91	100	100	100	90	94
1943	W	81	76	81	83	94	100	91	91	100	100	100	88	90
1944	D	77	70	83	80	79	86	73	73	84	96	84	72	80
1945	BN	60	51	64	63	75	85	74	73	85	96	94	83	75
1946	BN	71	70	83	83	94	100	89	89	100	100	88	75	87
1947	D	70	70	82	78	78	85	73	72	83	95	80	67	78
1948	BN	54	45	49	44	44	56	68	73	84	96	88	75	65
1949	D	70	70	72	70	63	73	60	60	71	83	74	62	69
1950	BN	50	44	45	44	55	67	73	72	84	95	95	88	68
1951	AN	78	76	89	100	100	100	90	90	100	100	100	87	92
1952	W	75	70	83	84	95	100	91	91	100	100	100	96	90
1953	W	100	100	100	100	100	100	91	91	100	100	100	90	98
1954	AN	78	72	82	82	93	100	90	90	100	100	100	88	90
1955	D	77	70	83	83	94	100	87	87	98	100	97	88	89
1956	W	76	67	81	82	93	100	91	91	100	100	100	90	89
1957	AN	80	74	75	71	83	92	83	82	94	100	100	87	85
1958	W	75	70	82	83	96	100	95	94	100	100	100	92	91
1959	BN	91	88	91	91	100	100	89	89	100	100	94	80	93
1960	D	70	70	72	70	70	77	65	64	76	83	72	70	72
1961	D	58	49	62	55	50	57	45	44	56	54	44	44	51
1962	BN	44	44	56	56	68	76	70	70	81	93	80	70	67
1963	W	70	82	94	95	100	100	92	91	100	100	100	91	93
1964	D	80	72	84	97	100	100	87	87	98	100	83	68	88
1965	W	55	46	59	60	71	79	70	70	81	93	100	88	73
1966	BN	77	73	86	99	93	100	89	89	100	100	90	77	89
1967	W	70	70	83	85	97	100	92	92	100	100	100	98	91
1968	BN	100	100	100	100	100	100	89	89	100	100	94	80	96
1969	W	70	70	82	84	97	100	91	91	100	100	100	100	90
1970	W	96	100	100	100	100	100	91	90	100	100	100	89	97
1971	W	78	72	85	85	97	100	91	91	100	100	100	90	91
1972	BN	80	73	76	72	70	80	70	70	81	93	85	72	77
1973	AN	70	70	82	97	100	100	90	90	100	100	100	89	91
1974	W	77	71	84	97	100	100	91	91	100	100	100	91	92
1975	W	87	82	85	82	94	100	91	91	100	100	100	90	92
1976	C	85	82	82	78	74	81	67	63	54	47	47	44	67
1977	C	44	44	44	44	44	44	43	43	43	42	42	42	43
1978	AN	42	42	42	43	56	69	72	72	83	95	100	94	67
1979	BN	84	77	76	75	87	97	86	86	97	100	100	88	88
1980	AN	76	70	83	84	98	100	90	90	100	100	100	100	91
1981	D	90	83	84	82	93	100	87	87	98	92	77	67	87
1982	W	55	46	58	74	85	96	88	87	98	100	100	100	82
1983	W	100	100	100	100	100	100	92	92	100	100	100	100	99
1984	W	100	100	100	100	100	100	91	90	100	100	100	89	98
1985	D	78	71	83	96	100	100	87	87	98	94	78	65	86
1986	W	53	45	50	46	45	58	70	73	84	95	100	100	68
1987	D	90	83	85	81	77	87	74	74	85	97	84	70	82
1988	C	57	48	48	48	59	66	53	53	64	76	65	51	57
1989	D	44	44	44	44	44	54	44	44	56	67	52	44	48
1990	C	44	44	44	44	44	51	44	44	49	44	44	43	45
1991	C	43	43	43	43	42	42	46	46	45	44	44	43	44
1992	C	43	43	43	43	43	51	44	44	46	46	44	44	45
1993	AN	44	44	44	45	58	71	70	70	81	93	100	91	68
1994	C	79	71	83	79	77	85	71	71	82	67	50	44	72

Note: * Water year type defined by Sacramento Valley index: AN = above normal BN =below normal C = critical D = dry W =wet
Key: TAF = thousand acre-feet

Table B-19. Plan 3: Los Vaqueros Reservoir Average Monthly Storage (TAF)

Water Year	Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
1922	AN	80	92	100	100	100	100	90	90	100	100	100	100	96
1923	BN	97	100	100	100	100	100	89	89	100	100	100	100	98
1924	C	95	91	100	100	96	95	81	73	64	63	63	58	82
1925	D	47	44	56	56	68	74	61	61	72	84	83	91	66
1926	D	81	73	74	74	86	93	80	80	91	100	99	100	86
1927	W	92	94	100	100	100	100	91	91	100	100	100	100	97
1928	AN	95	93	100	100	100	100	90	90	100	100	100	100	97
1929	C	93	92	100	100	97	100	86	86	80	79	78	76	89
1930	D	65	56	67	68	79	89	77	76	87	94	93	93	79
1931	C	82	73	73	73	67	61	47	44	44	43	43	43	58
1932	D	42	42	49	61	74	81	69	68	80	91	90	100	71
1933	C	94	88	100	100	100	100	86	86	85	84	84	83	91
1934	C	73	64	69	69	70	70	56	56	49	49	48	48	60
1935	BN	44	44	48	49	55	67	73	72	84	95	100	100	69
1936	BN	94	90	100	100	100	100	89	89	100	100	100	100	97
1937	BN	93	88	100	100	100	100	89	89	100	100	100	100	97
1938	W	93	100	100	100	100	100	91	91	100	100	100	100	98
1939	D	100	100	100	100	98	100	87	87	98	97	96	87	96
1940	AN	76	70	73	74	86	96	87	86	98	100	100	100	87
1941	W	91	86	100	100	100	100	93	92	100	100	100	100	97
1942	W	97	100	100	100	100	100	92	91	100	100	100	100	98
1943	W	100	100	100	100	100	100	91	91	100	100	100	100	98
1944	D	94	89	100	100	100	100	87	87	98	100	99	100	96
1945	BN	92	90	100	100	100	100	89	89	100	100	100	100	97
1946	BN	93	91	100	100	100	100	89	89	100	100	100	95	96
1947	D	88	100	100	100	96	100	87	87	98	97	96	96	95
1948	BN	86	81	86	86	83	91	80	79	91	100	100	100	89
1949	D	95	100	100	100	93	100	87	87	98	100	99	100	97
1950	BN	91	86	98	96	100	100	89	89	100	100	100	100	96
1951	AN	100	100	100	100	100	100	90	90	100	100	100	97	98
1952	W	90	93	100	100	100	100	91	91	100	100	100	100	97
1953	W	100	100	100	100	100	100	91	91	100	100	100	100	98
1954	AN	93	100	100	100	100	100	90	90	100	100	100	100	98
1955	D	94	96	100	100	100	100	87	87	98	100	99	100	97
1956	W	91	85	99	100	100	100	91	91	100	100	100	100	96
1957	AN	100	100	100	100	100	100	90	90	100	100	100	98	98
1958	W	91	99	100	100	100	100	95	94	100	100	100	100	98
1959	BN	100	100	100	100	100	100	89	89	100	100	100	93	98
1960	D	84	77	89	89	88	95	82	82	93	100	99	100	90
1961	D	93	88	99	99	98	100	87	87	98	100	99	99	96
1962	BN	91	85	97	97	100	100	89	89	100	100	100	90	95
1963	W	79	91	100	100	100	100	92	91	100	100	100	100	96
1964	D	96	89	100	100	100	100	87	87	98	100	92	85	94
1965	W	75	72	85	99	100	100	91	91	100	100	100	100	93
1966	BN	95	100	100	100	100	100	89	89	100	100	100	96	97
1967	W	88	100	100	100	100	100	92	92	100	100	100	100	98
1968	BN	100	100	100	100	100	100	89	89	100	100	100	90	97
1969	W	82	90	100	100	100	100	91	91	100	100	100	100	96
1970	W	100	100	100	100	100	100	91	90	100	100	100	100	98
1971	W	94	100	100	100	100	100	91	91	100	100	100	100	98
1972	BN	100	100	100	99	96	100	89	89	100	100	100	93	97
1973	AN	82	82	95	100	100	100	90	90	100	100	100	100	95
1974	W	91	100	100	100	100	100	91	91	100	100	100	100	98
1975	W	100	100	100	100	100	100	91	91	100	100	100	100	99
1976	C	100	100	100	100	98	100	86	80	75	74	73	66	88
1977	C	55	51	53	49	44	44	44	43	43	43	42	42	46
1978	AN	42	42	49	50	63	73	70	70	81	93	100	100	69
1979	BN	100	100	100	100	100	100	89	89	100	100	100	100	98
1980	AN	93	100	100	100	100	100	90	90	100	100	100	100	98
1981	D	100	100	100	100	97	100	87	87	98	100	98	100	97
1982	W	92	86	99	100	100	100	92	91	100	100	100	100	97
1983	W	100	100	100	100	100	100	92	92	100	100	100	100	99
1984	W	100	100	100	100	100	100	91	90	100	100	100	100	98
1985	D	94	90	100	100	100	100	87	87	98	100	92	85	94
1986	W	79	75	88	88	100	100	91	91	100	100	100	100	93
1987	D	97	94	100	100	99	100	87	87	98	100	99	92	96
1988	C	81	77	89	91	100	100	86	86	77	76	75	74	84
1989	D	63	54	59	59	54	64	51	51	62	74	74	65	61
1990	C	57	60	66	59	55	63	49	49	45	45	44	44	53
1991	C	44	44	44	44	44	44	46	46	45	45	44	44	44
1992	C	44	44	44	44	44	51	44	44	44	43	43	43	44
1993	AN	43	42	47	48	62	73	70	70	81	93	100	100	69
1994	C	95	93	100	100	94	100	86	86	97	96	96	100	95

Note: * Water year type defined by Sacramento Valley index: AN = above normal BN =below normal C = critical D = dry W =wet
Key: TAF = thousand acre-feet

Table B-20. Future No-Action: Contra Costa Water District Delivered Water Quality (mg/L)

Water Year	Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
1922	AN	9	11	7	30	41	30	29	35	24	9	27	65	26
1923	BN	65	65	47	28	36	38	32	35	27	30	65	65	44
1924	C	65	148	65	116	126	65	33	65	86	69	75	154	89
1925	D	250	209	79	79	65	65	41	35	26	25	55	65	83
1926	D	65	65	56	84	62	28	39	36	31	45	62	65	53
1927	W	65	65	28	37	60	31	42	29	21	10	30	65	40
1928	AN	65	71	52	44	35	22	40	30	24	20	36	65	42
1929	C	65	65	65	84	120	65	42	54	61	62	65	65	68
1930	D	65	181	62	69	57	29	47	42	35	57	65	65	64
1931	C	211	190	96	121	132	113	109	90	93	107	76	135	123
1932	D	199	184	72	36	39	39	44	37	28	24	63	65	69
1933	C	65	65	58	80	49	38	43	48	55	64	65	69	58
1934	C	177	188	77	114	66	60	59	53	53	56	77	113	91
1935	BN	195	164	65	81	52	44	27	29	24	19	64	65	69
1936	BN	65	95	65	62	45	33	40	32	24	22	51	65	50
1937	BN	65	65	65	65	65	39	39	36	23	18	35	65	48
1938	W	65	65	24	22	19	16	32	14	19	9	22	65	31
1939	D	65	43	47	65	65	54	34	46	42	65	65	65	55
1940	AN	65	65	61	67	51	36	30	31	25	26	65	65	49
1941	W	106	146	36	39	34	33	32	29	22	13	30	65	49
1942	W	65	65	46	32	43	31	33	30	22	14	30	65	40
1943	W	65	65	65	35	31	39	33	34	27	19	36	65	43
1944	D	65	65	64	65	65	40	38	44	33	50	65	65	55
1945	BN	65	65	59	65	52	23	42	38	27	28	65	65	49
1946	BN	65	132	29	18	20	27	36	37	27	32	65	65	46
1947	D	127	107	57	65	65	52	41	42	31	62	65	65	65
1948	BN	65	65	65	72	100	40	28	32	23	25	65	65	54
1949	D	116	102	65	85	40	51	40	38	26	38	65	65	61
1950	BN	65	87	65	101	62	25	27	34	23	26	65	65	54
1951	AN	65	65	18	28	41	30	33	36	27	23	51	65	40
1952	W	65	74	36	24	23	39	34	28	19	9	24	65	37
1953	W	51	31	19	26	24	23	34	38	26	12	27	65	31
1954	AN	65	65	65	63	25	19	35	30	22	34	65	65	46
1955	D	65	65	52	37	51	41	39	44	27	31	65	65	48
1956	W	65	65	40	28	46	28	38	35	24	15	29	65	40
1957	AN	65	65	65	65	62	36	40	32	23	20	55	65	49
1958	W	65	81	41	36	36	35	34	29	18	10	32	65	40
1959	BN	65	65	65	53	27	26	34	44	31	40	65	65	48
1960	D	94	157	65	81	106	37	36	52	32	65	65	65	71
1961	D	65	65	65	65	65	46	46	39	27	65	74	88	59
1962	BN	163	135	56	62	61	22	37	38	28	38	65	108	68
1963	W	211	48	53	43	42	25	42	32	23	12	20	65	51
1964	D	65	65	49	63	52	37	45	42	27	63	65	65	53
1965	W	65	65	26	23	27	29	37	29	23	18	35	65	37
1966	BN	65	65	28	26	31	23	31	39	29	47	65	65	43
1967	W	99	97	58	26	42	38	35	33	21	12	24	65	46
1968	BN	33	26	32	31	25	26	34	38	29	32	65	65	36
1969	W	80	102	55	31	19	31	33	11	15	8	21	54	38
1970	W	65	31	22	17	29	30	31	37	32	26	28	65	34
1971	W	65	65	47	22	20	21	33	36	24	11	31	65	37
1972	BN	65	65	65	65	65	39	33	38	25	25	65	65	51
1973	AN	207	137	58	41	39	42	35	34	25	16	45	65	62
1974	W	65	65	18	24	31	28	31	33	19	12	48	65	37
1975	W	65	65	65	65	56	30	34	31	23	12	43	65	46
1976	C	65	65	65	65	65	63	36	65	65	65	64	161	70
1977	C	212	150	96	135	147	131	122	106	104	86	72	152	126
1978	AN	224	189	81	61	58	50	53	37	26	20	39	65	75
1979	BN	65	65	65	65	37	32	36	31	24	21	65	65	48
1980	AN	65	72	46	30	37	37	34	30	26	19	33	60	41
1981	D	65	65	65	65	47	29	36	38	30	65	65	65	53
1982	W	65	65	27	49	36	38	33	19	18	13	23	49	36
1983	W	36	15	12	18	14	19	27	14	12	7	7	20	17
1984	W	28	8	10	18	25	23	26	36	28	17	33	65	26
1985	D	65	65	29	31	59	46	30	44	32	65	65	65	50
1986	W	65	65	65	65	65	32	44	43	28	23	31	55	48
1987	D	65	65	65	65	65	54	35	41	37	52	65	65	56
1988	C	65	65	63	61	36	39	40	50	60	59	65	65	56
1989	D	128	180	77	116	109	43	42	30	23	53	65	120	82
1990	C	176	116	76	162	93	56	47	49	55	80	94	118	93
1991	C	199	204	107	139	140	86	38	35	39	77	92	107	105
1992	C	188	210	113	97	112	39	38	36	39	52	96	134	96
1993	AN	194	178	79	64	45	38	36	30	22	16	35	65	67
1994	C	65	65	65	65	65	54	41	46	53	65	65	163	68

Note: * Water year type defined by Sacramento Valley index: AN = above normal BN =below normal C = critical D = dry W =wet
Key: mg/L = milligrams per liter

Table B-21. Plan 3: Contra Costa Water District Delivered Water Quality (mg/L)

Water Year	Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
1922	AN	23	20	7	21	41	30	29	35	29	9	18	39	25
1923	BN	65	58	29	28	36	38	31	35	35	16	34	55	38
1924	C	65	65	53	65	59	65	36	65	65	61	43	65	59
1925	D	65	90	59	49	52	65	50	35	38	17	39	54	51
1926	D	65	65	65	56	41	27	48	36	54	25	29	34	45
1927	W	65	58	22	28	50	31	48	29	20	7	13	54	35
1928	AN	65	65	38	33	30	22	45	30	28	13	18	45	36
1929	C	65	65	45	60	65	57	46	54	65	41	53	65	57
1930	D	65	65	54	43	42	27	48	42	58	30	41	48	47
1931	C	65	65	65	65	65	65	51	86	75	63	41	66	64
1932	D	105	109	54	29	38	37	44	37	38	14	32	41	48
1933	C	65	65	63	54	43	39	49	48	63	41	49	57	53
1934	C	65	65	60	62	55	55	50	53	65	40	48	63	57
1935	BN	87	90	50	53	50	44	35	30	28	12	26	62	47
1936	BN	65	65	52	39	38	27	45	32	23	10	22	40	38
1937	BN	65	65	49	55	44	31	44	36	18	16	18	40	40
1938	W	65	53	21	25	23	18	45	14	8	9	13	34	27
1939	D	45	31	26	60	65	50	43	46	54	34	54	65	48
1940	AN	65	65	65	48	41	38	42	31	34	14	30	61	45
1941	W	65	65	36	39	33	33	37	29	25	13	14	37	35
1942	W	65	65	26	34	39	31	38	30	24	14	15	46	36
1943	W	58	48	29	30	27	34	37	34	32	19	18	58	35
1944	D	65	65	51	58	53	36	39	44	42	23	45	48	48
1945	BN	65	65	38	40	41	24	42	38	33	14	29	46	40
1946	BN	65	65	29	20	25	28	41	37	34	17	46	65	39
1947	D	65	64	24	47	49	44	49	42	50	31	58	57	48
1948	BN	65	65	56	58	65	41	49	34	27	11	37	65	48
1949	D	65	61	32	56	48	37	48	38	35	18	39	53	44
1950	BN	65	65	50	65	43	25	50	34	29	11	29	36	42
1951	AN	63	46	18	23	31	30	48	36	32	14	24	65	36
1952	W	65	65	27	27	38	39	47	28	16	9	11	29	33
1953	W	33	31	23	33	27	25	45	38	28	10	12	56	30
1954	AN	65	59	25	36	22	18	50	30	28	17	29	57	36
1955	D	65	61	35	27	39	37	48	44	44	17	41	46	42
1956	W	65	65	34	17	24	28	46	35	28	15	14	44	35
1957	AN	60	55	32	54	49	28	45	32	27	11	24	65	40
1958	W	65	62	21	31	40	37	44	29	17	10	13	37	34
1959	BN	40	44	31	34	28	29	44	44	40	19	35	65	38
1960	D	65	65	58	63	65	33	46	52	53	31	50	39	52
1961	D	65	65	38	56	65	37	50	39	35	35	54	41	48
1962	BN	65	65	42	40	48	22	49	38	40	17	49	65	45
1963	W	65	35	39	38	41	26	46	32	25	12	9	41	34
1964	D	65	65	45	40	43	37	45	42	40	36	65	65	49
1965	W	65	65	23	22	26	29	39	29	25	14	14	56	34
1966	BN	65	50	19	26	25	23	41	39	37	23	43	65	38
1967	W	65	56	29	32	37	39	45	33	14	12	15	28	34
1968	BN	33	27	20	27	27	26	44	38	42	18	38	65	34
1969	W	65	61	32	30	22	28	46	11	7	8	19	28	30
1970	W	40	26	22	20	28	30	43	37	41	22	14	58	32
1971	W	65	63	25	23	26	22	48	36	28	7	13	49	34
1972	BN	65	63	27	65	54	27	47	38	34	11	38	65	45
1973	AN	65	65	46	32	43	43	44	34	28	10	19	51	40
1974	W	65	58	16	27	35	28	48	33	19	9	20	45	34
1975	W	47	56	27	45	50	32	46	31	26	12	18	48	37
1976	C	47	41	31	65	65	51	46	65	65	49	30	65	52
1977	C	65	65	65	65	74	115	119	107	88	54	36	76	78
1978	AN	118	114	63	48	44	46	50	37	21	12	19	37	51
1979	BN	63	60	35	48	37	30	41	31	25	12	29	58	39
1980	AN	65	65	22	27	35	31	43	30	31	19	20	30	35
1981	D	56	61	35	44	41	27	43	38	39	42	65	48	45
1982	W	65	65	26	36	28	32	40	19	17	12	13	28	32
1983	W	26	15	14	21	16	23	34	14	7	7	7	20	17
1984	W	28	8	10	18	22	23	32	36	38	15	15	60	25
1985	D	65	65	29	22	41	43	33	44	44	43	65	65	47
1986	W	65	65	43	46	44	33	43	41	34	19	19	31	40
1987	D	65	65	58	56	65	44	44	41	59	28	46	65	53
1988	C	65	65	48	39	33	38	49	50	65	40	49	65	51
1989	D	65	65	61	63	65	34	48	30	33	24	60	65	51
1990	C	65	65	53	65	65	48	50	49	65	59	50	59	58
1991	C	97	116	69	86	101	74	35	35	51	51	51	54	68
1992	C	93	115	73	71	67	32	40	36	57	34	55	68	62
1993	AN	97	100	59	45	34	38	37	30	25	10	15	42	44
1994	C	65	65	45	43	36	45	37	46	40	24	32	54	44

Note: * Water year type defined by Sacramento Valley index: AN = above normal BN =below normal C = critical D = dry W =wet
Key: mg/L = milligrams per liter

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