C-3 MODELING ASSUMPTIONS

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Introduction

This chapter discusses the modeling assumptions used to characterize the Existing Conditions, the Future No Action/No Project Alternative, and the project alternatives described previously in Chapter 3. The different assumptions for the 2005 (existing) and 2030 (future) levels of development are summarized in **Table C3-1**. Table 3-3 in Chapter 3 summarizes the major facility components of the project alternatives.

TABLE C3-1:
OPERATIONS MODEL ASSUMPTIONS FOR EXISTING AND FUTURE LEVELS OF DEVELOPMENT

Description	Units	Existing Level of Development	Future Level of Development
PROJECTS OR FACILITIES			
Rock Slough Intake and Contra Costa Canal Pumping Plant No.1	(cfs)	350	350
Rock Slough Canal Replacement Project		NA[1]	Included
CCWD/EBMUD Intertie			
Annual delivery[2]	(TAF)	NA	3.2
Intertie capacity	(cfs)	NA	155
South Bay Aqueduct Improvement and Enlargement[3]			
Brushy Creek Pipeline capacity	(cfs)	430	430
Freeport Regional Water Project[4,5]		NA	Included
DMC-CA Intertie		NA	Included
South Delta Improvements Program, Phase 1 (barriers)		NA	Included
South Delta Improvements Program, Phase 2		NA	Not Included
WATER DEMANDS			
CCWD demand[6,7]	(TAF/yr)		
Wet year		111	149
Above normal year		118	157
Below normal year		124	162
Dry year		135	175
Critical year		144	184
EBMUD - CCWD Settlement Agreement			
Delivery amount[8]	(TAF/yr)	NA	3.2
Delivery location		NA	Preferential delivery to storage, also direct delivery
Period of diversion		NA	December

[1] NA = not applicable.
[2] Under the CCWD settlement agreement, FRWA and EBMUD will wheel CVP contract water for CCWD.
[3] Due to the current construction schedule of the SBA Improvement and Enlargement Project, the expanded SBA capacity of 430 cfs is included in the existing condition scenarios.
[4] Included in 2004 OCAP as part of the formal consultation.
[5] The Freeport Regional Water Project is a joint venture of the Sacramento County Water Agency and East Bay Municipal Utility District to supply water from the Sacramento River to customers in Sacramento County and the East Bay. Final EIR has been certified, Final EIS has been released, and on January 4, 2005, Reclamation issued the Record of Decision.
[6] Derived from CCWD's Future Water Supply Study (CCWD, August 1996), with adjustments made for the future condition to estimate the demand distribution in 2030. Future condition demands represent Service Area C. Demands and demand pattern taken from April 2004 Planning Report.
[7] Water-years defined by Sacramento Valley Index.
[8] Included in CCWD's 195 TAF/year CVP contract

TABLE C3-1:
OPERATIONS MODEL ASSUMPTIONS FOR EXISTING AND FUTURE LEVELS OF DEVELOPMENT

Description	Units	Existing Level of Development	Future Level of Development
WATER QUALITY INPUT DATA – chloride concentration			
Rock Slough at CCWD Pumping Plant No. 1	(mg/L)	DSM2 output (CHCCC006)	DSM2 output (ROLD024)
Old River at Old River Pumping Plant	(mg/L)	DSM2 output (ROLD034)	DSM2 output (ROLD034)
New Delta Intake	(mg/L)	DSM2 output (ROLD034)	DSM2 output (ROLD034)
Victoria Canal at AIP	(mg/L)	DSM2 output (229_3048)	DSM2 output (229_3048)
Kellogg Creek	(mg/L)	Varies, 11 - 300	Varies, 11 - 300
Precipitation inflow to Los Vaqueros	(mg/L)	7	7
Mokelumne Aqueduct	(mg/L)	NA	7.5

Fishery Restrictions Applied in CalSim II Model

Biological opinions (BOs) from the United States Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) impose restrictions on CVP and SWP operations for the protection of federally listed threatened and endangered species and their critical habitat. On May 16, 2008, Reclamation requested the initiation of formal consultation under Section 7 of ESA for the continued long-term operation of the CVP and SWP.

In *NRDC v. Kempthorne*, Federal District Judge Oliver Wanger ordered USFWS to issue a new BO for the protection of Delta smelt. Until the new BO was issued, project operations adhered to the interim remedies order issued by Judge Wanger on December 14, 2007. The order provides for a range of restrictions based on real-time conditions that cannot be simulated with one simple set of rules. Therefore, a range of operating restrictions of the interim remedies order are used to encompass the range of existing and future operational restrictions in the project modeling studies. Future restrictions will be examined to determine if the analyses results change. If those analyses indicate a new or substantially more severe impact would occur, then supplemental environmental review under CEQA and NEPA would be required prior to taking further actions.

Modeling for the project alternatives includes constraints on export diversions at the SWP Banks and CVP Jones (formerly Tracy) pumping facilities to meet reverse flow requirements in the Old and Middle rivers that are similar to those specified in the interim remedies order, which are designed to be protective of delta smelt. In addition, to be protective of longfin smelt, the starting date of the period during which the constraints can be triggered has been set to December 1, which is earlier than the date specified in the interim order (December 25).

Table C3-2 outlines the *NRDC vs. Kempthorne* interim remedies order and the actions required to protect delta smelt and their habitat.

TABLE C3-2:
NRDC VS. KEMPTHORNE INTERIM REMEDIES ORDER ACTIONS

Timing of Action	Delta Smelt Life Stage Protected by Action	OMR Flow Requirements	Trigger for Start of Action	End of Action	Reference in Interim Order
10 days in late-Dec to early Jan	Adult	-2,000	Turbidity, unless Sacramento inflow > 80,000 cfs (3-day average)	10 days after initiation of action or January 15 (whichever is first); can be ended early if: (a) Sacramento inflow > 80,000 cfs (3-day average), or (b) onset of spawning (identified by any of the indicators listed below)	p. 5-6
Jan to start of spawning	Adult	-5,000	Immediately following pulse flow (first action) or January 15 (whichever is earlier), but not start until Sacramento inflow < 80,000 cfs	**Onset of spawning as indicated by:** (1) the presence of spent female delta smelt in the Spring Kodiak Trawl survey or at either export plant's salvage facility; (2) when larval delta smelt are detected in the 20-mm survey or at either export pumping plant's salvage facility; or (3) when water temperature in the Delta reaches 12°C (53.6°F) determined by the average of the daily water temperatures at the Mossdale (MSD), Antioch (ANH or ANC) and Rio Vista (RIV or RVB) monitoring stations.	p. 6-7
Start of spawning to June 20	Adult / larval / juvenile	-750 to -5,000	Onset of spawning (identified by any of the indicators listed above)	Whichever occurs first: June 20 or when risk of entrainment is abated (to be determined by USFWS, Reclamation, and DWR, no metrics given)	p. 7-8

As shown in Table C3-2, the timing of the OMR flow requirements, as well as the level of required OMR flow, vary depending on Delta conditions. This creates uncertainty regarding implementation of the required actions detailed in the interim remedies order. To capture the range of potential requirements, and to capture the range of operational constraints that will be included in new BOs, two scenarios were simulated. The "moderate fishery restriction" scenario represents a less restrictive set of actions, while the "severe fishery restriction" scenario captures more restrictive actions that may be required under the interim remedies order (**Table C3-3**).

TABLE C3-3:
MODEL ASSUMPTIONS FOR COMBINED OMR FLOW CONSTRAINTS

Month	Trigger	Condition	Minimum OMR Flow	
			Moderate fishery restriction	***Severe fishery restriction***
October - November	N A	N A	No Action	
December	Turbidity	Sacramento Inflow - Sacramento Inflow (previous month) <= 6,000 cfs OR Sacramento plus Yolo Inflow > 80,000 cfs	No Action	
		6,000 cfs < Sacramento Inflow - Sacramento Inflow (previous month) <= 10,000 cfs	Dec. 1-15: No Action Dec. 16-25: -2,000 cfs Dec. 26-31: -5,000 cfs	
		Sacramento Inflow - Sacramento Inflow (previous month) > 10,000 cfs	Dec. 1-10: -2,000 cfs Dec. 11-31: -5,000 cfs	
January	Turbidity	Action taken in December	-5000 cfs	
		Sacramento plus Yolo Inflow <= 50,000 cfs AND Sacramento Inflow - Sacramento Inflow (previous month) <= 6,000 cfs	Jan. 1-14: No Action Jan. 15-31: -5,000 cfs	
		Sacramento plus Yolo Inflow <= 50,000 cfs AND 6,000 cfs < Sacramento Inflow - Sacramento Inflow (previous month) <= 10,000 cfs	Jan. 1-9: No Action Jan. 10-14: -2,000 cfs Jan. 15-31: -5,000 cfs	
		Sacramento plus Yolo Inflow <= 50,000 cfs AND Sacramento Inflow - Sacramento Inflow (previous month) > 10,000 cfs	Jan. 1-10: -2,000 cfs Jan. 11-31: -5,000 cfs	
		50,000 cfs < Sacramento plus Yolo Inflow <= 80,000 cfs	Jan. 1-10: -2,000 cfs Jan. 11-31: -5,000 cfs	
		Sacramento plus Yolo Inflow > 80,000 cfs	No Action	
February	Spawning (12 deg. C)	Sacramento plus Yolo Inflow > 30,000 cfs	Feb. 1-15: -5,000 cfs Feb. 16-28: -4,500 cfs	Feb. 1-15: -5,000 cfs Feb. 16-28: -2,500 cfs
		Sacramento plus Yolo Inflow <= 30,000 cfs	Feb. 1-15: -5,000 cfs Feb. 16-28: -3,500 cfs	Feb. 1-15: -5,000 cfs Feb. 16-28: -1,500 cfs
March	Proximity of smelt to export pumps	Sacramento plus Yolo Inflow > 30,000 cfs	-4,500 cfs	-2,500 cfs
		Sacramento plus Yolo Inflow <= 30,000 cfs	-3,500 cfs	-1,500 cfs
April	Proximity of smelt to export pumps	Sacramento plus Yolo Inflow > 30,000 cfs	-4,500 cfs	-2,500 cfs
		Sacramento plus Yolo Inflow <= 30,000 cfs	-3,500 cfs	-1,500 cfs
May	Proximity of smelt to export pumps	Sacramento plus Yolo Inflow > 30,000 cfs	-4,500 cfs	-2,500 cfs
		Sacramento plus Yolo Inflow <= 30,000 cfs	-3,500 cfs	-1,500 cfs
June	Proximity of smelt to export pumps	Sacramento plus Yolo Inflow > 30,000 cfs	-4,500 cfs	-2,500 cfs
		Sacramento plus Yolo Inflow <= 30,000 cfs	-3,500 cfs	-1,500 cfs
July - September	N A	N A	No Action	

Common Assumptions has not yet developed a standard constraint equation for OMR flows under either the Wanger Ruling or the 2008 OCAP. Currently, more than one equation is being evaluated by the Common Assumptions effort. For this Draft EIS/EIR, the average of three previously developed relationships for OMR net flow was used. To meet the OMR flow restrictions, export diversions at the Banks and Jones pumping facilities are varied based on a linear relationship between OMR flows and export pumping and San Joaquin River inflow to the Delta of the form $Q_{OMR} = A*Q_{San\ Joaquin\ River} + B*Q_{Exports} + C$. The coefficients of these relationships are presented in **Table C3-4**.

In Alternatives 1 and 2, the term used for export diversions ($Q_{Exports}$) includes the portion of the pumping at Los Vaqueros intakes for South Bay water agencies that is shifted from the Banks and Jones facilities. The relationship used to represent OMR net flow in these alternatives is $Q_{OMR} = A*Q_{San\ Joaquin\ River} + B*Q_{(Banks+Jones+Improved\ Fish\ Screening)} + C$, where "Improved Fish Screening" is the pumping shifted from the Banks and Jones facilities to Los Vaqueros Reservoir intakes.

In without project conditions, and in Alternatives 3 and 4, the exports term is represented by pumping at the Banks and Jones facilities such that $Q_{OMR} = A*Q_{San\ Joaquin\ River} + B*Q_{(Banks+Jones)} + C$.

TABLE C3-4:
OMR NET FLOW RELATIONSHIPS

OMR Relationship	A	B	C
DWR	0.58	-0.913	0
USGS 1	0.4486	-0.7695	-590
USGS 2	0.7094	-0.7094	-4619

Factors such as tides and wind that may have a smaller, short-term effect on OMR flows are not included in the calculation. It is assumed that the fishery restrictions are shared equally between Banks and Jones.

The interim remedies order calls for adaptive management of operations based on real-time monitoring of conditions in the Delta, including the turbidity and temperature of Delta waters, the location of delta smelt populations, and the seasonal onset of delta smelt spawning. These parameters are not directly available from the CalSim II and DSM2 model tools used in this analysis. Therefore, Delta flow conditions that are available as CalSim II model outputs were used as surrogates for estimation of these parameters, as described below.

Bracketing

Flow-based or calendar-based triggers for protective actions can be implemented in CalSim II, while triggers based on water turbidity, water temperature, or fish survey results, cannot be directly implemented, because these parameters are not used in the CalSim II model. Modeling adaptive management actions is, by the nature of the actions, approximate. To capture the range of potential actions and resulting Delta water project operations under the interim remedies order, and also attempt to anticipate the USFWS and NMFS OCAP BO documents, two operations scenarios based on the interim remedies order were simulated. The "moderate fishery restriction" scenario represents the least restrictive set of actions that are reasonably expected to occur, while

the "severe fishery restriction" scenario captures more restrictive requirements that are reasonably expected to occur. The modeling analysis for the project was performed using both the moderate and severe fishery restrictions assumptions to bracket the range of benefits and resulting environmental effects of the project alternatives.

Turbidity

An increase in turbidity in Delta waters is used in the interim remedial order to indicate the movement of delta smelt into their Delta spawning grounds. Limited turbidity data are available from Delta channels; therefore, available data from Freeport on the Sacramento River were used to identify a relationship between changes in Sacramento River flow and increases in turbidity in Sacramento River water at Freeport. A similar set of turbidity data were available for the San Joaquin River at Vernalis, but no clear relationship between flow and turbidity was apparent, possibly because of differences in runoff patterns in response to precipitation events on the two rivers. The pattern identified for the Sacramento River at Freeport, illustrated in **Figure C3-1**, was assumed to be valid for Delta channels also, and was incorporated as shown in Table C3-3.

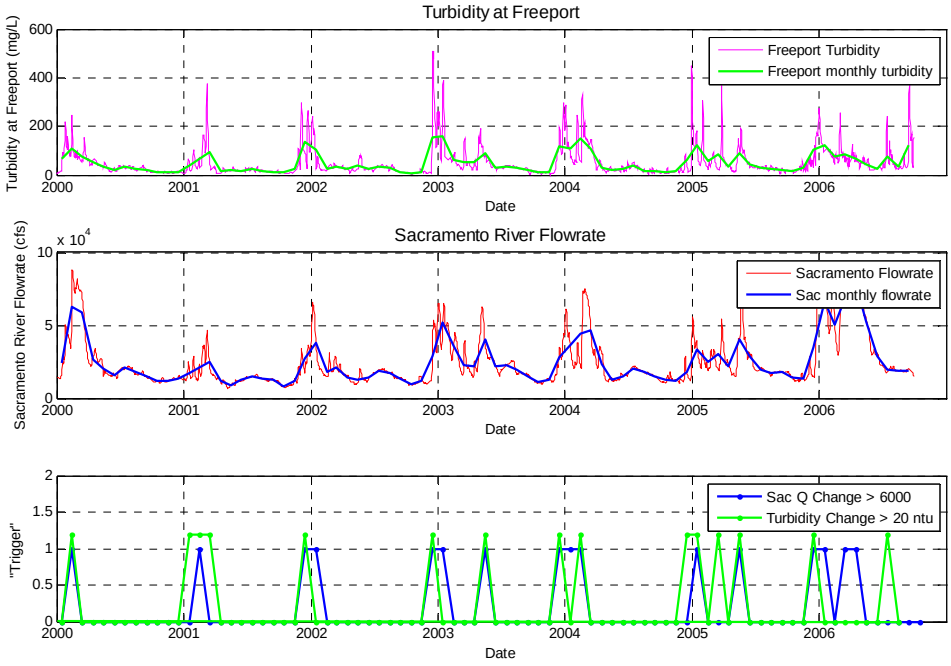

Figure C3-1: Application of Available Turbidity Data

The data for daily turbidity at Freeport and for Sacramento River daily flowrate were averaged to obtain monthly turbidity and monthly flowrate values. These are shown in Figure C3-1a and Figure C3-1b. It was observed that increases in monthly average flowrate at Freeport of greater than 6,000 cfs are correlated with increases in turbidity of greater than 20 ntu at Freeport. In Figure C3-1c, this relationship is presented graphically to demonstrate the co-occurrence of the increases in flow and turbidity. To make the relationship easier to see, the changes in flow and turbidity are represented either as a positive "trigger" value when the change is larger than 6,000 cfs or 20 ntu, respectively, or are assigned a value of zero when the change in monthly average

flow or turbidity is not larger than these values. As shown, a spike in the flowrate of 6,000 cfs in Sacramento River over one or two months serves as a good proxy for turbidity increases in the Sacramento River.

Note that the interim remedial order on delta smelt calls for the initial pulse flow action to begin on or after December 25 in response to increased Delta turbidity, but the project modeling assumes the action could begin as early as December 1, as a conservative estimate that can also account for a potential future action to protect longfin smelt.

Temperature

The interim remedial order requires that adaptive management of the OMR flows be initiated in response to the onset of delta smelt spawning. According to the order, the onset of spawning is to be determined by one of three methods: collection of spent (post-spawning) adult smelt, collection of larval smelt, or an increase above 12 deg. C in Delta waters. Because neither temperature data nor fish monitoring results are incorporated in the CalSim II model, temperature data from an external source was used in the project studies to identify the assumed onset of spawning. Temperature data for Delta waters from the Interagency Ecological Program database (http://www.iep.ca.gov/dss/) were applied for this purpose. A relationship between these temperature data and available flow values was not apparent. Therefore, February 15, which is the average date of the temperature increase above 12 deg. C in Delta waters (as measured by the average of three monitoring stations located at Antioch, Rio Vista and Mossdale) was used in all years in the model studies performed for the EIS/EIR to indicate the onset of delta smelt spawning.

Adaptive Management

Once delta smelt spawning has begun, the interim remedial order requires that OMR flows be regulated to minimize smelt mortality at the Banks and Jones facilities. Likelihood of mortality is to be determined by evaluating the location of smelt populations from fisheries surveys, in conjunction with salvage monitoring at the export facilities. Because this type of information is not available in CalSim II, a relationship to flow was again used as a rough estimator of smelt population location. Analysis of available sampling information indicates that under relatively higher Delta outflow conditions, the delta smelt population tends to be near the confluence and in Suisun Bay (Bennett, 2005). Conversely, under relatively lower outflow conditions, the delta smelt population tends to be farther into the south Delta. These general relationships are reflected in the parameters chosen for required OMR flow values under the adaptive management period that begins with the onset of spawning, as shown in Table C3-3.

Water Demand Assumptions

CCWD Demand

CCWD demands are summarized by water-year type in Table C3-1. CCWD has a delivered water quality goal of delivering water with less than or equal to 65 mg/L chloride concentration. The model delivers the best possible water quality to CCWD customers while optimizing reservoir storage.

Delta Supply Restoration Demand

The South Bay water agencies' demand for Delta Supply Restoration water from an expanded Los Vaqueros Reservoir system was estimated using CalSim II data for each of the three SBA water agencies (ACWD, SCVWD, and Zone 7) and the SCVWD CVP M&I water users, collectively referred to as the South Bay water agencies. Delta supply restoration deliveries to the South Bay water agencies in Alternative 1 were assumed to replace deliveries lost due to the implementation of the *NRDC vs. Kempthorne* decision. The Delta Supply Restoration demands were estimated by taking the difference in deliveries for each participating agency as output from CalSim II simulations for both pre- and post-delta smelt protection actions. Dry and critical year demands were then increased by an additional 50 percent and 200 percent, respectively, to approximate the estimated level of water supply required by these agencies in all years (contract allocation values are lower in dry and critically dry years, requiring more reliability water to meet a minimum delivery requirement). These values may be refined in future studies if improved estimates of the reliability demands of these agencies are developed. **Table C3-5** summarizes by water-year type the assumed Bay Area reliability demand from an expanded Los Vaqueros Reservoir.

TABLE C3-5:
DELTA SUPPLY RESTORATION DEMANDS BY WATER-YEAR TYPE

	Total Demand (TAF/year)[2]			
	Existing		Future	
Water-Year Type[1]	Severe fishery restriction	Moderate fishery restriction	Severe fishery restriction	Moderate fishery restriction
Wet	54.4	36.5	67.5	45.9
Above Normal	76.6	50.6	94.2	63.0
Below Normal	72.6	53.2	92.0	62.1
Dry	92.3	69.5	100.0	66.5
Critical	114.1	82.3	100.7	71.4

Notes:
[1] Water-years defined by Sacramento Valley Index (Oct – Nov).
[2] TAF/year = thousand acre-feet per year

Environmental Water Demand

Environmental water demands met by Alternatives 2 and 3 are represented in the model by Incremental Level 4 and replacement demands, as established by water service contracts in the San Joaquin Valley and Tulare Basin. The annual refuge demands have been scaled up to account for an assumed average 11.3 percent conveyance loss. **Table C3-6** summarizes monthly refuge demands to be met through deliveries from the project facilities for Alternatives 2 and 3.

In Alternative 2, environmental water is delivered through the South Bay Connection to Bethany Reservoir, and from there to San Luis Reservoir. In Alternative 3, there is no direct connection from the project facilities to Bethany Reservoir to deliver refuge supplies. Instead, CCWD foregoes its CVP contract diversions during Delta balanced conditions and meets demands through releases from an expanded Los Vaqueros Reservoir. The forgone Delta diversions are wheeled through available capacity at the CVP Jones Pumping Plant and delivered to the refuges as additional environmental water supply.

TABLE C3-6:
REFUGE DEMANDS BY MONTH (TAF)

Month	San Joaquin Valley	Tulare Basin	Total
January	7.2	1.3	8.4
February	6.2	1.1	7.3
March	3.5	0.6	4.1
April	3.5	0.6	4.1
May	9.5	1.7	11.2
June	6.3	1.1	7.4
July	4.5	0.8	5.3
August	7.8	1.4	9.1
September	28.1	5.0	33.1
October	27.7	4.9	32.6
November	13.2	2.3	15.5
December	8.6	1.5	10.1
Total Annual (TAF/yr)	**126.0**	**22.3**	**148.2**

Water Supply Assumptions

CCWD Supply

On May 10, 2005, CCWD signed a long-term contract with Reclamation for delivery of up to 195,000 acre-feet of water per year for M&I uses in the CCWD service area. The contract expires in 2045. Through a settlement agreement with EBMUD, CCWD may receive a portion of its CVP supplies from the existing intertie with the Mokelumne Aqueduct. This settlement agreement supply is outlined in Table C3-1. The CVP annual allocation to north-of-Delta (NOD) M&I water service contractors is assigned for the contract year beginning in March and ending in February and is taken from CalSim II. For modeling purposes and the allocation of shortages, it is considered that CCWD facilities are NOD.

D-1629, issued on June 2, 1994, gives CCWD the rights to divert and store water for beneficial uses. Under SWRCB Water Right Permits No. 20749 and 20750, CCWD may fill Los Vaqueros Reservoir from the intake at Old River and divert and store water from Kellogg Creek.

These rights are in addition to the contractual rights to divert and store CVP contract water. Up to 95,850 acre-feet per year may be diverted for storage between November 1 and June 30 at a maximum rate of 200 cfs. Diversion is limited to periods when the Delta is in excess water conditions under the Coordinated Operations Agreement when those diversions will not adversely impact the operations of the SWP and CVP. CCWD may also divert water under its CVP water supply contract to storage in Los Vaqueros Reservoir throughout the year. CCWD diversions and filling of the reservoir are also subject to the provisions of the 1993 delta smelt and chinook salmon BOs.

The water right permit for filling Los Vaqueros Reservoir includes the diversion and storage of water from Kellogg Creek (up to 9,640 acre-feet per year). The simulated inflow from Kellogg Creek was defined as part of the modeling effort conducted for the 2004 Project Planning Report (CCWD, DWR, Reclamation, 2004). For the period of October 1921 to September 2003, Kellogg Creek inflow varies between 0 and 9,000 acre-feet per year, with an average of approximately 1,400 acre-feet per year; 96 percent of the inflow occurs from December to April.

CCWD can divert up to 26,780 acre-feet per year of water from Mallard Slough under its own water rights (SWRCB Water Right License No. 317 and Permit No. 19856). Diversions under this water right are not explicitly modeled in this study. The City of Antioch and several industrial customers of CCWD have water right permits to divert water from the Delta. These diversions are included in the CalSim II model through CCWD's diversions, and to some extent through the Delta Island Consumptive Use (DICU) estimates.

Historically, CCWD has relied on water transfers to supplement its CVP contract allocation. For example, in 2003, CCWD purchased 5,000 acre-feet from Yuba County Water Agency and CCWD regularly uses water under its contract with East Contra Costa Irrigation District. The availability of water from single-year transfer agreements is represented indirectly. In the operations modeling, water transfers are represented to a limited extent. It is assumed that transfer water is available once CCWD has depleted its annual CVP allocation. Typically, CCWD will purchase an amount of water equal to the difference between its annual demand and its CVP allocation, consistent with CCWD's Future Water Supply Implementation EIR.

Operational Constraints

San Luis Reservoir

Storage in San Luis Reservoir plays a role in the delivery of refuge and SCVWD CVP water from the Los Vaqueros facilities in Alternative 2 because these supplies are temporarily stored in San Luis Reservoir for use in later months to match the monthly demand patterns. It has been assumed that other similar environmental water programs would also rely on San Luis Reservoir operations.

Preference is given to storing CVP and SWP water in San Luis Reservoir, so current and future available storage in San Luis Reservoir is evaluated in the model used in this EIS/EIR to ensure that Los Vaqueros supplies (refuge and SCVWD CVP) stored in San Luis Reservoir are not "spilled" in later months because of San Luis Reservoir reaching the top of the conservation pool. For modeling purposes, a perfect forecast of the storage at the end of the filling cycle was used to avoid spilling. During CalSim II simulation, a cumulative account of stored Los Vaqueros water

in San Luis Reservoir is maintained. In any given month, the allowable releases from the project facilities cannot exceed the following:

- The annual demand (the sum of refuge and SCVWD CVP reliability demands and SCVWD April CVP allocation for M&I use), accounting for all deliveries made in previous months of that year.
- The available storage capacity in San Luis Reservoir (including the cumulative Los Vaqueros account) less the sum of refuge and SCVWD CVP demands for that month.
- The projected available storage capacity in San Luis Reservoir (including the cumulative Los Vaqueros account) at the end of the filling cycle minus total annual demands (refuge plus SCVWD CVP reliability plus SCVWD CVP M&I April allocation).

When there are no Los Vaqueros supplies in San Luis Reservoir, Los Vaqueros Reservoir can be used to meet SCVWD CVP and refuge demands. When Los Vaqueros Reservoir is at or below 80 TAF, no deliveries are made to either of these entities.

Los Vaqueros Reservoir

As described in Chapter 2.1.2, existing biological opinions for the Los Vaqueros Project impose certain restrictions on operations of the Los Vaqueros system and CCWD's Delta diversions, including an annual 75-day no-fill period and a concurrent 30-day no-diversion period. The default dates for the no-fill and no-diversion periods are March 15 through May 31 and April 1 through April 30, respectively. Per the biological opinions, these restrictions are waived if storage in Los Vaqueros Reservoir is at or below emergency levels of 70 TAF in wet, above-normal, or below normal water years, and 44 TAF in dry or critically dry water years. In the CalSim II modeling for this Draft EIS/EIR, the default no-fill and no-diversion periods are applied in CCWD operations for the Existing and Future Without Project conditions and for Alternative 4. For Alternatives 1, 2 and 3, a 30-day no diversion period was assumed to be in effect.

In all scenarios, water is preferentially diverted at the Old River, AIP and (in the case of Alternative 1 and 2) new Delta intakes, over the Rock Slough intake, unless this preference results in a reduction in total diversions. This maximizes use of currently screened intakes.

The operations model fills Los Vaqueros Reservoir with water from the Delta of up to 65 mg/L chloride concentration. Due to evaporation, it is possible for Los Vaqueros Reservoir to exceed 65 mg/L chloride concentration; under such a circumstance, filling with water above 65 mg/L chloride concentration is allowed as long as it lowers the salinity in the reservoir.

The increased number of available intakes in the Delta with the construction of the AIP Intake and the potential new Delta Intake provides increased flexibility to respond to the results of fish monitoring by allow greater flexibility in the point(s) of diversion. The benefits of this added flexibility have been determined through a post processing to the CalSim II results to allow a shift in diversions from intakes where fish densities are higher (according to historical survey and salvage data) to intakes where fish densities are lower (See Appendix C-7).

Alternatives 1 & 2

To improve fish screening in Delta diversions, Alternative 1 shifts the pumping of SWP and CVP supplies for South Bay water agencies to the more effectively screened Los Vaqueros Reservoir system intakes from the existing SWP or CVP export facilities. Alternative 1 also provides Delta supply restoration for these same agencies through direct diversions or by making releases from Los Vaqueros Reservoir. Alternative 2 performs the same improved fish screening operations as Alternative 1. It also provides environmental water supplies for refuges, wildlife areas, and wetlands in the San Joaquin Valley.

In the modeling for Alternatives 1 and 2, first priority was given to improved fish screening operations, as governed by the following assumed operational rules:

- A 30-day no-diversion period is observed in the spring (April) of each year at CCWD intakes (other than to meet CCWD service area demands when storage in Los Vaqueros Reservoir is at or below emergency levels). Deliveries to the SBA and SCVWD are made through releases from Los Vaqueros Reservoir during these no-diversion periods.

- During periods of suitable water quality (< 65 mg/L chloride at CCWD intakes), filling of Los Vaqueros Reservoir is given priority over deliveries to South Bay water agencies under improved fish screening operations.

- Delivery of CVP/SWP contract water to South Bay water agencies through the expanded Los Vaqueros system is limited to the exports at Banks Pumping Plant and Jones Pumping Plant that would have occurred to deliver water to the SBA and SCVWD in the absence of the project. These deliveries are augmented with Delta Supply Restoration in Alternative 1 only, as described above in the discussion of water demand assumptions.

- Water deliveries to South Bay water agencies that are shifted from Banks and Jones pumping plants to the Los Vaqueros system are assumed to be diverted from the Delta year-round, with the exception of the 30-day no-diversion period, as described above. Additional deliveries for Delta Supply Restoration that are made in Alternative 1 only are assumed to be diverted directly from the Delta when surplus water is available, and are assumed to be released from Los Vaqueros Reservoir when the Delta is in balanced conditions.

- Delivery of CVP/SWP contract water to South Bay water agencies through the expanded Los Vaqueros system is given conveyance capacity priority (to Bethany Reservoir) over deliveries for Delta Supply Restoration in Alternative 1.

- Releases are made from Los Vaqueros Reservoir to the South Bay water agencies during the 30-day no diversion period, when direct delivery via direct diversion at Rock Slough, Old River, AIP and the new Delta Intakes is precluded by the no-

diversion period, and when storage is Los Vaqueros Reservoir is above 80 TAF. If storage in Los Vaqueros Reservoir is below 80 TAF during this period, the South Bay water agency contract deliveries are made through Banks and Jones Pumping Plants. The use of 80 TAF as a threshold to stop reservoir releases to the South Bay water agencies was intended to preserve CCWD's existing benefit in the reservoir.

- Reduction in exports are made at Banks Pumping Plant equal to the volume of water wheeled through Los Vaqueros diversion facilities or released from Los Vaqueros Reservoir to meet SWP/CVP contract allocations.

- SWP is compensated for wheeling of CVP water through LV facilities, and corresponding reduction in exports at Banks Pumping Plant, through reassignment of storage in San Luis Reservoir from CVP water to SWP water.

- Wheeled water is subject to the E/I standard. D-1641 specifies export limits in the form of an E/I ratio, and defines export as the combined inflow rate to Clifton Court Forebay and the export rate of the Jones Pumping Plant. CCWD is considered an in-Delta diverter, not an exporter; therefore the project diversions used by CCWD are not constrained by the E/I ratio. For modeling purposes, water deliveries to South Bay water agencies that are shifted from Banks or Jones export facilities to the Los Vaqueros system in Alternatives 1 and 2 are assumed to be limited by E/I requirements.

Delta Supply Restoration demands (Alternative 1) or environmental water supply deliveries (Alternative 2) would be met through additional diversions at project facilities during Delta excess conditions, either for direct delivery or for storage in Los Vaqueros Reservoir for later release. Assumed operating rules for these diversions and deliveries are as follows:

- Deliveries from Los Vaqueros facilities for Delta supply restoration (Alternative 1) or environmental water supply (Alternative 2) are secondary to deliveries to South Bay water agencies under improved fish screening operations.

- During periods of suitable water quality (< 65 mg/L chloride), filling of Los Vaqueros Reservoir is given priority over delivery of Delta Supply Restoration or environmental water supply.

- Diversions for direct delivery are limited by existing X2 requirements.

- Releases from Los Vaqueros Reservoir for refuge supply are restricted when Los Vaqueros Reservoir storage is at or below 80 TAF.

Alternative 3

As modeled under Alternative 3, CCWD would forego Delta diversions to provide water supplies for environmental use by relying on supplies from an expanded Los Vaqueros Reservoir when the following conditions are met:

- Balanced water conditions exist in the Delta from December through June
- Storage in Los Vaqueros Reservoir is above 80,000 acre-feet
- Delta diversions foregone by CCWD can be retained in Shasta Reservoir without being released to meet instream flow requirements

Water retained in Shasta Reservoir in this manner would increase water storage in the summer, which would help maintain the cold water pool needed for temperature control in the Sacramento River in summer and fall. Water stored in Shasta Reservoir in this manner would be conveyed through the Delta for south-of-Delta environmental purposes, such as delivery for Level 4 refuge water supply, when there is available capacity at the CVP/SWP export pumps, as limited by permit conditions at Jones Pumping Plant.

Alternative 4

Under Alternative 4, CCWD would operate an expanded Los Vaqueros Reservoir for blending purposes and water supply reliability. Operational criteria would be as described for the No Action/No Project Alternative.