Appendix B

CALSIM II Modeling Studies of the Delta-Mendota Canal/California Aqueduct Intertie

DRAFT TECHNICAL MEMORANDUM CH2MHILL

CALSIM II Modeling Studies of the Delta Mendota Canal/California Aqueduct Intertie

Introduction

The proposed action, known as the Delta Mendota Canal (DMC) and California Aqueduct Intertie (Intertie), consists of the construction and operation of a 400-cfs pumping plant and pipeline connections between the DMC and California Aqueduct. The Intertie alignment is proposed for DMC milepost 7.1, where the DMC and California Aqueduct are about 400 feet apart.

The Intertie provides operational flexibility between the DMC and the California Aqueduct. It does not result in any changes to authorized pumping capacity at Jones Pumping Plant or Banks Delta Pumping Plant.

The average daily pumping capacity at the Jones PP is limited to 4,600 cfs, which is the existing capacity of the upper DMC and its intake channel. However, due to conveyance limitations in the lower DMC and other factors, pumping at Jones PP is almost always less than 4,600 cfs. DMC conveyance capacity is affected by subsidence, canal siltation and deposition, the amount, timing, and location of water deliveries from the DMC, the facility design, and other factors. By linking the upper DMC with the California Aqueduct, the Intertie would allow year-round Jones pumping capacity up to 4,600 cfs, subject to all applicable export pumping restrictions for water quality and fishery protections. Jones PP capacity would remain limited to its existing authorized pumping capacity of 4,600 cfs.

For this analysis, the Intertie alternative has been compared to a No Action alternative representing a future level of development (2030 LOD). The assumptions and results of this comparison are presented in the sections below. In addition, a Virtual Intertie alternative was also developed by post-processing the results of the Intertie alternative. The assumptions, approach and results of the Virtual Intertie alternative are presented in the final section of this memorandum.

Overview of CALSIM II Studies

Two CALSIM II modeling studies were developed to analyze the Intertie using assumptions consistent with the OCAP Biological Assessment (BA) CALSIM II Study 8.0 (May 2008). The Future No Action alternative study was developed to represent a 2030 LOD using essentially the same hydrologic inputs and assumptions that are being used for the CALSIM II modeling developed for the OCAP BA.

The Intertie alternative study was developed to simulate the project. This study is at the same LOD as the Base study and includes the same CVPIA (b)(2) and EWA actions as the Base study.

The Virtual Intertie alternative was not simulated in CALSIM II but was developed by post-processing the results of the Intertie alternative CALSIM II study.

Study Methodology and Assumptions

The current planning model used by DWR and USBR is CALSIM II, a general-purpose simulation model of the combined CVP/SWP systems as well as a host of smaller water supply entities with which the CVP/SWP systems interact. A geographically comprehensive model, CALSIM II includes the Sacramento River basin, the San Joaquin River basin, and the Delta, as well as portions of the Tulare Basin and Southern California. CALSIM II provides a platform for assessing changes in Delta water quality and water supply operations of the CVP and SWP projects. All water supply evaluations of the Intertie presented in this report utilized the CALSIM II model.

The sections that follow outline the hydrologic and operational assumptions behind the Intertie modeling analyses. These assumptions are consistent across both studies with the exception that the Intertie study includes the Intertie project and fixed CVPIA (b)(2) actions. The assumptions used in each alternative are summarized in Table 1.

Geographic Coverage

The valley floor drainage area of the Sacramento and San Joaquin Rivers, the upper Trinity River, and the San Joaquin Valley, Tulare Basin, and Southern California areas served by the Federal Central Valley Project (CVP) and the California State Water Project (SWP) are simulated in CALSIM II. The focus of CALSIM II is on the major CVP and SWP facilities, but operations of many other facilities are included to varying degrees.

Hydrology

CALSIM II includes a hydrology developed jointly by DWR and USBR. Water diversion requirements (demands), stream accretions and depletions, rim basin inflows, irrigation efficiencies, return flows, non-recoverable losses, and groundwater operation are all components that make up the hydrology used in CALSIM II. Sacramento Valley and tributary rim basin hydrologies are developed using a process designed to adjust the historical sequence of monthly stream flows to represent a sequence of flows at a future level of development. Adjustments to historic water supplies are determined by imposing future level land use on historical meteorological and hydrologic conditions. San Joaquin River basin hydrology is developed using fixed annual demands and regression analysis to develop accretions and depletions. The resulting hydrology represents the water supply available from Central Valley streams to the CVP and SWP at a future level of development.

Delta Water Quality

CALSIM II uses DWR's Artificial Neural Network (ANN) model to simulate the flow-salinity relationships for the Delta. The ANN model correlates DSM2 model-generated salinity at key locations in the Delta with Delta inflows, Delta exports, and Delta Cross Channel operations. The ANN flow-salinity model estimates electrical conductivity at the following four locations for the purpose of modeling Delta water quality standards: Old River at Rock Slough, San Joaquin River at Jersey Point, Sacramento River at Emmaton, and

Sacramento River at Collinsville. In its estimates, the ANN model considers antecedent conditions up to 148 days, and considers a "carriage-water" type of effect associated with Delta exports.

CVP/SWP Delivery Logic

The CALSIM II delivery logic uses runoff forecast information, which incorporates uncertainty and standardized rule curves (i.e. Water Supply Index versus Demand Index Curve), to estimate the water available for delivery and carryover storage. Updates of delivery levels occur monthly from January 1 through May 1 for the SWP and March 1 through May 1 for the CVP as water supply parameters become more certain. The south-of Delta SWP delivery is determined based upon water supply parameters and operational constraints. The CVP system wide delivery and south-of-Delta delivery are based similarly upon water supply parameters and operational constraints with specific consideration for export constraints.

CVPIA 3406(b)(2) Water

CALSIM II incorporates procedures for dynamic modeling of CVPIA 3406(b)(2) water and the Environmental Water Account (EWA), under the CALFED Framework and Record of Decision (ROD). Per the October, 1999 Decision and the subsequent February, 2002 Decision, CVPIA 3406(b)(2) accounting procedures are based on system conditions under operations associated with SWRCB D-1485 and D-1641 regulatory requirements. Similarly, the operating guidelines for selection of actions and allocation of assets under the EWA are based on system conditions under operations associated with SWRCB D-1641 regulatory requirements. This requires sequential layering of multiple system requirements and simulations.

CVPIA 3406(b)(2) allocates 800 TAF (600 TAF in Shasta critical years) of CVP project water to targeted fish actions. The full amount provides support for SWRCB D-1641 implementation. To simulate the 3406 (b)(2) accounting, the model uses metrics calculated in the (b)(2) simulation step. The metrics measure the flow increases and export decreases from D1485 to D1641 WQCP Costs, and from D1485 to (b)(2), total (b)(2) costs. The following assumptions were used to model the May 2003 3406 (b)(2) Department of the Interior decision.

1. **Allocation of (b)(2) water** is 800,000 acre-feet per year (af/yr), 700,000 af/yr in 40-30-30 Dry Years, and 600,000 af/yr in 40-30-30 Critical years

2. **Upstream flow metrics** are calculated at Clear Creek, Keswick, Nimbus, and Goodwin Reservoirs where (b)(2) water can be used to increase flow for fishery purposes. The assumptions used in CalSim II for taking an upstream action at one of the previously mentioned reservoirs are:

    - **October-January**

        - Clear Creek Releases: Action is on if Trinity Beginning of Month Storage >600,000 af.

        - Keswick Releases: Action is on if Shasta Beginning-of-Month Storage > 1,900,000 af.

- Nimbus Releases: Action is on if Folsom Beginning-of-Month Storage > 300,000 af.
- For all releases, if the 200,000-af target is projected to be violated the model will try to reduce the magnitude of the actions in December and/or January.

- **February-September**
  - Clear Creek Releases: Action is on if Trinity Beginning-of-Month Storage >600,000 af.
  - Keswick Releases: Action is on if Shasta Beginning-of-Month Storage > 1,900,000 af and if remaining (b)(2) account > projected coming WQCP costs.
  - Nimbus Releases: Action is on if Folsom Beginning-of-Month Storage > 300,000 af and if remaining (b)(2) account > projected coming WQCP costs.

3. **The export metric** is the change in total CVP pumping (Jones + CVP Banks) from the base case (D1485). Assumptions used in CalSim II for taking a delta action are:
   - Winter Actions (December through February) and Pre-Vernalis Adaptive Management Plan (VAMP) (April Shoulder) actions are off.
   - VAMP Actions: Always taken and done at a 2:1 (Vernalis flow to CVP pumping ratio) ratio if non-VAMP Vernalis flows are greater than 8,600 cubic feet per second (cfs).
   - May Shoulder: Action turned on if the remaining (b)(2) is greater than or equal to the discounted remaining WQCP cost + anticipated Clear Creek cost (25,000 af). DISCOUNT = If the annual WQCP cost > 500,000 af, the difference is subtracted from the remaining WQCP cost.
   - June Ramping: Action turned on if the remaining (b)(2) is greater than or equal to the discounted remaining WQCP cost + anticipated Clear Creek cost (20,000 af).

Both May Shoulder and June Ramping are further restricted to stay within the remaining (b)(2)account – remaining WQCP costs.

Environmental Water Account

These modeling studies utilize the "Limited EWA" assumption included in OCAP BA Study 8.0. The action strategy for the Limited EWA includes the VAMP (Action 3) and Post-VAMP (Action 5) actions. Both actions occur in every year in both alternatives. No other actions are taken. The following assumptions are used for each of these actions.

VAMP Export *Restriction* (April 15 – May 15):

- a *restriction* on total Delta exports to a target level during the VAMP-period, where the target depends on San Joaquin River flow conditions. Action applies only to SWP exports

because CVP exports are already restricted to the same target level through the B2 action strategy included in the baseline operation relative to EWA.

VAMP May-Shoulder Export *Restriction* (May 16 – May 31):

- an extension of the VAMP-period export restriction into the May 16-31 period. SWP export is constrained to the target level. CVP exports are similarly restricted unless they were already constrained by the analogous B2 "Post-VAMP" action.

Table 1. CALSIM II Intertie Studies Assumptions

		Future No Action Alternative	Intertie Alternative
Planning horizon		2030	Same
Period of Simulation		82 years (1922-2003)	Same
HYDROLOGY			
Level of development (Land Use)		2030 level[a]	Same
Sacramento Valley (excluding American R.)			
	CVP	CVP Land-use based, Full build out of CVP contract amounts	Same
	SWP (FRSA)	Land-use based, limited by contract amounts	Same
	Non-project	Land-use based	Same
	Federal refuges	Firm Level 2 water needs	Same
American River			
	Water rights	2025	Same
	CVP (PCWA American River Pump Station)	CVP (PCWA modified)[b]	Same
San Joaquin River[c]			
	Friant Unit	Limited by contract amounts, based on current allocation policy	Same
	Lower Basin	Land-use based, based on district level operations & constraints	Same
	Stanislaus River	Draft Transitional Operations Plan	Same
South of Delta			
	(CVP/SWP project facilities)	CVP Demand based on contracts amounts	Same
	Contra Costa Water District	195 TAF CVP contract supply and water rights[d]	Same
	SWP Demand - Table A	Full Table A	Same
	SWP Demand - North Bay Aqueduct (Table A)	77 TAF/Yr	Same
	SWP Demand - Article 21 demand	Up to 314 TAF/month from December to March, total of demands up to 214 TAF/month in all other months[e]	Same
	Federal refuges	Firm Level 2 water needs	Same
FACILITIES			
Systemwide		Existing facilities	Same
Sacramento Valley			

		Future No Action Alternative	Intertie Alternative
	Red Bluff Diversion Dam	Diversion Dam operated July - August (diversion constraint)	Same
	Colusa Basin	Existing conveyance and storage facilities	Same
	Upper American River	PCWA American River pump station[f]	Same
	Sacramento River Water Reliability	American/Sacramento River Diversions[m]	Same
	Lower Sacramento River	Freeport Regional Water Project (Full Demand)[g]	Same
Delta Region			
	SWP Banks Pumping Plant	South Delta Improvements Program Permanent Barriers (Stage 1). 6,680 cfs capacity in all months and an additional 1/3 of Vernalis flow from Dec 15 through Mar 15 (addit. 500 cfs Jul - Sep)	Same
	CVP C.W. Bill Jones (Jones) Pumping Plant	4,200 cfs + deliveries upstream of DMC constriction	4,600 cfs capacity in all months (allowed for by the Delta-Mendota Canal–California Aqueduct Intertie)
	City of Stockton Delta Water Supply Project (DWSP)	DWSP WTP 30 mgd	Same
	Contra Costa Water District	Existing pump locations[h]	Same
South of Delta (CVP/SWP project facilities)			
	South Bay Aqueduct (SBA)	SBA Rehabilitation: 430 cfs capacity from junction with California Aqueduct to Alameda County FC&WSD Zone 7 diversion point	Same
REGULATORY STANDARDS			
Trinity River			
	Minimum flow below Lewiston Dam	Trinity EIS Preferred Alternative (369-815 TAF/year)	Same
	Trinity Reservoir end-of-September minimum storage	Trinity EIS Preferred Alternative (600 TAF as able)	Same
Clear Creek			
	Minimum flow below Whiskeytown Dam	Downstream water rights, 1963 USBR Proposal to USFWS and NPS, and USFWS discretionary use of CVPIA 3406(b)(2)	Same
Upper Sacramento River			

		Future No Action Alternative	Intertie Alternative
	Shasta Lake	NMFS 2004 BiOp: 1.9 MAF end of Sep. storage target in non-critical years	Same
	Minimum flow below Keswick Dam	Flows for SWRCB WR 90-5 temperature control, and USFWS discretionary use of CVPIA 3406(b)(2)	Same
Feather River			
	Minimum flow below Thermalito Diversion Dam	2006 Settlement Agreement (700 / 800 cfs)	Same
	Minimum flow below Thermalito Afterbay outlet	1983 DWR, DFG Agreement (750-1,700 cfs)	Same
Yuba River			
	Minimum flow below Daguerre Point Dam	Yuba Accord Adjusted Data[j]	Same
American River			
	Minimum flow below Nimbus Dam	American River Flow Management [I]	Same
	Minimum Flow at H Street Bridge	SWRCB D-893	Same
Lower Sacramento River			
	Minimum flow near Rio Vista	SWRCB D-1641	Same
Mokelumne River			
	Minimum flow below Camanche Dam	FERC 2916-029, 1996 (Joint Settlement Agreement) (100-325 cfs)	Same
	Minimum flow below Woodbridge Diversion Dam	FERC 2916-029, 1996 (Joint Settlement Agreement) (25-300 cfs)	Same
Stanislaus River			
	Minimum flow below Goodwin Dam	1987 USBR, DFG agreement, & USFWS discretionary use of CVPIA 3406(b)(2)	Same
	Minimum dissolved oxygen	SWRCB D-1422	Same
Merced River			
	Minimum flow below Crocker-Huffman Diversion Dam	Davis-Grunsky (180-220 cfs, Nov-Mar), Cowell Agreement	Same

		Future No Action Alternative	Intertie Alternative
	Minimum flow at Shaffer Bridge	FERC 2179 (25-100 cfs)	Same
Tuolumne River			
	Minimum flow at Lagrange Bridge	FERC 2299-024, 1995 (Settlement Agreement) (94-301 TAF/year)	Same
San Joaquin River			
	Maximum salinity near Vernalis	SWRCB D-1641	Same
	Minimum flow near Vernalis	SWRCB D-1641, and Vernalis Adaptive Management Plan per San Joaquin River Agreement	Same
Sacramento River–San Joaquin River Delta			
	Delta Outflow Index (Flow and Salinity)	SWRCB D-1641	Same
	Delta Cross Channel gate operation	SWRCB D-1641	Same
	Delta exports	SWRCB D-1641, USFWS discretionary use of CVPIA 3406(b)(2)	Same
OPERATIONS CRITERIA: RIVER-SPECIFIC			
Upper Sacramento River			
	Flow objective for navigation (Wilkins Slough)	3,250 - 5,000 cfs based on CVP water supply condition	Same
American River			
	Folsom Dam flood control	Variable 400/670 flood control diagram (without outlet mods)	Same
	Flow below Nimbus Dam	American River Flow Management [l]	Same
	Sacramento Area Water Forum "Replacement" Water	"Replacement" water is not implemented	Same
Stanislaus River			
	Flow below Goodwin Dam	Draft Transitional Operations Plan	Same
San Joaquin River			
	Flow at Vernalis	D1641[q]	Same
OPERATIONS CRITERIA: SYSTEMWIDE			
CVP water allocation			

		Future No Action Alternative	Intertie Alternative
	CVP Settlement and Exchange	100% (75% in Shasta critical years)	Same
	CVP refuges	100% (75% in Shasta critical years)	Same
	CVP agriculture	100%-0% based on supply (South-of-Delta allocations are reduced due to D-1641 and 3406(b)(2) allocation-related export restrictions)	Same
	CVP municipal & industrial	100%-50% based on supply (South-of-Delta allocations are reduced due to D-1641 and 3406(b)(2) allocation-related export restrictions)	Same
SWP water allocation			
	North of Delta (FRSA)	Contract specific	Same
	South of Delta (including North Bay Aqueduct)	Based on supply; equal prioritization between Ag and M&I based on Monterey Agreement	Same
	Sharing of responsibility for in-basin-use	1986 Coordinated Operations Agreement (FRWP EBMUD and 2/3 of the North Bay Aqueduct diversions are considered as Delta Export, 1/3 of the North Bay Aqueduct diversion is considered as in-basin-use)	Same
	Sharing of surplus flows	1986 Coord. Ops Agreement	Same
	Sharing of Export/Inflow Ratio	Equal sharing of export capacity under SWRCB D-1641; use of CVPIA 3406(b)(2) restricts only CVP and/or SWP exports	Same
	Sharing of export capacity for lesser priority and wheeling related pumping	Cross Valley Canal wheeling (max of 128 TAF/year), CALFED ROD defined Joint Point of Diversion (JPOD)	Same
Study assumptions from above apply		**Future No action Alternative**	**Intertie Alternative**
CVPIA 3406(b)(2): Per May 2003 Dept. of Interior Decision			
	Allocation	800 TAF, 700 TAF in 40-30-30 dry years, and 600 TAF in 40-30-30 critical years	Same
Study assumptions from above apply		**Future No action Alternative**	**Intertie Alternative**
CALFED Environmental Water Account / Limited Environmental Water Account			
	Actions	VAMP (Apr 15 - May 16) export restriction on SWP; If Stored assets and Purchases from the Yuba are sufficient, Post (May 16-31) VAMP export restriction on SWP [j,k]	Same

		Future No Action Alternative	Intertie Alternative
	Assets	Purchase of Yuba River Stored Water under the Lower Yuba River Accord (average of 48 TAF/yr), use of 50% of any CVPIA 3406(b)(2) releases pumped by SWP, additional 500 CFS pumping capacity at Banks in Jul-Sep	Same
	Debt	No Carryover Debt	Same
WATER MANAGEMENT ACTIONS (CALFED)			
Water Transfers			
	Water transfers	Not included	Same
	Phase 8[i]	Not included	Same
	Refuge Level 4 water	Not included	Same

Notes:

[a] The Sacramento Valley hydrology used in the CalSim II model reflects 2020 land-use assumptions associated with Bulletin 160-98. The San Joaquin Valley hydrology reflects draft 2030 land-use assumptions developed by Reclamation. Development of 2030 land-use assumptions are being coordinated with the California Water Plan Update for future models.

[b] PCWA demand is set at 35 TAF/yr.

[c] The new CalSim II representation of the San Joaquin River has been included in this model package (CalSim II San Joaquin River Model, Reclamation, 2005). Updates to the San Joaquin River have been included since the preliminary model release in August 2005. The model reflects the difficulties of on-going groundwater overdraft problems. The 2030 level of development representation of the San Joaquin River Basin does not make any attempt to offer solutions to on-going groundwater overdraft problems. In addition, a dynamic groundwater simulation is not yet developed for San Joaquin River Valley. Groundwater extraction/ recharge and stream-groundwater interaction are static assumptions and may not accurately reflect a response to simulated actions. These limitations should be considered in the analysis of results.

[d] Los Vaqueros Reservoir storage capacity is 100 TAF.

[e] It is assumed that the demand for full Table A will be independent of other water sources. Article 21 demand assumes MWD demand of 100 TAF (Dec-Mar), Kern demand of 180 TAF (Jan-Dec), and other contractor demand of 34 TAF (Jan-Dec).

[f] PCWA American River pumping facility upstream of Folsom Lake is under construction.

[g] Mokelumne River flows reflect EBMUD supplies associated with the Freeport Regional Water Project.

[h] The CCWD Alternate Intake Project (AIP), an intake at Victoria Canal, which operates as an alternate Delta diversion for Los Vaqueros Reservoir is not included.

[i] This Phase 8 requirement is assumed to be met through Sacramento Valley Water Management Agreement Implementation.

[j] OCAP BA 2004 modeling used available hydrology at the time which was data developed based on 1965 Yuba County Water Agency -Department of Fish of Game Agreement. Since the OCAP BA 2004 modeling, Yuba River hydrology was revised. Interim D-1644 is assumed to be fully implemented with or without the implementation of the Lower Yuba River Accord. This is consistent with the future no-action condition being assumed by the Lower Yuba River Accord EIS/EIR study team. For studies with the Lower Yuba River Accord, an adjusted hydrology is used.

[k] It is assumed that either VAMP, a functional equivalent, or D-1641 requirements would be in place in 2030.

[l] The flow components of the proposed American River Flow Management are included and applied using CVPIA 3406(b)(2). The American River Flow Management is assumed to be the new minimum instream flow.

	Future No Action Alternative	Intertie Alternative

[m] OCAP BA assumes the flexibility of diversion location but does not assume the Sacramento Area Water Forum Water Forum "replacement water" in drier water year types.

The Intertie study presented in this report was developed by adding a 400-cfs Intertie between the upper DMC and the CA as shown in Figure 1. To more closely represent projected facility operations, water is only routed through the Intertie once the upper DMC capacity is maximized. Simulation of the Intertie enables CVP water pumped at Jones PP to be wheeled through the CA and subsequently returned to CVP control in O'Neill Forebay. From the O'Neill Forebay, the water can be delivered directly to CVP SOD contractors (including wildlife refuges) or stored in San Luis storage for subsequent delivery. Estimates of Jones capacity that include the potential for delivery to upper DMC demands were modified to reflect the impact of Intertie capacity.

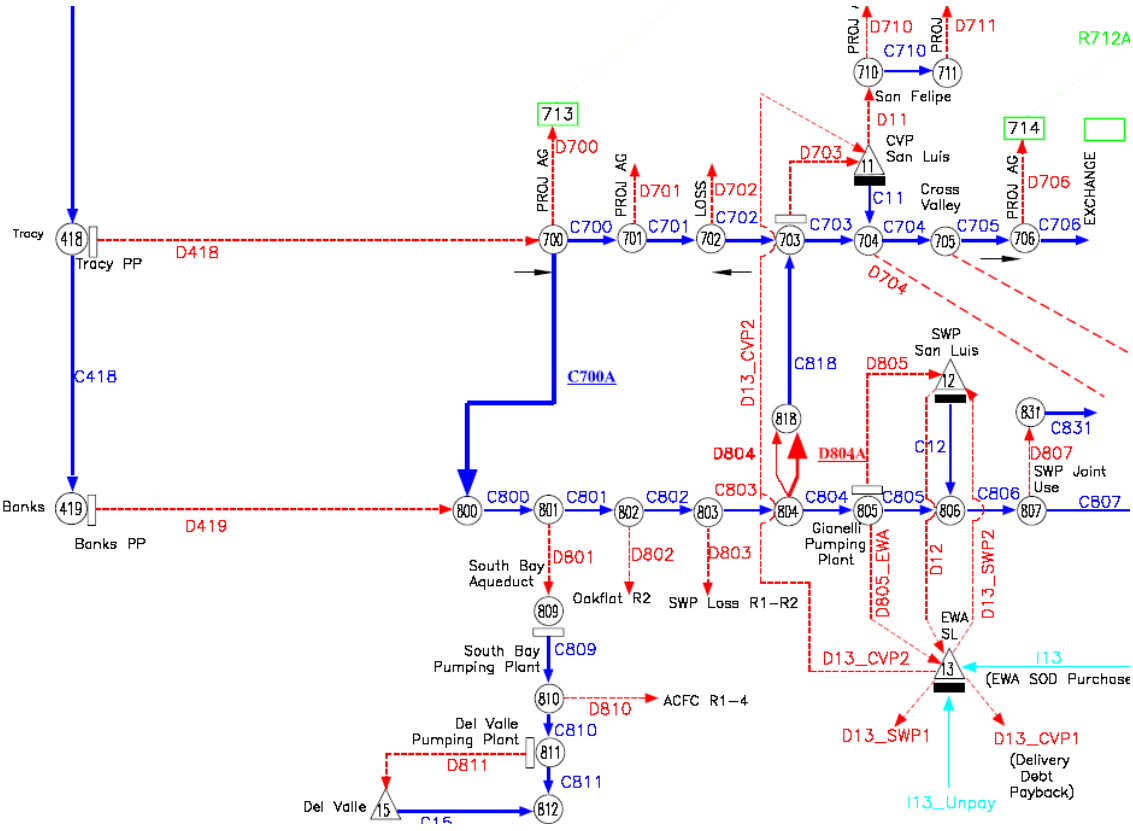


Figure 1: Detail of the CALSIM II Schematic showing Jones PP, Banks PP, and the Intertie (represented in the model with arcs C700A and D804A).

The SWP and CVP share water available in the Delta under the Coordinated Operating Agreement (COA). Under current operating conditions, the CVP is not always able to take all of the water it is entitled to due to pumping limitations, including those that arise due to the upper DMC conveyance limitation. When this is the case, the SWP is permitted to

capture the unused CVP water, in addition to their share, if pumping capacity is available and other operating criteria are satisfied. The CVP water pumped by the SWP is referred to as unused federal share under COA. The Intertie project enables the CVP to recapture some of the CVP water that was previously abandoned to the SWP due to conveyance limitations.

Comparison of Intertie Alternative with Future No Action

Intertie Use

The Intertie is assumed to be operable in all months of the year up to full capacity, but actual use is limited to periods in which there is CVP water that could not be conveyed under existing capacities. The long-term average annual Intertie use is 76 TAF/yr. The months of highest use are September through March (Figures 2 and 3). July and August also show Intertie use. The Intertie facility enables Jones PP to be operated at its maximum capacity in months that the upper DMC restrictions would not have otherwise enabled this to occur. This increase in maximum Jones PP operable capacity is shown in the Figure 4. The Intertie facility use appears to be rather well distributed across all hydrologic years as can be construed from Figure 5. The facility is used in all years of the study, which can be explained by noting that even in the driest sequence of years, there are a number of months of surplus flows that can be captured through the use of the Intertie.

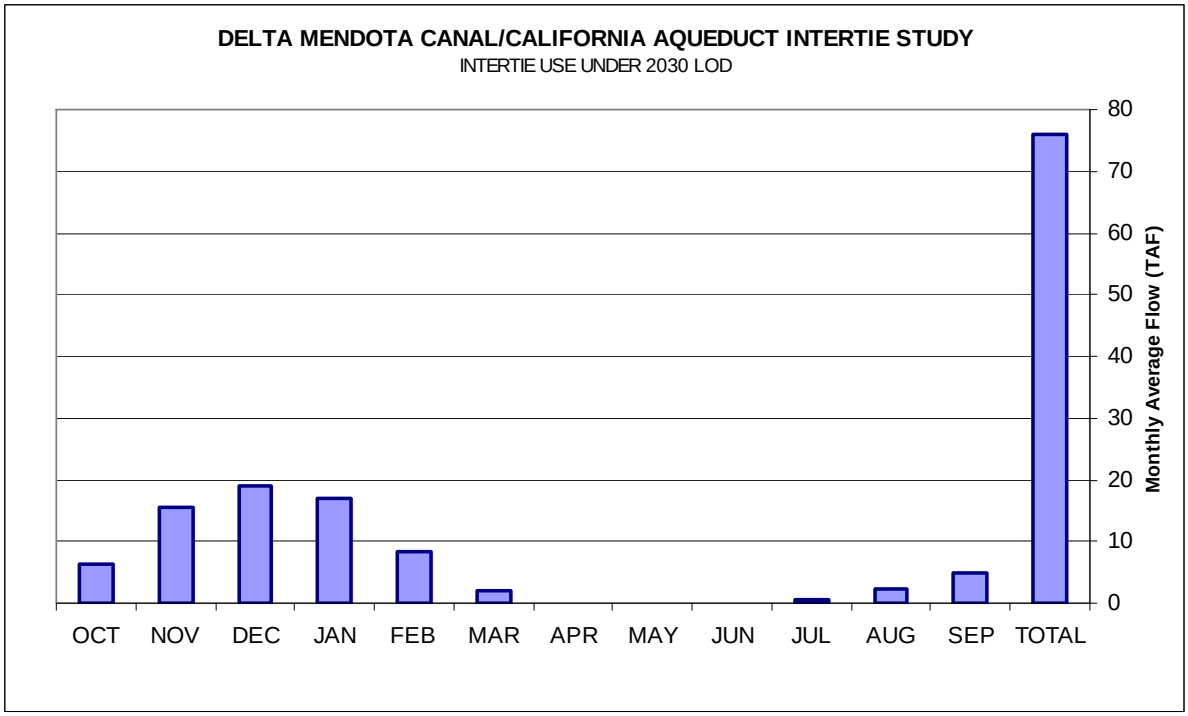


Figure 2: Monthly average Intertie flows (taf) under 2030 LOD.

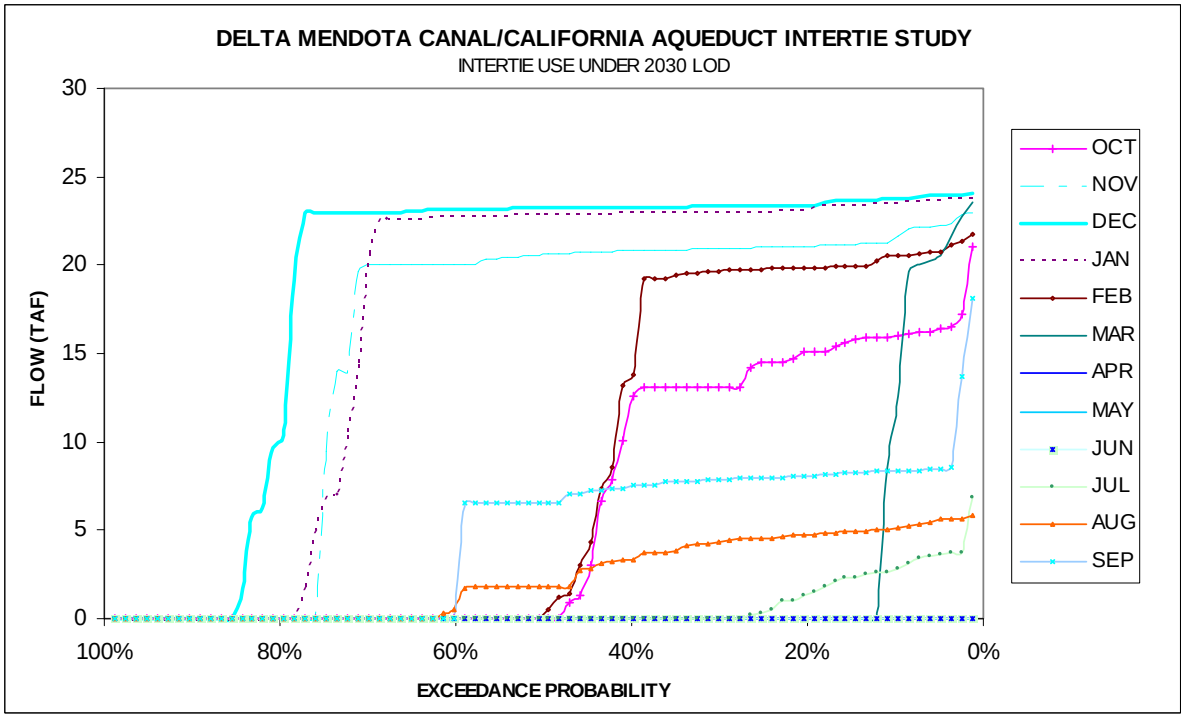


Figure 3: Exceedance probability of Intertie use (taf) in each month under the 2030 LOD

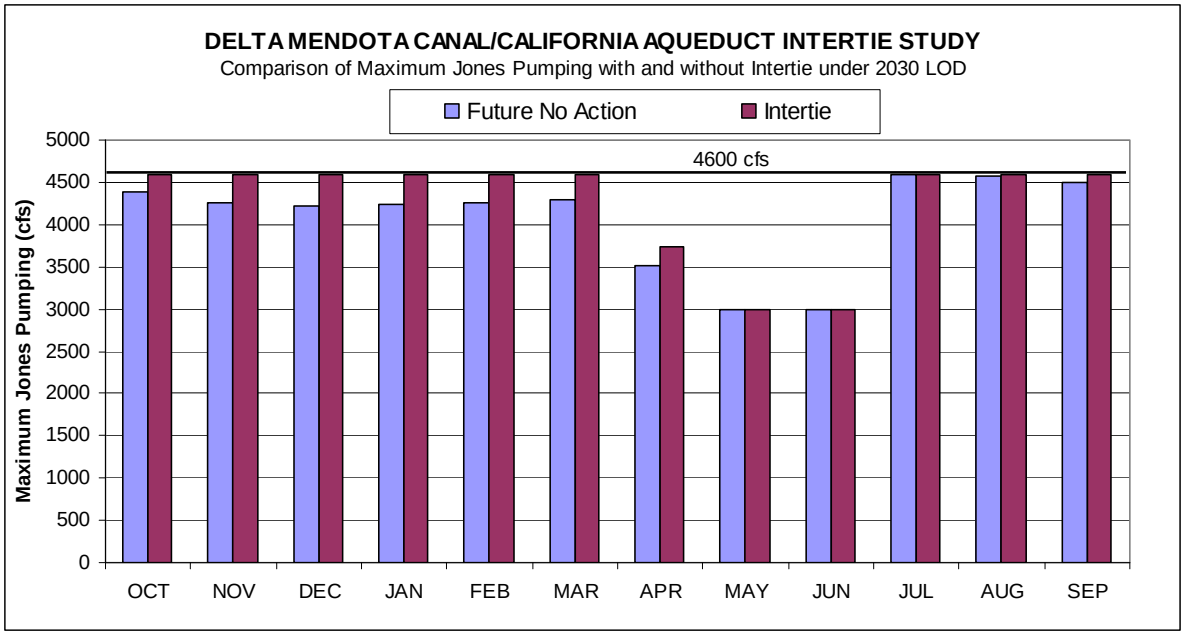


Figure 4: Monthly maximum Jones pumping (cfs) under 2030 LOD.

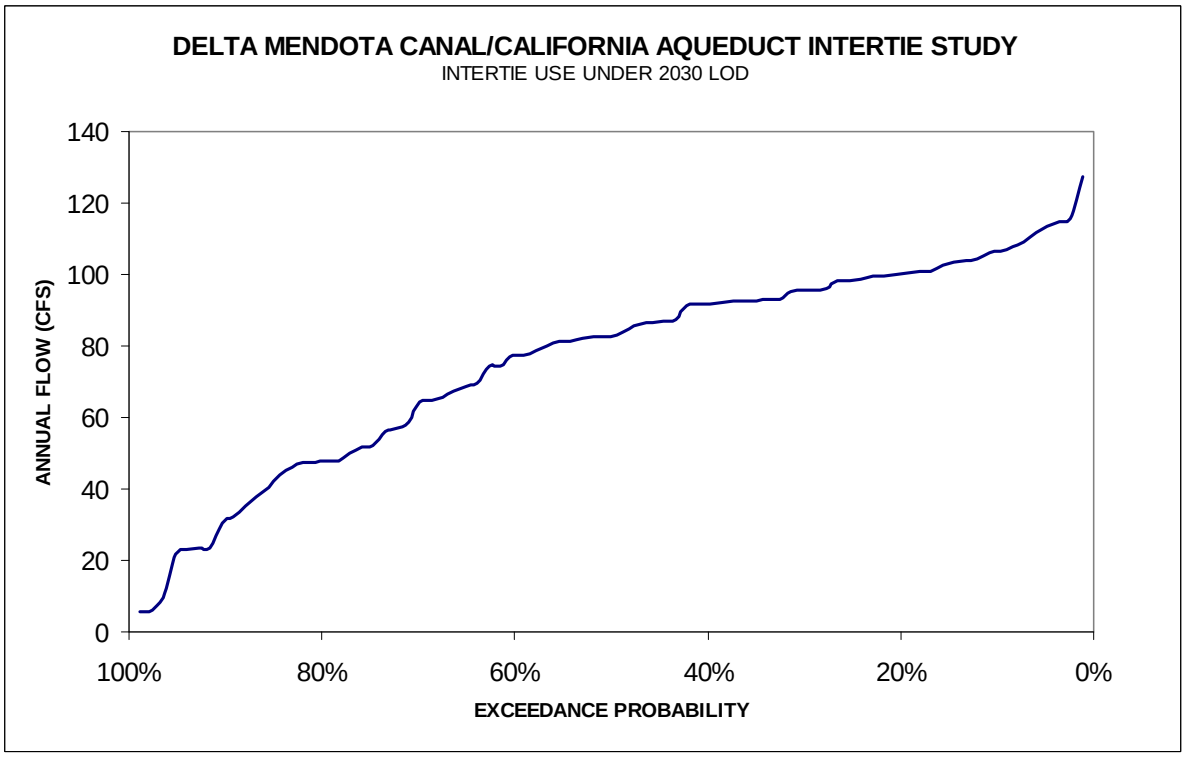


Figure 5: Exceedance probability of annual Intertie use (taf/yr) under 2030 LOD.

Water Supply Impacts

The restored CVP export capacity provided by the Intertie results in changes to deliveries, and these are summarized by Table 2 and Figures 6 and 7. The average annual CVP delivery benefit from the Intertie is approximately 35 taf/yr. The plots in Figures 5 and 6 show annual changes in CVP and SWP total deliveries for the Intertie study compared to the Future No Action (2030 LOD Base). Note that the CVP delivery increase is less than the actual Intertie usage. The reason for this difference is that the Intertie reduces the need for the CVP use of Banks PP (termed joint point of diversion, JPOD). Under the No Action Alternative, the CVP is permitted to use available Banks PP capacity to export water under JPOD. This water is only available if the SWP cannot deliver or store the water in SWP south of Delta facilities and capacity remains at Banks PP. Under the Intertie Alternative, CVP water is first pumped at Jones PP, and since greater conveyance capability now exists here, less is required through JPOD.

Average annual SWP SOD deliveries over the entire 82-year period are approximately the same in the two alternatives, with a reduction of about 7 taf/year in Table A deliveries during the dry period of 1928-1934.

Table 2: Change in water supply deliveries with Intertie under 2030 LOD (taf/year)

2030 LOD	DRY PERIOD AVERAGE (1928-34)			82-YEAR AVERAGE (1922-2003)		
	BASE	ALTERNATIVE	CHANGE	BASE	ALTERNATIVE	CHANGE
CVP DELIVERY NOD	2026	2029	3	2403	2407	5
CVP DELIVERY SOD (INCL.CVC)	1534	1541	7	2494	2525	31
CVP DELIVERY TOTAL	3560	3569	9	4897	4932	35
SWP DELIVERY TABLE A	1547	1540	-7	3007	3008	1
SWP DELIVERY ARTICLE 21	366	377	12	286	283	-3
SWP DELIVERY TOTAL	1913	1917	4	3293	3291	-2

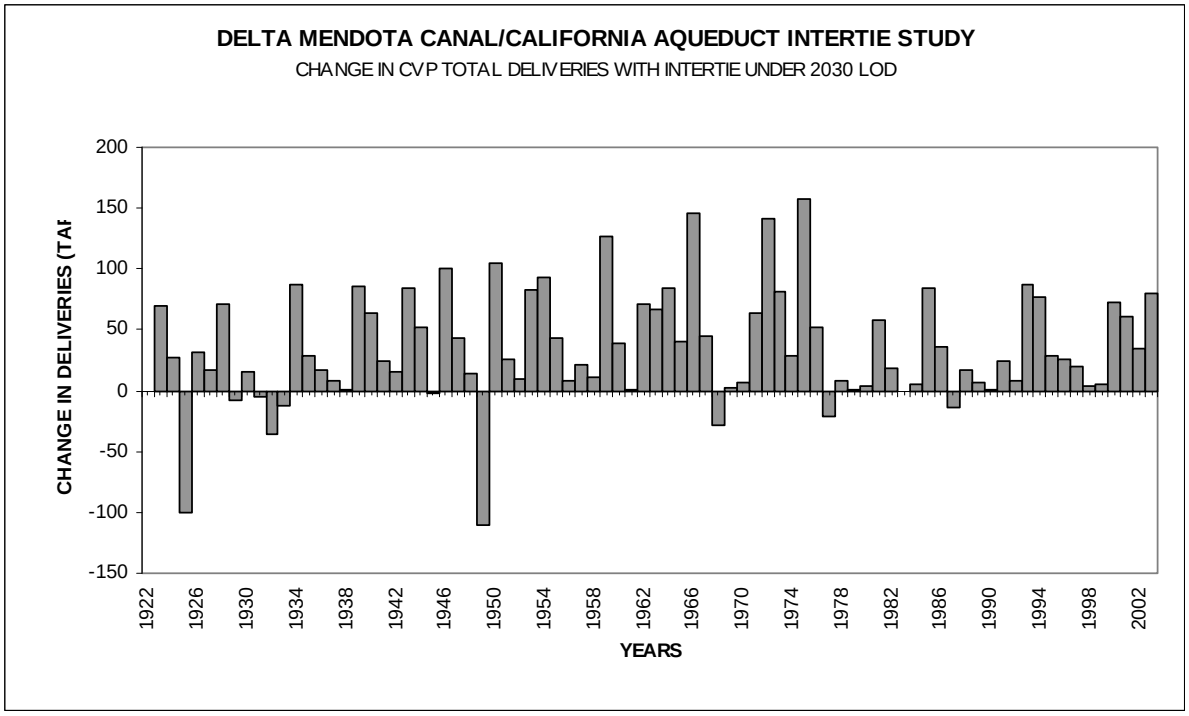


Figure 6: Change in CVP total deliveries with Intertie 2030 LOD.

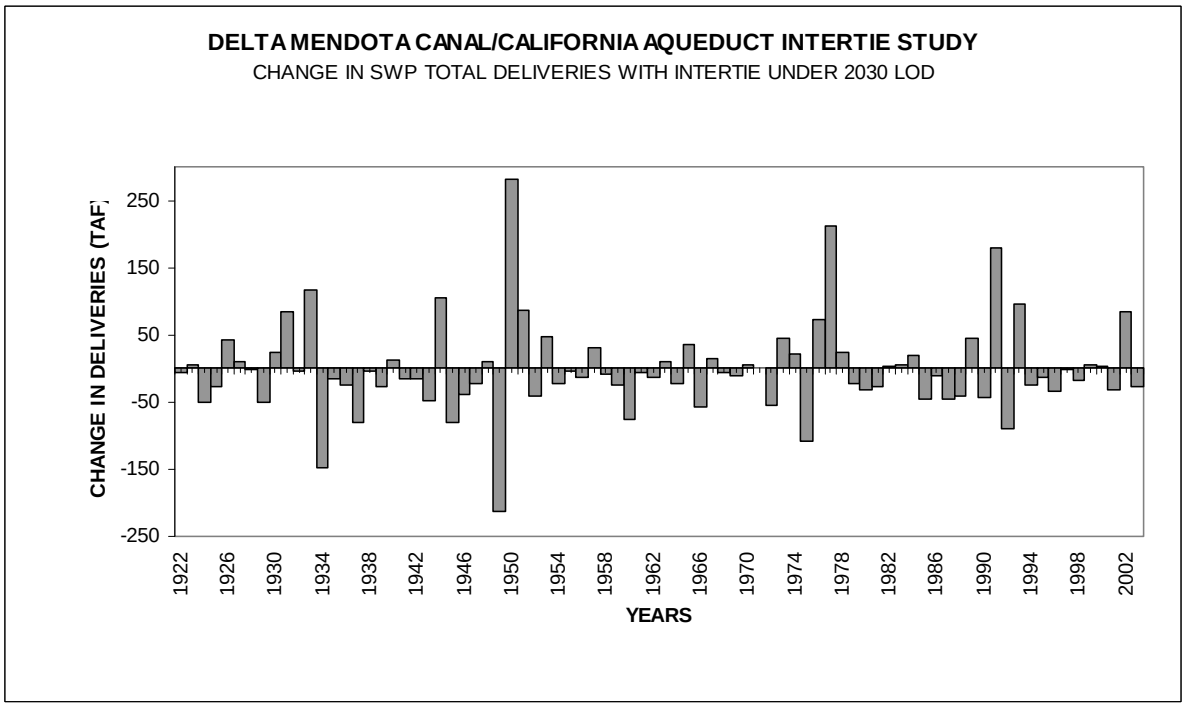


Figure 7: Change in SWP SOD total deliveries with Intertie under 2030 LOD.

Export Impacts

Figure 8 shows the average changes to Jones pumping by month for each of the five 40-30-30 Sacramento Valley water types. Jones pumping shows increases in October through January and to a lesser extent in June through September. Noteworthy is the decrease in March pumping at Jones due to the restored ability to fill CVP San Luis earlier in the year. This implies that the CVP has restored some operational flexibility that may allow the project to operate more effectively around periods of export restrictions. The study shows substantial benefit of the Intertie in most water year types. In critical years, as expected due to low Delta flows and low allocations, there is less benefit in Jones pumping due to the Intertie. Figure 9 shows the relative changes in Jones and Banks exports for each year in the study. Average annual Banks pumping is approximately the same in the Intertie alternative as in the Future No Action alternative.

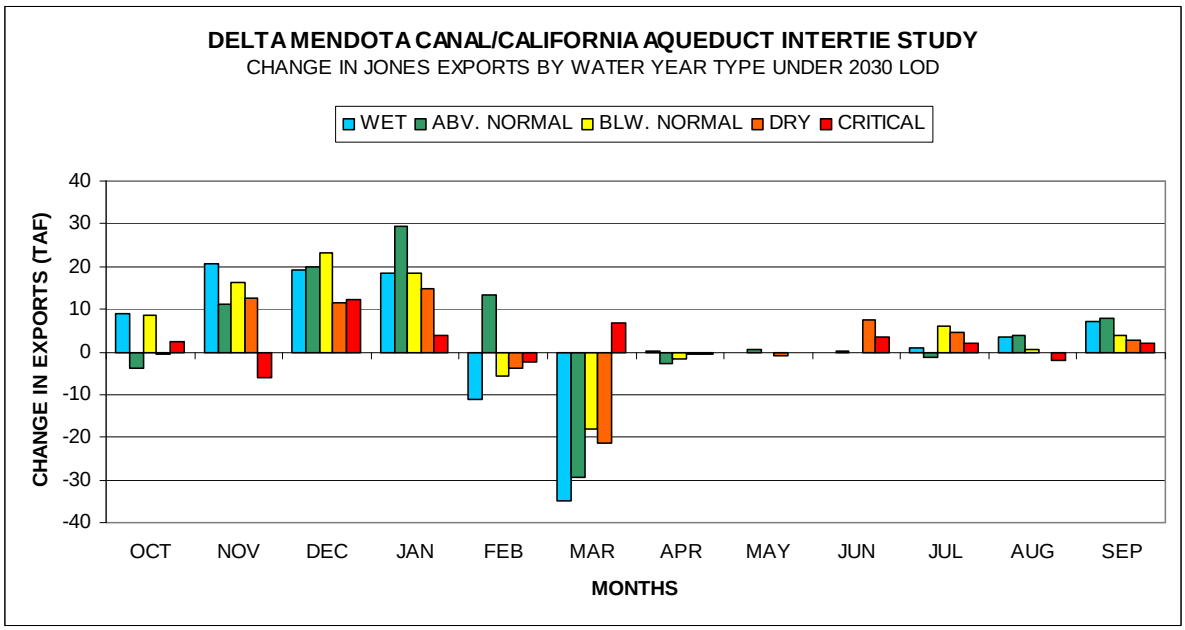


Figure 8: Monthly change in Jones exports with Intertie by water year type under 2030 LOD.

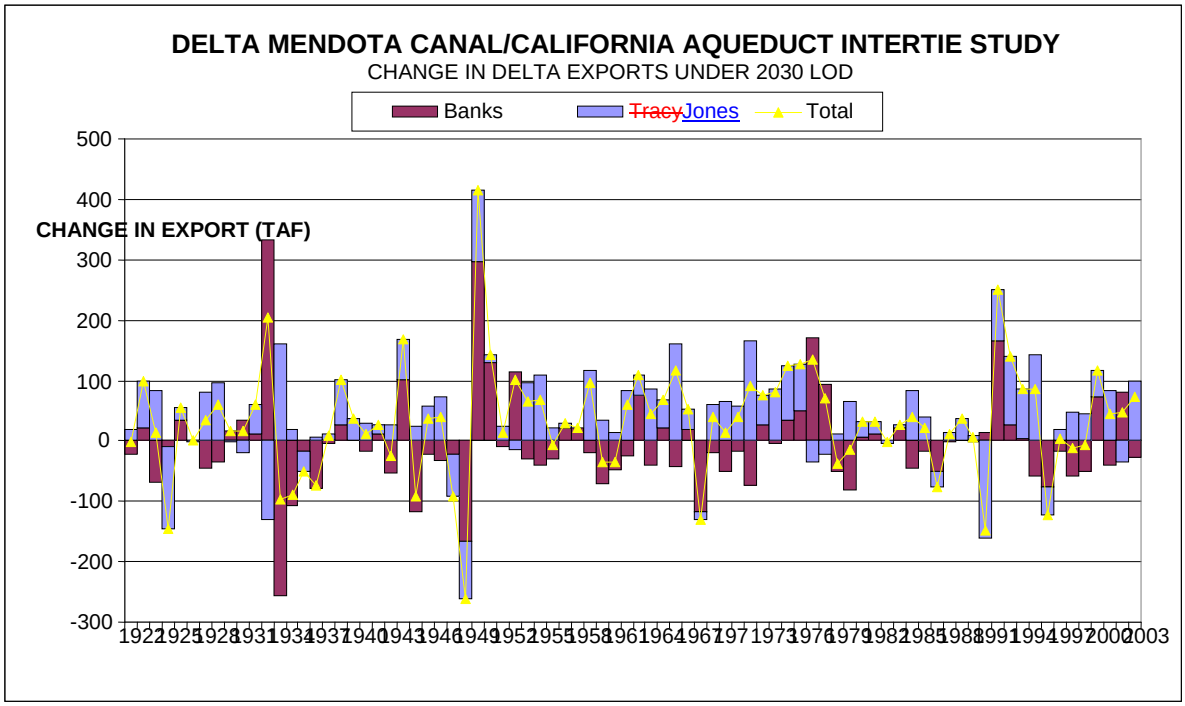


Figure 9: Changes in annual Delta exports with Intertie under 2030 LOD.

San Luis Reservoir Operations

The Intertie conveyance allows water to reach San Luis during the winter months filling cycle where capacity was previously constrained. Figure 10 compares the average end-of-March and end-of-August storage values for the Intertie study to the Future No Action study (2030 LOD Base). The studies show overall increases in CVP San Luis storage levels during the filling period. Increases in March CVP San Luis storage due to the Intertie occur in approximately 50% of all years. August CVP San Luis storage is somewhat reduced in a number of wet years with high carryover storage (Figure 11). The reduction in August storage is largely due to more effective delivery allocation scheduling caused by earlier filling. In many of these years, earlier filling of CVP San Luis (before May) allows higher allocations to be made for CVP SOD contractors. The higher allocations, which continue throughout the delivery year, cause more water to be moved from CVP San Luis storage for delivery.

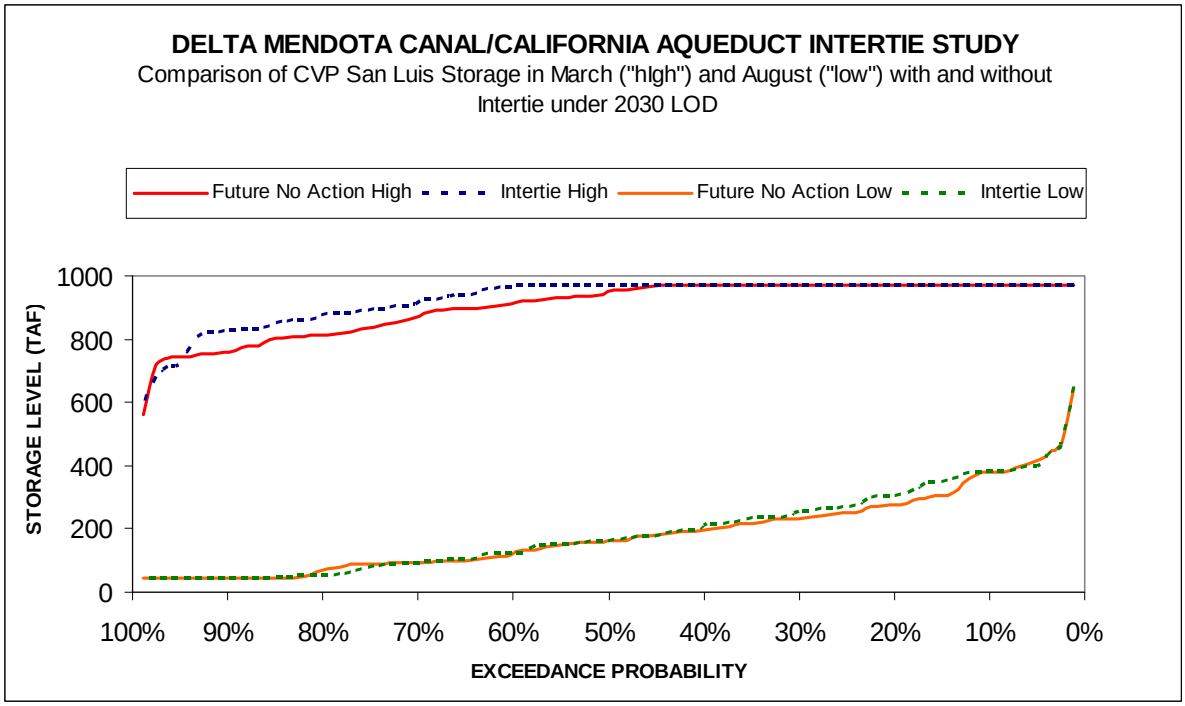


Figure 10: Comparison of CVP San Luis storage in March ("high") and August ("low") under 2030 LOD.

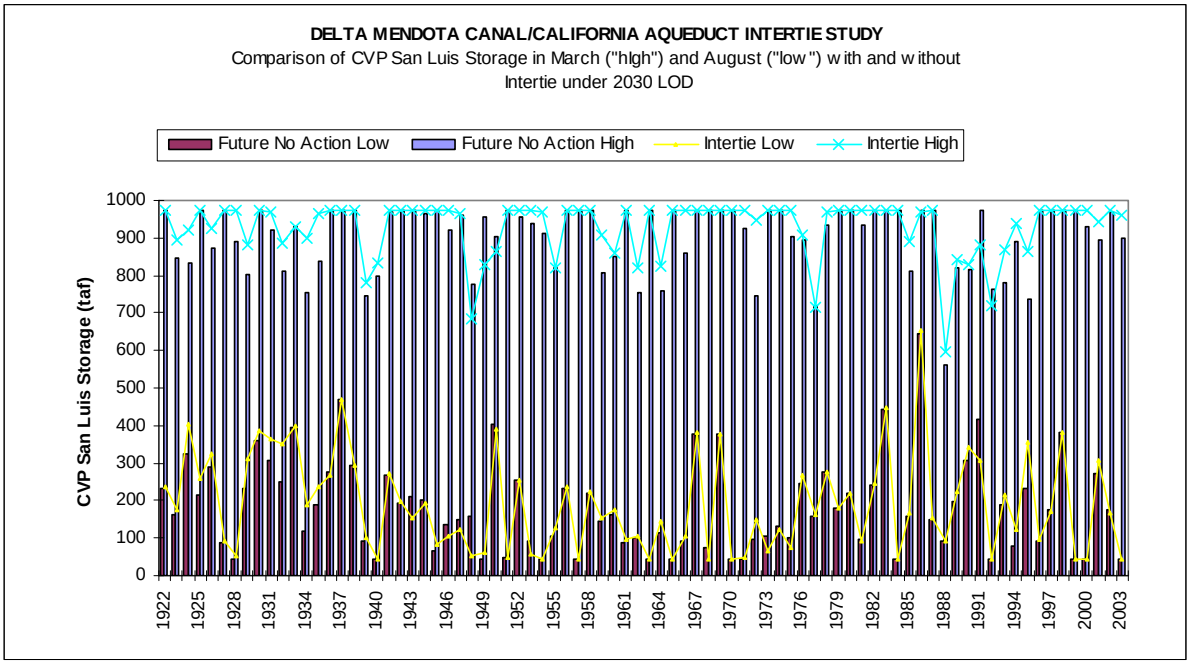


Figure 11: Comparison of CVP San Luis storage in March ("high") and August ("low") under 2030 LOD.

North of Delta Storage Impacts

Figures 12 through 15 compare the carryover storage conditions in Trinity, Shasta, Folsom, and Oroville Reservoirs in the Intertie and Future No Action alternatives. The results are similar between the two alternatives except for some differences in Folsom Reservoir during dry periods caused by the need to make project releases to maintain a minimum pumping amount in Jones Pumping Plant.

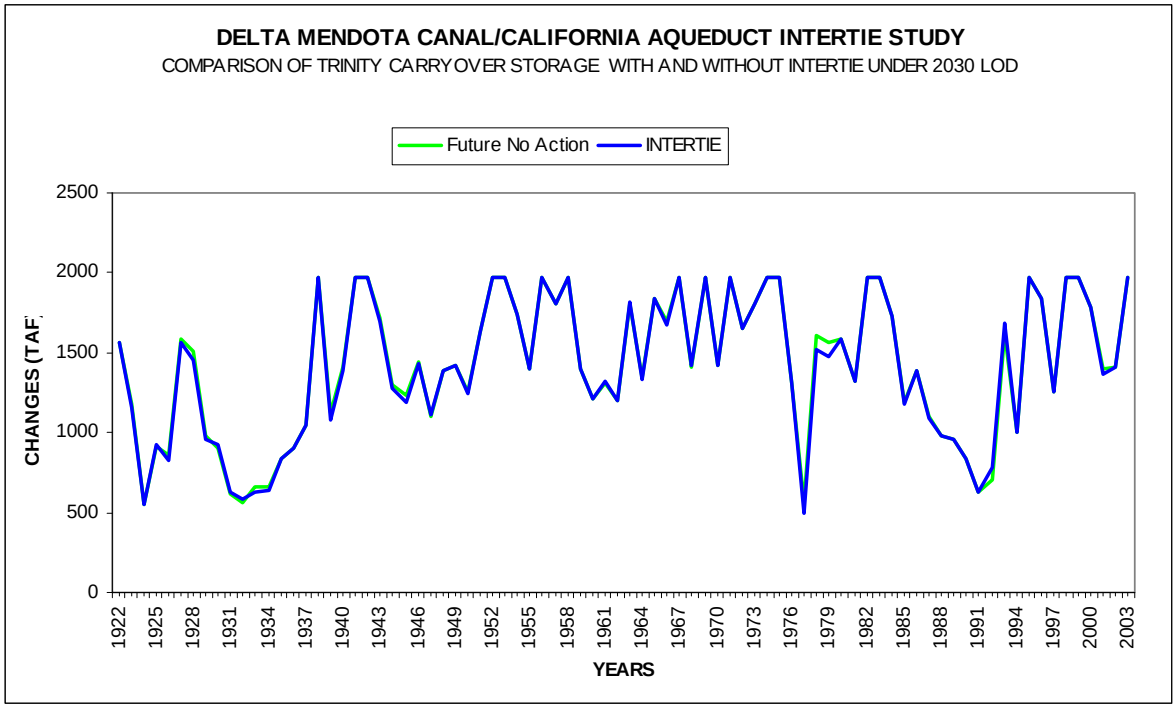


Figure 12: Trinity carryover storage under 2030 LOD.

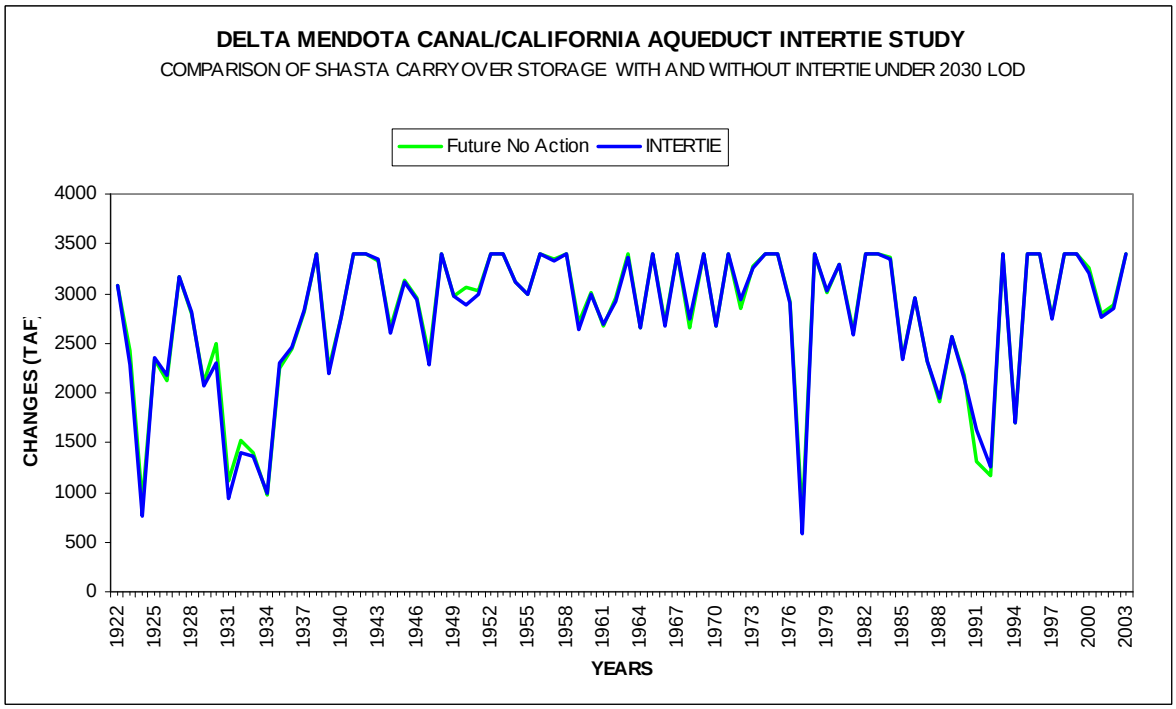


Figure 13: Shasta carryover storage under 2030 LOD.

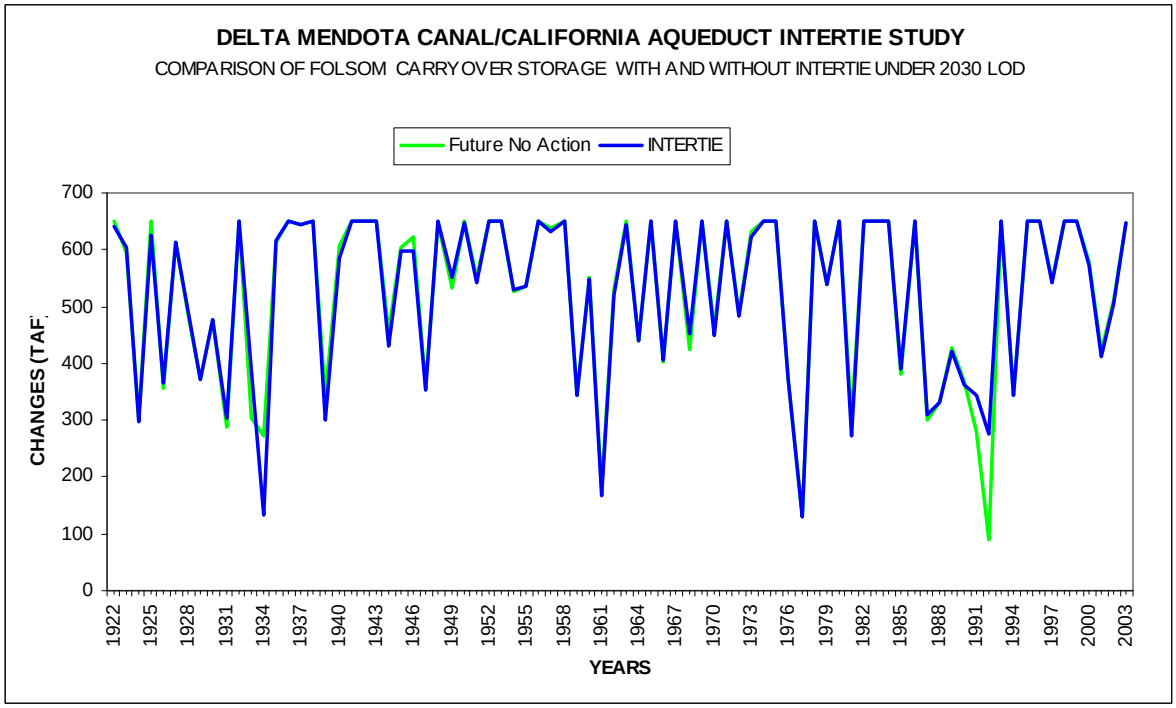


Figure 14: Folsom carryover storage under 2030 LOD.

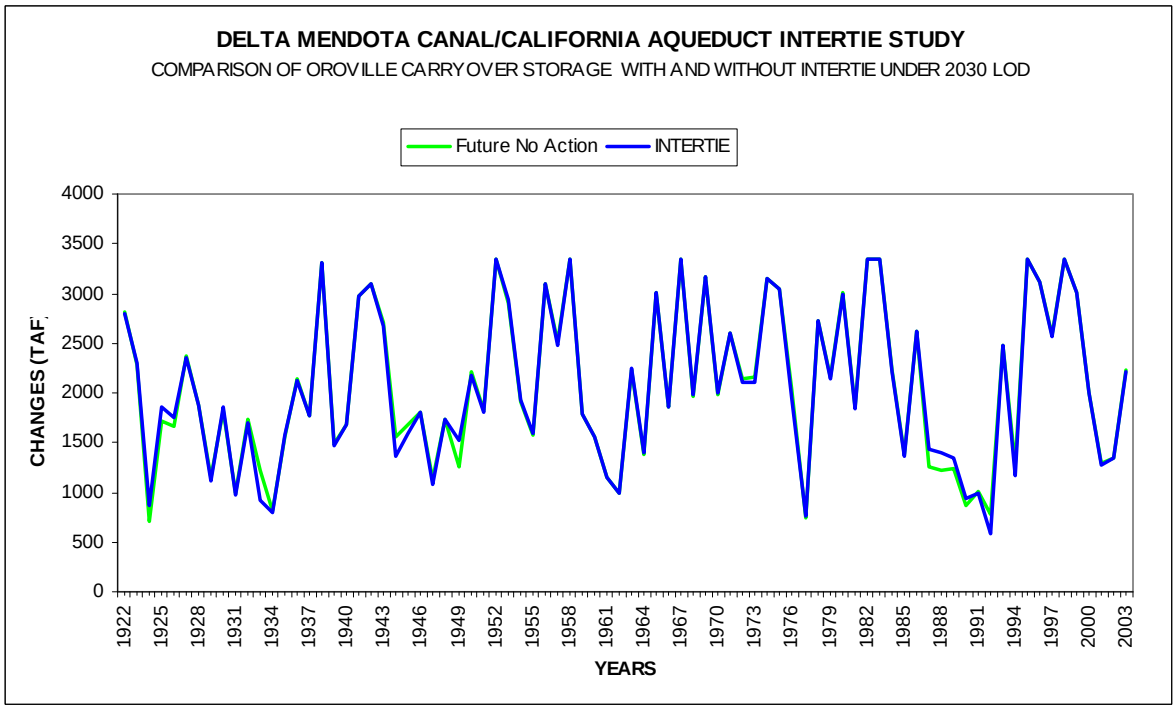


Figure 15: Oroville carryover storage under 2030 LOD.

Delta Outflow Impacts

The Delta outflow reflects a combination of required flows for water quality and flow standards as well as higher flows during wet periods. The water supply benefits of the Intertie project are largely realized through greater capture of Delta flows that are greater than the required quantities during the October through March period. As a result, these "surplus" Delta outflows decrease by an average of 43 taf/yr. The increased pumping in the winter, however, does cause a minor increase in the "required" Delta outflows in the spring. The required Delta outflows increase by an average of 10 taf/yr and are predominantly due to additional flow requirements for the X2 standard. Total Delta outflow (the sum of required and surplus outflows) decreases by an average of 33 taf/yr. Changes to surplus Delta outflows reflect the source of most of the additional exports for the Intertie study. Figure 16 shows the changes in annual Delta outflow for the Intertie study and the changes in total Delta exports.

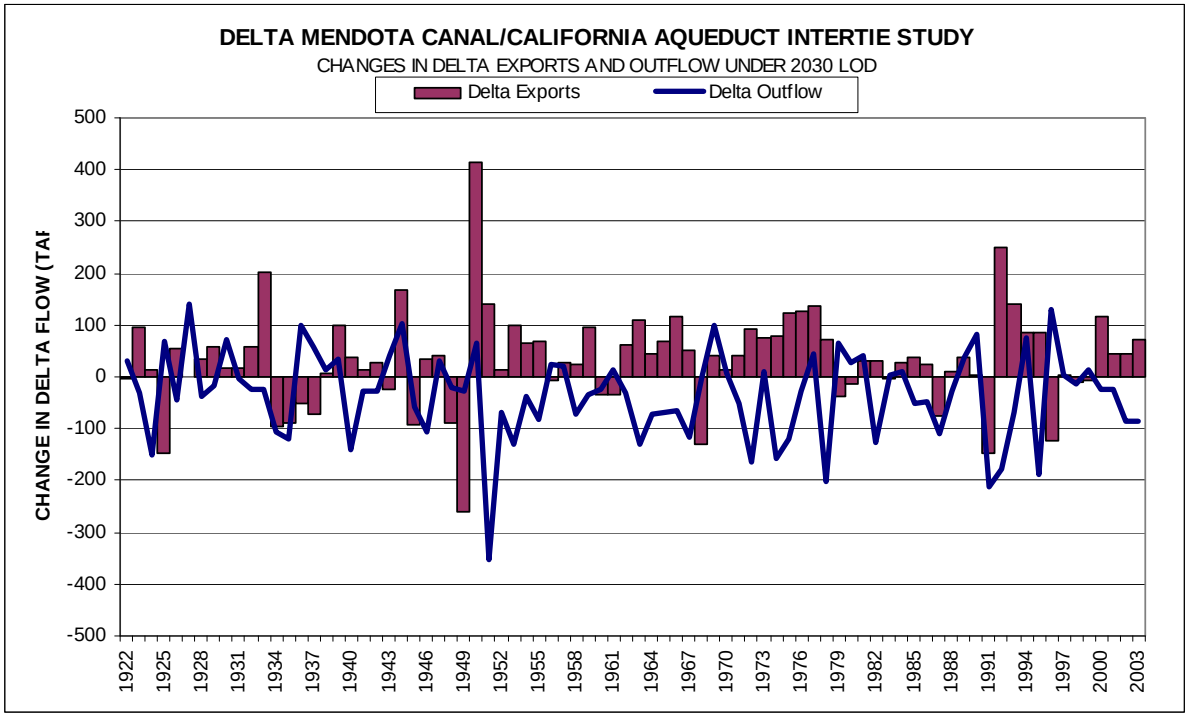


Figure 16: Changes in Delta exports and outflow with Intertie (taf/yr) under 2030 LOD.

CVPIA (b)(2) Impacts

In order to operate to a relatively consistent environmental condition, the fish protective actions and the costs associated with them simulated in the Future No Action alternative were fixed in the Intertie alternative. This is shown graphically in Figure 17. Figures 18 and 19 show the exceedance probability of the costs of satisfying the CVP WQCP Delta requirements and the b(2) overall cost, respectively, in the Future No Action and Intertie alternatives.

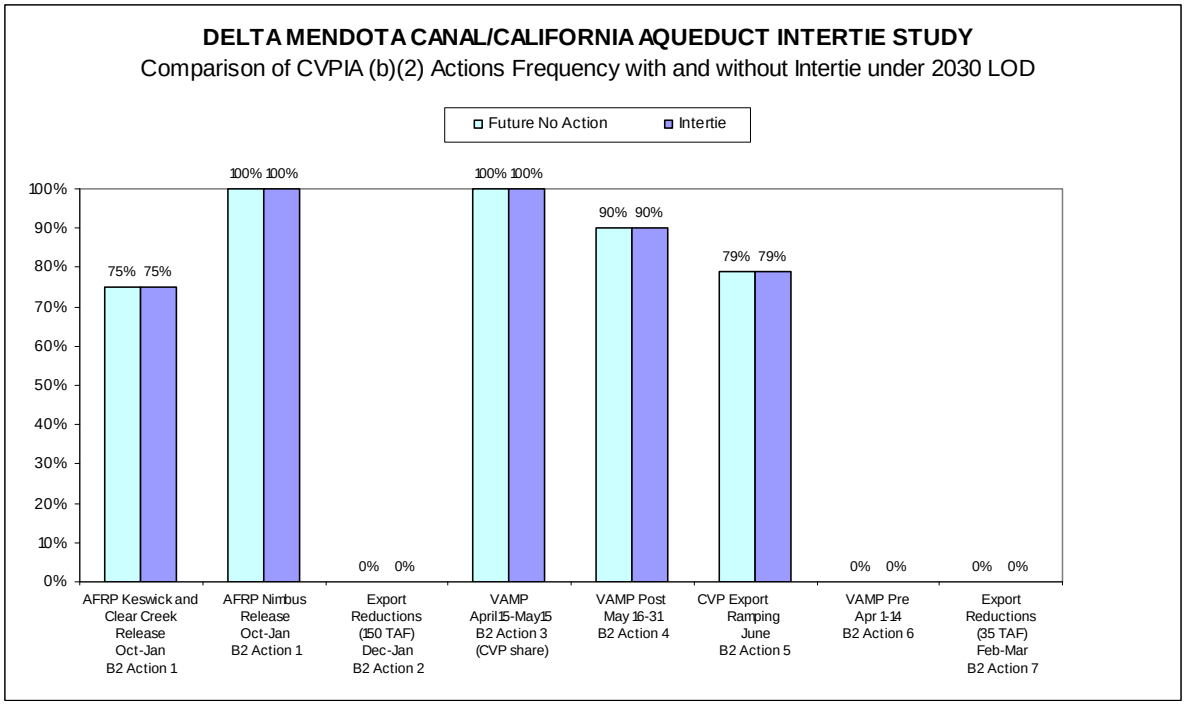


Figure 17: Comparison of frequency of CVPIA (b)(2) actions taken in 2030 LOD Base and Intertie studies.

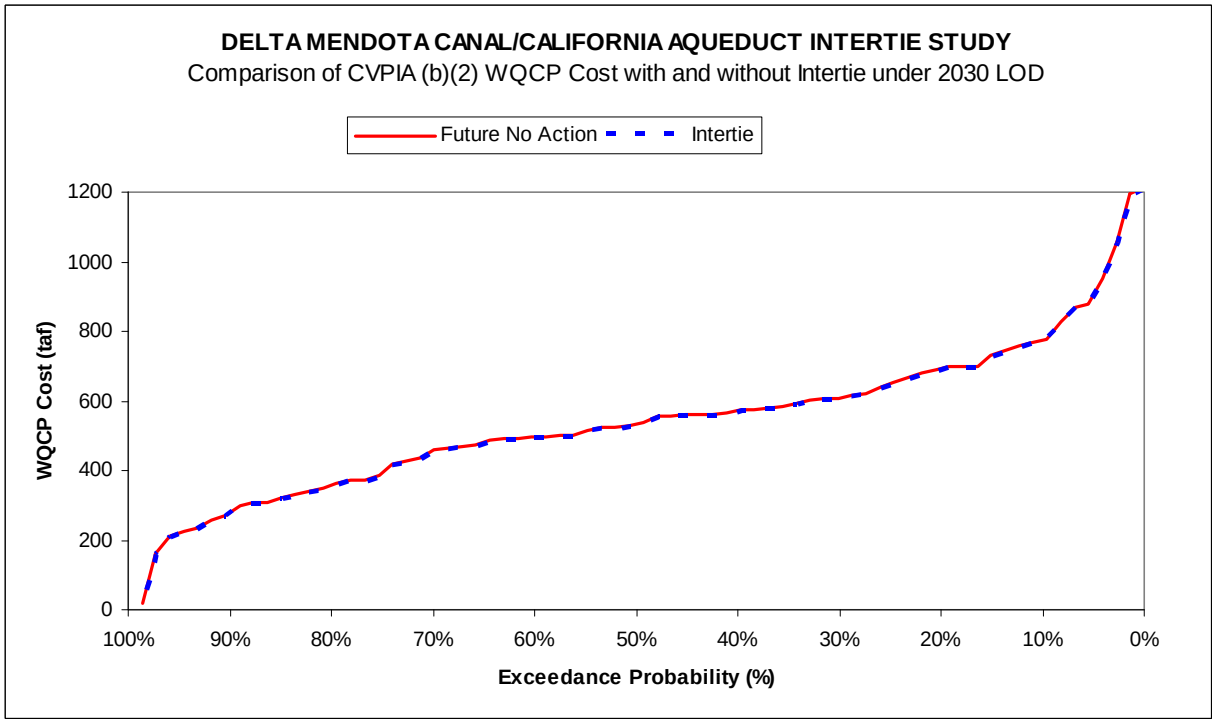


Figure 18: Comparison of the (b)(2) WQCP costs between 2030 LOD Base and Intertie studies.

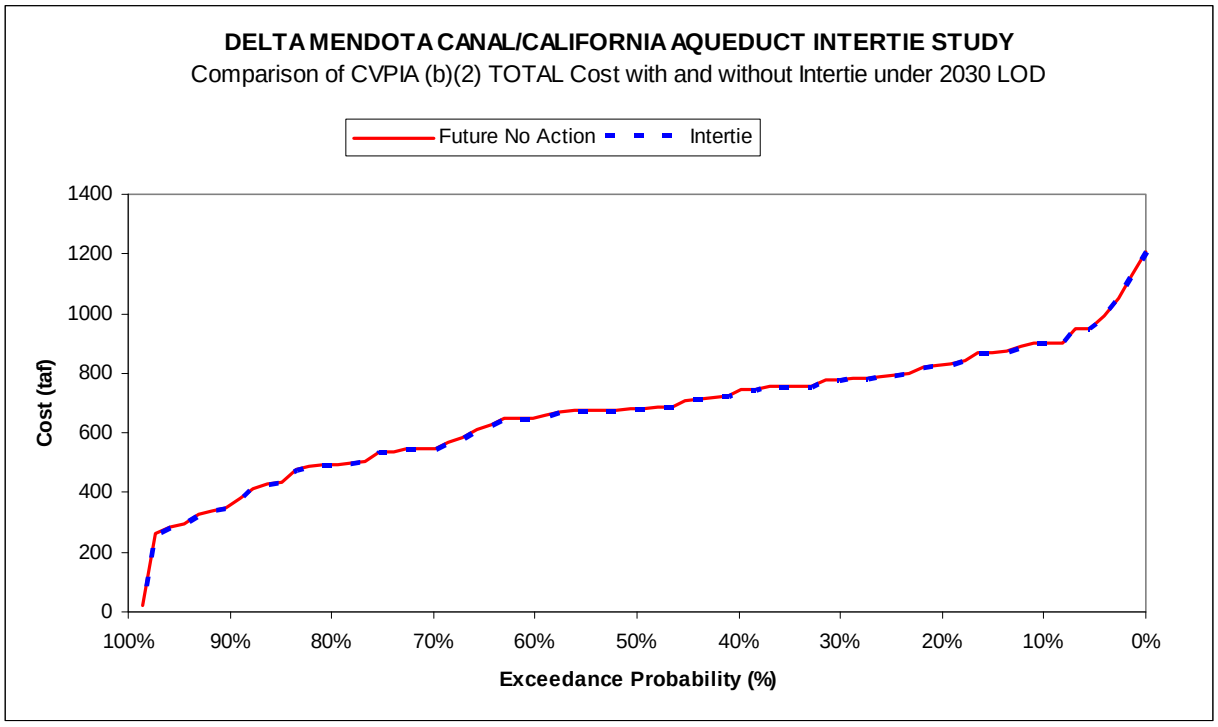


Figure 19: Comparison of the total cost of (b)(2) actions taken between 2030 LOD Intertie and Base studies.

CALSIM II Modeling Limitations for the Intertie Analysis

The CALSIM II model was used to analyze the Intertie project by simulating SWP and CVP operations over an 82-year period that approximated future level of development conditions with historic climatic conditions. Like all models CALSIM II has limitations that need to be kept in mind when interpreting its results. The following are some general limitations of CALSIM II that are identified in Chapter 9 of the OCAP BA document and are applicable to the analysis performed for the USBR Intertie project:

- The main limitation of the CALSIM II model is the time step. Mean monthly flows do not define daily variations that could occur in the rivers from dynamic conditions. As a result, the model will not capture the peak flows that may occur on a daily time step, though monthly changes may be overestimated to some extent. This may have an effect on the evaluation of the Intertie project because the Intertie operates primarily in the winter months when the largest daily flows typically occur. However, monthly results are still useful for general comparison of alternatives.
- CALSIM II is most appropriately used in comparative mode, where only the difference between two simulations is of importance and the errors and uncertainties that exist in both simulations are largely removed (or significantly reduced) when measuring the change between simulations. The results in individual months or years may not directly compare between the two model runs due to changing

antecedent conditions and operational targets. Multi-year averages or other statistics are most suitable for comparing results between alternatives.

- CALSIM II cannot completely capture the policy-oriented operations and coordination of the 800,000 af of dedicated CVPIA 3406 (b)(2) water and the CALFED EWA. The CALSIM II model is set up to run each step of the 3406(b)(2) on an annual basis and because the WQCP and Endangered Species Act (ESA) actions are set on a priority basis that can trigger actions using 3406(b)(2) water or EWA assets, the model will exceed at times the dedicated amount of 3406(b)(2) that is available. Moreover, the 3406(b)(2) and EWA operations in CALSIM II are just one set of plausible actions aggregated to a monthly representation and modulated by year type. However, they do not fully account for the potential weighing of assets versus cost or the dynamic influence of biological factors on the timing of actions. The monthly time-step of CALSIM II also require day-weighted monthly averaging to simulate minimum in-stream flow levels. This averaging can either under- or over-estimate the amount of water needed for these actions.
- CALSIM II uses simplified rules and guidelines to simulate SWP and CVP delivery allocation. Therefore the results may not reflect how the SWP and CVP would actually operate under extreme hydrologic conditions (very wet or very dry). The allocation process in the modeling is weighted heavily on storage conditions and inflow to the reservoirs and does not project inflow from contributing streams when making an allocation. This curve-based approach does cause some variation in results between studies that would be closer with a more robust approach to the allocation process.
- There are a number of rule-curves embedded in CALSIM II and it is these rule curves that drive the water balance between the reservoirs, determine how much water to carryover until the following year, and allocate the amount of water for delivery. It is difficult to produce a rule curve in CALSIM II that produces good realistic results in the full spectrum of year types. CALSIM II rule curves often produce sub-optimal with respect to Project operations in the driest years. Some results imply that the projects would operate the reservoirs to unrealistically low levels in these dry year outliers. In reality the Projects could and would operate to higher reservoir elevations in these extremely dry years.

There are also some additional limitations that are specific to the Intertie analysis:

- The effects of the Intertie are fairly small compared to the overall flows that enter and leave the Delta. Because of this, it may be difficult to discern all of the possible effects of the Intertie in the CALSIM II results.
- The demands on the Delta Mendora Canal upstream of the constriction to 4,200 cfs are based on the best available information developed from historic patterns, but may different than that expected in the future. Demand pattern predictions are complex and are affected by crop types, irrigation technologies, local rainfall, and district-scale water management. Changes in the demand patterns could have some effect on the timing and magnitude of Intertie usage in each month, but are expected to be relatively small and uncertain. The overall Intertie usage shown in the model results should be reasonably accurate for comparative purposes of project evaluation.

Virtual Intertie Alternative Analysis

Under the Virtual Intertie alternative, the CVP would use the SWP Banks Pumping Plant to convey CVP water to San Luis Reservoir. The permitted pumping capacity at Banks would not change from the No Action Alternative. Under the No Acton Alternative, available CVP water for export that cannot be pumped at Jones due to the conveyance limitations is treated as unused federal share under the Coordinated Operations Agreement and can be exported by the SWP at Banks. This water, often stemming from upstream CVP instream flow or temperature releases cannot be recovered by the CVP. In addition, due to Banks Pumping Plant priorities, pumping for Article 21 deliveries is made at a higher priority than CVP pumping in Banks.

In the Virtual Intertie alternative it is assumed that the CVP would be given up to 400 cfs of priority capacity in Banks to pump water that cannot be pumped at Jones due to conveyance limitations in the Delta Mendota Canal. This water would be pumped at a higher priority than SWP pumping of Article 21 water or other pumping of the water that is released from CVP project reservoirs for b(2) and other environmental purposes. This additional capacity can occur during any month but is restricted to 400 cfs minus the total diversions off of the Delta-Mendota Canal upstream of the constriction to 4,200 cfs (D701 and D702). Typically this occurs during the period from September through March when Jones Pumping Plant cannot pump at capacity. Thus, the Virtual Intertie alternative allows that the CVP to pump some of the water that is currently lost due to limitations on pumping at Jones Pumping Plant in the No Action Alternative.

The analysis has been performed by post-processing the results of the Intertie CALSIM II study. The post-processing routine attempts to pump the additional flow that occurred in Jones Pumping Plant in the Intertie alternative through Banks Pumping Plant instead and computes losses that are accrued to the CVP and SWP (as compared to the Intertie alternative) when there is insufficient capacity to pump the entire Intertie flow.

Pumping Priorities

The following pumping priorities are assumed for Banks Pumping Plant in the Virtual Intertie alternative (along with associated labels used in the computations below):

1. EWA priority pumping (D419_EWA_Priority)
2. SWP pumping of SWP water for Table A (D419_EXP1_TA)
3. CVP pumping of the Intertie Increment (Intertie_Increment)
3. SWP pumping of SWP water for Article 21 ((D419_EXP1_ART21)
4. SWP pumping of CVP water for Table A (D419_EXP2_TA)
5. SWP pumping of CVP water for Article 21 (D419_EXP2_ART21)
6. EWA JPOD pumping (D419_EWA_Other)
7. CVP JPOD pumping (D419_CVP)

These priorities are the same as in the No Action and Intertie alternatives except for the inclusion of the Intertie Increment.

Analysis Approach

The Virtual Intertie alternative has been post-processed using the results of the CALSIM II study for the Intertie alternative. The following assumptions are used to perform the calculations:

- The desired pumping quantities in Banks for each flow component in each month are computed from the results of the Intertie alternative. The following shows the computation for each component using the Intertie alternative CALSIM II outputs (all computed in cfs):
    - D419_EXP1_TA = MIN(*D419_SWP – SWP_IN_TOTAL*, *D419_EXP1*)
    - D419_EXP1_ART21 = *D419_EXP1* – D419_EXP1_TA
    - D419_EWA_Priority = IF(*D419_EWA*<500, *D419_EWA*, 500) from July-September
    - D419_EWA_Other = *D419_EWA* – D419_EWA_Priority
    - D419_CVP = *D419_CVP*
    - D419_EXP2_TA = *D419_SWP – SWP_IN_TOTAL* - D419_EXP1_TA
    - D419_EXP2_ART21 = *D419_EXP2* – D419_EXP2_TA
    - Intertie Increment = Max (*D418* – 4200 – *D701* – *D702*, 0)

  (Note: variables from the Intertie CALSIM II study are shown in italics)
- The maximum allowed pumping (before makeup) in Banks is assumed to be the lesser of the Banks Permit Capacity and the actual Banks pumping in the Intertie Alternative (D419) plus the Intertie Increment. This assumption reflects that, because Jones pumping goes down by the same amount that Banks pumping goes up, there is no increase in total Delta exports and therefore no additional Delta restrictions on Banks pumping.
- If the total desired Banks pumping was greater than the Banks permit capacity in any month, the components of pumping are reduced in the following order until the final Banks pumping equaled the permit capacity:
    - D419_CVP
    - D419_EWA_Other
    - D419_EXP2_ART21
    - D419_EXP2_TA
    - D419_EXP1_ART21
    - Intertie_Increment
    - D419_EXP1_TA
    - D419_EWA_Priority
- The loss for each component is computed as the difference between the desired and final pumping quantity for that component.
- The total SWP Table A loss (D419_EXP1_TA + D419_EXP2_TA) is tracked cumulatively each year starting in September. During each month from October through March, the SWP is permitted to make up the lost pumping by increasing pumping at Banks Pumping Plant. The makeup is determined using the following computations (all computed in cfs):
    - Banks Remaining Capacity = Permit Capacity – Banks Final Capacity (before makeup)
    - Makeup Pumping = Min(SWP Table A Cumulative Loss, Banks Remaining Capacity, Surplus Delta Outflow), where the Surplus Delta Outflow has been

computed taking into account the Required Delta Outflow, E/I Ratio, and Delta salinity controls. If Makeup Pumping occurs in any month from October through February, then this amount is subtracted from the Cumulative Loss when the computation is done in subsequent months.
    - The SWP Makeup pumping is added to the D419_EXP2_TA quantity for final reporting of results.
- The total CVP loss (Intertie_Increment + D419_CVP) is tracked cumulatively each year starting in September. During each month from October through March, the CVP is permitted to make up the lost pumping by increasing pumping in Jones Pumping Plant. The makeup is determined using the following computations (all computed in cfs):
    - Jones Remaining Capacity = 4,200 + D701+ D702 – (D418 – Desired Intertie Increment)
    - Makeup Pumping = Min(CVP Cumulative Loss, Jones Remaining Capacity, Surplus Delta Outflow), where the Surplus Delta Outflow has been computed taking into account the Required Delta Outflow, E/I Ratio, and Delta salinity controls. If Makeup Pumping occurs in any month from October through February, then this amount is subtracted from the Cumulative Loss when the computation is done in subsequent months.
    - Final Jones Pumping = D418 – Desired Intertie Increment + Makeup Pumping

Summary of Results

Table 3 summarizes the changes in CVP and SWP exports in the Virtual Intertie alternative as compared to the Intertie and No Action alternatives. The Virtual Intertie alternative increases average annual CVP exports by about 27 TAF/year as compared to the No Action alternative, which is 6 TAF/year less than the increase that occurs in the Intertie alternative. This reduction in benefits occurs because there is not enough capacity in Banks to pump all of the additional water than is pumped in the Intertie alternative at Jones.

The Virtual Intertie alternative increases Banks CVP pumping by about 58 TAF/year as compared to the No Action alternative, but Jones pumping is reduced by about 31 TAF/year because the CVP portion of San Luis Reservoir fills earlier in the year. SWP exports are decreased by about 13 TAF/year due to reduced available SWP pumping capacity at Banks under the CVP priority use assumed in this alternative. This reduction is greater than the reduction of 3 TAF/year in the Intertie alternative. The Virtual Intertie alternative results in lower CVP export benefits and greater decreases in SWP exports than the Intertie alternative.

Table 3: Summary of Average Annual Virtural Intertie Alternative Results (taf/year)

2030 LOD	COMPARISON WITH INTERTIE			COMPARISON WITH NO ACTION		
	VIRTUAL INTERTIE	INTERTIE	CHANGE	VIRTUAL INTERTIE	NO ACTION	CHANGE
CVP EXPORTS						
JONES PUMPING	2256	2322	-66	2256	2287	-31
BANKS PUMPING						
INTERTIE INCREMENT	61	0	61	61	0	61
JPOD	77	78	-1	77	80	-3
TOTAL	138	78	60	148	80	58
TOTAL CVP EXPORTS	2394	2400	-6	2394	2367	27
SWP EXPORTS						
BANKS PUMPING						
TABLE A	2996	2997	-1	2996	2993	3
ARTICLE 21	270	279	-9	270	286	-16
TOTAL	3266	3276	-10	3266	3279	-13

Appendix C

DSM2 Modeling Studies of the Delta-Mendota Canal/California Aqueduct Intertie

DRAFT TECHNICAL MEMORANDUM CH2MHILL

DSM2 Modeling Studies of the Delta Mendota Canal/California Aqueduct Intertie

Introduction

The proposed Delta-Mendota Canal / California Aqueduct Intertie Project (Intertie) will allow for increased pumping through the Jones Pumping Plant. The proposed Intertie will restore DMC flow capacity above the 4,200 cfs capacity of the O'Neil pumping plant not available along the upper DMC during the winter months. The increase in flow through the Jones Pumping Plant will slightly alter the existing hydraulic patterns in the Delta and thus the distribution of salinity throughout the Delta. The Delta Simulation Model (DSM2) was used to predict changes in Delta water quality associated with changes in Delta inflows, exports, and outflows associated with the Intertie. Electrical Conductivity (EC) was used as a surrogate for salinity.

Overview

DSM2 is a branched one-dimensional hydrodynamic and water quality simulation model used to predict conditions in the Sacramento-San Joaquin Delta. The model was developed by the California Department of Water Resources (DWR) and is frequently used to ascertain impacts associated with projects in the Delta, such as changes in exports, diversions, or channel geometries associated with dredging in Delta channels. For this analysis, CH2M HILL conducted two 16-year DSM2 simulations representing Future No Action conditions and conditions with implementation of the Intertie alternative at the future 2030 Level-of-Development. Simulations were made for water years 1975 to 1991, with the first year of model predictions discarded to allow for model spin-up from specified initial conditions. This standard 16-year simulation period (water year 1976-1991) is routinely used for impact analyses of in-Delta projects.

Model-predicted EC were compared in graphical and tabular format at 11 selected locations throughout the Delta to quantify any changes in salinity for the Intertie alternative. These locations include: Martinez, Collinsville, Emmaton, Rio Vista, Antioch, Jersey Point, Rock Slough, Brandt Bridge, Old River at State Highway 4, Clifton Court Forebay, Jones Pumping Plant, and Old River at Tracy Road Bridge. Model output was generated at additional locations, but not all output locations were included in this comparative analysis. All model results have been archived and are available for additional analysis.

The DSM2 simulations used daily boundary conditions derived from monthly hydrologic data supplied by CALSIM II model results from simulations with consistent Future No Action and Intertie assumptions. The CALSIM II model simulations and results are discussed in a separate memorandum.

Methodology

This section discusses the methodology used in the DSM2 simulations. A discussion of hydrodynamic and water quality boundary conditions, as well as physical structures in the Delta, is included to provide information on how the simulations were developed. A complete discussion of results follows.

Boundary Conditions

DSM2 simulations were conducted with a revised astronomical tide elevation at Martinez that was developed by DWR as part of the Common Assumptions process to maintain consistency with the USBR OCAP Modeling. The new planning tide was adjusted to compensate for past sea level rise and was normalized to a 1993-level using the National Oceanic and Atmospheric Administration's National Ocean Service estimates of trends.

Sacramento River inflows to DSM2 were taken from CALSIM II channel C169. The monthly values obtained from CALSIM II were smoothed into a daily time series according to standard practice. Tools provided by DWR were used to smooth the Sacramento River flows. Other boundary condition flows, including inflows from Mokelumne, Calaveras, and Consumnes Rivers, flows in the Yolo Bypass, and exports through the North Bay Aqueduct and to Vallejo and Contra Costa Water Districts were taken directly from CALSIM II model output.

Export flows at Jones and Banks, as well as inflows from the San Joaquin River, were modified from time series data obtained directly from CALSIM II in order to incorporate flow changes associated with VAMP. Tools supplied by DWR were used to generate daily time series data at Jones, Banks, and Vernalis accounting for the VAMP period (April 15 to May 15). Mass balance checks were performed to insure the partial month flow representation maintained mass.

The Martinez EC boundary condition was calculated by standard methods taking into account the astronomical tide level and the net Delta outflow. DWR supplied programs for calculating this boundary condition. The EC boundary condition on the San Joaquin River at Vernalis was also adjusted from CALSIM II output in order to account for changes during the VAMP period. Tools developed and supplied by DWR were used to generate daily EC conditions at Vernalis. Sacramento River and Yolo Bypass EC boundary conditions were held constant at 175 μmhos/cm to maintain consistency with OCAP Modeling. Similarly, a constant value of 150 μmhos/cm was applied for the Mokelumne, Cosumnes, and Calaveras River inflows.

Delta Island Consumptive Use

Delta Island Consumptive Use (DICU) was consistent with CALSIM II. Diversions from the Delta, agricultural return flows, channel seepage, and water quality in the return flows were all taken from HEC-DSS files generated for full-period (water years 1922-2003) DSM2 simulations. A total water balance on all components of DICU was conducted to assure consistency with those values used in the CALSIM II runs. The DICU salinity used for discharge from Delta islands is an approximation of monthly salinity from three regions in the Delta. These monthly values are repeated each year in each region, regardless of the flow conditions. The DICU diversion salinity values change with channel salinity, so the

constant monthly pattern of discharge salinity does not provide a salt balance for the Delta islands.

Gate Operations

DSM2 includes the operation of several tide gates, culverts, and weirs which influence the hydrodynamic patterns in the Delta. In addition to these standard fixed structures, South Delta Improvements Program (SDIP) permanent operable gates (stage 1) in the south Delta, such as those proposed at Grant Line Canal, Old River at Tracy Road Bridge, Middle River near Tracy Blvd, and Head of Old River near San Joaquin River, were modeled in this analysis. All permanent gate operations remained consistent with the OCAP Modeling assumptions. Modified Plan C operations (i.e., gates closed at high tide to allow only upstream tidal flows in Old and Middle River) were used for the permanent gates. Tools developed and supplied by DWR were used to generate the permanent gate operations based on flow in the San Joaquin River (i.e., gates were opened at higher SJR flows). Permanent gate operations were identical for the two DSM2 simulations.

Clifton Court Forebay operations were defined by Priority 3 operations to maintain consistency with the OCAP Modeling assumptions. The CCF gates were closed during the flood tide prior to the higher-high tide each day, to allow the high tide elevations to be protected in the south Delta channels.

Delta Cross Channel Gate

The operation of the Delta Cross Channel Gate in the DSM2 simulations was consistent with the OCAP Modeling assumptions. Delta Cross Channel Gate position was based on CALSIM II output, and was processed through programs written and supplied by DWR in order to generate a time series of daily gate operations.

Comparison of Intertie Alternative with Future No Action

Model predictions for EC concentration were analyzed at several locations throughout the Delta. All Delta EC measurements are made with a 15-minute interval to capture the tidal variations throughout each day. DSM2 output consists of 15-minute, hourly, daily, and monthly average flow and electrical conductivity (EC, a surrogate for salinity). Comparisons were made between monthly average EC values for the Future No Action and Intertie Alternative conditions at select locations throughout the Delta.

This section discusses changes made to DSM2 to simulate impacts associated with the Intertie Alternative at a 2030 Level-of-Development. Each major boundary condition is presented comparing the Future No Action conditions to the Intertie Alternative conditions. The impacts of these changes are then discussed.

Figures 1 through 4 below present a comparison of the major flow boundary conditions, including exports at CVP Jones and SWP Banks, and flows on the Sacramento and San Joaquin Rivers, respectively. In general, average exports at Jones increased as a result of the Intertie Alternative, while exports at Banks are similar to the Future No Action Scenario. Figure 5 presents the effect on Net Delta Outflow of these changes and those on the Sacramento and San Joaquin Rivers.

Since the Martinez EC boundary condition is calculated using NDO, and changes to NDO will affect the EC at Martinez and thus the EC throughout the majority of the Delta. Figures 6 and 7 summarize the changes in simulated EC throughout the Delta as a result of the Intertie. Figure 6 presents results in the southern Delta, including Old River at Rock Slough, San Joaquin River at Brandt Bridge, Clifton Court Forebay, Old River at Tracy Road Bridge, Los Vaqueros Intake and Jones Pumping Plant. Peak changes in EC in the South Delta are approximately 150 µmhos/cm. Figure 7 presents changes in EC at Martinez, Collinsville, Emmaton, Rio Vista, Antioch, and Jersey Point. Water Year 1991 changes in EC at Martinez approach 1500 µmhos/cm. However, the change in EC at Martinez decreases in magnitude as the water filters through the Delta. For example, at Jersey Point, the changes have been reduced by a factor of three. Still, the changes in Martinez EC have a far-reaching influence on EC throughout the Delta, including the South Delta.

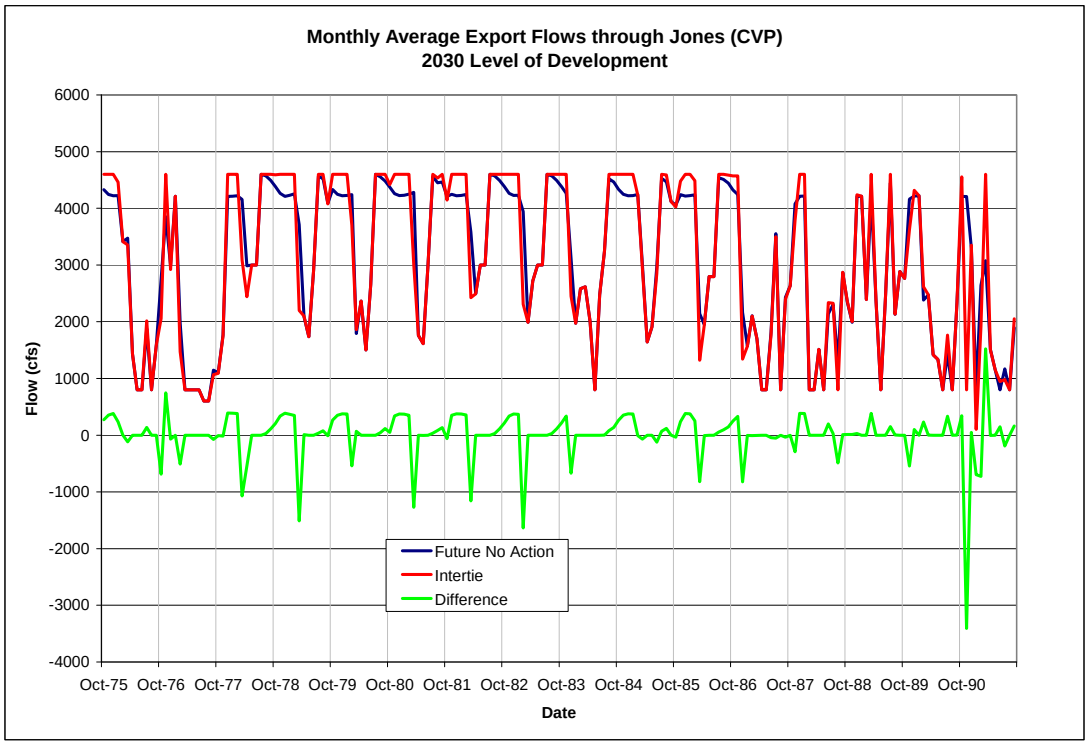


Figure 1. Comparison of Future No Action and Intertie Alternative Flows at Jones (2030 LOD)

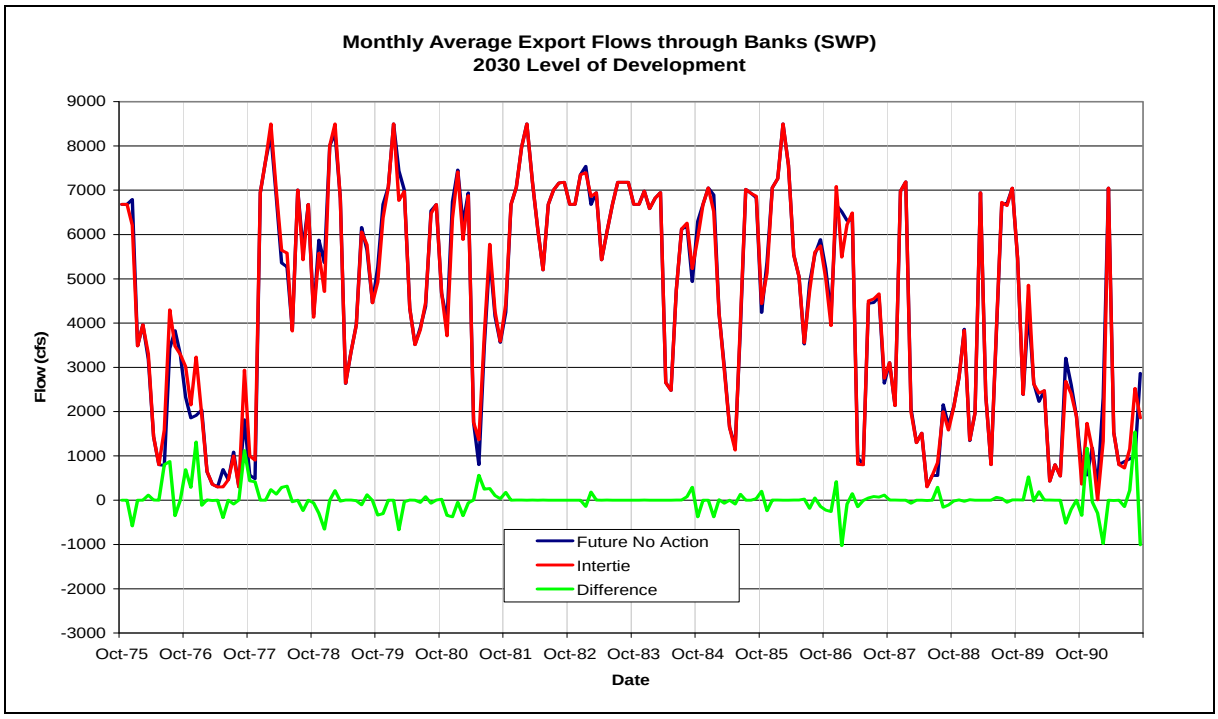


Figure 2. Comparison of Future No Action and Intertie Alternative Flows at Banks (2030 LOD)

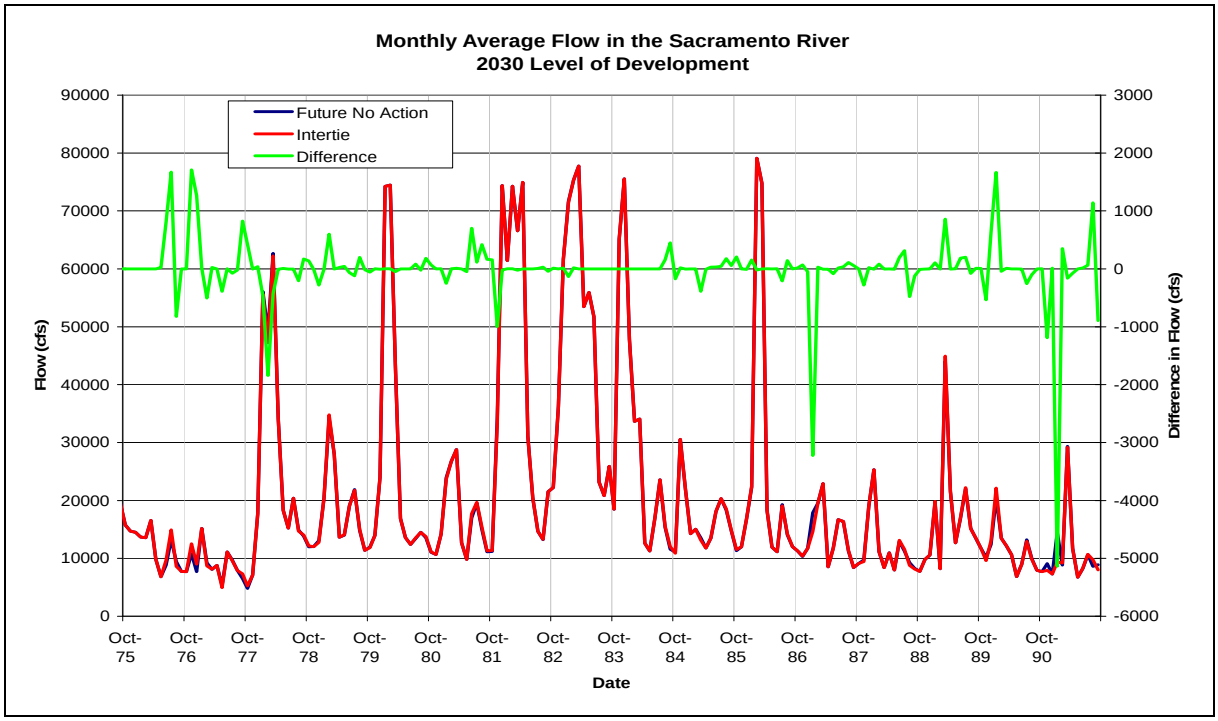


Figure 3. Comparison of Future No Action and Intertie Alternative Flows, Sacramento River (2030 LOD)

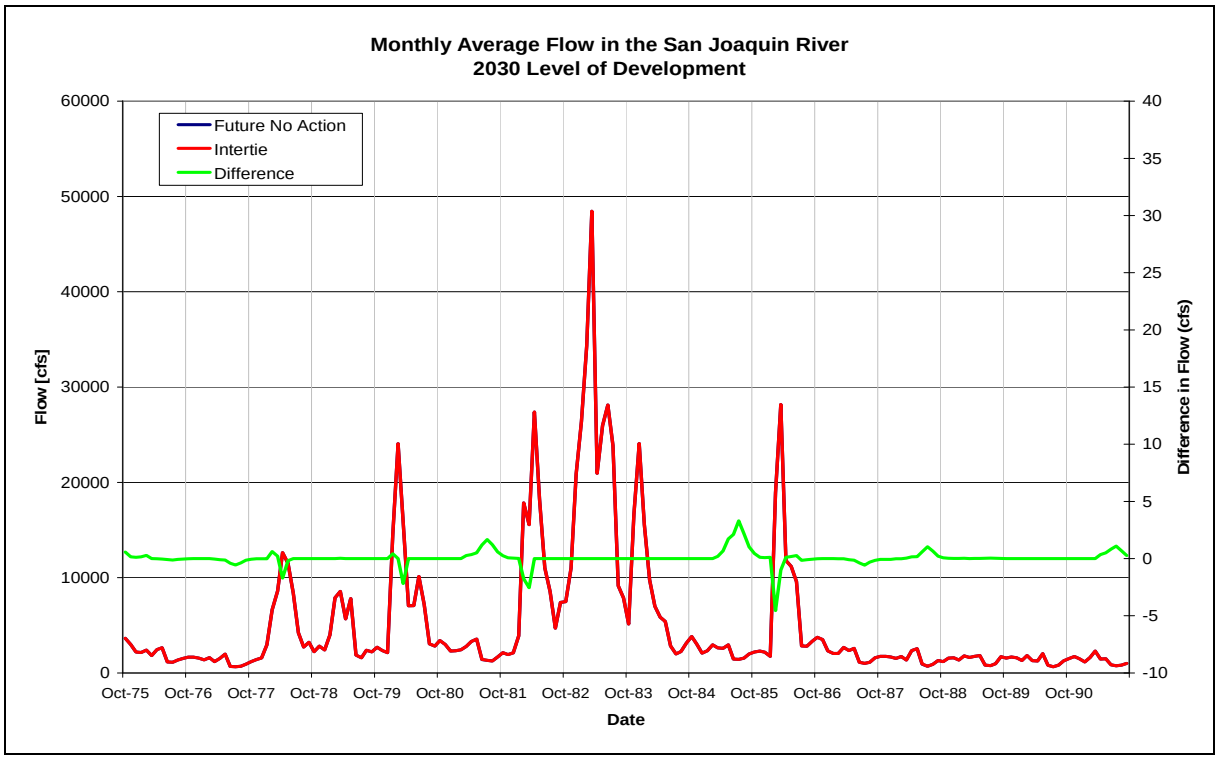


Figure 4. Comparison of Future No Action and Intertie Alternative Flows, San Joaquin River (2030 LOD)

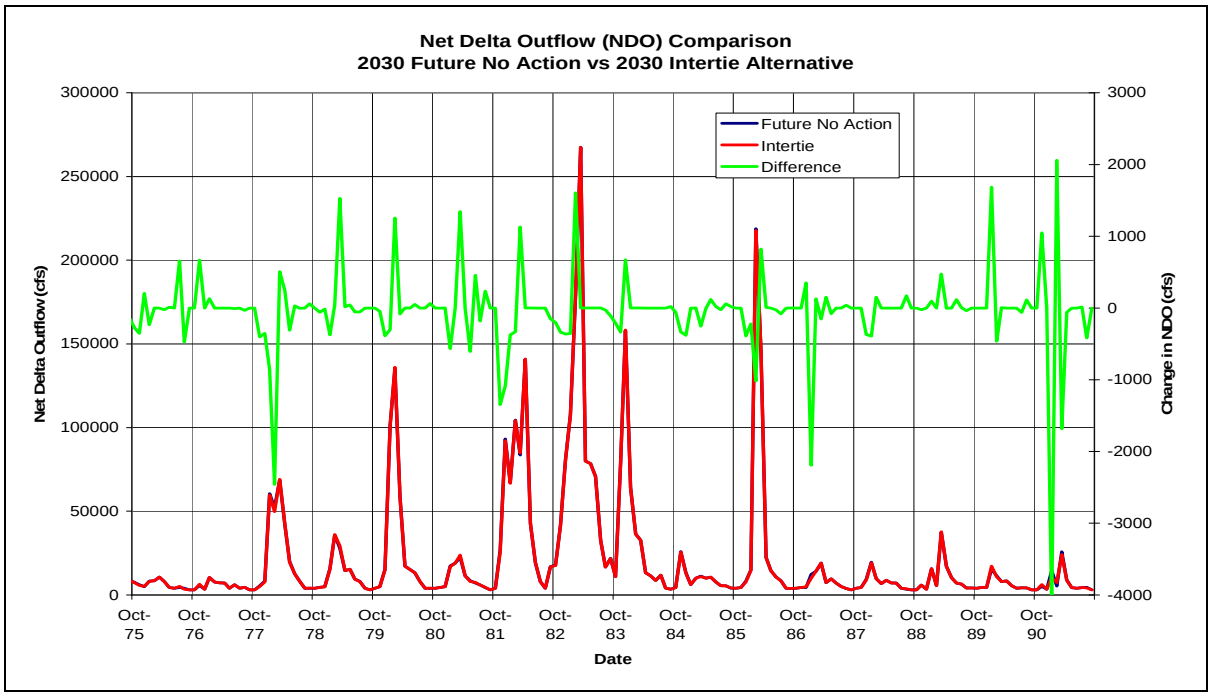


Figure 5. Comparison of Future No Action and Intertie Alternative Flows, Net Delta Outflow (2030 LOD)

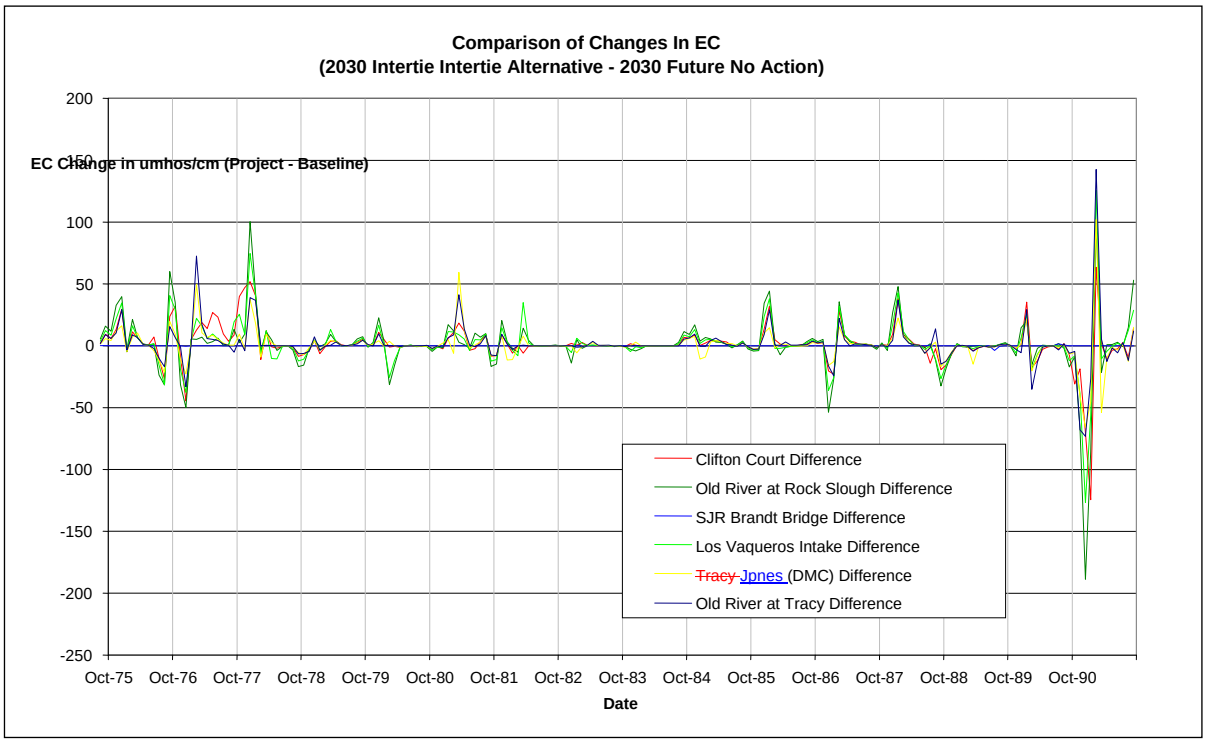


Figure 6. Comparison of EC Changes with Intertie Alternative, West Delta (2030 LOD)

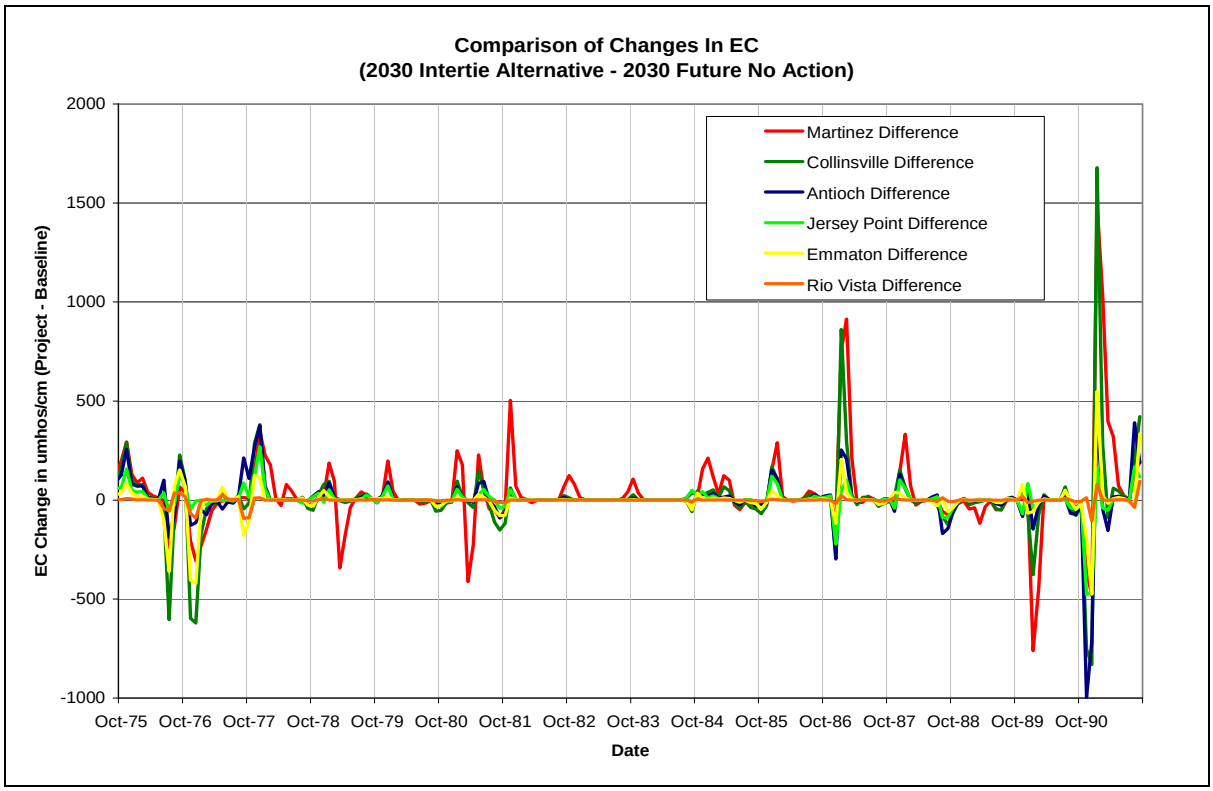


Figure 7. Comparison of EC Changes with Intertie Alternative, South Delta (2030 LOD)

Table 1 presents a summary of monthly EC values at select locations throughout the Delta. The statistics were computed on monthly average EC values from the 16-year simulation. The maximum, minimum, and average monthly EC values are presented for the Future No Action and Intertie Alternative simulations. A more in-depth analysis of variations in model results for the Intertie Alternative is presented in Appendix A. Time series comparison plots were generated with model results from water years 1976 through 1991. These plots, as well as summary tabulations of model results, are compiled in Appendix A.

Table 1. Summary of Monthly EC at Select Locations throughout Delta (2030 LOD)

Location	Future No Action			Intertie Alternative		
	Maximum	Average	Minimum	Maximum	Average	Minimum
Martinez	23,895	15,570	199	23,876	15,603	199
Collinsville	10,876	3,783	181	10,927	3,790	181
Emmaton	4,452	1,120	177	4,395	1,116	177
Rio Vista	1,128	290	137	1,039	288	138
Antioch	6,004	2,058	184	6,094	2,064	184
Jersey Point	3,084	1,065	182	3,087	1,071	182
Clifton Court	908	457	115	908	459	117
Old River at Rock Slough	1161	490	95	1196	491	98
SJR Brandt Bridge	961	552	159	961	552	159
Los Vaqueros Intake	956	476	112	985	478	113
Jones (DMC)	866	486	150	840	487	150
Old River at Tracy Road Bridge	891	501	133	908	502	133

Table 2 presents the seasonal trend in the average percent difference in EC between the Intertie Alternative and the Future No Action simulation at all locations. In general, the Intertie Alternative is shown to cause little or no changes in EC throughout the Delta, with the largest average changes occurring during the month of January. The greatest EC increases occur at Martinez, Collinsville, Emmaton and Antioch in January 1991. These EC increases are caused by a reduction in required Delta outflow and exports that occur because the antecedent EC at Rock Slough is lower in the Intertie alternative as compared to the Future No Action, resulting in a lower release from Lake Shasta in that month.

Figures 8 and 9 present the results demonstrating changes in predicted X2 position as a result of the Intertie. The data used to generate these figures are the results of the monthly Kimmerer-Monismith equation that calculates X2 position based on NDO and antecedent X2 conditions. Average changes in X2 position as a result of the Intertie Alternative are less than 0.4 kilometers. The four largest upstream movements of X2 were caused by reduced

Delta outflow in the previous months that were simulated by the CALSIM II model. Figure 9 presents a scatter plot allowing for the comparison of the change in X2 to the X2 position in the Future No Action simulation before the change. Table 3 presents a tabular summary of the data presented in Figure 8.

Table 2. Summary of DSM2 EC Results at Select Locations – Average Percent Difference in Monthly Average EC between Intertie Alternative and Future No Action Scenario in each month

Location	2030 (Intertie Alternative – Future No Action) %											
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
Martinez	0.2	0.5	0.8	1.5	1.7	-0.5	-0.2	0.2	0.0	-0.1	0.0	0.0
Collinsville	0.5	0.3	0.4	5.1	2.1	-0.5	0.0	0.7	0.0	-0.5	-0.1	0.1
Emmaton	0.0	0.2	-0.5	5.8	1.3	0.0	0.1	0.7	-0.3	-1.0	-0.2	-0.1
Rio Vista	-0.7	-0.1	-1.7	2.4	0.2	0.0	0.0	0.5	-0.4	-0.8	0.0	-0.1
Antioch	0.9	-0.1	0.9	4.5	1.9	-0.4	0.2	0.9	0.5	-0.2	0.3	0.6
Jersey Point	0.8	0.3	1.1	3.9	1.4	0.2	0.3	0.6	0.6	0.1	0.4	0.7
Clifton Court	0.2	0.6	0.2	0.4	1.3	0.8	0.3	0.2	0.2	-0.1	-0.1	0.2
Old River at Rock Slough	0.1	0.3	-0.1	1.3	2.1	0.5	0.5	0.0	0.3	0.0	0.0	0.6
SJR Brandt Bridge	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Los Vaqueros Intake	0.3	0.1	0.1	1.1	1.9	1.2	0.2	-0.1	0.1	0.0	0.0	0.4
Jones (CVP)	0.0	-0.1	-0.4	-0.1	1.3	0.6	0.4	0.1	-0.1	-0.1	-0.2	0.1
Old River at Tracy road bridge	0.0	-0.3	-0.1	0.8	2.1	0.9	0.3	0.1	-0.1	-0.1	0.0	0.0

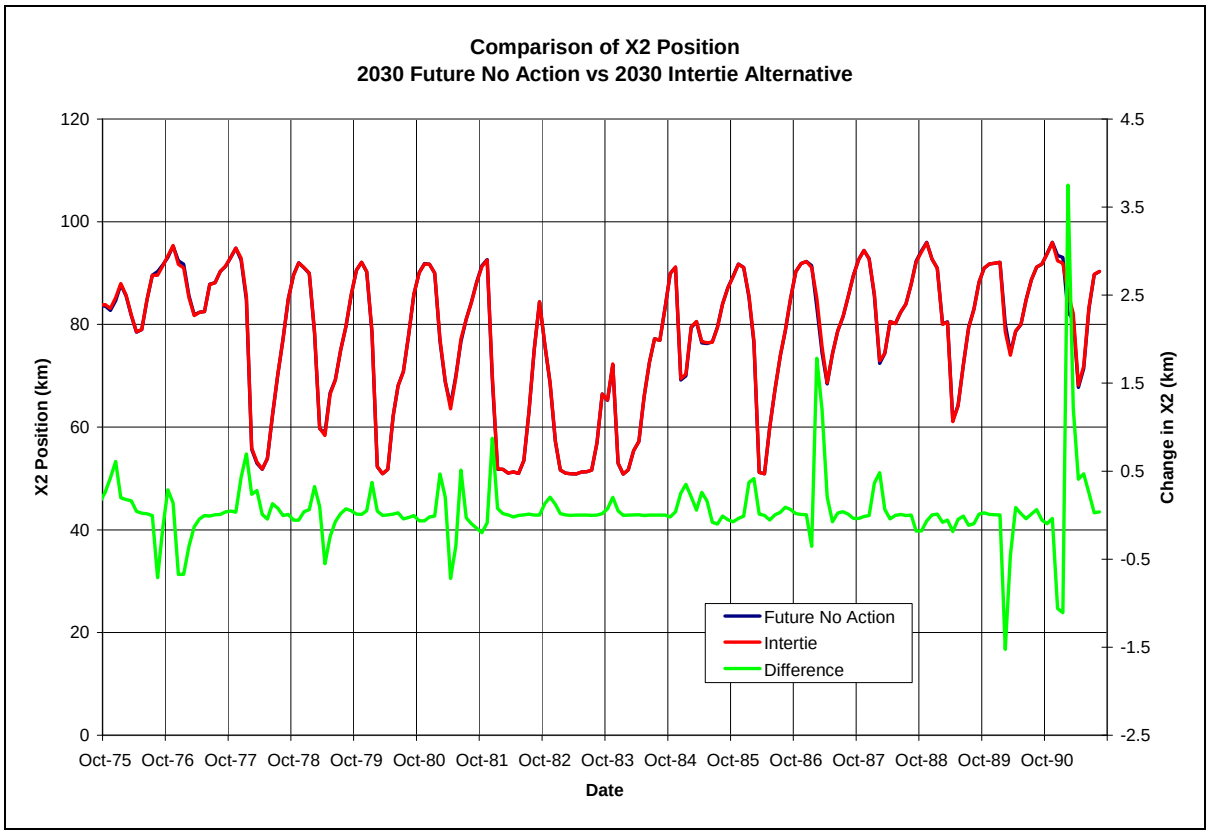


Figure 8. Comparison of X2 Changes with Intertie Alternative (2030 LOD)

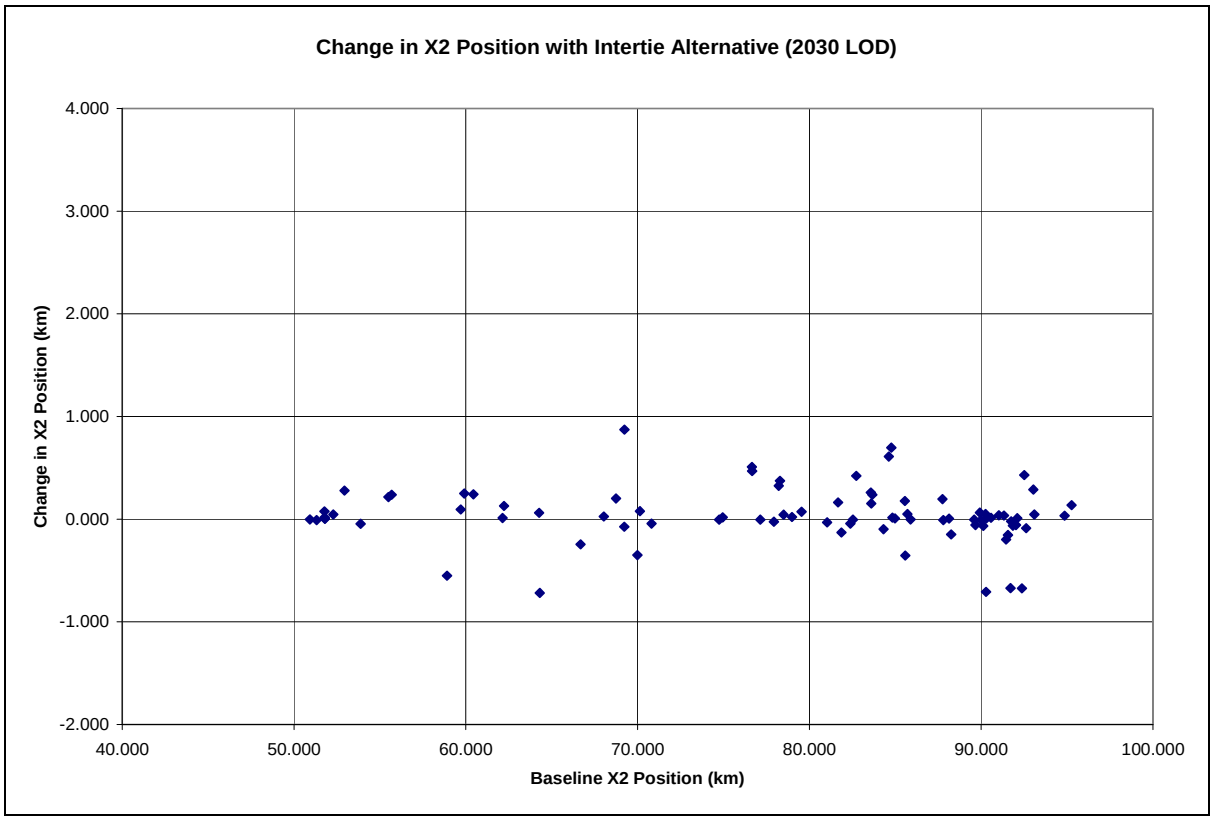


Figure 9. Change in X2 Position with Intertie Alternative, February through June (2030 LOD)

Table 3. Difference in X2 Predictions (in kilometers)
(2030 Intertie Alternative - 2030 Future No Action)

WY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1976	0.3	0.4	0.6	0.2	0.2	0.2	0.0	0.0	0.0	0.0	-0.7	-0.2
1977	0.3	0.1	-0.7	-0.7	-0.4	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
1978	0.0	0.0	0.4	0.7	0.2	0.3	0.0	0.0	0.1	0.1	0.0	0.0
1979	-0.1	-0.1	0.0	0.1	0.3	0.1	-0.6	-0.2	-0.1	0.0	0.1	0.1
1980	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1981	-0.1	-0.1	0.0	0.0	0.5	0.2	-0.7	-0.4	0.5	0.0	-0.1	-0.1
1982	-0.2	-0.1	0.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1983	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1984	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1985	0.0	0.0	0.2	0.3	0.2	0.1	0.3	0.2	-0.1	-0.1	0.0	-0.1
1986	-0.1	0.0	0.0	0.4	0.4	0.0	0.0	-0.1	0.0	0.0	0.1	0.1
1987	0.0	0.0	0.0	-0.4	1.8	1.2	0.2	-0.1	0.0	0.0	0.0	0.0
1988	0.0	0.0	0.0	0.4	0.5	0.1	0.0	0.0	0.0	0.0	0.0	-0.2
1989	-0.2	-0.1	0.0	0.0	-0.1	-0.1	-0.2	0.0	0.0	-0.1	-0.1	0.0
1990	0.0	0.0	0.0	0.0	-1.5	-0.5	0.1	0.0	0.0	0.0	0.1	-0.1
1991	-0.1	0.0	-1.1	-1.1	3.7	1.2	0.4	0.5	0.3	0.0	0.0	0.0
AVG	0.0	0.0	0.0	0.0	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0
MAX	0.3	0.4	0.9	0.7	3.7	1.2	0.4	0.5	0.5	0.1	0.1	0.1
MIN	-0.2	-0.1	-1.1	-1.1	-1.5	-0.5	-0.7	-0.4	-0.1	-0.1	-0.7	-0.2

Conclusions

The Delta Simulation Model was used to predict changes in Delta water quality associated with changes in CALSIM II simulated flow patterns in the Delta caused by the DMC-CA Intertie Alternative. The comparative nature of this analysis is appropriate for impact studies, although the DSM2 model may not predict existing conditions with complete accuracy, the consistent nature in which the simulations were developed allows for an adequate estimate of Intertie Alternative impacts.

Table 2 presents a summary of average monthly percentage changes in EC at 12 locations throughout the Delta for the Intertie Alternative as compared to the Future No Action alternative. The average monthly changes in EC are less than 1% for all locations, and no change is observed at Rio Vista and San Joaquin River at Brandt Bridge locations.

Detailed monthly comparisons of differences in EC between the Intertie alternative and the Future No Action alternative are presented in Appendix A.

Limitations

DSM2 was used to analyze Delta hydrodynamic and water quality conditions in the Future No Action and Intertie alternatives. Like all models DSM2 has limitations that need to be kept in mind when interpreting its results. The following are some general limitations of DSM2, some of which are identified in Chapter 9 of the OCAP BA document and are applicable to the analysis performed for the USBR Intertie project.

DSM2 is a one-dimensional model. As such, it is only capable of simulating the flow in the longitudinal direction. Any detailed description such as vertical/lateral mixing, changing of the flow patterns due to bends or unusual expansion or contraction of the rivers are not simulated. DSM2 simulates reservoirs as constantly mixed reactors and each is essentially only a container that holds water. Any mixing of water in there occurs instantly and uniformly. Reservoirs are used for five locations in the model: Clifton Court Forebay, Franks Tract, Little Franks Tract, Mildred Island, and Discovery Bay.

The model at times may see very steep transitions in flow from month to month. Because of these transitions the hydrodynamic conditions may take a few simulation days to adjust to the new inflows. Given this transition period the results from DSM2-Hydro should not be used during the transitions between months. However, the hydrodynamic results do include periods up to the transition.

Finally, the Delta Island Consumptive Use (DICU) simulates the agriculture diversions and return flows. The DICU for the model is consistent with the total monthly volume in CalSim-II. Though the DICU for DSM2 is more spatially represented it still assumes a constant monthly flow rate.

Despite these limitations, DSM2 is appropriate and reasonable for comparative analyses such as the one presented here for the Intertie alternative. The relative changes in flow and EC conditions due to the Intertie alternative are simulated with reasonable accuracy. Further, since the Delta configuration does not change with or without the Intertie alternative and the Intertie alternative is found to cause little or no change to net salt transport in the Delta, DSM2 results presented in this analysis are valid.

Appendix A. Summary Tables of Differences in EC between Intertie Alternative and Future No Action Alternative (2030 Level-of-Development)

This appendix contains a plot of Net Delta Outflow and graphical and tabular summaries of differences in predicted EC between the Intertie alternative and the Future No Action alternative at the following locations in the Delta:

- Martinez
- Collinsville
- Emmaton
- Rio Vista
- Antioch
- Jersey Point
- Old River at Rock Slough
- San Joaquin River at Brandt Bridge
- Old River at State Highway 4 (Los Vaqueros Intake)
- Clifton Court Forebay
- Jones Pumping Plant (Head of Delta-Mendota Canal)
- Old River at Tracy Road Bridge

There are two summary tables for each location comparing the Intertie alternative to the Future No Action alternative. Each set of tables summarizes the actual difference in EC, and the percent difference in EC between two simulations on a monthly basis. Summary tables are generated for water years 1976 through 1991. These tables were generated to allow for the determination of seasonal differences in changes in EC throughout the Delta associated with the Intertie alternative.

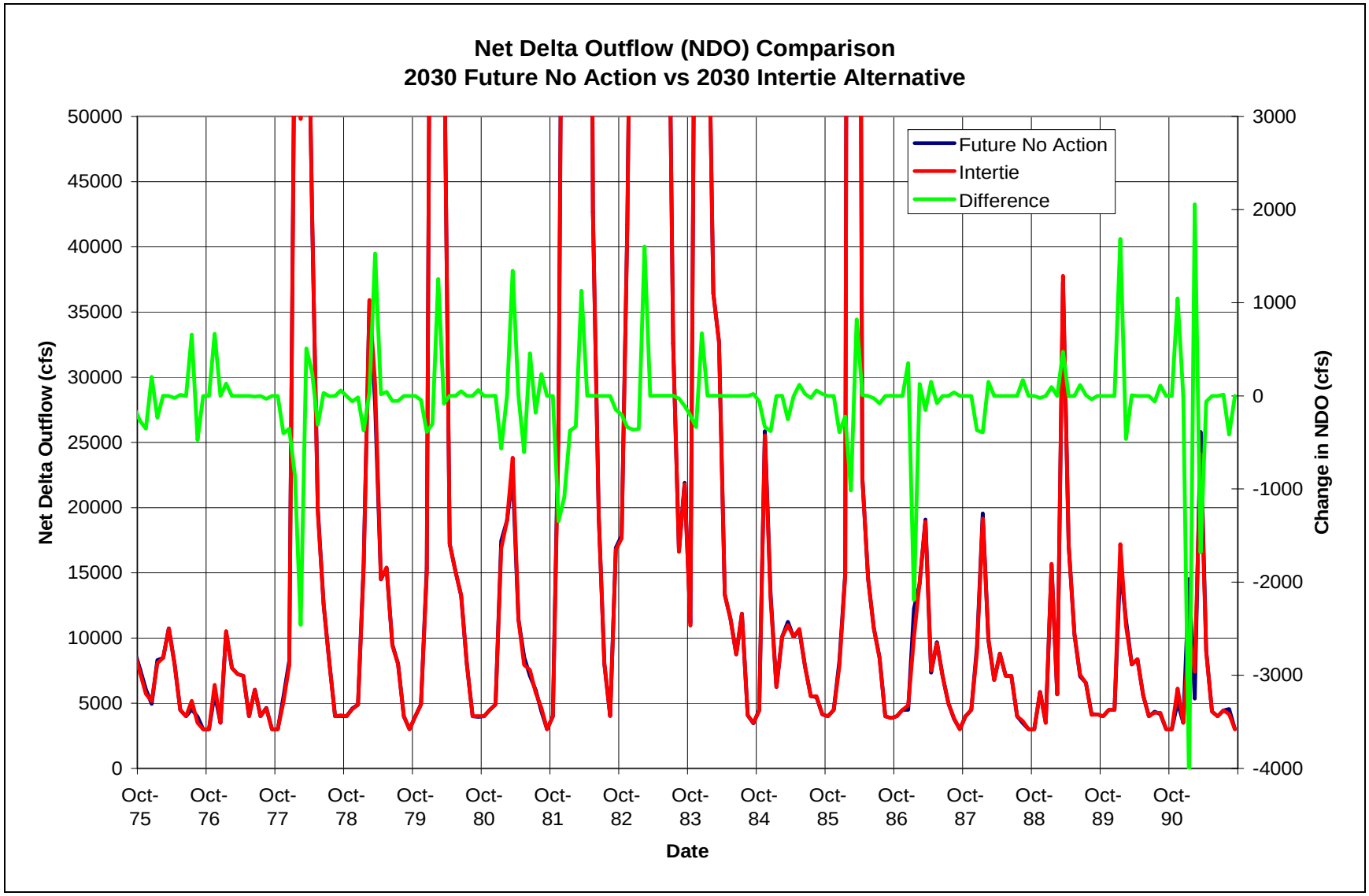


Figure A-1. Comparison of Baseline and Project Flows, Net Delta Outflow (2030 LOD)

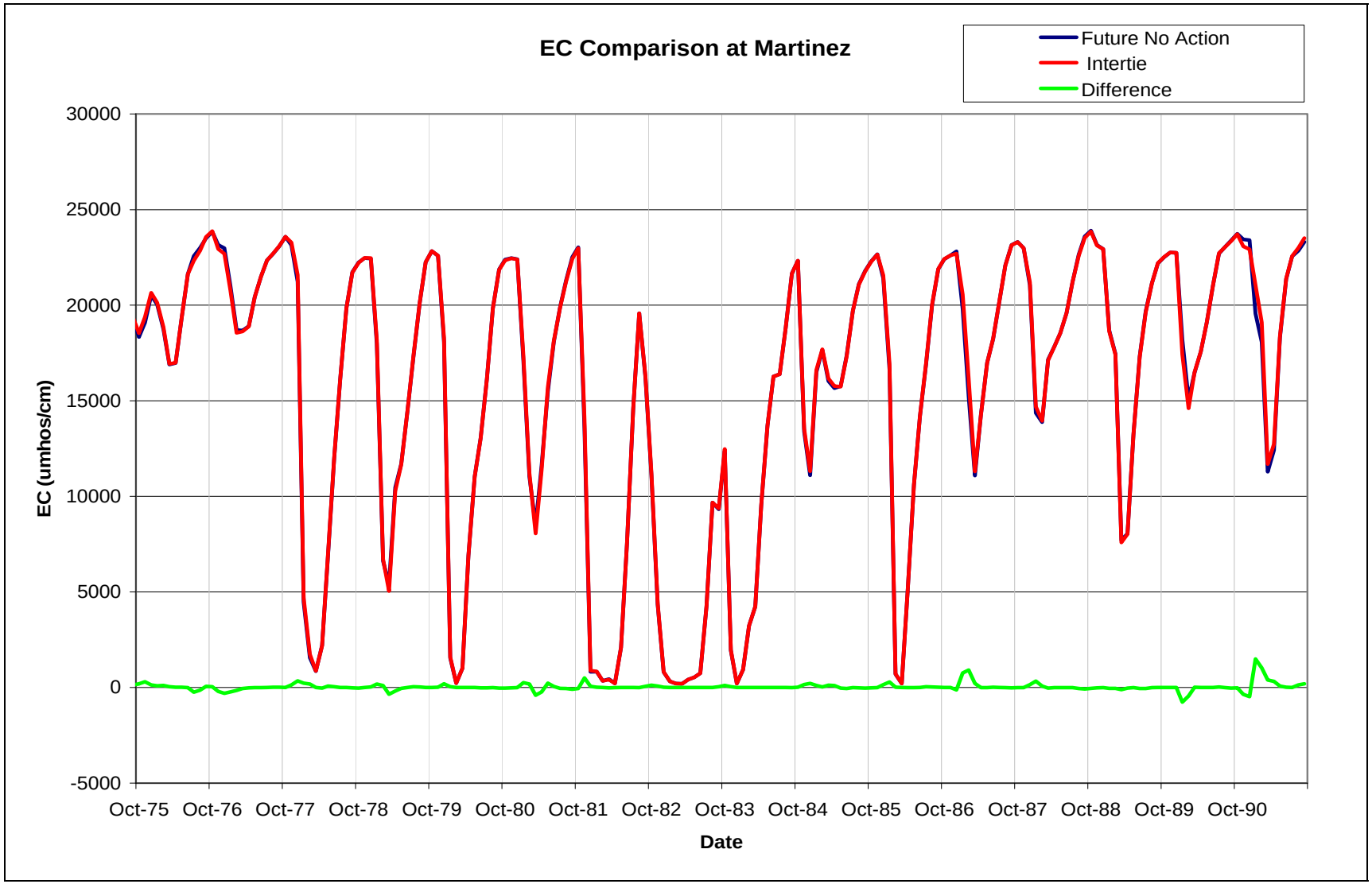


Figure A-2. EC Comparison at Martinez (2030 Conditions)

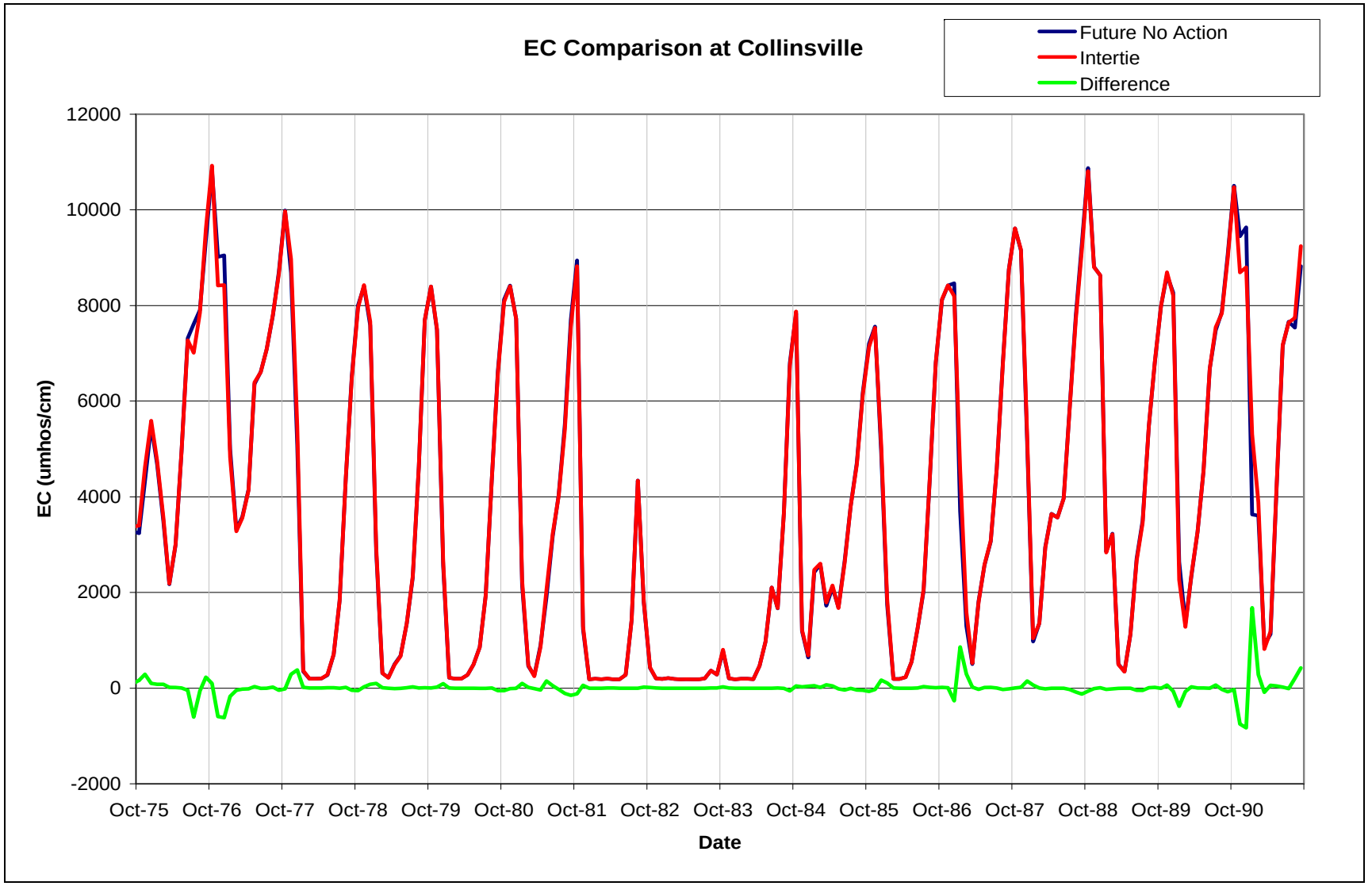


Figure A-3. EC Comparison at Collinsville (2030 Conditions)

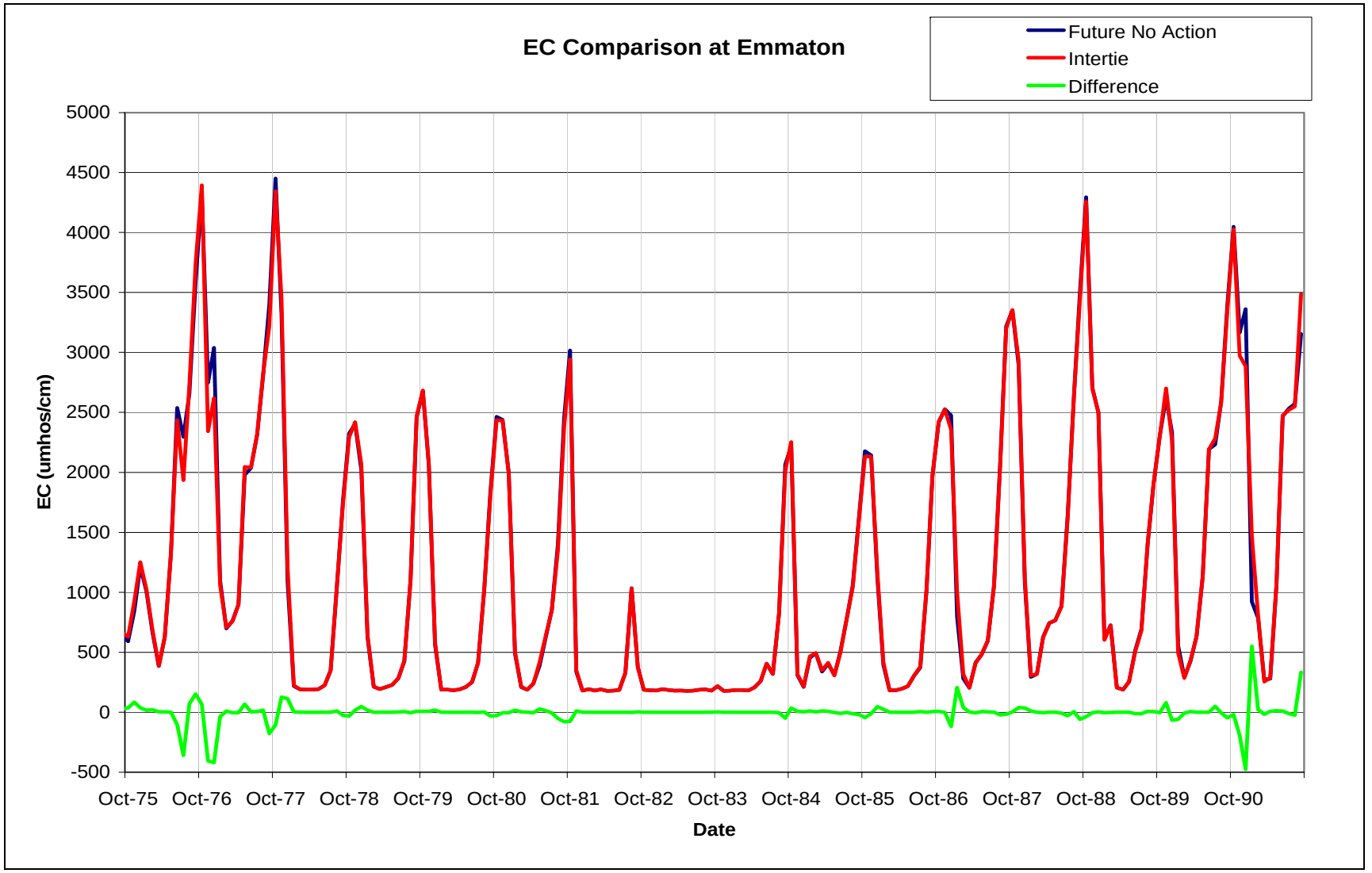


Figure A-4. EC Comparison at Emmaton (2030 Conditions)

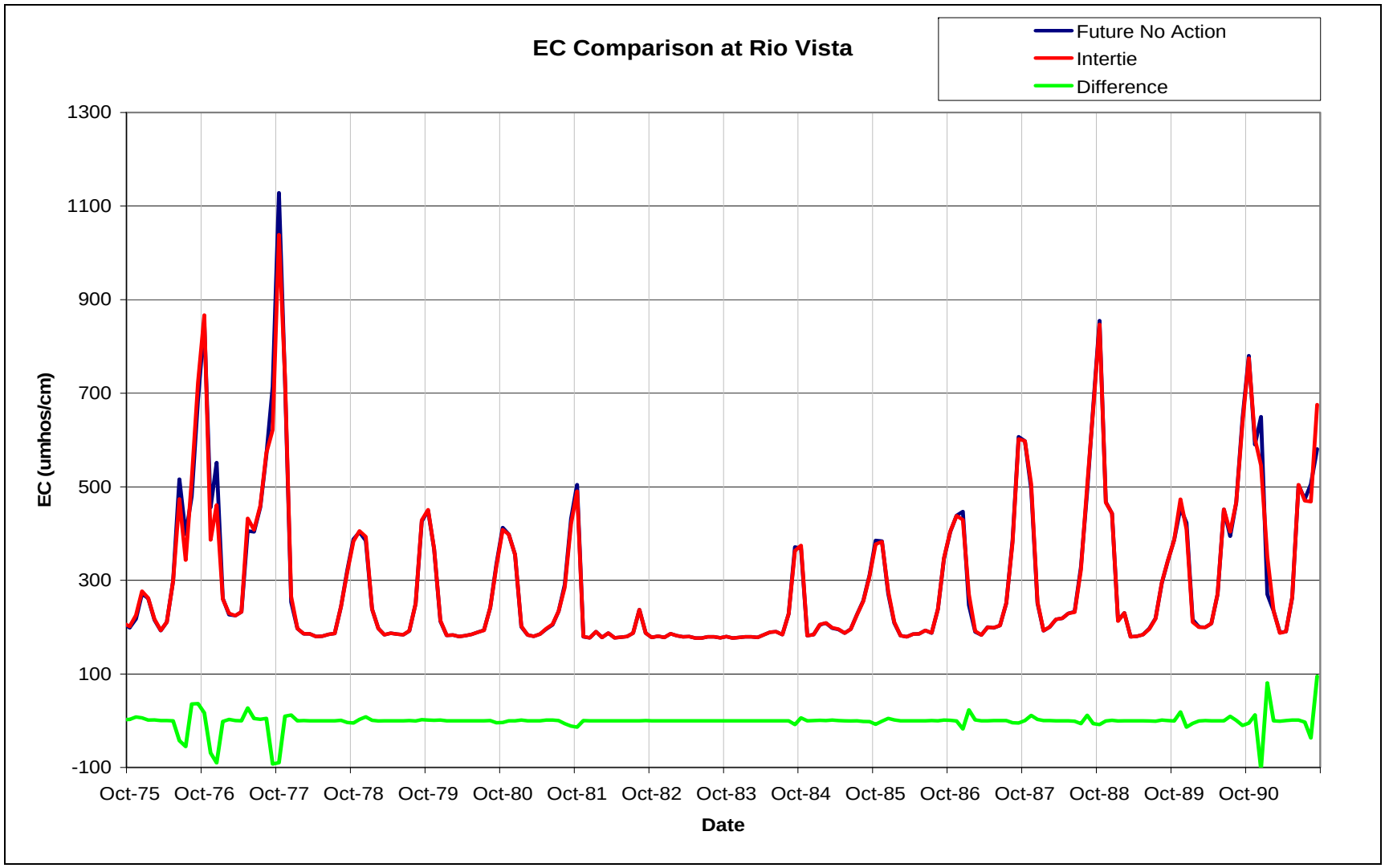


Figure A-5. EC Comparison at Rio Vista (2030 Conditions)

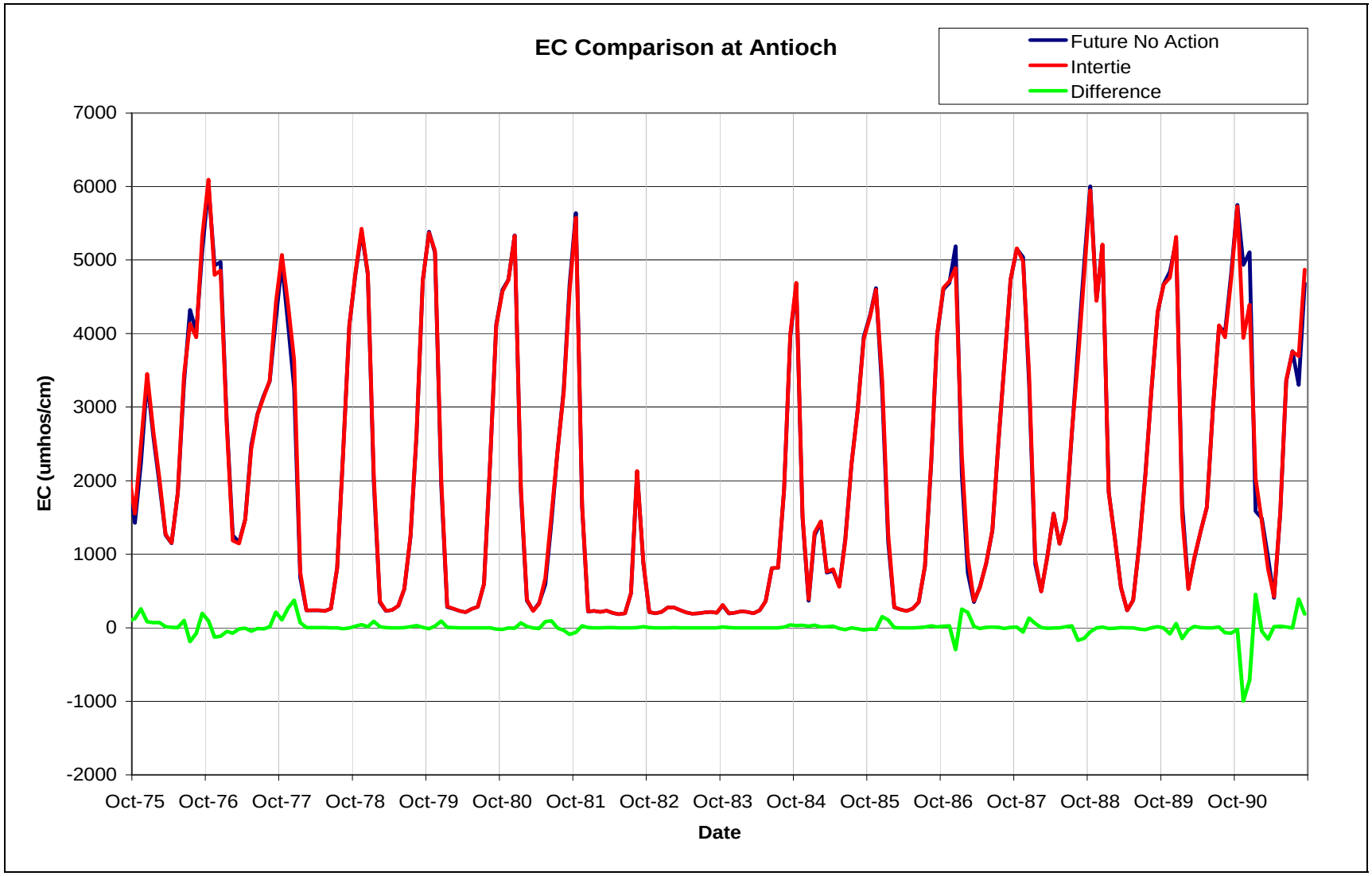


Figure A-6. EC Comparison at Antioch (2030 Conditions)

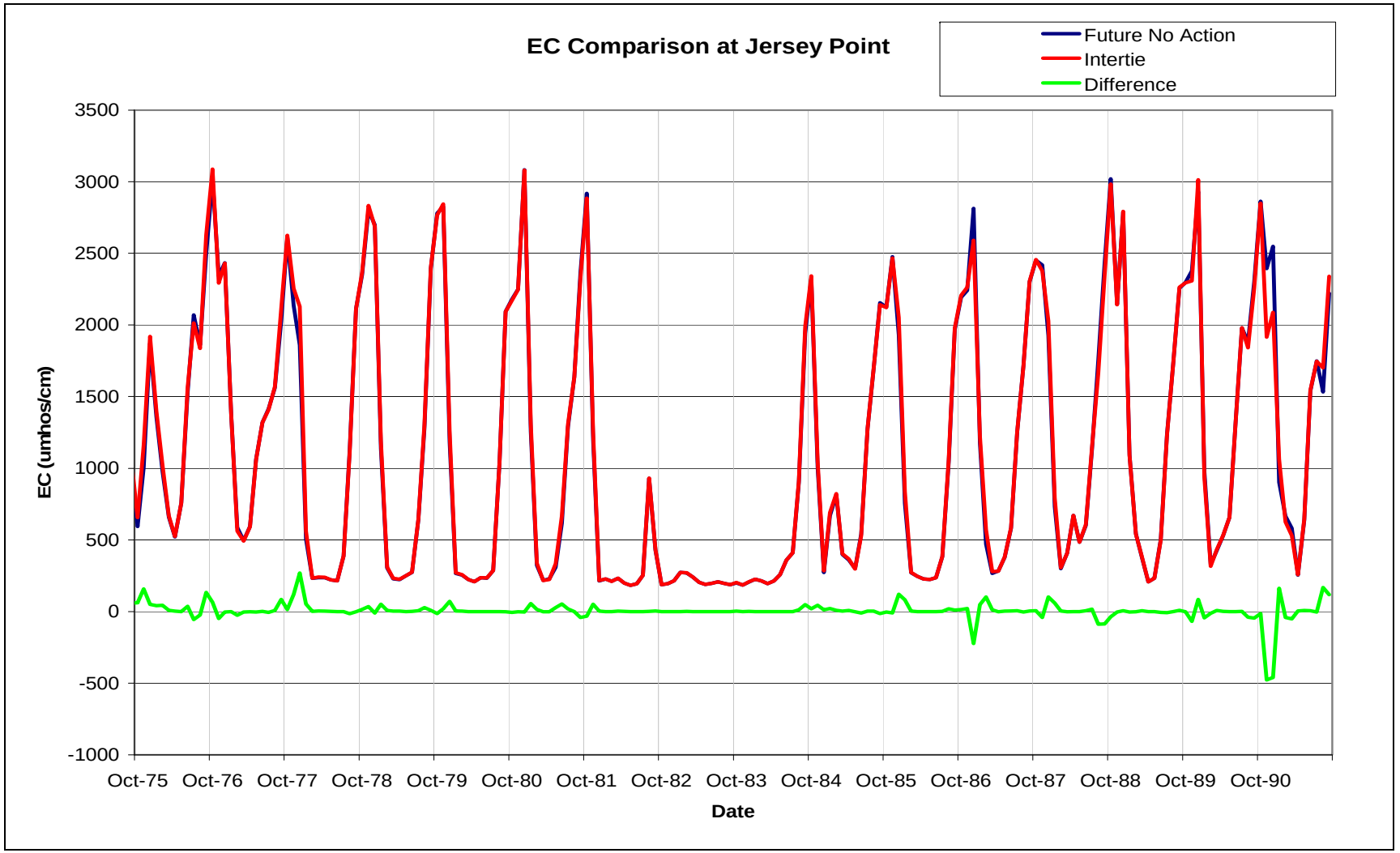


Figure A-7. EC Comparison at Jersey Point (2030 Conditions)

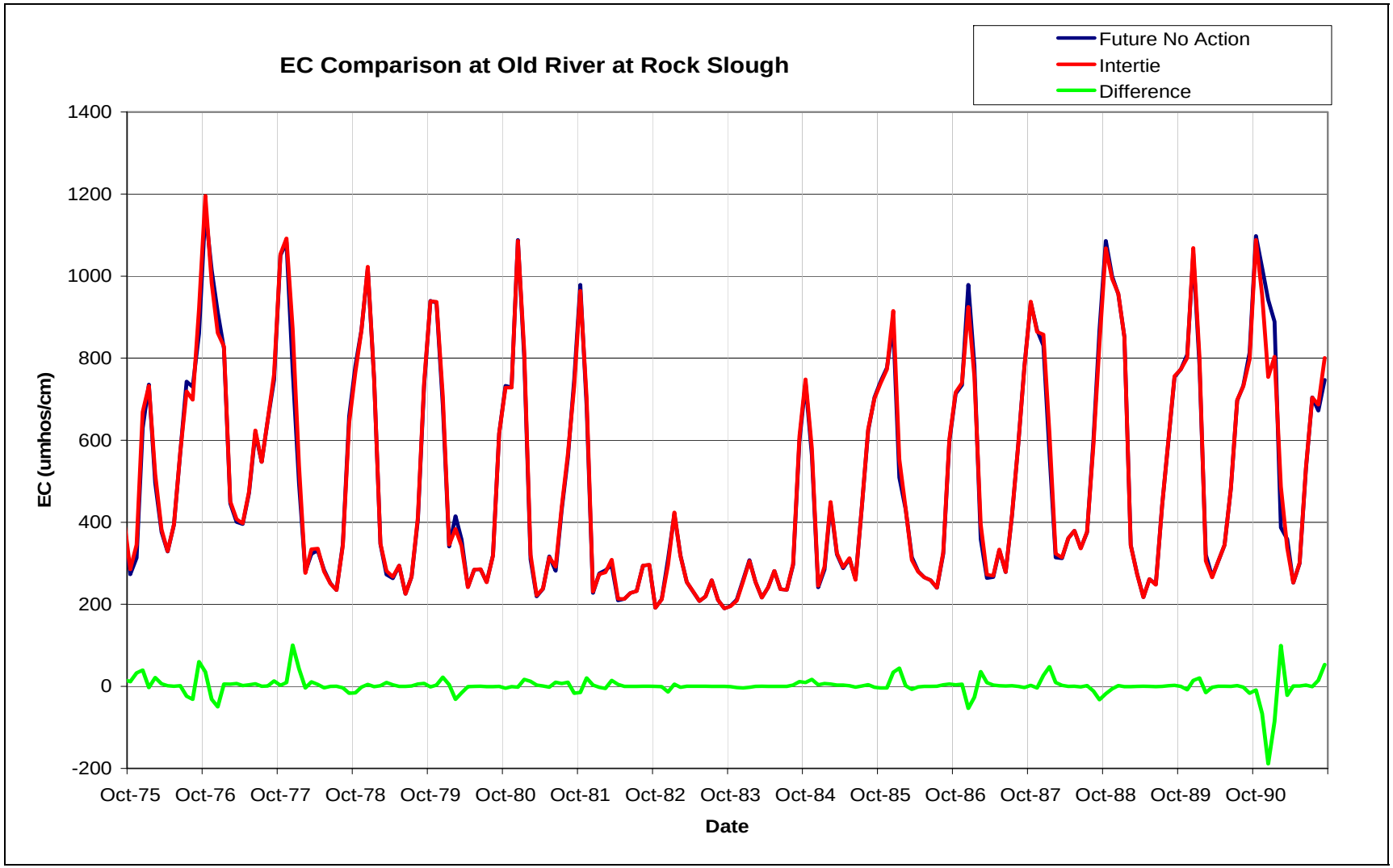


Figure A-8. EC Comparison at Old River near Rock Slough (2030 Conditions)

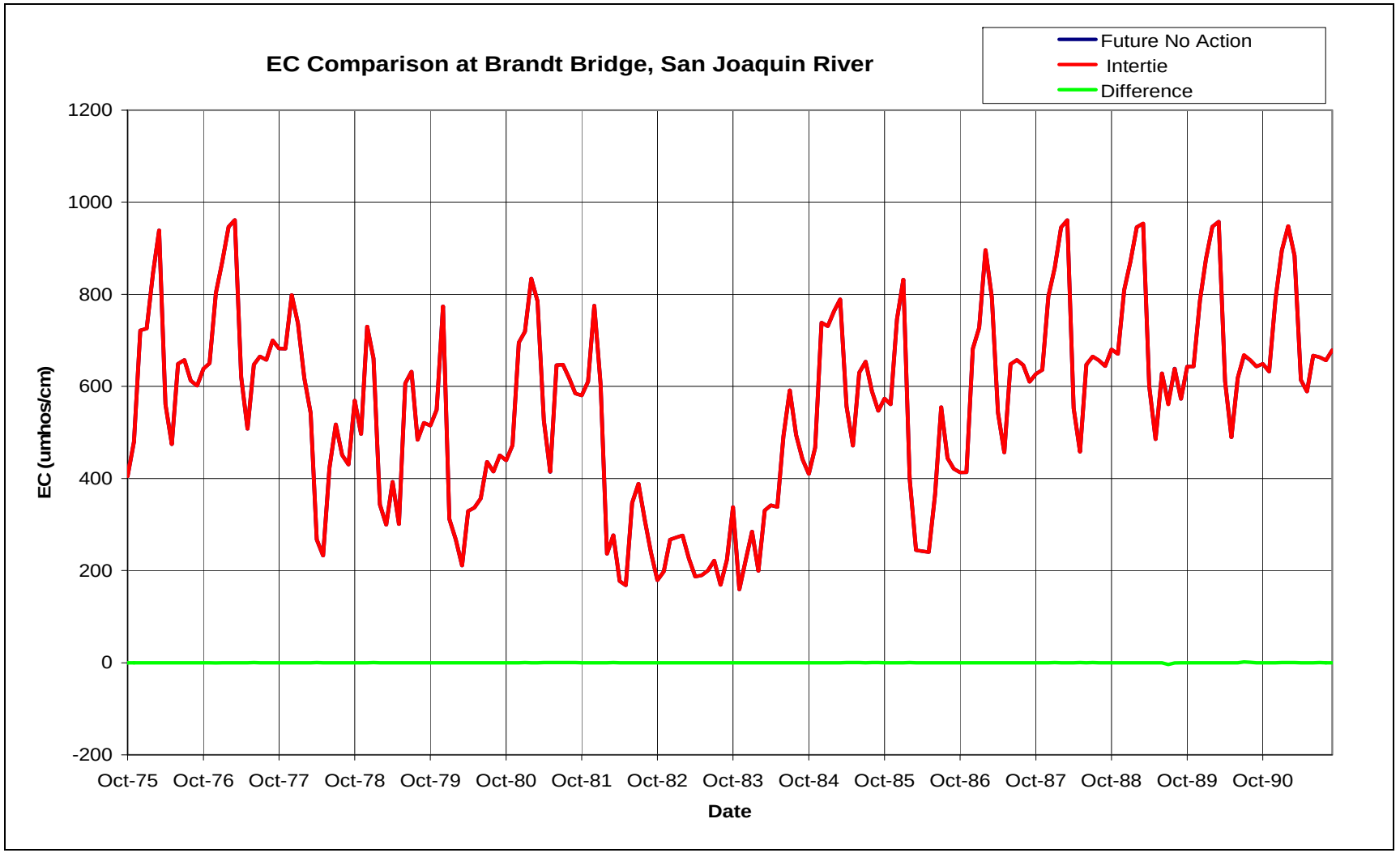


Figure A-9. EC Comparison at Brandt Bridge, San Joaquin River (2030 Conditions)

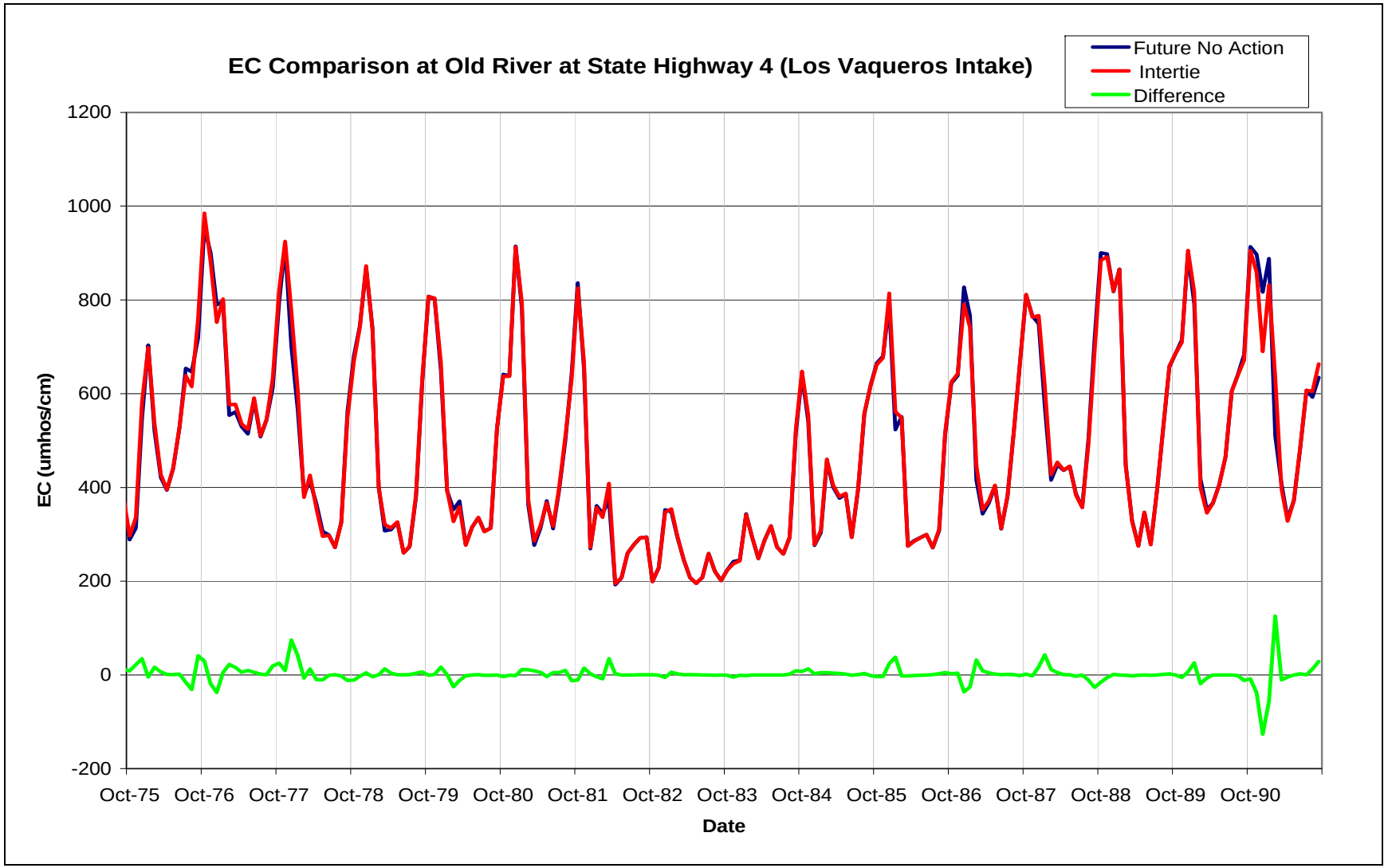


Figure A-10. EC Comparison at Old River, State Highway 4 / Los Vaqueros Intake (2030 Conditions)

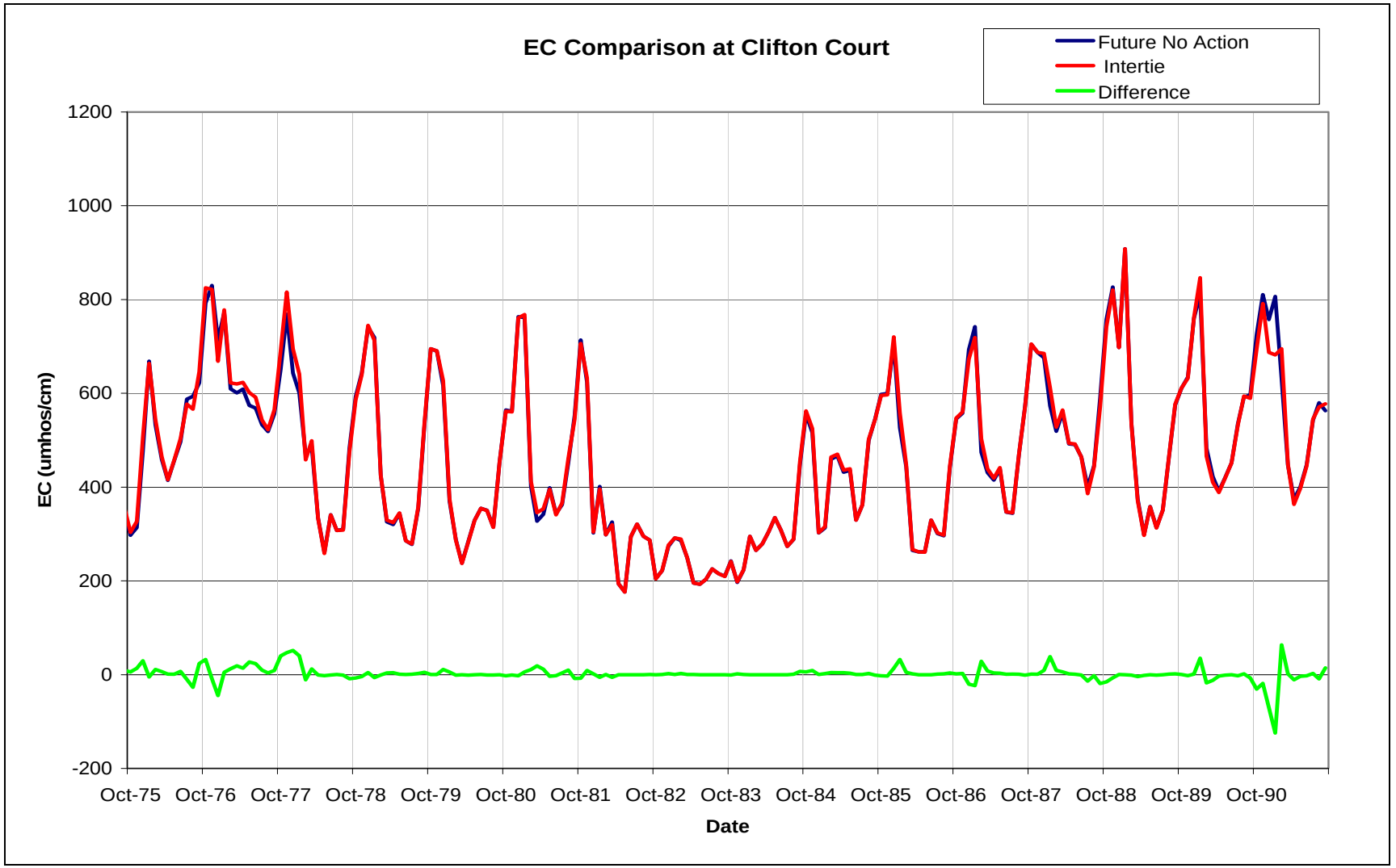


Figure A-11. EC Comparison at Clifton Court (2030 Conditions)

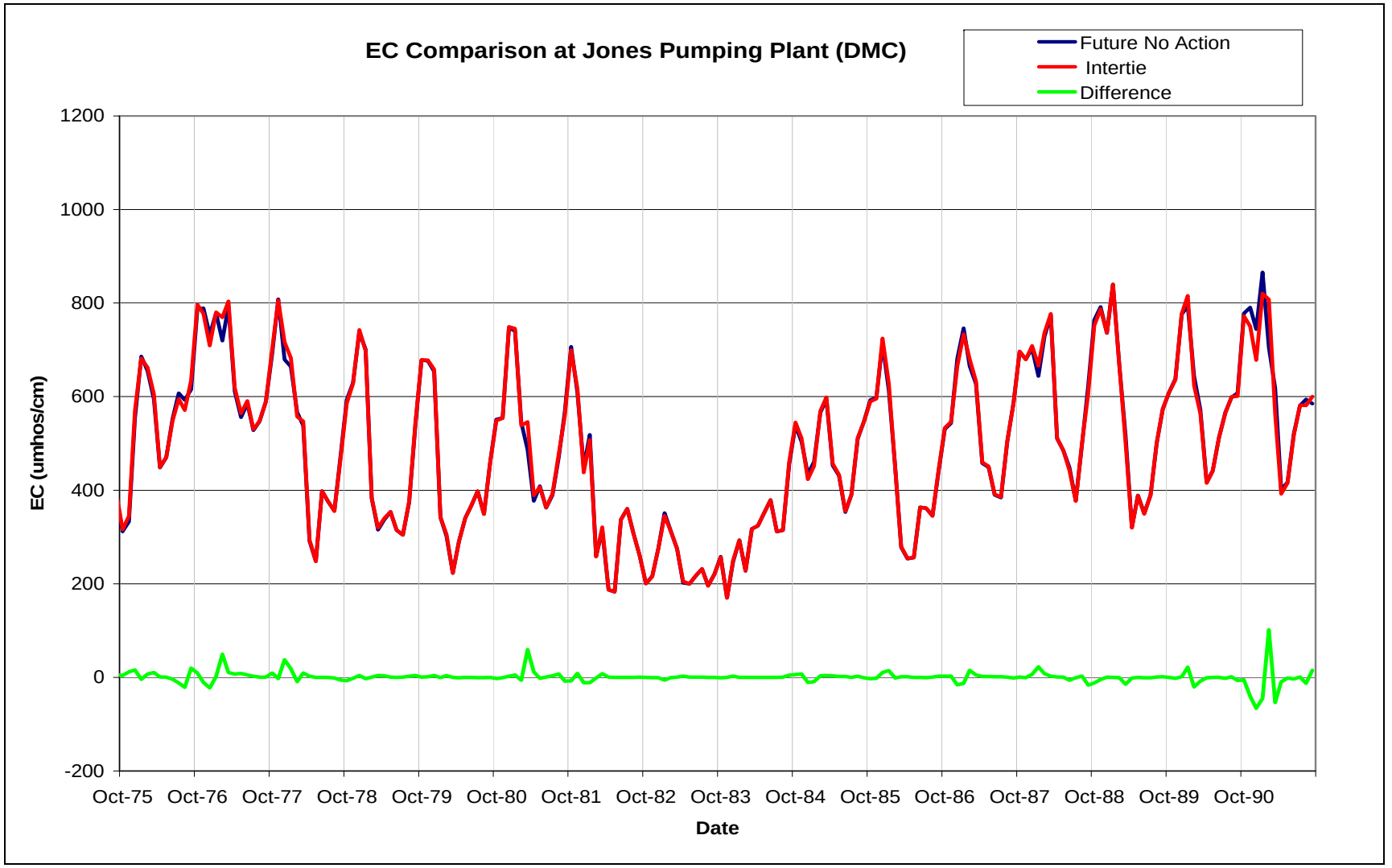


Figure A-12. EC Comparison at Jones Pumping Plant / Head of Delta-Mendota Canal (2030 Conditions)

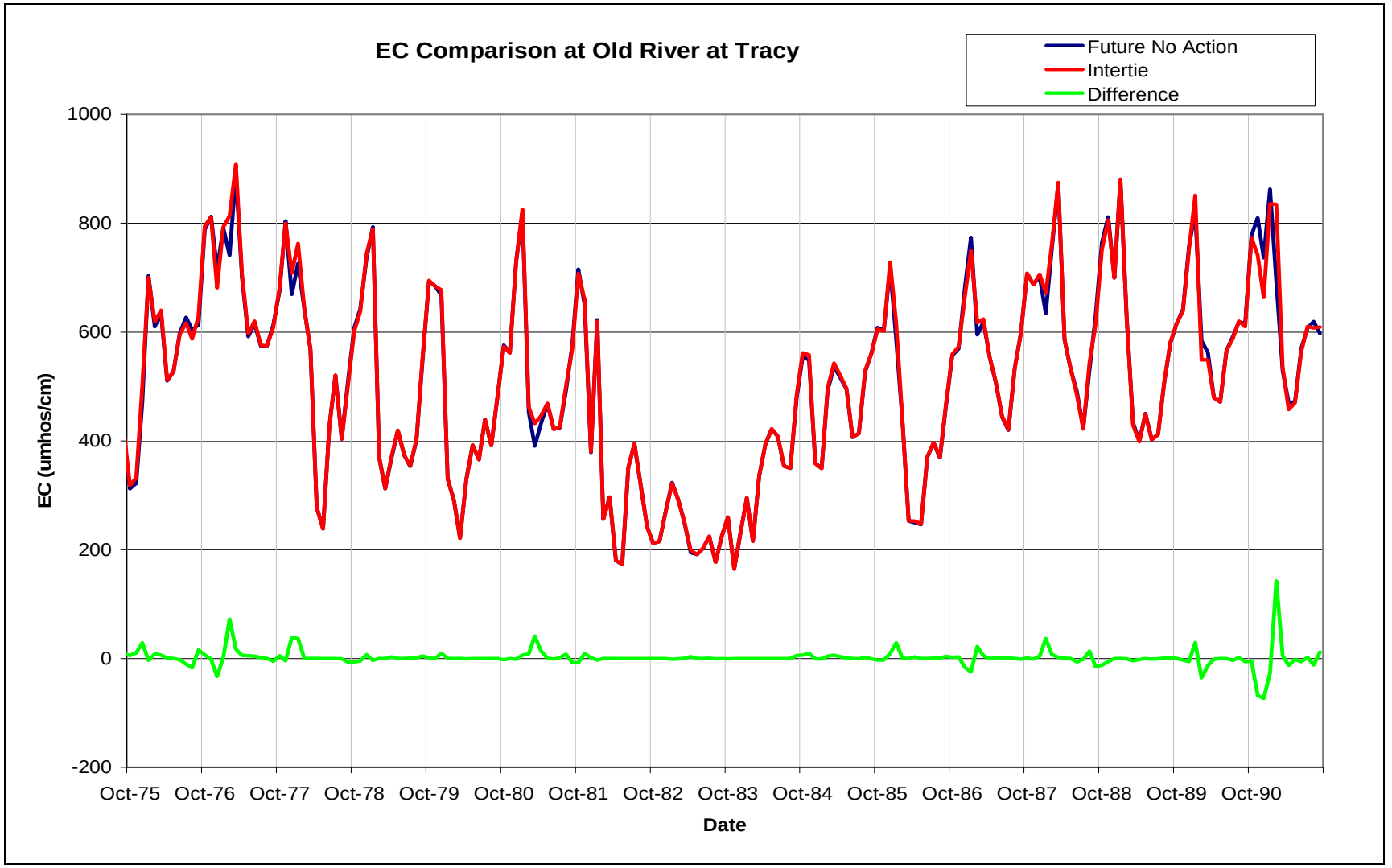


Figure A-13. EC Comparison at Old River at Tracy Road Bridge (2030 Conditions)

Difference in EC Predictions (2030 Intertie Alternative - 2030 Future No Action) Martinez												
WY	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**
1976	197.0	294.0	130.0	87.0	111.0	39.0	21.0	11.0	-2.0	-241.0	-136.0	65.0
1977	37.0	-208.0	-306.0	-231.0	-147.0	-53.0	-18.0	-4.0	-1.0	2.0	12.0	13.0
1978	7.0	138.0	348.0	225.0	178.0	8.0	-28.0	79.0	45.0	0.0	1.0	-22.0
1979	-28.0	7.0	27.0	187.0	95.0	-343.0	-179.0	-37.0	9.0	41.0	25.0	9.0
1980	4.0	18.0	198.0	43.0	0.0	3.0	2.0	0.0	-21.0	-15.0	-4.0	-25.0
1981	-30.0	-15.0	-9.0	249.0	178.0	-412.0	-228.0	228.0	51.0	-45.0	-51.0	-90.0
1982	-48.0	504.0	69.0	13.0	3.0	-13.0	-1.0	0.0	0.0	0.0	-1.0	66.0
1983	124.0	80.0	12.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	9.0	41.0
1984	106.0	35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-10.0
1985	12.0	157.0	212.0	116.0	31.0	123.0	101.0	-26.0	-49.0	-11.0	-20.0	-32.0
1986	-23.0	-11.0	150.0	290.0	17.0	0.0	-5.0	-1.0	10.0	45.0	33.0	11.0
1987	6.0	3.0	-122.0	754.0	914.0	212.0	-11.0	-11.0	20.0	6.0	-12.0	-16.0
1988	-8.0	-4.0	145.0	332.0	72.0	-26.0	-7.0	-2.0	-1.0	-3.0	-58.0	-74.0
1989	-41.0	-18.0	-4.0	-46.0	-39.0	-118.0	-34.0	-3.0	-49.0	-50.0	-4.0	10.0
1990	4.0	4.0	4.0	-760.0	-446.0	20.0	3.0	1.0	1.0	23.0	-10.0	-36.0
1991	-19.0	-363.0	-480.0	1493.0	1032.0	396.0	321.0	71.0	22.0	4.0	138.0	192.0
AVG	18.8	38.8	23.4	172.1	124.9	-10.3	-3.9	19.1	2.2	-15.3	-4.9	6.4
MAX	197.0	504.0	348.0	1493.0	1032.0	396.0	321.0	228.0	51.0	45.0	138.0	192.0
MIN	-48.0	-363.0	-480.0	-760.0	-446.0	-412.0	-228.0	-37.0	-49.0	-241.0	-136.0	-90.0

Difference in EC Predictions (2030 Intertie Alternative - 2030 Future No Action) Martinez												
WY	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**
1976	1.1	1.5	0.6	0.4	0.6	0.2	0.1	0.1	0.0	-1.1	-0.6	0.3
1977	0.2	-0.9	-1.3	-1.1	-0.8	-0.3	-0.1	0.0	0.0	0.0	0.1	0.1
1978	0.0	0.6	1.6	5.0	11.4	0.9	-1.3	1.1	0.4	0.0	0.0	-0.1
1979	-0.1	0.0	0.1	1.0	1.4	-6.4	-1.7	-0.3	0.1	0.2	0.1	0.0
1980	0.0	0.1	1.1	2.8	0.0	0.3	0.0	0.0	-0.2	-0.1	0.0	-0.1
1981	-0.1	-0.1	0.0	1.5	1.6	-4.9	-2.0	1.5	0.3	-0.2	-0.2	-0.4
1982	-0.2	3.7	8.4	1.6	0.9	-3.0	-0.5	0.0	0.0	0.0	0.0	0.4
1983	1.1	1.8	1.5	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4
1984	0.9	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1985	0.1	1.2	1.9	0.7	0.2	0.8	0.6	-0.2	-0.3	-0.1	-0.1	-0.1
1986	-0.1	0.0	0.7	1.7	2.4	0.0	-0.1	0.0	0.1	0.3	0.2	0.1
1987	0.0	0.0	-0.5	3.8	6.0	1.9	-0.1	-0.1	0.1	0.0	-0.1	-0.1
1988	0.0	0.0	0.7	2.3	0.5	-0.2	0.0	0.0	0.0	0.0	-0.3	-0.3
1989	-0.2	-0.1	0.0	-0.2	-0.2	-1.5	-0.4	0.0	-0.3	-0.3	0.0	0.0
1990	0.0	0.0	0.0	-4.2	-3.0	0.1	0.0	0.0	0.0	0.1	0.0	-0.2
1991	-0.1	-1.5	-2.1	7.6	5.7	3.5	2.6	0.4	0.1	0.0	0.6	0.8
AVG	0.2	0.5	0.8	1.5	1.7	-0.5	-0.2	0.2	0.0	-0.1	0.0	0.0
MAX	1.1	3.7	8.4	7.6	11.4	3.5	2.6	1.5	0.4	0.3	0.6	0.8
MIN	-0.2	-1.5	-2.1	-4.2	-3.0	-6.4	-2.0	-0.3	-0.3	-1.1	-0.6	-0.4

Table A-1. Differences and Percent Differences between Future No Action and Intertie Alternative EC at Martinez (2030 LOD)

Difference in EC Predictions (2030 Intertie Alternative - 2030 Future No Action) Collinsville												
WY	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**
1976	161.0	291.0	98.0	77.0	77.0	15.0	12.0	3.0	-44.0	-604.0	-57.0	227.0
1977	98.0	-598.0	-621.0	-171.0	-43.0	-23.0	-15.0	31.0	-5.0	-3.0	23.0	-45.0
1978	-15.0	289.0	381.0	18.0	1.0	1.0	1.0	7.0	7.0	-1.0	15.0	-43.0
1979	-52.0	27.0	80.0	96.0	7.0	-3.0	-12.0	-6.0	7.0	28.0	5.0	6.0
1980	4.0	23.0	91.0	2.0	0.0	0.0	0.0	0.0	-5.0	-7.0	3.0	-56.0
1981	-52.0	-13.0	-9.0	96.0	17.0	-13.0	-38.0	149.0	51.0	-24.0	-112.0	-152.0
1982	-118.0	61.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	-2.0	23.0
1983	12.0	1.0	0.0	-1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0
1984	27.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	-6.0	-59.0
1985	45.0	26.0	39.0	52.0	13.0	67.0	47.0	-17.0	-40.0	-5.0	-38.0	-46.0
1986	-69.0	-30.0	167.0	107.0	1.0	0.0	0.0	0.0	4.0	30.0	17.0	9.0
1987	16.0	7.0	-268.0	862.0	295.0	20.0	-24.0	14.0	15.0	3.0	-32.0	-18.0
1988	1.0	18.0	151.0	64.0	1.0	-18.0	-4.0	0.0	-3.0	-29.0	-83.0	-125.0
1989	-63.0	-11.0	6.0	-24.0	-14.0	-8.0	-1.0	-1.0	-44.0	-50.0	8.0	15.0
1990	-7.0	62.0	-64.0	-377.0	-73.0	27.0	2.0	1.0	0.0	66.0	-27.0	-78.0
1991	-29.0	-753.0	-831.0	1679.0	280.0	-89.0	60.0	45.0	20.0	-12.0	203.0	421.0
AVG	-2.6	-37.4	-48.8	155.0	35.1	-1.4	1.8	14.1	-2.3	-37.9	-5.1	5.1
MAX	161.0	291.0	381.0	1679.0	295.0	67.0	60.0	149.0	51.0	66.0	203.0	421.0
MIN	-118.0	-753.0	-831.0	-377.0	-73.0	-89.0	-38.0	-17.0	-44.0	-604.0	-112.0	-152.0

Difference in EC Predictions (2030 Intertie Alternative - 2030 Future No Action) Collinsville												
WY	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**
1976	5.0	6.7	1.8	1.6	2.2	0.7	0.4	0.1	-0.6	-7.9	-0.7	2.4
1977	0.9	-6.6	-6.9	-3.4	-1.3	-0.6	-0.4	0.5	-0.1	0.0	0.3	-0.5
1978	-0.2	3.3	7.5	5.2	0.5	0.5	0.5	2.6	1.0	-0.1	0.3	-0.7
1979	-0.6	0.3	1.1	3.4	2.3	-1.4	-2.4	-0.9	0.5	1.2	0.1	0.1
1980	0.0	0.3	3.6	0.9	0.0	0.0	0.0	0.0	-0.6	-0.4	0.1	-0.8
1981	-0.6	-0.2	-0.1	4.4	3.7	-4.9	-4.3	7.8	1.6	-0.6	-2.0	-2.0
1982	-1.3	4.9	0.0	0.0	0.0	0.5	0.6	0.0	0.0	0.0	0.0	1.3
1983	2.9	0.5	0.0	-0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.7
1984	3.5	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	-0.2	-0.9
1985	0.6	2.2	6.1	2.1	0.5	3.9	2.2	-1.0	-1.5	-0.1	-0.8	-0.7
1986	-1.0	-0.4	3.4	6.1	0.5	0.0	0.0	0.0	0.3	1.5	0.4	0.1
1987	0.2	0.1	-3.2	23.3	22.7	4.0	-1.3	0.5	0.5	0.1	-0.5	-0.2
1988	0.0	0.2	2.9	6.6	0.1	-0.6	-0.1	0.0	-0.1	-0.5	-1.1	-1.3
1989	-0.6	-0.1	0.1	-0.8	-0.4	-1.6	-0.3	-0.1	-1.6	-1.4	0.1	0.2
1990	-0.1	0.7	-0.8	-14.3	-5.4	1.2	0.1	0.0	0.0	0.9	-0.3	-0.9
1991	-0.3	-8.0	-8.6	46.2	7.8	-9.9	5.3	1.1	0.3	-0.2	2.7	4.8
AVG	0.5	0.3	0.4	5.1	2.1	-0.5	0.0	0.7	0.0	-0.5	-0.1	0.1
MAX	5.0	6.7	7.5	46.2	22.7	4.0	5.3	7.8	1.6	1.5	2.7	4.8
MIN	-1.3	-8.0	-8.6	-14.3	-5.4	-9.9	-4.3	-1.0	-1.6	-7.9	-2.0	-2.0

Table A-2. Differences and Percent Differences between Future No Action and Intertie Alternative EC at Collinsville (2030 LOD)

Difference in EC Predictions (2030 Intertie Alternative - 2030 Future No Action) Emmaton												
WY	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**
1976	36.6	82.6	36.5	16.7	19.9	2.9	3.3	-0.5	-103.0	-360.0	69.7	152.2
1977	66.1	-405.1	-421.2	-37.0	8.9	-3.6	-3.6	65.8	4.3	6.1	16.6	-178.8
1978	-106.3	124.8	113.5	4.4	0.6	0.4	0.4	0.4	0.4	-0.2	10.8	-26.1
1979	-31.1	16.0	48.3	16.7	0.2	0.7	0.2	-0.6	1.2	5.7	-4.7	6.8
1980	6.6	7.8	17.9	0.3	0.2	0.0	0.0	0.0	-0.5	-1.8	1.8	-31.2
1981	-27.9	-4.8	-4.0	15.7	2.8	-0.3	-3.6	27.5	12.5	-5.0	-51.6	-79.3
1982	-75.7	11.8	0.2	0.0	-0.1	0.2	0.1	0.0	-0.1	-0.1	-1.5	3.0
1983	0.5	0.0	-0.1	-0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0
1984	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	-3.7	-49.4
1985	34.7	7.1	3.3	10.8	3.2	11.2	8.0	-2.0	-9.2	-1.5	-13.9	-18.0
1986	-45.1	-12.1	45.7	23.1	0.1	0.1	0.0	0.0	0.6	6.1	0.7	5.3
1987	6.5	-1.4	-119.0	206.0	37.9	2.5	-5.4	4.9	3.3	0.2	-22.1	-16.2
1988	2.2	39.2	34.9	11.0	0.5	-3.6	-0.9	0.7	-7.0	-29.1	5.3	-58.7
1989	-36.8	-4.3	3.9	-4.4	-2.5	-0.2	-0.1	0.0	-11.1	-13.0	7.7	5.2
1990	-4.5	78.9	-66.2	-59.4	-8.2	4.8	0.6	0.3	-0.1	49.4	-6.0	-46.4
1991	-19.7	-192.9	-475.2	549.0	22.7	-16.5	7.1	12.6	8.2	-11.1	-23.4	333.8
AVG	-12.0	-15.8	-48.8	47.1	5.4	-0.1	0.4	6.8	-6.3	-22.1	-0.9	0.1
MAX	66.1	124.8	113.5	549.0	37.9	11.2	8.0	65.8	12.5	49.4	69.7	333.8
MIN	-106.3	-405.1	-475.2	-59.4	-8.2	-16.5	-5.4	-2.0	-103.0	-360.0	-51.6	-178.8

Difference in EC Predictions (2030 Intertie Alternative - 2030 Future No Action) Emmaton												
WY	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**
1976	6.2	9.8	3.0	1.7	3.0	0.8	0.5	0.0	-4.1	-15.7	2.6	4.2
1977	1.5	-14.8	-13.9	-3.4	1.3	-0.5	-0.4	3.3	0.2	0.3	0.6	-5.3
1978	-2.4	3.8	10.4	2.0	0.3	0.2	0.2	0.2	0.2	-0.1	1.0	-1.5
1979	-1.3	0.7	2.4	2.7	0.1	0.4	0.1	-0.3	0.4	1.3	-0.4	0.3
1980	0.2	0.4	3.2	0.2	0.1	0.0	0.0	0.0	-0.2	-0.4	0.2	-1.7
1981	-1.1	-0.2	-0.2	3.2	1.3	-0.2	-1.5	7.1	2.0	-0.6	-3.7	-3.2
1982	-2.5	3.5	0.1	0.0	-0.1	0.1	0.1	0.0	-0.1	0.0	-0.1	0.8
1983	0.3	0.0	-0.1	-0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0
1984	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.4	-2.4
1985	1.6	2.3	1.6	2.4	0.7	3.3	2.0	-0.6	-1.8	-0.2	-1.3	-1.1
1986	-2.1	-0.6	4.1	5.8	0.1	0.1	0.0	0.0	0.2	1.6	0.1	0.3
1987	0.3	-0.1	-4.8	25.8	13.5	1.2	-1.3	1.0	0.6	0.0	-1.1	-0.5
1988	0.1	1.4	3.2	3.7	0.2	-0.6	-0.1	0.1	-0.8	-1.8	0.2	-1.7
1989	-0.9	-0.2	0.2	-0.7	-0.3	-0.1	-0.1	0.0	-2.2	-1.9	0.5	0.3
1990	-0.2	3.0	-2.8	-10.7	-2.8	1.1	0.1	0.0	0.0	2.2	-0.2	-1.4
1991	-0.5	-6.1	-14.1	59.6	2.9	-6.1	2.5	1.2	0.3	-0.4	-0.9	10.6
AVG	0.0	0.2	-0.5	5.8	1.3	0.0	0.1	0.7	-0.3	-1.0	-0.2	-0.1
MAX	6.2	9.8	10.4	59.6	13.5	3.3	2.5	7.1	2.0	2.2	2.6	10.6
MIN	-2.5	-14.8	-14.1	-10.7	-2.8	-6.1	-1.5	-0.6	-4.1	-15.7	-3.7	-5.3

Table A-3. Differences and Percent Differences between Future No Action and Intertie Alternative EC at Emmaton (2030 LOD)

Difference in EC Predictions (2030 Intertie Alternative - 2030 Future No Action) Rio Vista												
WY	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**
1976	2.8	8.0	5.8	1.1	1.9	0.3	0.3	-0.3	-42.6	-55.2	35.8	36.5
1977	17.0	-69.1	-90.2	-1.6	2.7	0.2	-0.2	27.1	4.5	3.0	4.9	-92.3
1978	-89.5	9.8	12.0	0.1	0.4	0.0	0.0	0.0	0.0	0.0	0.9	-4.1
1979	-4.7	2.6	8.3	0.7	-0.4	0.1	0.1	-0.1	0.1	0.4	-0.4	2.2
1980	1.5	0.9	1.3	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	0.2	-4.3
1981	-4.1	-0.3	-0.3	1.4	0.1	0.0	-0.1	1.2	1.5	0.6	-6.0	-11.6
1982	-13.9	0.6	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	-0.1	0.2
1983	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1984	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	-8.2
1985	6.0	0.1	0.2	1.0	0.4	1.1	0.5	0.0	-0.6	-0.1	-1.4	-2.0
1986	-7.8	-1.1	5.2	1.7	0.1	0.0	0.0	0.0	0.0	0.4	0.1	1.4
1987	0.9	-0.6	-17.5	23.0	1.9	0.1	-0.1	0.4	0.2	0.2	-4.3	-4.9
1988	0.4	11.2	2.9	0.3	0.3	-0.1	-0.1	0.1	-1.2	-6.0	11.7	-6.2
1989	-8.2	-0.8	0.7	-0.6	-0.1	-0.1	0.0	0.0	-0.7	-1.2	1.2	0.5
1990	-0.7	18.7	-13.8	-5.9	-0.6	0.2	0.1	0.1	-0.1	9.4	0.8	-9.9
1991	-5.1	12.2	-104.1	80.3	0.0	-1.0	0.4	1.3	1.3	-3.1	-36.8	95.0
AVG	-6.6	-0.5	-11.8	6.3	0.4	0.1	0.1	1.9	-2.4	-3.2	0.4	-0.5
MAX	17.0	18.7	12.0	80.3	2.7	1.1	0.5	27.1	4.5	9.4	35.8	95.0
MIN	-89.5	-69.1	-104.1	-5.9	-0.6	-1.0	-0.2	-0.3	-42.6	-55.2	-36.8	-92.3

Difference in EC Predictions (2030 Intertie Alternative - 2030 Future No Action) Rio Vista												
WY	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**
1976	1.4	3.7	2.1	0.4	0.9	0.2	0.1	-0.1	-8.2	-13.8	7.5	5.3
1977	2.0	-15.2	-16.4	-0.6	1.2	0.1	-0.1	6.7	1.1	0.7	0.9	-12.9
1978	-7.9	1.3	4.7	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.4	-1.3
1979	-1.2	0.6	2.2	0.3	-0.2	0.1	0.1	-0.1	0.1	0.2	-0.2	0.5
1980	0.3	0.2	0.6	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.1	-1.3
1981	-1.0	-0.1	-0.1	0.7	0.1	0.0	-0.1	0.6	0.7	0.3	-2.1	-2.7
1982	-2.8	0.3	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1
1983	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1984	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-2.2
1985	1.6	0.1	0.1	0.5	0.2	0.6	0.3	0.0	-0.3	0.0	-0.5	-0.6
1986	-2.0	-0.3	1.9	0.8	0.1	0.0	0.0	0.0	0.0	0.2	0.0	0.4
1987	0.2	-0.1	-3.9	9.3	1.0	0.1	0.0	0.2	0.1	0.1	-1.1	-0.8
1988	0.1	2.3	1.2	0.2	0.1	0.0	0.0	0.0	-0.5	-1.8	2.4	-0.9
1989	-1.0	-0.2	0.2	-0.3	0.0	-0.1	0.0	0.0	-0.4	-0.5	0.4	0.1
1990	-0.2	4.1	-3.3	-2.7	-0.3	0.1	0.0	0.0	0.0	2.4	0.2	-1.5
1991	-0.7	2.1	-16.0	29.7	0.0	-0.5	0.2	0.5	0.3	-0.7	-7.3	16.4
AVG	-0.7	-0.1	-1.7	2.4	0.2	0.0	0.0	0.5	-0.4	-0.8	0.0	-0.1
MAX	2.0	4.1	4.7	29.7	1.2	0.6	0.3	6.7	1.1	2.4	7.5	16.4
MIN	-7.9	-15.2	-16.4	-2.7	-0.3	-0.5	-0.1	-0.1	-8.2	-13.8	-7.3	-12.9

Table A-4. Differences and Percent Differences between Future No Action and Intertie Alternative EC at Rio Vista (2030 LOD)

Difference in EC Predictions (2030 Intertie Alternative - 2030 Future No Action) Antioch												
WY	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**
1976	126.2	255.9	81.0	69.8	71.2	13.5	5.7	1.2	100.4	-188.7	-76.3	197.6
1977	93.8	-127.5	-114.9	-50.1	-74.2	-16.3	-6.1	-45.8	-9.4	-16.0	12.4	212.6
1978	109.0	267.9	375.2	70.4	1.1	3.7	3.0	2.0	0.6	-0.8	-13.5	-3.2
1979	19.5	41.8	15.1	87.3	13.7	2.1	0.7	-0.8	2.2	14.3	29.9	6.5
1980	-14.0	23.5	91.4	6.9	2.1	-0.6	-0.2	0.0	-0.7	0.8	0.2	-18.8
1981	-20.7	-4.3	-6.2	67.1	16.7	-4.1	-10.6	85.0	93.7	-3.7	-33.3	-90.2
1982	-62.6	26.7	3.6	-0.2	-0.8	1.8	1.4	0.0	0.0	0.0	2.0	13.8
1983	2.4	0.0	-0.9	-0.7	1.2	0.2	0.0	0.0	0.0	0.0	0.1	0.6
1984	10.3	1.0	0.5	-0.1	0.0	0.0	0.0	-0.1	0.0	0.4	9.6	37.4
1985	30.0	32.6	21.0	34.9	11.2	15.1	20.6	-8.6	-25.0	-0.4	-11.8	-30.5
1986	-19.3	-21.4	152.3	106.8	3.4	0.3	-0.1	0.0	0.9	8.1	27.3	11.9
1987	20.5	25.9	-297.4	253.4	207.7	18.1	-10.2	5.5	8.6	5.5	-9.0	5.8
1988	7.3	-57.3	132.6	57.2	2.9	-7.3	-2.3	0.1	15.4	25.8	-169.2	-143.9
1989	-54.9	-3.9	7.3	-8.7	-6.2	2.6	-0.5	0.0	-18.6	-26.2	0.3	13.1
1990	-4.6	-82.8	56.0	-146.4	-26.5	18.7	1.8	0.4	-0.4	12.7	-67.5	-73.0
1991	-21.7	-995.1	-713.7	453.1	-45.5	-154.1	15.4	19.5	12.1	-4.2	390.6	187.2
AVG	13.8	-38.6	-12.3	62.5	11.1	-6.6	1.2	3.7	11.2	-10.8	5.7	20.4
MAX	126.2	267.9	375.2	453.1	207.7	18.7	20.6	85.0	100.4	25.8	390.6	212.6
MIN	-62.6	-995.1	-713.7	-146.4	-74.2	-154.1	-10.6	-45.8	-25.0	-188.7	-169.2	-143.9

Difference in EC Predictions (2030 Intertie Alternative - 2030 Future No Action) Antioch												
WY	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**
1976	8.8	11.5	2.4	2.7	3.6	1.1	0.5	0.1	3.0	-4.4	-1.9	3.9
1977	1.6	-2.6	-2.3	-1.8	-5.9	-1.4	-0.4	-1.8	-0.3	-0.5	0.4	5.0
1978	2.2	6.5	11.5	10.3	0.5	1.6	1.3	0.9	0.2	-0.1	-0.6	-0.1
1979	0.4	0.8	0.3	4.4	4.0	0.9	0.3	-0.3	0.4	1.1	1.1	0.1
1980	-0.3	0.5	4.7	2.4	0.8	-0.3	-0.1	0.0	-0.2	0.1	0.0	-0.5
1981	-0.5	-0.1	-0.1	3.6	4.5	-1.8	-3.1	14.4	6.5	-0.2	-1.0	-1.9
1982	-1.1	1.6	1.6	-0.1	-0.4	0.8	0.7	0.0	0.0	0.0	0.1	1.6
1983	1.1	0.0	-0.4	-0.3	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.3
1984	3.4	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.9
1985	0.6	2.2	5.8	2.8	0.8	2.0	2.7	-1.5	-2.1	0.0	-0.4	-0.8
1986	-0.5	-0.5	4.7	9.1	1.2	0.1	0.0	0.0	0.3	1.0	1.2	0.3
1987	0.4	0.6	-5.7	12.2	27.9	5.2	-1.8	0.6	0.6	0.2	-0.2	0.1
1988	0.1	-1.1	4.0	6.6	0.6	-0.7	-0.1	0.0	1.0	1.0	-4.4	-2.9
1989	-0.9	-0.1	0.1	-0.5	-0.5	0.5	-0.2	0.0	-1.6	-1.2	0.0	0.3
1990	-0.1	-1.7	1.1	-8.7	-4.8	2.0	0.1	0.0	0.0	0.3	-1.7	-1.5
1991	-0.4	-20.2	-14.0	28.6	-3.1	-16.1	3.8	1.3	0.4	-0.1	11.8	4.0
AVG	0.9	-0.1	0.9	4.5	1.9	-0.4	0.2	0.9	0.5	-0.2	0.3	0.6
MAX	8.8	11.5	11.5	28.6	27.9	5.2	3.8	14.4	6.5	1.1	11.8	5.0
MIN	-1.1	-20.2	-14.0	-8.7	-5.9	-16.1	-3.1	-1.8	-2.1	-4.4	-4.4	-2.9

Table A-5. Differences and Percent Differences between Future No Action and Intertie Alternative EC at Antioch (2030 LOD)

Difference in EC Predictions (2030 Intertie Alternative - 2030 Future No Action) Jersey Point												
WY	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**
1976	62.5	157.1	49.1	39.9	43.6	8.5	2.7	0.4	36.1	-56.4	-24.2	133.4
1977	65.3	-49.1	-4.0	-0.6	-25.6	-3.1	-1.5	-2.8	0.7	-5.8	7.8	85.1
1978	13.4	120.0	269.5	52.2	0.9	4.1	2.9	0.8	-0.2	-0.2	-15.5	-2.0
1979	15.5	34.6	-11.6	51.7	6.8	3.2	2.4	-0.2	0.7	5.2	26.4	8.9
1980	-13.3	18.8	71.3	4.8	2.1	-0.3	-0.1	0.0	0.1	0.3	-0.8	-2.4
1981	-6.8	-1.9	-3.3	55.2	14.4	-2.1	-2.4	26.7	53.1	17.2	-0.6	-41.5
1982	-32.9	51.7	3.3	-0.2	-0.9	2.0	1.1	0.0	0.0	-0.1	1.9	4.8
1983	0.2	-0.2	-0.9	-0.7	0.7	0.3	0.0	0.0	0.0	0.0	-0.1	0.1
1984	2.3	0.0	0.5	-0.1	0.0	0.0	0.0	0.0	0.1	0.1	11.6	48.8
1985	19.5	43.6	12.0	21.0	8.2	3.4	7.0	-2.6	-11.1	2.8	3.2	-14.1
1986	-2.9	-9.0	121.3	81.5	2.4	0.3	-0.1	0.0	0.0	1.2	19.5	10.7
1987	13.7	20.4	-223.2	48.0	100.8	12.2	-1.7	2.3	3.7	5.0	-3.2	3.8
1988	5.4	-40.7	101.7	59.4	4.9	-1.3	-0.9	0.1	5.8	16.7	-88.4	-86.0
1989	-36.4	-3.2	5.1	-3.5	-2.5	5.0	0.1	0.0	-6.5	-7.2	-0.5	8.2
1990	-2.3	-69.2	84.0	-44.3	-11.8	7.2	1.2	0.2	-0.2	1.9	-39.3	-45.7
1991	-13.6	-477.9	-460.3	161.1	-41.0	-51.7	4.0	7.3	6.4	-3.0	167.7	117.1
AVG	5.6	-12.8	0.9	32.8	6.4	-0.8	0.9	2.0	5.5	-1.4	4.1	14.3
MAX	65.3	157.1	269.5	161.1	100.8	12.2	7.0	26.7	53.1	17.2	167.7	133.4
MIN	-36.4	-477.9	-460.3	-44.3	-41.0	-51.7	-2.4	-2.8	-11.1	-56.4	-88.4	-86.0

Difference in EC Predictions (2030 Intertie Alternative - 2030 Future No Action) Jersey Point												
WY	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**
1976	10.5	15.6	2.6	2.9	4.4	1.3	0.5	0.1	2.4	-2.7	-1.3	5.3
1977	2.2	-2.1	-0.2	0.0	-4.4	-0.6	-0.3	-0.3	0.1	-0.4	0.5	4.2
1978	0.5	5.6	14.5	10.3	0.4	1.7	1.2	0.4	-0.1	-0.1	-1.4	-0.1
1979	0.7	1.2	-0.4	4.5	2.2	1.4	1.1	-0.1	0.3	0.8	2.1	0.4
1980	-0.5	0.7	6.0	1.8	0.8	-0.1	0.0	0.0	0.0	0.1	-0.1	-0.1
1981	-0.3	-0.1	-0.1	4.4	4.5	-1.0	-1.1	8.7	8.6	1.3	0.0	-1.8
1982	-1.1	4.3	1.6	-0.1	-0.4	0.9	0.6	0.0	0.0	0.0	0.2	1.1
1983	0.1	-0.1	-0.4	-0.3	0.3	0.1	0.0	0.0	0.0	0.0	-0.1	0.1
1984	1.1	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	2.5
1985	0.8	4.3	4.4	3.1	1.0	0.9	1.9	-0.9	-2.1	0.2	0.2	-0.7
1986	-0.1	-0.4	6.3	10.8	0.9	0.1	0.0	0.0	0.0	0.3	1.9	0.5
1987	0.6	0.9	-7.9	4.1	21.4	4.6	-0.6	0.6	0.6	0.4	-0.2	0.2
1988	0.2	-1.7	5.3	8.1	1.6	-0.3	-0.1	0.0	1.0	1.5	-5.0	-3.5
1989	-1.2	-0.1	0.2	-0.3	-0.5	1.3	0.0	0.0	-1.3	-0.6	0.0	0.4
1990	-0.1	-2.9	2.9	-4.5	-3.6	1.7	0.2	0.0	0.0	0.1	-2.1	-2.0
1991	-0.5	-20.0	-18.1	17.9	-6.2	-8.9	1.6	1.1	0.4	-0.2	10.9	5.3
AVG	0.8	0.3	1.1	3.9	1.4	0.2	0.3	0.6	0.6	0.1	0.4	0.7
MAX	10.5	15.6	14.5	17.9	21.4	4.6	1.9	8.7	8.6	1.5	10.9	5.3
MIN	-1.2	-20.0	-18.1	-4.5	-6.2	-8.9	-1.1	-0.9	-2.1	-2.7	-5.0	-3.5

Table A-6. Differences and Percent Differences between Future No Action and Intertie Alternative EC at Jersey Point (2030 LOD)

Difference in EC Predictions (2030 Intertie Alternative - 2030 Future No Action) Rock Slough												
WY	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**
1976	11.9	32.7	39.7	-3.0	21.4	6.5	1.5	0.6	1.5	-23.7	-31.6	60.0
1977	35.1	-31.4	-49.9	5.7	5.2	7.0	2.0	3.4	6.2	0.3	0.9	13.4
1978	2.5	9.6	100.4	43.0	-4.1	11.3	4.8	-3.7	-0.4	0.1	-3.4	-16.8
1979	-15.6	-2.0	4.7	-0.6	1.5	9.3	3.7	0.0	0.0	0.8	5.7	7.5
1980	-1.2	2.8	22.6	4.1	-31.4	-15.8	-0.5	0.0	0.5	-0.5	-0.5	-0.4
1981	-4.5	-0.9	-1.7	17.2	12.0	2.9	0.9	-1.9	10.2	7.0	9.9	-16.7
1982	-14.7	20.5	3.2	-2.1	-5.2	14.2	4.4	0.0	-0.1	-0.1	0.2	0.6
1983	-0.2	-0.6	-13.9	5.0	-2.1	0.2	0.5	0.2	0.1	0.0	-0.3	-0.2
1984	-0.5	-2.9	-4.1	-2.2	0.0	0.1	0.0	0.0	0.0	0.0	2.8	11.6
1985	9.3	17.0	3.8	6.7	5.6	3.0	2.8	1.3	-1.6	0.8	3.9	-2.6
1986	-4.2	-4.0	34.5	44.3	1.4	-7.3	-1.2	-0.3	-0.2	0.3	3.5	5.9
1987	3.3	5.1	-53.7	-26.5	35.7	9.0	3.2	1.4	1.0	1.5	0.0	-2.8
1988	2.3	-3.8	26.8	47.9	9.4	2.4	0.0	0.1	-1.3	1.7	-11.5	-32.4
1989	-17.9	-6.1	1.9	-0.8	-1.0	-0.1	0.1	0.0	-0.9	-0.3	1.2	2.6
1990	-0.2	-8.1	14.6	20.1	-15.3	-2.1	0.5	0.1	0.0	1.9	-2.0	-17.1
1991	-9.0	-66.5	-188.7	-85.3	99.4	-21.5	0.9	1.1	2.9	-0.6	14.7	53.1
AVG	-0.2	-2.4	-3.7	4.6	8.3	1.2	1.5	0.1	1.1	-0.7	-0.4	4.1
MAX	35.1	32.7	100.4	47.9	99.4	14.2	4.8	3.4	10.2	7.0	14.7	60.0
MIN	-17.9	-66.5	-188.7	-85.3	-31.4	-21.5	-1.2	-3.7	-1.6	-23.7	-31.6	-32.4

Difference in EC Predictions (2030 Intertie Alternative - 2030 Future No Action) Rock Slough												
WY	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**
1976	4.4	10.4	6.3	-0.4	4.3	1.7	0.5	0.2	0.3	-3.2	-4.3	7.0
1977	3.0	-3.1	-5.5	0.7	1.2	1.7	0.5	0.7	1.0	0.1	0.1	1.8
1978	0.2	0.9	13.0	8.7	-1.5	3.5	1.4	-1.3	-0.2	0.0	-1.0	-2.6
1979	-2.0	-0.2	0.5	-0.1	0.4	3.4	1.4	0.0	0.0	0.3	1.4	1.0
1980	-0.1	0.3	3.3	1.2	-7.6	-4.4	-0.2	0.0	0.2	-0.2	-0.2	-0.1
1981	-0.6	-0.1	-0.2	2.2	3.9	1.3	0.4	-0.6	3.6	1.6	1.8	-2.2
1982	-1.5	3.0	1.4	-0.8	-1.8	4.8	2.1	0.0	0.0	0.0	0.1	0.2
1983	-0.1	-0.3	-4.5	1.2	-0.7	0.1	0.2	0.1	0.0	0.0	-0.1	-0.1
1984	-0.3	-1.4	-1.6	-0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.9	1.9
1985	1.3	3.0	1.6	2.4	1.3	0.9	1.0	0.4	-0.6	0.2	0.6	-0.4
1986	-0.6	-0.5	3.9	8.7	0.3	-2.3	-0.4	-0.1	-0.1	0.1	1.1	1.0
1987	0.5	0.7	-5.5	-3.4	9.9	3.4	1.2	0.4	0.4	0.4	0.0	-0.4
1988	0.2	-0.4	3.2	8.4	3.0	0.8	0.0	0.0	-0.4	0.5	-1.9	-3.7
1989	-1.6	-0.6	0.2	-0.1	-0.3	0.0	0.0	0.0	-0.4	-0.1	0.2	0.3
1990	0.0	-1.0	1.4	2.6	-4.8	-0.8	0.2	0.0	0.0	0.3	-0.3	-2.1
1991	-0.8	-6.5	-20.0	-9.6	25.7	-6.0	0.4	0.4	0.5	-0.1	2.2	7.1
AVG	0.1	0.3	-0.1	1.3	2.1	0.5	0.5	0.0	0.3	0.0	0.0	0.6
MAX	4.4	10.4	13.0	8.7	25.7	4.8	2.1	0.7	3.6	1.6	2.2	7.1
MIN	-2.0	-6.5	-20.0	-9.6	-7.6	-6.0	-0.4	-1.3	-0.6	-3.2	-4.3	-3.7

Table A-7. Differences and Percent Differences between Future No Action and Intertie Alternative EC at Old River near Rock Slough (2030 LOD)

Difference in EC Predictions (2030 Intertie Alternative - 2030 Future No Action) SJR Brandt Bridge												
WY	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**
1976	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1977	0.0	0.0	-0.5	0.0	0.0	0.0	0.0	0.0	0.2	-0.1	0.0	0.0
1978	0.0	0.0	0.0	0.0	-0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0
1979	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1980	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1981	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0
1982	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1983	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1984	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1985	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.0	0.1	0.1
1986	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1987	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1988	0.0	0.0	-0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.4	0.0	0.0
1989	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.8	-0.5	0.0
1990	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.6	0.0
1991	0.0	0.0	0.0	0.1	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0
AVG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.0
MAX	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.2	0.2	1.6	0.6	0.1
MIN	0.0	0.0	-0.5	0.0	-0.1	0.0	0.0	0.0	0.0	-3.8	-0.5	0.0

Difference in EC Predictions (2030 Intertie Alternative - 2030 Future No Action) SJR Brandt Bridge												
WY	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**
1976	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1977	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1978	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1979	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1980	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1981	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1982	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1983	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1984	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1985	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1986	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1987	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1988	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
1989	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.7	-0.1	0.0
1990	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.0
1991	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.0
MIN	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	-0.7	-0.1	0.0

Table A-8. Differences and Percent Differences between Future No Action and Intertie Alternative EC at Brandt Bridge, San Joaquin River (2030 LOD)

Difference in EC Predictions (2030 Intertie Alternative - 2030 Future No Action) Clifton Court												
WY	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**
1976	5.9	13.3	29.7	-4.8	11.2	6.3	1.3	0.7	7.1	-10.2	-27.0	23.7
1977	32.2	-8.6	-44.6	5.1	12.7	18.8	14.0	27.1	23.2	9.6	3.6	8.6
1978	39.9	47.1	51.8	40.5	-11.0	12.1	-0.8	-1.9	-0.7	0.1	-1.2	-8.5
1979	-7.1	-4.1	4.4	-6.4	-0.8	3.6	4.1	0.8	0.1	0.6	2.7	5.2
1980	0.2	0.3	11.0	5.3	-1.0	-0.2	-1.1	-0.2	0.3	-0.5	-0.5	-0.3
1981	-2.5	-0.6	-2.3	6.1	10.7	18.4	11.8	-3.6	-2.3	3.4	9.5	-8.3
1982	-7.8	8.8	1.6	-5.8	0.1	-5.9	-0.2	-0.2	0.0	-0.1	-0.1	0.3
1983	-0.3	0.2	2.0	0.4	2.8	0.3	0.0	0.0	0.0	0.0	-0.3	-0.3
1984	-0.7	1.7	0.4	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.6	6.8
1985	6.1	8.8	0.4	2.3	4.5	3.8	3.8	3.2	0.1	0.1	2.6	-0.9
1986	-2.7	-2.8	13.6	32.1	5.0	1.5	-0.3	-0.1	-0.1	1.1	1.5	3.5
1987	1.9	2.7	-20.3	-23.1	28.7	7.7	3.8	2.9	0.7	1.0	0.7	-1.2
1988	1.0	0.5	9.3	38.2	9.2	5.7	1.5	0.7	-0.6	-14.1	-2.2	-19.2
1989	-15.3	-6.8	0.3	0.0	-1.1	-3.8	-1.4	-0.4	-1.1	-0.4	1.0	1.5
1990	0.3	-2.1	1.4	35.3	-17.5	-12.1	-2.8	-0.9	-0.2	-2.6	1.7	-7.2
1991	-31.0	-18.6	-70.2	-124.4	63.5	1.8	-10.9	-3.6	-2.4	2.7	-9.3	14.3
AVG	1.2	2.5	-0.7	0.1	7.3	3.6	1.4	1.5	1.5	-0.6	-1.0	1.1
MAX	39.9	47.1	51.8	40.5	63.5	18.8	14.0	27.1	23.2	9.6	9.5	23.7
MIN	-31.0	-18.6	-70.2	-124.4	-17.5	-12.1	-10.9	-3.6	-2.4	-14.1	-27.0	-19.2

Difference in EC Predictions (2030 Intertie Alternative - 2030 Future No Action) Clifton Court												
WY	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**
1976	2.0	4.2	6.2	-0.7	2.1	1.4	0.3	0.1	1.4	-1.7	-4.5	3.8
1977	4.1	-1.0	-6.3	0.7	2.1	3.1	2.3	4.7	4.1	1.8	0.7	1.5
1978	6.1	6.1	8.1	6.7	-2.3	2.5	-0.2	-0.7	-0.2	0.0	-0.4	-1.8
1979	-1.2	-0.6	0.6	-0.9	-0.2	1.1	1.3	0.2	0.0	0.2	0.8	1.0
1980	0.0	0.0	1.8	1.4	-0.4	-0.1	-0.4	0.0	0.1	-0.2	-0.2	-0.1
1981	-0.4	-0.1	-0.3	0.8	2.7	5.6	3.5	-0.9	-0.7	0.9	2.1	-1.5
1982	-1.1	1.4	0.5	-1.5	0.0	-1.8	-0.1	-0.1	0.0	0.0	0.0	0.1
1983	-0.1	0.1	0.7	0.1	1.0	0.1	0.0	0.0	0.0	0.0	-0.1	-0.2
1984	-0.3	0.8	0.2	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.2	1.5
1985	1.1	1.7	0.1	0.7	1.0	0.8	0.9	0.7	0.0	0.0	0.5	-0.2
1986	-0.4	-0.5	1.9	6.1	1.1	0.6	-0.1	0.0	0.0	0.4	0.5	0.8
1987	0.3	0.5	-2.9	-3.1	6.0	1.8	0.9	0.7	0.2	0.3	0.2	-0.2
1988	0.1	0.1	1.4	6.7	1.8	1.0	0.3	0.1	-0.1	-3.5	-0.5	-3.3
1989	-2.0	-0.8	0.0	0.0	-0.2	-1.0	-0.5	-0.1	-0.3	-0.1	0.2	0.3
1990	0.0	-0.3	0.2	4.4	-3.6	-2.9	-0.7	-0.2	0.0	-0.5	0.3	-1.2
1991	-4.3	-2.3	-9.3	-15.4	10.1	0.4	-2.9	-0.9	-0.5	0.5	-1.6	2.5
AVG	0.2	0.6	0.2	0.4	1.3	0.8	0.3	0.2	0.2	-0.1	-0.1	0.2
MAX	6.1	6.1	8.1	6.7	10.1	5.6	3.5	4.7	4.1	1.8	2.1	3.8
MIN	-4.3	-2.3	-9.3	-15.4	-3.6	-2.9	-2.9	-0.9	-0.7	-3.5	-4.5	-3.3

Table A-9. Differences and Percent Differences between Future No Action and Intertie Alternative EC at Old River, State Highway 4 / Los Vaqueros Intake (2030 LOD)

Difference in EC Predictions (2030 Intertie Alternative - 2030 Future No Action) Los Vaqueros Intake												
WY	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**
1976	8.5	21.8	34.7	-4.6	16.2	6.5	1.3	0.5	1.7	-15.6	-31.4	40.6
1977	29.5	-19.1	-37.6	4.8	22.3	16.0	5.8	9.6	5.6	1.5	0.5	19.4
1978	25.5	9.2	74.6	40.8	-6.7	12.4	-10.1	-10.6	-0.7	0.1	-2.0	-12.2
1979	-10.8	-3.2	4.6	-3.8	0.2	13.2	3.8	0.3	0.0	0.8	3.8	6.2
1980	-0.5	1.4	16.8	0.9	-25.4	-11.9	-1.4	-0.1	0.6	-0.6	-0.5	-0.4
1981	-3.4	-0.9	-1.5	11.5	11.0	9.0	5.4	-3.7	5.1	4.9	9.6	-12.4
1982	-11.1	14.6	2.7	-3.8	-8.1	34.8	2.2	-0.2	0.0	-0.1	0.2	0.3
1983	0.0	-0.7	-5.4	6.0	2.2	0.3	0.6	0.2	0.0	0.0	-0.6	-0.3
1984	-0.8	-4.7	-0.7	-1.5	-0.3	0.0	0.0	0.0	0.0	-0.3	1.6	8.7
1985	7.4	13.0	2.0	4.8	5.1	4.2	3.1	1.6	-0.6	0.6	3.2	-1.7
1986	-3.3	-3.3	23.6	38.0	-2.1	-2.1	-1.2	-0.5	-0.3	0.5	2.5	4.8
1987	2.7	3.7	-36.1	-25.7	31.8	9.0	4.3	1.8	0.8	1.2	0.6	-1.7
1988	1.6	-2.1	17.1	42.8	11.8	5.1	0.6	0.3	-3.0	-0.2	-10.8	-26.6
1989	-15.3	-6.0	1.1	-0.3	-0.7	-2.2	-0.5	-0.2	-0.9	-0.3	1.1	2.1
1990	0.0	-5.6	6.5	25.6	-18.8	-6.8	-0.4	-0.1	0.0	-0.1	-1.0	-12.0
1991	-8.2	-38.5	-126.6	-56.3	125.6	-10.6	-4.4	-0.3	1.9	0.1	12.4	28.7
AVG	1.4	-1.3	-1.5	4.9	10.3	4.8	0.6	-0.1	0.6	-0.5	-0.7	2.7
MAX	29.5	21.8	74.6	42.8	125.6	34.8	5.8	9.6	5.6	4.9	12.4	40.6
MIN	-15.3	-38.5	-126.6	-56.3	-25.4	-11.9	-10.1	-10.6	-3.0	-15.6	-31.4	-26.6

Difference in EC Predictions (2030 Intertie Alternative - 2030 Future No Action) Los Vaqueros Intake												
WY	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**
1976	3.0	7.0	6.3	-0.7	3.1	1.5	0.3	0.1	0.3	-2.4	-4.9	5.6
1977	3.1	-2.1	-4.8	0.6	4.0	2.8	1.1	1.9	1.0	0.3	0.1	3.2
1978	3.2	1.0	10.6	7.2	-1.7	3.0	-2.8	-3.4	-0.2	0.0	-0.6	-2.2
1979	-1.6	-0.4	0.5	-0.5	0.0	4.3	1.2	0.1	0.0	0.3	1.0	1.0
1980	-0.1	0.2	2.6	0.2	-7.2	-3.2	-0.5	0.0	0.2	-0.2	-0.1	-0.1
1981	-0.5	-0.1	-0.2	1.5	3.0	3.2	1.7	-1.0	1.6	1.2	1.9	-1.9
1982	-1.3	2.2	1.0	-1.1	-2.3	9.3	1.2	-0.1	0.0	0.0	0.1	0.1
1983	0.0	-0.3	-1.5	1.7	0.7	0.1	0.3	0.1	0.0	0.0	-0.3	-0.1
1984	-0.3	-2.0	-0.3	-0.4	-0.1	0.0	0.0	0.0	0.0	-0.1	0.5	1.7
1985	1.2	2.4	0.7	1.6	1.1	1.0	0.8	0.4	-0.2	0.1	0.6	-0.3
1986	-0.5	-0.5	3.0	7.3	-0.4	-0.7	-0.4	-0.2	-0.1	0.2	0.8	0.9
1987	0.4	0.6	-4.4	-3.4	7.7	2.6	1.2	0.4	0.2	0.3	0.1	-0.3
1988	0.2	-0.3	2.3	7.4	2.8	1.1	0.1	0.1	-0.8	0.0	-2.1	-3.7
1989	-1.7	-0.7	0.1	0.0	-0.1	-0.7	-0.2	0.0	-0.3	-0.1	0.2	0.3
1990	0.0	-0.8	0.7	3.2	-4.5	-1.9	-0.1	0.0	0.0	0.0	-0.2	-1.8
1991	-0.9	-4.3	-15.5	-6.3	24.6	-2.6	-1.3	-0.1	0.4	0.0	2.1	4.5
AVG	0.3	0.1	0.1	1.1	1.9	1.2	0.2	-0.1	0.1	0.0	0.0	0.4
MAX	3.2	7.0	10.6	7.4	24.6	9.3	1.7	1.9	1.6	1.2	2.1	5.6
MIN	-1.7	-4.3	-15.5	-6.3	-7.2	-3.2	-2.8	-3.4	-0.8	-2.4	-4.9	-3.7

Table A-10. Differences and Percent Differences between Future No Action and Intertie Alternative EC at Clifton Court Forebay (2030 LOD)

Difference in EC Predictions (2030 Intertie Alternative - 2030 Future No Action) Jones (DMC)												
WY	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**
1976	4.2	11.8	16.0	-4.5	7.0	10.3	1.0	0.4	-4.0	-11.9	-21.3	19.6
1977	9.5	-11.1	-22.8	2.0	49.6	10.5	6.9	8.5	5.3	2.2	0.4	0.5
1978	9.4	-2.6	37.5	18.4	-9.2	9.3	2.4	-0.2	-0.1	0.1	-1.3	-5.7
1979	-7.1	-1.8	4.2	-3.1	0.4	4.4	3.1	0.3	0.1	0.4	2.3	4.4
1980	0.4	1.2	4.1	-0.4	3.6	-0.1	-1.0	-0.1	0.1	-0.3	-0.6	-0.2
1981	-2.3	-0.5	2.2	4.9	-6.0	59.3	11.8	-1.9	0.7	3.0	7.4	-8.2
1982	-7.8	8.4	-11.5	-11.2	-1.4	7.8	0.2	-0.2	0.1	0.0	-0.1	0.2
1983	-0.2	-0.3	-0.3	-5.8	-0.5	0.5	2.7	0.2	0.3	0.2	-0.2	-0.3
1984	-1.1	-0.2	2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	4.6
1985	5.9	7.6	-10.7	-9.0	3.1	4.1	3.4	1.7	1.8	-0.2	2.1	-1.0
1986	-2.8	-2.2	10.4	14.6	-1.7	1.2	1.3	0.0	-0.1	-0.3	0.2	2.7
1987	2.1	2.6	-15.9	-12.7	15.2	5.0	1.9	1.9	1.4	1.3	0.6	-1.4
1988	0.9	-0.5	6.3	22.5	8.1	2.8	0.9	0.3	-6.1	-0.9	2.9	-16.8
1989	-11.9	-5.0	0.4	0.0	-0.5	-14.8	-1.3	-0.2	-0.8	-1.1	0.7	1.3
1990	0.1	-2.2	1.2	21.6	-20.3	-7.9	-1.0	-0.2	0.0	-1.8	1.2	-6.8
1991	-5.4	-40.7	-66.1	-45.1	102.0	-54.0	-9.6	-1.4	-3.4	0.9	-12.6	15.0
AVG	-0.4	-2.2	-2.6	-0.5	9.3	2.4	1.4	0.6	-0.3	-0.5	-1.1	0.5
MAX	9.5	11.8	37.5	22.5	102.0	59.3	11.8	8.5	5.3	3.0	7.4	19.6
MIN	-11.9	-40.7	-66.1	-45.1	-20.3	-54.0	-9.6	-1.9	-6.1	-11.9	-21.3	-16.8

Difference in EC Predictions (2030 Intertie Alternative - 2030 Future No Action) Jones (DMC)												
WY	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**
1976	1.4	3.5	2.9	-0.7	1.1	1.7	0.2	0.1	-0.7	-2.0	-3.6	3.2
1977	1.2	-1.4	-3.1	0.3	6.9	1.3	1.1	1.5	0.9	0.4	0.1	0.1
1978	1.4	-0.3	5.5	2.8	-1.6	1.7	0.8	-0.1	0.0	0.0	-0.4	-1.2
1979	-1.2	-0.3	0.6	-0.4	0.1	1.4	0.9	0.1	0.0	0.1	0.6	0.8
1980	0.1	0.2	0.6	-0.1	1.2	-0.1	-0.4	0.0	0.0	-0.1	-0.2	0.0
1981	-0.4	-0.1	0.3	0.7	-1.1	12.2	3.1	-0.5	0.2	0.8	1.6	-1.4
1982	-1.1	1.4	-2.6	-2.2	-0.5	2.5	0.1	-0.1	0.0	0.0	0.0	0.1
1983	-0.1	-0.2	-0.1	-1.6	-0.2	0.2	1.3	0.1	0.2	0.1	-0.1	-0.1
1984	-0.4	-0.1	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.0
1985	1.1	1.5	-2.5	-2.0	0.5	0.7	0.8	0.4	0.5	0.0	0.4	-0.2
1986	-0.5	-0.4	1.5	2.4	-0.4	0.4	0.5	0.0	0.0	-0.1	0.0	0.6
1987	0.4	0.5	-2.3	-1.7	2.3	0.8	0.4	0.4	0.4	0.3	0.1	-0.2
1988	0.1	-0.1	0.9	3.5	1.1	0.4	0.2	0.1	-1.4	-0.2	0.6	-2.7
1989	-1.6	-0.6	0.0	0.0	-0.1	-2.9	-0.4	-0.1	-0.2	-0.3	0.1	0.2
1990	0.0	-0.3	0.1	2.7	-3.1	-1.4	-0.2	0.0	0.0	-0.3	0.2	-1.1
1991	-0.7	-5.1	-8.9	-5.2	14.5	-8.7	-2.4	-0.3	-0.7	0.1	-2.1	2.6
AVG	0.0	-0.1	-0.4	-0.1	1.3	0.6	0.4	0.1	-0.1	-0.1	-0.2	0.1
MAX	1.4	3.5	5.5	3.5	14.5	12.2	3.1	1.5	0.9	0.8	1.6	3.2
MIN	-1.6	-5.1	-8.9	-5.2	-3.1	-8.7	-2.4	-0.5	-1.4	-2.0	-3.6	-2.7

Table A-11. Differences and Percent Differences between Future No Action and Intertie Alternative EC at Jones Pumping Plant / Delta-Mendota Canal (2030 LOD)

Difference in EC Predictions (2030 Intertie Alternative - 2030 Future No Action) Old River at Tracy												
WY	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**
1976	5.9	10.4	29.2	-3.5	9.0	6.5	1.1	0.4	-2.3	-10.1	-17.0	15.5
1977	6.7	-0.8	-33.2	1.4	72.6	17.1	5.8	5.2	4.3	1.4	0.3	-5.2
1978	5.1	-4.1	38.9	36.8	-0.2	0.3	0.1	0.0	0.0	0.0	-0.6	-6.6
1979	-6.3	-4.6	7.3	-3.5	-0.3	0.4	3.0	0.3	0.1	0.7	1.5	4.6
1980	1.0	-0.1	9.7	0.3	0.0	0.1	-0.5	-0.1	0.0	0.0	-0.1	0.3
1981	-2.3	-0.2	-1.3	6.5	8.8	41.3	13.6	0.7	-0.8	1.5	8.1	-7.6
1982	-8.0	9.3	1.5	-3.0	-0.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0
1983	-0.1	0.0	0.0	-1.2	-0.7	0.5	3.6	0.3	0.4	0.5	-0.4	0.0
1984	-0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.5
1985	6.3	9.4	-0.5	-0.4	4.3	6.3	3.5	1.1	0.4	-0.4	2.3	-0.7
1986	-3.0	-2.6	9.1	29.2	0.5	0.3	3.0	0.4	0.4	0.7	1.0	3.8
1987	2.3	3.3	-16.3	-24.4	22.2	5.0	-0.1	1.7	1.4	0.9	0.4	-1.4
1988	0.9	-1.0	4.4	36.9	7.3	2.1	0.9	0.3	-6.1	-1.4	13.7	-14.9
1989	-12.5	-5.4	0.1	0.3	-0.5	-4.3	-1.6	-0.2	-0.9	-0.7	0.9	1.4
1990	0.4	-3.0	-5.6	29.3	-35.2	-13.2	-1.1	-0.2	0.0	-3.3	1.6	-6.0
1991	-4.5	-67.9	-73.2	-26.8	142.6	5.5	-12.7	-1.6	-5.7	2.5	-11.8	11.8
AVG	-0.5	-3.6	-1.9	4.9	14.4	4.3	1.2	0.5	-0.5	-0.5	0.0	0.0
MAX	6.7	10.4	38.9	36.9	142.6	41.3	13.6	5.2	4.3	2.5	13.7	15.5
MIN	-12.5	-67.9	-73.2	-26.8	-35.2	-13.2	-12.7	-1.6	-6.1	-10.1	-17.0	-14.9

Difference in EC Predictions (2030 Intertie Alternative - 2030 Future No Action) Old River at Tracy												
WY	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**
1976	1.9	3.2	6.2	-0.5	1.5	1.0	0.2	0.1	-0.4	-1.6	-2.8	2.5
1977	0.9	-0.1	-4.6	0.2	9.8	1.9	0.8	0.9	0.7	0.2	0.1	-0.8
1978	0.7	-0.5	5.8	5.1	0.0	0.1	0.0	0.0	0.0	0.0	-0.1	-1.3
1979	-1.0	-0.7	1.0	-0.4	-0.1	0.1	0.8	0.1	0.0	0.2	0.4	0.8
1980	0.1	0.0	1.4	0.1	0.0	0.0	-0.2	0.0	0.0	0.0	0.0	0.1
1981	-0.4	0.0	-0.2	0.8	1.9	10.6	3.1	0.1	-0.2	0.4	1.7	-1.3
1982	-1.1	1.4	0.4	-0.5	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
1983	0.0	0.0	0.0	-0.4	-0.2	0.2	1.8	0.1	0.2	0.2	-0.2	0.0
1984	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1
1985	1.1	1.7	-0.1	-0.1	0.9	1.2	0.7	0.2	0.1	-0.1	0.4	-0.1
1986	-0.5	-0.4	1.3	5.0	0.1	0.1	1.2	0.2	0.1	0.2	0.3	0.8
1987	0.4	0.6	-2.4	-3.1	3.7	0.8	0.0	0.3	0.3	0.2	0.1	-0.2
1988	0.1	-0.1	0.6	5.8	1.0	0.2	0.1	0.0	-1.2	-0.3	2.6	-2.4
1989	-1.6	-0.7	0.0	0.0	-0.1	-1.0	-0.4	-0.1	-0.2	-0.2	0.2	0.2
1990	0.1	-0.5	-0.7	3.6	-6.0	-2.3	-0.2	0.0	0.0	-0.6	0.3	-1.0
1991	-0.6	-8.4	-9.9	-3.1	20.6	1.0	-2.7	-0.3	-1.0	0.4	-1.9	2.0
AVG	0.0	-0.3	-0.1	0.8	2.1	0.9	0.3	0.1	-0.1	-0.1	0.0	0.0
MAX	1.9	3.2	6.2	5.8	20.6	10.6	3.1	0.9	0.7	0.4	2.6	2.5
MIN	-1.6	-8.4	-9.9	-3.1	-6.0	-2.3	-2.7	-0.3	-1.2	-1.6	-2.8	-2.4

Table A-12 Differences and Percent Differences between Future No Action and Intertie Alternative EC at Jones Pumping Plant / Delta at Old River at Tracy Road Bridge (2030 Conditions).

Appendix D

List of Plant Species Observed in the Study Area

Appendix D

List of Plant Species Observed in the Study Area

Scientific Name	Common Name
Amsinckia menziesii	common fiddleneck
*Avena barbata**	wild oat
Baccharis pilularis	coyote brush
*Brassica nigra**	black mustard
*Bromus diandrus**	ripgut brome
*Bromus hordeaceus**	soft chess
*Carduus pycnocephalus**	Italian thistle
*Centaurea solstitialis**	yellow star-thistle
*Conium maculatum**	poison hemlock
Conyza canadensis	horseweed
*Crypsis schoenoides**	swamp grass
*Cynodon dactylon**	Bermudagrass
Cyperus eragrostis	tall flatsedge
Datura wrightii	Jimson weed
Distichlis spicata	saltgrass
*Dittrichia graveolens**	stinkweed
Eremocarpus setigerus	turkey mullein
Eucalyptus sp.*	eucalyptus
Grindelia sp.	gumweed
*Hirschfeldia incana**	Mediterranean mustard
Hordeum marinum ssp. *gussoneanum**	Mediterranean barley
Hordeum murinum ssp. *leporinum**	hare barley
Juncus balticus	Baltic rush
*Lactuca serriola**	prickly lettuce
*Lepidium latifolium**	perennial pepperweed
Leymus triticoides	creeping wildrye
*Lolium multiflorum**	Italian ryegrass
Lupinus sp.	lupine
Malva sp.	cheeseweed
*Marrubium vulgare**	horehound
*Medicago sativa**	alfalfa
*Phoenix canariensis**	Canary Island date palm

Scientific Name	Common Name
*Picris echioides**	bristly oxtongue
Pinus sp.*	pine (ornamental)
*Plantago lanceolata**	English plantain
Polygonum amphibium	water smartweed
Polygonum hydropiperoides	swamp smartweed
*Polypogon monspeliensis**	rabbitsfoot grass
Populus fremontii ssp. *fremontii*	Fremont cottonwood
*Rumex crispus**	curly dock
Salix gooddingii	black willow
Salix laevigata	red willow
*Salsola tragus**	Russian thistle
*Silybum marianum**	milk thistle
Typha latifolia	broadleaf cattail
Vulpia myuros var. *myuros**	rattail fescue
Xanthium strumarium	rough cocklebur
*nonnative species	

Appendix E

California Department of Fish and Game Natural Diversity Database Search for the Delta-Mendota Canal/ California Aqueduct Intertie Project

California Department of Fish and Game
Natural Diversity Database
Delta-Mendota Canal/California Aqueduct Intertie Project- wildlife
USGS Quads searched: Tracy, Midway, Clifton Court Forebay, Union Island, Byron Hot Springs, and Altamont

	Common Name/Scientific Name	Element Code	Federal Status	State Status	GRank	SRank	CDFG or CNPS
1	Alameda whipsnake *Masticophis lateralis euryxanthus*	ARADB21031	Threatened	Threatened	G4T2	S2	
2	American badger *Taxidea taxus*	AMAJF04010			G5	S4	SC
3	California horned lark *Eremophila alpestris actia*	ABPAT02011			G5T3Q	S3	
4	California red-legged frog *Rana draytonii*	AAABH01022	Threatened		G4T2T3	S2S3	SC
5	California tiger salamander *Ambystoma californiense*	AAAAA01180	Threatened		G2G3	S2S3	SC
6	San Joaquin kit fox *Vulpes macrotis mutica*	AMAJA03041	Endangered	Threatened	G4T2T3	S2S3	
7	San Joaquin pocket mouse *Perognathus inornatus inornatus*	AMAFD01061			G4T2T3	S2S3	
8	San Joaquin whipsnake *Masticophis flagellum ruddocki*	ARADB21021			G5T2T3	S2?	SC
9	Swainson's hawk *Buteo swainsoni*	ABNKC19070		Threatened	G5	S2	
10	burrowing owl *Athene cunicularia*	ABNSB10010			G4	S2	SC
11	coast (California) horned lizard *Phrynosoma coronatum (frontale population)*	ARACF12022			G4G5	S3S4	SC
12	curved-foot hygrotus diving beetle *Hygrotus curvipes*	IICOL38030			G1	S1	
13	ferruginous hawk *Buteo regalis*	ABNKC19120			G4	S3S4	
14	golden eagle *Aquila chrysaetos*	ABNKC22010			G5	S3	
15	hoary bat *Lasiurus cinereus*	AMACC05030			G5	S4?	
16	loggerhead shrike *Lanius ludovicianus*	ABPBR01030			G4	S4	SC
17	longhorn fairy shrimp *Branchinecta longiantenna*	ICBRA03020	Endangered		G1	S1	
18	midvalley fairy shrimp *Branchinecta mesovallensis*	ICBRA03150			G2	S2	
19	northern harrier *Circus cyaneus*	ABNKC11010			G5	S3	SC
20	pallid bat *Antrozous pallidus*	AMACC10010			G5	S3	SC
21	prairie falcon *Falco mexicanus*	ABNKD06090			G5	S3	
22	silvery legless lizard *Anniella pulchra pulchra*	ARACC01012			G3G4T3T4Q	S3	SC
23	tricolored blackbird *Agelaius tricolor*	ABPBXB0020			G2G3	S2	SC

	Common Name/Scientific Name	Element Code	Federal Status	State Status	GRank	SRank	CDFG or CNPS
24	valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	IICOL48011	Threatened		G3T2	S2	
25	vernal pool fairy shrimp *Branchinecta lynchi*	ICBRA03030	Threatened		G3	S2S3	
26	western mastiff bat *Eumops perotis californicus*	AMACD02011			G5T4	S3?	SC
27	western pond turtle *Actinemys marmorata*	ARAAD02030			G3G4	S3	SC
28	western spadefoot *Spea hammondii*	AAABF02020			G3	S3	SC
29	white-tailed kite *Elanus leucurus*	ABNKC06010			G5	S3	

Appendix F

U.S. Fish and Wildlife Service Species List for the Delta-Mendota Canal/ California Aqueduct Intertie Project

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825

February 10, 2009

Document Number: 090210052031

Jennifer Haire
ICF Jones & Stokes
630 K Street, Suite 400
Sacramento, CA 95814

Subject: Species List for Delta-Mendota Canal/California Aqueduct Intertie Project

Dear: Ms. Haire

We are sending this official species list in response to your February 10, 2009 request for information about endangered and threatened species. The list covers the California counties and/or U.S. Geological Survey 7½ minute quad or quads you requested.

Our database was developed primarily to assist Federal agencies that are consulting with us. Therefore, our lists include all of the sensitive species that have been found in a certain area *and also ones that may be affected by projects in the area*. For example, a fish may be on the list for a quad if it lives somewhere downstream from that quad. Birds are included even if they only migrate through an area. In other words, we include all of the species we want people to consider when they do something that affects the environment.

Please read Important Information About Your Species List (below). It explains how we made the list and describes your responsibilities under the Endangered Species Act.

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be May 11, 2009.

Please contact us if your project may affect endangered or threatened species or if you have any questions about the attached list or your responsibilities under the Endangered Species Act. A list of Endangered Species Program contacts can be found at www.fws.gov/sacramento/es/branches.htm.

Endangered Species Division

TAKE PRIDE IN AMERICA

U.S. Fish & Wildlife Service
Sacramento Fish & Wildlife Office
Federal Endangered and Threatened Species that Occur in or may be Affected by Projects in the Counties and/or U.S.G.S. 7 1/2 Minute Quads you requested

Document Number: 090210052031

Database Last Updated: January 29, 2009

Quad Lists

Listed Species

Invertebrates

Branchinecta conservatio
- Conservancy fairy shrimp (E)

Branchinecta longiantenna
- longhorn fairy shrimp (E)

Branchinecta lynchi
- Critical habitat, vernal pool fairy shrimp (X)
- vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus
- valley elderberry longhorn beetle (T)

Lepidurus packardi
- vernal pool tadpole shrimp (E)

Fish

Acipenser medirostris
- green sturgeon (T) (NMFS)

Hypomesus transpacificus
- Critical habitat, delta smelt (X)
- delta smelt (T)

Oncorhynchus mykiss
- Central Valley steelhead (T) (NMFS)
- Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha
- Central Valley spring-run chinook salmon (T) (NMFS)
- winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Ambystoma californiense
- California tiger salamander, central population (T)

Rana aurora draytonii
- California red-legged frog (T)

Reptiles

Masticophis lateralis euryxanthus
- Alameda whipsnake [=striped racer] (T)
- Critical habitat, Alameda whipsnake (X)

Thamnophis gigas
giant garter snake (T)

Mammals

Vulpes macrotis mutica
San Joaquin kit fox (E)

Plants

Amsinckia grandiflora
Critical habitat, large-flowered fiddleneck (X)
large-flowered fiddleneck (E)

Lasthenia conjugens
Critical habitat, Contra Costa goldfields (X)

Proposed Species

Amphibians

Rana aurora draytonii
Critical habitat, California red-legged frog (PX)

Quads Containing Listed, Proposed or Candidate Species:

TRACY (444B)
MIDWAY (445A)
CLIFTON COURT FOREBAY (463D)

County Lists

No county species lists requested.

Key:

(E) *Endangered* - Listed as being in danger of extinction.

(T) *Threatened* - Listed as likely to become endangered within the foreseeable future.

(P) *Proposed* - Officially proposed in the Federal Register for listing as endangered or threatened.

(NMFS) Species under the Jurisdiction of the National Oceanic & Atmospheric Administration Fisheries Service. Consult with them directly about these species.

Critical Habitat - Area essential to the conservation of a species.

(PX) *Proposed Critical Habitat* - The species is already listed. Critical habitat is being proposed for it.

(C) *Candidate* - Candidate to become a proposed species.

(V) Vacated by a court order. Not currently in effect. Being reviewed by the Service.

(X) *Critical Habitat* designated for this species

Important Information About Your Species List

How We Make Species Lists

We store information about endangered and threatened species lists by U.S. Geological Survey 7½ minute quads. The United States is divided into these quads, which are about the size of San Francisco.

The animals on your species list are ones that occur within, **or may be affected by** projects within, the quads covered by the list.

- Fish and other aquatic species appear on your list if they are in the same watershed as your quad or if water use in your quad might affect them.

- Amphibians will be on the list for a quad or county if pesticides applied in that area may be carried to their habitat by air currents.
- Birds are shown regardless of whether they are resident or migratory. Relevant birds on the county list should be considered regardless of whether they appear on a quad list.

Plants

Any plants on your list are ones that have actually been observed in the area covered by the list. Plants may exist in an area without ever having been detected there. You can find out what's in the surrounding quads through the California Native Plant Society's online Inventory of Rare and Endangered Plants.

Surveying

Some of the species on your list may not be affected by your project. A trained biologist and/or botanist, familiar with the habitat requirements of the species on your list, should determine whether they or habitats suitable for them may be affected by your project. We recommend that your surveys include any proposed and candidate species on your list. See our Protocol and Recovery Permits pages.

For plant surveys, we recommend using the Guidelines for Conducting and Reporting Botanical Inventories. The results of your surveys should be published in any environmental documents prepared for your project.

Your Responsibilities Under the Endangered Species Act

All animals identified as listed above are fully protected under the Endangered Species Act of 1973, as amended. Section 9 of the Act and its implementing regulations prohibit the take of a federally listed wildlife species. Take is defined by the Act as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" any such animal.

> Take may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or shelter (50 CFR §17.3).

Take incidental to an otherwise lawful activity may be authorized by one of two procedures:

- If a Federal agency is involved with the permitting, funding, or carrying out of a project that may result in take, then that agency must engage in a formal consultation with the Service.

  During formal consultation, the Federal agency, the applicant and the Service work together to avoid or minimize the impact on listed species and their habitat. Such consultation would result in a biological opinion by the Service addressing the anticipated effect of the project on listed and proposed species. The opinion may authorize a limited level of incidental take.

- If no Federal agency is involved with the project, and federally listed species may be taken as part of the project, then you, the applicant, should apply for an incidental take permit. The Service may issue such a permit if you submit a satisfactory conservation plan for the species that would be affected by your project.

  Should your survey determine that federally listed or proposed species occur in the area and are likely to be affected by the project, we recommend that you work with this office and the California Department of Fish and Game to develop a plan that minimizes the project's direct and indirect impacts to listed species and compensates for project-related loss of habitat. You should include the plan in any environmental documents you file.

Critical Habitat

When a species is listed as endangered or threatened, areas of habitat considered essential

to its conservation may be designated as critical habitat. These areas may require special management considerations or protection. They provide needed space for growth and normal behavior; food, water, air, light, other nutritional or physiological requirements; cover or shelter; and sites for breeding, reproduction, rearing of offspring, germination or seed dispersal.

Although critical habitat may be designated on private or State lands, activities on these lands are not restricted unless there is Federal involvement in the activities or direct harm to listed wildlife.

If any species has proposed or designated critical habitat within a quad, there will be a separate line for this on the species list. Boundary descriptions of the critical habitat may be found in the Federal Register. The information is also reprinted in the Code of Federal Regulations (50 CFR 17.95). See our Map Room page.

Candidate Species

We recommend that you address impacts to candidate species. We put plants and animals on our candidate list when we have enough scientific information to eventually propose them for listing as threatened or endangered. By considering these species early in your planning process you may be able to avoid the problems that could develop if one of these candidates was listed before the end of your project.

Species of Concern

The Sacramento Fish & Wildlife Office no longer maintains a list of species of concern. However, various other agencies and organizations maintain lists of at-risk species. These lists provide essential information for land management planning and conservation efforts. More info

Wetlands

If your project will impact wetlands, riparian habitat, or other jurisdictional waters as defined by section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act, you will need to obtain a permit from the U.S. Army Corps of Engineers. Impacts to wetland habitats require site specific mitigation and monitoring. For questions regarding wetlands, please contact Mark Littlefield of this office at (916) 414-6580.

Updates

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be May 11, 2009.

Appendix G

Site Safety and Security for the Delta-Mendota Canal/California Aqueduct Intertie Pumping Plant

Appendix G

Site Safety and Security for the Delta-Mendota Canal/California Aqueduct Intertie Pumping Plant

I. Background

A. Brief Project Description

The proposed intertie between the federal Delta-Mendota Canal (DMC) and the state California Aqueduct (Project) will consist of a pumping plant and intake structure located on the Delta-Mendota Canal (DMC) and a turnout structure located on the adjacent California Aqueduct. The pumping plant and turnout are connected by two buried 108-inch diameter discharge/reverse flow pipelines. The buried pipelines will cross underneath the Transmission Agency of Northern California's (TANC) 500 kV transmission line. The pumping plant and turnout structure are separated by a horizontal distance of approximately 410 feet.

B. Site Location

The construction site is located at Mile Post 7.2 of the DMC, approximately 10 miles west of Tracy, California in Alameda County. The project site is on U.S. Department of the Interior (DOI), Bureau of Reclamation (Reclamation) withdrawn land and easement on State land. Access to the site is via West Grant Line Road and onto the east DMC operation and maintenance road.

II. Safety

A. General

Reclamation, as a matter of policy, is committed to provide safe and healthful working conditions and facilities to protect persons from injury/illness, to prevent accidental damage to facilities, and to prevent public exposure to unsafe conditions. To accomplish this policy, Reclamation has established and maintains an effective and comprehensive safety and health program which

meets or exceeds the standards or requirements issued by the Occupational Safety and Health Act (OSHA), the DOI, or Reclamation.

It is the responsibility of the contractor to develop and maintain an effective safety program on construction sites for contracts administered by Reclamation. Reclamation takes an active role in monitoring the contractor's safety program and ensuring compliance with their safety program and contract safety provisions. This is accomplished by frequent monitoring of job site safety conditions by Reclamation construction personnel, contractor weekly tool box meetings, monthly joint safety meetings, and periodic inspections by Reclamation's safety professionals.

B. Construction Safety

i. General

All construction contracts issued and administered by Reclamation must contain a version of the specification Section 01527 Safety and Health. The section requirements vary according to the size and complexity of the construction project. The specification section defines the contractor's safety responsibilities and along with contract clause WBR 1452.223-81 incorporates the Reclamation Safety and Health Standards (RSHS) into the contract. The specification section and the RSHS specifically detail the safety and health requirements for Reclamation and contractor activities and operations. See Attachment A for draft specification Section 01527.

ii. Contractor's Safety and Health

In accordance with the specification section, the Contractor must develop and submit for approval by the Contracting Officer's Representative (COR) a comprehensive written safety program covering all aspects of the onsite and applicable offsite operations and activities associated with the contract. Unless adequately covered in the original plan, the contractor must submit a supplementary detailed plan before starting each major phase of work or when requested by the COR. Onsite work must not begin until the COR has accepted the program or appropriate supplemental submittals. Initial and supplemental submittals must include a timetable for completing the required, detailed, job hazard analysis (JHA). See Attachment D for the outline of Contractor's Safety Plan.

Therefore the Contractor's Safety Plan therefore will include specific sections that address working near energized overhead powerlines and control of hazardous energy.

In accordance with the RSHS, the Contractor's Safety Plan must address the following when working near energized overhead powerlines:

- A signal or flag person must guide cranes, aerial lifts, or other high profile equipment in transit near exposed energized lines.
- Post all crossings where equipment will be moved under high voltage lines with appropriate signs.
- Prohibit equipment from coming within the minimum safe clearance of the high voltage line.
- Implement safety procedures to ensure that the insulation level of the air is maintained to avoid flashovers.

In accordance with the RSHS, the Contractor's Safety Plan must establish a hazardous energy control program (HECP) for the site. If a Reclamation program has been established for the site, then the Contractor must incorporate that into their safety plan. The HECP establishes the minimum performance requirements to control unexpected energization, release of stored energy, or start up of machinery or equipment that could injure employees. The HECP establishes written procedures, personnel training, and periodic inspections to ensure that during any of the contractor's activities that no release of stored energy could occur and cause injury or death and the machinery or equipment is isolated from all hazardous energy.

Specifically, the HECP will address the security zones established in the specifications in relationship to the Contractor's activities, the safety of employees, and the protection of the transmission line. The plan establishes written procedures for the issue of clearances to work or transport equipment in Zone 3, the proper training of employees in the HECP, and the administration and periodic inspection of the program.

The Contractor's Safety Plan will also include a Flashover Prevention Plan for all work under and adjacent to the TANC 500 kV transmission line. The plan would identify activities such as smoke from burning debris or power tools or their operation, water spray for dust control, etc. that could lead to fires, smoke, water spray, or other particulate matter or potential for other suspended fines between the ground and the 500 kV conductors. The intent of the plan is to address adequate safety procedures to ensure the insulation level of the air is maintained to avoid flashovers. Flashovers occur when higher voltage electricity "jumps across" an air gap to create a conductive path.

iii. Specification Section 01528 Contractor's Onsite Safety Personnel

The specification Section 01528 Contractor's Onsite Safety Personnel for the construction contract will require a full-time safety professional onsite during the construction of the project. The onsite safety professional is expected to strengthen the contractor's safety program through continual monitoring and oversight of the contractor's activities and operations. See Attachment B for draft specification Section 01528.

iv. Specification Section 01568 Site Security

a. General

The contract specification for the construction contract will contain a site security section. The section is customized according to the specific site security requirements. It is anticipated for this construction contract that the significant issues addressed by this section will include controlled access areas, personnel access requirements, and vehicle access requirements, personnel identification verification, and personnel identification. See Attachment C for draft specification Section 01568.

b. Controlled Access Areas

The construction site will be designated a controlled access area. The entire construction site will be fenced accordingly to prevent public access. Inside the controlled access area, multiple security zones will be established. The Contractor's office and equipment yard would be Zone 1. Zone 1 would be the lowest security zone allowing visitors access to the Contractor and Reclamation construction offices. Beyond Zone 1, only personnel with proper badges or escorted visitors would be allowed. This zone would be designated Zone 2 and would include the majority of the construction site. The 200 foot wide easement for the TANC 500 kV transmission line that crosses the construction right-of-way would be designated as Zone 3. See Figure No. 1 for access zones.

Any construction work performed within Zone 3 shall require submittal of specific JHA-Zone 3 (Job Hazard Analysis for Zone 3 Work). The JHA Zone 3 shall address all work activities and the associated safety and security measures that will be implemented. Any cranes, aerial lifts, or high profile equipment with the potential of coming within the minimum safe distance of the transmission line will not be allowed to operate in Zone 3. Zone 3 may be adjusted to prevent a particular piece of equipment operating in the other zones from violating the minimum safe clearance of the transmission line. Under no circumstance will a piece of construction equipment be allowed to operate in a location or configuration that would allow the possibility of any portion of that equipment to come within the minimum safe distance of the transmission line. The minimum safe distance for any overhead transmission line is designated in the RSHS or by the transmission line operating agency, whichever is more stringent.

Zone 3, defined by the TANC 500 kV transmission line 200-foot easement, will be designated by orange security fencing. Openings in the security fence will be necessary for vehicle travel along the construction right-of-way (ROW) for the discharge/reverse flow pipeline, access road construction, and access to the turnout structure. Normal vehicle traffic as well as heavy equipment will be allowed to move freely inside the construction ROW. However, cranes, aerial lifts, or other boomed or high profile equipment will require a special clearance

to be allowed to travel through Zone 3. See Figure No. 2 for detail view of Zone 3.

c. Personnel Access

In accordance with contract clause WBR 1452.237-80, the work performed under this contract shall only be accomplished by individuals (in the employment of the contractor or any subcontractor) whose conduct and behavior is consistent with the efficiency of the Federal Service and the requirements of this contract, and who are acceptable to the Contracting Officer (CO). If Reclamation finds a Contractor employee to be unsuitable or unfit for his or her assigned duties, the onsite government representative (OGR) will direct the Contractor to remove the individual from the contract and deny any access to the construction site.

Any Contractor employee that will have access to the site will be required to have a Personal Identification Verification (PIV) card, a temporary identification card, or a visitor badge. All Contractor employees shall access the facility via the facility's entry screening system and visibly display the Government-issued PIV card, temporary identification card, or visitor's badge.

C. Operation and Maintenance Safety

i. General

Reclamation's occupational safety and health policy is defined by directive and standard SAF-01-01 Occupational Safety and Health – General as part of the Reclamation Manual. The policy provides for the establishment of a training program that provides safety and health orientation and professional development necessary to meet management and operational safety and health needs. Each specific workplace is analyzed to identify specific safety and health needs. In addition, specific written hazard-specific programs and procedures are developed in accordance with regulations, standards, codes, or directives. Therefore it is anticipated the facility will have a Standard Operating Procedure (SOP), a Hazardous Energy Control Program (HECP), and a Site Security Plan.

ii. Standard Operating Procedure

An SOP is required to be available for the pumping plant and appurtenances upon transfer to operation and maintenance (O&M) status. Prior to transfer of the facility to operational status, a draft copy of the SOP will be made available.

The SOP will include all applicable operating instructions to adequately, safely, and reliably operate the pumping plant and intake structure and its appurtenant structures and equipment. Recommended contents and format for the SOP are

outlined within the Standing Operating Procedures Guide for Dams, Reservoirs, and Power Facilities.

All Reclamation operating procedures will incorporate measures which fulfill the provisions of the most current publication of Reclamation Safety and Health Standards and pertinent safety requirements of TANC. When safety and health standards require compliance with multiple and comprehensive safety and health program elements, procedures will be established which will allow for the safe and efficient accomplishment of the operations. Examples of operations which may require this degree of attention would include, but are not limited to: entry into confined spaces, rope-supported work, and operation and maintenance activities involving hazardous energy. For activities involving the control of hazardous energy, the procedures will comply with the Hazardous Energy Control Program (FIST Volume 1-1) and the area office's local hazardous energy control procedures.

iii. Facility Instructions, Standards, and Techniques (FIST) Volume 1.1 Hazardous Energy Control Program

A Hazardous Energy Control Program (HECP) will be developed specifically for the pumping plant and appurtenant structures by Reclamation O&M personnel. The HECP will incorporate specific hazardous energy control procedures for the facility, list the responsible official and authorized employees and their responsibilities, and define personnel training requirements.

The facility hazardous energy control procedures shall clearly and specifically outline the scope, purpose, responsibility, authorization, rules, and techniques to be used for the control of hazardous energy and the means to enforce compliance including, but not limited to, the following:

- A statement of the intended use of the procedure.
- Procedural steps for shutting down, isolating, blocking, and securing systems to control hazardous energy.
- Procedural steps for the placement and removal of lockout and tagout devices.
- Responsibility for placing, moving, or removing all protective grounds if required by Reclamation Safety and Health Standards.
- Requirements for inspecting and testing the system to verify the effectiveness of isolation and lockout and tagout devices
- Use of cranes, aerial lifts, and other high profile equipment at the facility and specifically address the 500 kV transmission line.
- Permanent marking of the 200-foot wide Zone 3.

iv. Site Security Plan

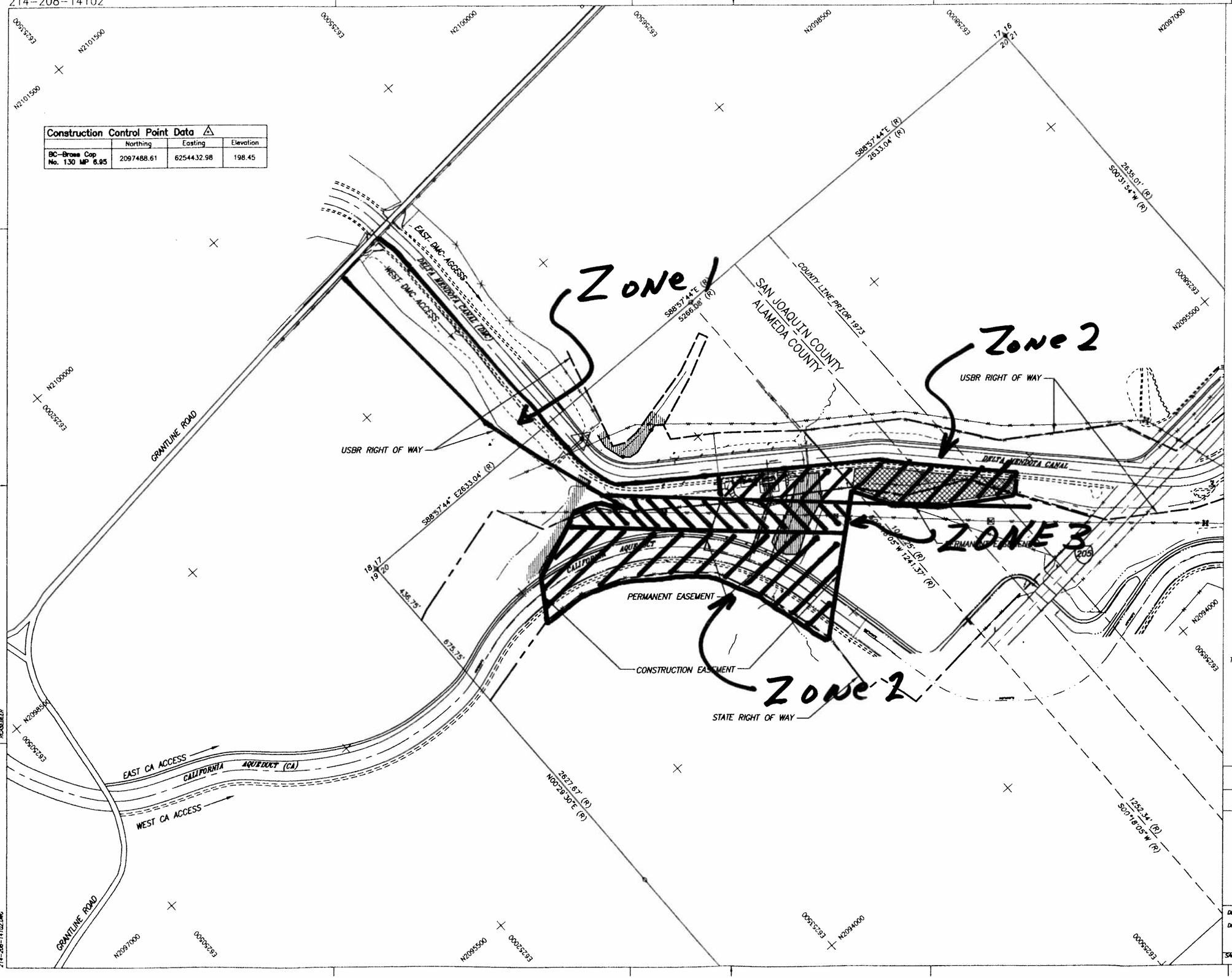
Site Security Plans are an important element of a facility's integrated security system. These plans document facility security responsibilities, systems, equipment, and procedures. Site Security Plans were required based on an Interim Policy Memorandum dated May 5, 2005, and via recommendations in Security Risk Assessments conducted on all facilities included in Reclamation's security inventory. The purpose of the memorandum is to provide a policy foundation for these recommendations. This interim policy will be incorporated into a Reclamation Manual Security Policy in the future.

Site Security Plans shall be prepared and/or updated following security risk assessments at all National Critical Infrastructure, Major Mission Critical, Mission Critical, and Project Essential facilities. Site Security Plans are recommended, but not required, for other facilities, including office buildings. Site Security Plans are revised as conditions warrant. Facility managers ensure that each Site Security Plan is prepared and incorporated into the facility emergency management program. The final documents are considered For Official Use Only and handled and stored as such.

The Site Security Plan is meant to work in conjunction with the Emergency Action Plan (EAP) and is practiced in conjunction with regularly scheduled EAP exercises for the facility. Exercises that involve the Site Security Plan are documented and reported as part of the annual Area Office Security Report and Regional Office Annual Security Assessment Report.

Each Reclamation Region has a Regional Security Officer, who oversees the security program for the Region. Within each Region, each Area Office has a security coordinator. Each Reclamation Region also has a Regional Special Agent who coordinates law enforcement issues with Reclamation's Law Enforcement Administrator in Denver and local law enforcement entities in the field.

Construction Control Point Data			
	Northing	Easting	Elevation
BC-Brass Cap No. 130 MP 8.95	2097488.61	62544.32.98	198.45



LEGEND

- USBR RIGHT OF WAY
- STATE RIGHT OF WAY
- CONSTRUCTION CONTROL POINT
- DESIGNATED SPOIL AREA
- RESTRICTED AREA
- ENVIRONMENTAL FENCING
- CONSTRUCTION EASEMENT
- PERMANENT EASEMENT

NOTES

1. Construction use areas exist within the designated easements of the State of California and within the limits of USBR Right of Way between Grantline Road and Interstate 205. Construction use areas shall be utilized as designated or as approved.
2. Environmental fencing to be installed by the contractor where shown.

CALIFORNIA STATE PLANE COORDINATE SYSTEM
ZONE 3 , U.S. SURVEY FEET
HORIZONTAL DATUM: NAD 1983
VERTICAL DATUM: NAVD 1988
CONTOUR INTERVAL: N/A

Topography by Photogrammetry and Surveys Section, Field Operations Branch, Division of Design and Construction, Mid-Pacific Region.
Compiled from photography: BR-DMC-18
Date of photography: 8/26/02

300 0 300 600 900
SCALE OF FEET

* Precision noted on water elevations for definition only.

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL VALLEY PROJECT - CALIFORNIA
DELTA DIVISION

DELTA MENDOTA CANAL AND CALIFORNIA AQUEDUCT INTERTIE
PUMPING PLANT
GENERAL USE PLAN

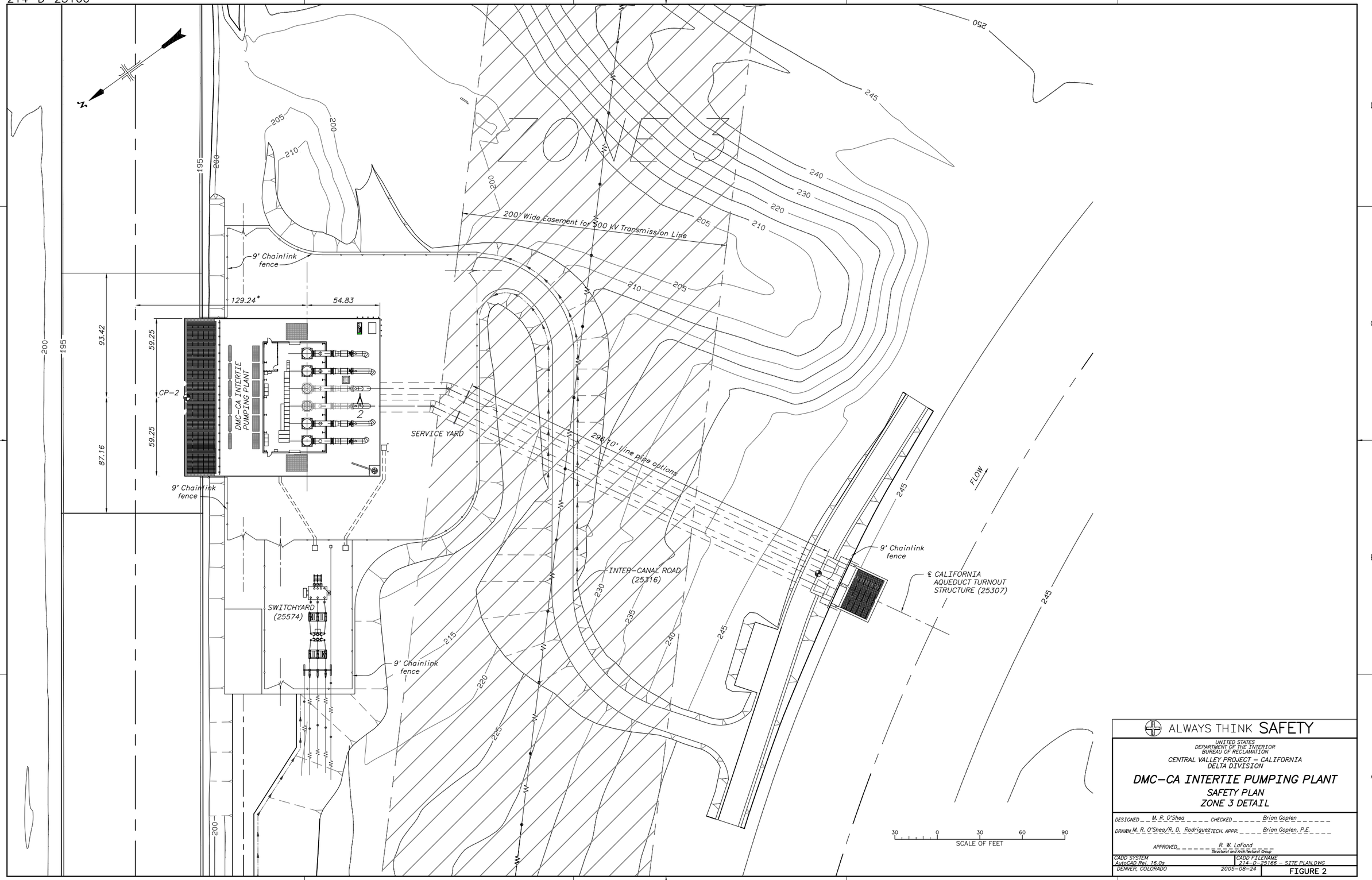
DESIGNED ... CHECKED ...
DRAWN ... TECH. APPR. ...
APPROVED ... ADMINISTRATIVE APPROVAL - DATE SIGNED - REGIONAL ENGINEER

SACRAMENTO, CALIFORNIA 2005-08-22
SHEET 1 OF 1
214-208-14102
SPECIFICATIONS NO. 20-C0648

DATE AND TIME PLOTTED SEPTEMBER 6, 2005 14:15
PLOTTED BY ROASEBERG

CAD SYSTEM AUTOCAD RNL 16.1s
FILENAME 214-208-14102.DWG

214-D-25166



ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

CENTRAL VALLEY PROJECT – CALIFORNIA
DELTA DIVISION

DMC–CA INTERTIE PUMPING PLANT

SAFETY PLAN
ZONE 3 DETAIL

DESIGNED	M. R. O'Shea	CHECKED	Brian Goplen
DRAWN	M. R. O'Shea/R. D. Rodriquez	TECH. APPR.	Brian Goplen, P.E.
APPROVED	R. W. LaFond, Structural and Architectural Group		

CADD SYSTEM: AutoCAD Rel. 16.0s, DENVER, COLORADO	CADD FILENAME: 214-D-25166 – SITE PLAN.DWG, 2005-08-24	FIGURE 2

SPECIFICATIONS NO. 20-C0648

PLOTTED BY:

Attachment A

Section 01527—Safety and Health

Part 1 General

1.01 Measurement And Payment

A. Cost:

1. Include in prices offered in the schedule for other items of work.

1.02 References

A. Bureau of Reclamation

1. USBR RSHS-2001 Reclamation Safety and Health Standards (RSHS)
   a. Available online at: <http://www.usbr.gov/ssle/safety/RSHS/rshs.html>.
   b. Hard copies available from:

      The Government Printing Office
      Superintendent of Documents
      North Capitol and H St. N. W.
      MS-SSMC - Room 566
      Washington, D.C. 20401
      (202) 512-1800
      (Stock item GPO-024-003-00190-2)

   c. Printed copies of RSHS are dated 2001. Electronic versions of the RSHS are dated 2002. These documents are identical. These specifications use the 2001 date.

1.03 Submittals

A. Submit the following in accordance with Section 01330—Submittals.

B. RSN 01527-1, Safety program:

1. Written safety program in accordance with Section 3 of USBR RSHS.
2. Detailed supplemental safety plan for each major phase of work, to include timetables to complete job hazard analyses.
3. Develop a specific Flashover Prevention Plan for all work adjacent to and underneath the Transmission Agency of Northern California's (TANC) 500 kV transmission line. The plan would identify activities such as smoke from burning debris or power tools or their operation, water spray for dust control, etc. that could lead to fires, smoke, water spray, or other particulate matter or potential for other suspended fines between the ground and the 500 kV conductors. The intent of the plan is to address adequate safety procedures to ensure the insulation level of the air is maintained to avoid flashovers. Flashovers occur when higher voltage electricity "jumps across" an air gap to create a conductive path.

C. RSN 01527-2, Monthly accident summary report:

1. Form 7-2218 or other acceptable form in accordance with paragraph 3.8 of USBR RSHS.

1.04 Project Conditions

A. Comply with USBR RSHS and applicable OSHA regulations.

B. Provide and maintain a work environment and procedures that will:

1. Safeguard the public and Government's personnel exposed to Contractor operations and activities.
2. Avoid interruptions of site operations and delays in project completion dates.
3. Control costs in contract performance.

C. Do not require persons employed in performance of this contract, including subcontracts, to work under conditions which are unsanitary, hazardous, or dangerous to the employee's health or safety.

D. Provide appropriate safety barricades, signs, and signal lights.

E. Maintain accurate record of and report to the CO:

1. All employee injuries and illnesses deemed recordable, as defined by OSHA 29 CFR 1904.
2. Any traumatic injury the members of the public that occur on the worksite.
3. Property damage in excess of $2,500.
4. Fatalities and multiple hospitalization incidents, as defined by OSHA 29 CFR 1904. Notification to the CO will be within the same reporting timeframe as required by OSHA, but does not relieve the contractor of its obligation to also notify OSHA of the incident.

Part 2 Products

Not used.

Part 3 Execution

Not used.

End of Section

Attachment B

Section 01528—
Contractor's Onsite Safety Personnel

Part 1 General

1.01 Measurement and Payment

A. Cost:

1. Include in prices offered in the schedule for other items of work.

1.02 Submittals

A. Submit the following in accordance with Section 01330—Submittals.

B. RSN 01528-1, Resume:

1. Safety Professional.

C. RSN 01528-2, Safety Inspection Reports:

1. Include a list of noted deficiencies, their abatement dates, and follow-up action for all jobsite activities.
2. Base inspection report on findings of jobsite walk-through with Government personnel.

1.03 Qualifications

A. Safety Professional:

1. Holds professional status in the safety field by virtue of education, training, certification and experience.

1.04 Application

A. Employ a full-time onsite Safety Professional as the Contractor's Onsite Safety Representative prior to start of construction.

1. Devotes full time toward accident prevention and shall not be used to perform any other portion of the Contractor's work under this contract.

B. Safety Professional duties, and responsibilities:

1. Review and approve the Contractor=s Safety Program prior to submittal.
2. Full authorization to correct unsafe acts on the spot.
3. Prepare safety inspection reports.
4. Onsite during any and all construction activities.

1.05 Quality Assurance

A. Contractor's Onsite Full-time Safety Professional:

1. The effectiveness of the Contractor's onsite full-time Safety Professional in prosecuting the safety program will be subject to continued review and approval by the CO.

B. Safety Program:

1. The effectiveness of the Contractor=s Safety Program will be subject to continued review and approval by the CO.

Part 2 Products

Not used.

Part 3 Execution

Not used.

End of Section

Attachment C

Section 01568—Site Security

Part 1 General

1.01 Measurement and Payment

A. Cost:

1. Include in prices offered in Schedule for other items of work.

1.02 Requirements for Working at Delta-Mendota/California Aqueduct Intertie Pumping Plant

A. Background

1. The Delta-Mendota/California Intertie Pumping Plant is located adjacent to and underneath critical infrastructure.

B. Authorities for Requirements

1. The security requirements at Delta-Mendota/California Intertie Pumping Plant are based on Reclamation Manual Directives and Standards, SSLE 01-01, Personnel Security and Suitability.

C. Controlled Access Areas

1. Non-Critical Areas
    a. Security Zone 1– Area designated for Contractor's office buildings and job entrance area. Area accessible by construction personnel and visitors.
2. Critical Area
    a. Security Zone 2 – Restricted personnel access.
    b. Security Zone 3 – Restricted personnel and vehicle access.

D. Personnel Access Requirements

1. Security Zone 2 – All contractor personnel entering Security Zone 2 areas shall be properly badged as described below.

a. Unescorted Access:

1) The Contractor shall designate individuals requiring unescorted access and/or escort privileges into Security Zone 2 and 3. Those individuals shall be subjected to a full background check or equivalent in accordance with Article entitled "Personal Identification Verification (PIV) - Zoned Areas" requirements.

2) In addition, personnel shall complete 1 hour of security training. This site-specific training will initially be provided by Reclamation personnel but the responsibility will be turned over to the Contractor. Attendance in the training shall be documented and maintained onsite by the Contractor.

3) In so far as is practicable, the Contractor should complete the required PIV paperwork, fingerprinting and security training process at least 30 days before their anticipated start work date in Security Zone 2 and 3 areas so as not to impact scheduled work. A red contractor picture badge marked for unescorted access and/or escort privileges to Security Zone 3 will be issued upon receiving clearance. An interim Unescorted Access badge may be granted after the Reclamation Construction Office receives the results of a preliminary criminal records check.

b. Escorted Access:

1) Visitors may enter Security Zone 3 if they have been issued a visitor badge and are escorted by an approved escort (person with Unescorted Access badges marked "escort").

2) A red contractor badge identifying that the contractor has escorted access to Security Zone 3 will be issued after the Security Training described in a.) above has been completed.

c. Escorts taking persons into Security Zone 3 shall continuously monitor the escorted personnel so that the employee overseeing the activity ensures that the escorted personnel do not enter an unsafe area. Escorts may turn the escorted personnel over to another approved escort to ensure uninterrupted monitoring of escorted personnel. Escorted contractor personnel shall be monitored continuously by approved contractor escorts.

E. Vehicle Access Requirements

1. Vehicle Access

a. No personal vehicles are allowed in Zones 2 and 3.

b. Contractor trucks and heavy equipment are allowed to travel and operate in Zone 2. No cranes, aerial lifts, or high profile equipment with the capability of coming within the minimum safe distance of the transmission line are allowed to operate in Zone 3. All said equipment may be transported or travel through Zone 3 if escorted by contractor personnel holding an escort badge. The limits of Zone 3 will be

modified to ensure any equipment operating in Zones 1 and 2 also cannot come with the minimum safe distance of the transmission line. All cranes, aerial lifts, or high profile equipment operating in Zones 1, 2, or 3 will require a clearance issued in accordance with the Hazardous Energy Control Program.

2. Deliveries

   a. All delivery vehicles must wait at the designated site access points for an approved escort before proceeding, and are subject to search and/or inspection by Reclamation.

F. Loss of Access Badges

1. Contractors who lose an access badge should report it immediately to the Contracting Officer's Representative (COR). Failure to report a lost badge may result in denial of a replacement badge.

G. Misuse of Access Badges

1. Contractors that misuse the access badges issued by Reclamation, enter unauthorized Security Zones, provide badge to others, follow improper escort procedures, or other misuses face the following actions:

   a. First offense—warning and requirement to retake the Security Training.

   b. Second offense—permanent loss of access badge.

1.03 Submittals

A. Submit the following in accordance with Section 01330—Submittals.

B. RSN 01568-1, Security Program:

1. Identify procedures for restricting entry onto project site to authorized persons.
2. Develop and implement Identification Badging process for critical areas.
3. Develop security plan and procedures for monitoring personnel and vehicle entry and egress to project site, control access to Zones 2 and 3, and develop a security sensitive traffic circulation plan for the various phases of work.

C. RSN 01568-2, List of Onsite Employees and Vehicles:

1. Provide list of employees. The list shall provide the full name, social security number, date of birth, place of birth, purpose or job title, and the estimated duration of access.

   a. Designate individuals for "Unescorted Access" or "Escorted Access".

2. Provide list of contractor vehicles and equipment. The list shall provide vehicle description, license number and state as applicable, year, make, and model.
3. Update and resubmit RSN 01568-2 monthly, or as employees and/or vehicles are added or deleted.

1.04 Criteria to Develop Security Program

A. Site access is limited to those access points shown on the Drawings.

B. The Contractor is responsible to control access through these site access points and provide overall security for the Government facilities.

C. When security fence or device protecting a critical area is removed for construction, a new "temporary critical area" perimeter fence shall be installed and maintained until the area is secured in accordance with Section 01565 – Existing Fences.

D. Personnel not having the required ID on their person at all times shall be subject to immediate removal from the site.

1.05 Responsibilities

A. Protect work and existing facilities from unauthorized entry, theft, and vandalism.

B. Initiate a security program in coordination with Government's existing security procedures at job mobilization.

C. Maintain security throughout construction period until acceptance of work by the Contracting Officer (CO).

1.06 Entry Control

A. Photo ID required for each employee entering site.

B. Entrance to site will be limited to authorized personnel and vehicles.

C. Maintain a continuous log of workmen and visitors and make available to the Government on request.

1.07 Personnel Identification (ID)—Critical Areas

A. For all employees entering critical areas, issue a durable CO approved identification card to each person authorized to enter site with the following information.

1. All ID's: a single unique background color, but not Blue, Red or Green.

2. Employee's name
3. Employee's photograph
4. Assigned identification number or alpha numeric ID.
5. Card issue and expiration date.
6. Responsible employee's supervisor name and phone number(s).
7. Responsible On-site Government Representative name and phone number(s).

B. Maintain a list of authorized persons and provide a copy to the COR.

C. Collect card from authorized person at completion of their work at site and surrender to the COR.

1.08 Personnel Identification Verification Identification (PIV-ID)—Critical Areas

A. Follow requirements as stipulated in WBR 1452.237-80 Security Requirements Contract Clause, (c) Contractor Employee Suitability and Issuance of Government Identification Cards.

B. The Contractor designated individuals shall provide the required PIV paperwork to the designated Reclamation Office after scheduling an appointment through the COR. Reclamation will photograph and fingerprint the individuals for the process.

C. Maintain a list of authorized persons issued a PIV-ID and provide a copy to the COR.

D. Collect PIV-ID card from authorized person at completion of their work at site and surrender to the COR.

Part 2 Products

Not used.

Part 3 Execution

Not used.

End of Section

Attachment D

Contractor Safety Program Outline

I. General Requirements

a. Statement of Policy

b. Statement of Safety and Health Responsibilities

c. Statement of Compliance with Regulations, Standards, and Codes

d. Statement of Subcontractor Compliance

e. Safety Inspection Procedures

f. Accident Investigation and Reporting Procedures

g. Applicable Emergency Plans

h. Confined Space Procedures

i. Lockout/Tagout Procedures

j. Fire Protection Plans

   i. Type and location of suppression equipment or systems

   ii. Offsite assistance agreement

   iii. Temporary heating devices

II. Medical

a. Facilities

b. Training

c. Certifications

d. Physician

e. Ambulance (Name, location, and telephone number)

f. Physical Qualification of Employees

g. Records

III. Communications

a. Employee Training

b. Safety Meetings

c. Onsite Training

d. Supervisor Training

IV. Occupational Health

a. Procedures and Equipment to Minimize Hazards

b. Testing program for employees and work environments

c. Qualified personnel

d. Personal protective equipment

e. Ventilation plans

V. Machinery and Mechanical Equipment

a. Procedures and Equipment to Minimize Hazards

   i. Testing program for employees and work environments

   ii. Mobile and stationary equipment

b. Inspection Procedures

c. Maintenance Procedures

d. Operating Personnel

e. Protective Safety Devices and Certifications

f. Aerial Lifts

VI. Excavation and Demolition

a. Excavations

   i. Slide protections

   ii. Support systems

   iii. Inspections

   iv. Access

b. Haulage

   i. Haul roads

   ii. Equipment and Procedures

VII. Working Surfaces

a. Access

   i. Ladders

   ii. Platforms, stairways, and ramps

b. Personal Protective Equipment

c. Scaffolding

d. Safety Nets

VIII. Protection of the Public

a. Signs and Barricades

b. Flagging Procedures

c. Jurisdictional Approvals

IX. Marine and Diving Operations

a. Detailed Plan and Written Procedures

X. Electrical Facilities

a. Working Near Exposed Energized Overhead Lines

b. Substations and Switchyards

XI. Required Safety Program Coordination

a. Confined Space Program

b. Hazardous Energy Control Program

Appendix H

U.S. Fish and Wildlife Service Coordination Act Report

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825

In reply refer to:
CRC-HC-DMC Intertie

APR 27 2009

Memorandum

To: Regional Director, Bureau of Reclamation, Mid-Pacific Region
Sacramento, California

From: Assistant Field Supervisor, Sacramento Fish and Wildlife Office
Sacramento, California

Subject: Amendments to the Fish and Wildlife Coordination Act Report for the Delta-Mendota Canal/California Aqueduct Intertie Project: Bureau of Reclamation and San Luis Delta Mendota Water Authority

This memorandum transmits the U.S. Fish and Wildlife Service's (Service) amendments to the April 2005 Fish and Wildlife Coordination Act (FWCA) report (Service 2005), as provided for in Section 2(b) of the FWCA (48 stat. 401, as amended), for the Delta-Mendota Canal/California Aqueduct Intertie Project (Intertie project). The FWCA report assessed potential project effects on fish and wildlife resources and provided our preliminary recommendations to avoid, minimize, rectify or compensate for potential adverse effects. The amendments to the FWCA report are based on the information contained in the March 2009 Administrative Draft Delta-Mendota Canal/California Aqueduct Intertie Project Environmental Impact Statement (EIS) (U.S. Bureau of Reclamation [Reclamation] 2009). This memorandum has also been submitted to California Department of Fish and Game (CDFG) and National Oceanic Atmospheric Administration/National Marine Fisheries Service (NOAA Fisheries) for their review and comment. Details of the project's effects on federally listed species, pursuant to section 7 of the Endangered Species Act of 1973, as amended, (ESA) are being addressed separately.

Background

In December 2004, Reclamation and the San Luis Delta Mendota Water Authority (Authority) issued an Environmental Assessment/Initial Study (EA/IS) for the Intertie project (Reclamation 2004). The Service provided Reclamation the Final FWCA report (Service 2005) for the Intertie project on April 26, 2005 (attached below), based on the December 2004 EA/IS. The Authority adopted a Mitigated Negative Declaration on April 20, 2005, and Reclamation adopted a Finding of No Significant Impact (FONSI) in May 2005. On August 31, 2005, the Planning and Conservation League brought suit against the FONSI under the National Environmental Policy Act (NEPA). Reclamation committed to preparing an EIS for the Intertie project, and the suit was dropped. In March 2009, the Service received the Administrative Draft Delta-Mendota Canal/California Aqueduct Intertie Project EIS (Reclamation 2009).

Amendments to the Project Description

The Service notes the following changes in the description of the Proposed Action (Alternative 2) in the March 2009 Administrative Draft EIS (Reclamation 2009) compared to what was described in the December 2004 EA/IS (Reclamation 2004) and the April 2005 FWCA report (Service 2005).

- The Proposed Action would result in the transfer of up to 467 cubic feet per second (cfs) of water from the Delta-Mendota Canal to the California Aqueduct instead of 400 cfs stated in the December 2004 EA/IS and April 2005 FWCA report. The maximum average monthly pumping, however, is expected to be around 400 cfs.
- The Proposed Action would result in the transfer of up to 900 cfs of water from the California Aqueduct to the Delta-Mendota Canal by gravity flow instead of 950 cfs stated in December 2004 EA/IS and April 2005 FWCA report.
- The 500-foot-long underground pipeline (intertie) would connect from milepost 7.2 on the Delta Mendota Canal to milepost 9.0 on the California Aqueduct. The December 2004 EA/IS and April 2005 FWCA report stated milepost 9.1 on the California Aqueduct.
- The Proposed Action would include the construction of a 4.5-mile long 69-kV transmission line to connect the Intertie pumping plant to the Tracy substation. The transmission line would run parallel to and along the west side of the Delta-Mendota Canal. The average span length across straight segments of the transmission line would be about 300 feet. The total permanent ground disturbance for the entire transmission line would be 0.005 to 0.02 acre. The Administrative Draft EIS (Reclamation 2009), however, does not state the amount of temporary disturbance that would result from the construction of the transmission line. Operation and maintenance activities within the transmission line right-of-way would be limited to once per year.
- The construction of the underground pipeline, switchyard, pumping station, and access road in the Proposed Action would result in impacts to 1.5 acres of annual grassland habitat (1.4 acres permanent and 0.1 acre temporary) instead of the 5.0 acres (0.5 acre permanent and 4.5 acres temporary) stated in the December 2004 EA/IS and April 2005 FWCA report. The exterior of the switchyard and pumping station facilities would be lighted. Lights would be installed at the lowest allowable height; the lowest allowable wattage would be used; lights would be screened and directed away from the night sky to the highest degree possible; and the amount of nighttime lights used would be minimized to the highest degree possible.

The Service amends the April 2005 Delta-Mendota Canal/California Aqueduct Intertie Project FWCA report (included as appendix below) (Service 2005) to include the above changes to the project description. The proposed 4.5-mile long 69-kV transmission line was not included in the project description in the December 2004 EA/IS (Reclamation 2004) and the April 2005 FWCA report (Service 2005). Thus, the effects of the proposed transmission line on migratory birds are discussed below.

Effects of the Transmission Line on Migratory and Special-Status Bird Species

The Central Valley is one of the most important regions in western North America to migratory and wintering shorebirds and waterfowl, supporting up to 60 percent of the total Pacific Flyway population in some years (Central Valley Joint Venture 2006, Shuford *et al.* 1998). Table 1 below lists the special-status migratory bird species with the potential to occur in the project area. Special-status bird species are those that are 1) federally-listed as endangered or threatened or a candidate for listing under ESA; 2) State-listed as endangered, threatened, or a candidate for

Table 1. Special-Status Avian Species Potentially Occurring in the Delta-Mendota Canal/California Aqueduct Intertie Project Area (continues on next pages).

Common Name	Scientific Name	Status[1]	Habitat/Occurrence
Aleutian Canada goose	*Branta canadensis leucopareia*	--	Winters in California. Lacustrine, fresh emergent wetlands, and moist grasslands, croplands, pastures, and meadows. Breeds in Alaska.
American peregrine falcon	*Falco peregrinus anatum*	CE,CPD, CFP, BCC	Year-round resident along coast, Coast Ranges, and Sierra Nevada. Winter resident in Central Valley. Breeds early March-late August. Woodland, forest, coastal, riparian, lacustrine, wetlands. Nest in high cliffs near lakes, rivers, or wetlands or in tall buildings or bridges. Forage in croplands and annual grasslands. 2 observed near Stockton and 2 in East Contra Costa County (National Audubon Society [Audubon] 2008).
American white pelican	*Pelecanus erythrorhynchos*	CSC	Year-round resident or winter migrant. Lacustrine, estuarine, salt ponds. Formerly bred in large numbers in Central Valley. Observed during Audubon Christmas Count in East Contra Costa County (Audubon 2008).
American wigeon	*Anas americana*	GBBDC	Common September-April. Lacustrine, fresh emergent and nearby herbaceous and croplands. Rarely nests in California. 183 observed during Audubon Christmas Count near Stockton (Audubon 2008).
Bald eagle	*Haliaeetus leucocephalus*	CE,BGE, CFP,BCC	Year-round resident or winter migrant. Lacustrine, riverine. Observed during Audubon Christmas Count in East Contra Costa County (Audubon 2008).
Barrow's goldeneye	*Bucephala islandica*	CSC	Winters October-March in riverine and lacustrine waters with rocky bottoms. Formerly nested in California, near alkaline lakes or slow moving rivers with abundant submerged aquatic vegetation and open water. Observed during Audubon Christmas Count (Audubon 2008).
Black-crowned night heron	*Nycticorax nycticorax*	--	Year-round resident. Lacustrine, estuarine, fresh and saline emergent wetlands, riverine. Breeds February-July. Nests in dense foliaged-trees and dense emergent wetlands. 52 observed near Stockton and 1 near East Contra Costa County (Audubon 2008).
California gull	*Larus californicus*	WL	Lacustrine, estuarine, salt ponds, coastal, fresh and saline emergent wetland, riverine, cropland. Formerly bred in Central Valley, now nests near Mono Lake. Observed during Audubon Christmas Count (Audubon 2008).
California horned lark	*Eremophila alpestris actia*	WL	Year-round resident. Breeds March-July. Nests on the ground in the open. Grassland, alkali flats, fallow grain fields. . Observed during Audubon Christmas Count (Audubon 2008).
Canvasback	*Aythya valisineria*	GBBDC	Winters September-May. Estuarine, lacustrine. 3,527 observed during Audubon Christmas Count near Stockton and 1,727 observed in East Contra Costa County (Audubon 2008).
Clark's grebe	*Aechmophorus clarkii*	BCC/c, CSC/c	Winters October-May along coast and inland lakes at low elevations. Breeds May-September on large marshy lakes (e.g., Sacramento River NWR, Lake Havasu, Salton Sea, Goose Lake, Sweetwater Reservoir). Require large, open waters for courtship, feeding, and flocking, and frequent extensive beds of tall, emergent vegetation such as tules or cattails for nesting. . Observed during Audubon Christmas Count (Audubon 2008).
Cooper's hawk	*Accipiter cooperii*	WL	Year-round resident. Breeds March-August. Dense stands of live oak, riparian deciduous, and other woodland. 10 observed near Stockton and 3 in East Contra Costa County (Audubon 2008).

[1] Status definitions are on p. 7.

Table 1 (continued). Special-Status Avian Species Potentially Occurring in the Delta-Mendota Canal/California Aqueduct Intertie Project Area (continues on next pages).

Common Name	Scientific Name	Status[1]	Habitat/Occurrence
Double-crested cormorant	*Phalacrocorax auritus*	WL	August-May in Central Valley lacustrine, riverine habitat. Breeds April-August along coast, inland lakes, estuaries. Observed during USGS Breeding Bird Survey Tracy route (Sauer *et al.* 2008) and Audubon Christmas Count (Audubon 2008).
Ferruginous hawk	*Buteo regalis*	WL, BCC	September- mid-April. Open grasslands, sagebrush flats, desert scrub, low foothills surrounding valleys, and fringes of pinyon-juniper habitats. Observed during Audubon Christmas Count (Audubon 2008).
Golden eagle	*Aquila chrysaetos*	WL,CFP, BG	Winters in Central Valley; migrates upslope to breed. Year-round resident in most of the rest of California. Breeds late January-August (peak in March-July). Grassland, savanna, desert, early-successional forest and shrub. Observed during USGS Breeding Bird Survey Tracy route (Sauer *et al.* 2008). 10 observed in East Contra Costa County (Audubon 2008).
Grasshopper sparrow	*Ammodramus savannarum*	CSC	Summer resident March-September. Breeds April- mid-July (peak May-June). Dry, dense grasslands with tall forbs and scattered shrubs.
Great blue heron	*Ardea herodias*	--	Year-round resident. Estuarine, fresh and saline emergent wetlands, croplands, pastures, salt ponds, riverine. Breeds February-March. Most nestlings fledge June-July. Nests in colonies in tops of secluded large snags or live trees, usually among the tallest available. Observed during USGS Breeding Bird Survey Tracy route (Sauer et al. 2008) and Audubon Christmas Count (Audubon 2008).
Great egret	*Ardea alba*	--	Year-round resident. Nests March-July in large trees near water. Estuarine, fresh and saline emergent wetlands, lacustrine, croplands, pastures, salt ponds, riverine. 260 observed near Stockton and 60 in East Contra Costa County (Audubon 2008).
Greater sandhill crane	*Grus canadensis tabida*	CT,CFP	September-April. Roost in shallow seasonal wetlands and forage in cropland and irrigated pasture (rice, corn, wheat, barley, oats, rye, sorghum, buckwheat, legumes, alfalfa).
Greater scaup	*Aythya marila*	GBBDC	October-May. Bays, estuaries, lakes, emergent wetlands. Does not breed in California.
Greater white-fronted goose	*Anser albifrons frontalis*	GBBDC	Early October-mid March in San Joaquin Valley. Moist and wet grasslands, pastures, croplands, meadows, fresh emergent wetlands, lacustrine habitat and, less commonly, in estuarine and saline (brackish) emergent habitats. 5000 observed during Audubon Christmas Count in East Contra Costa County; 10,359 near Stockton (Audubon 2008).
Lawrence's goldfinch	*Carduelis lawrencei*	BCC	April-September. Breeds in open oak or other arid woodland and chaparral, near water, valley foothill hardwood, valley foothill hardwood-conifer. Forages in grasslands.
Lesser sandhill crane	*Grus canadensis canadensis*	CSC (wintering)	September-April. Roost in shallow seasonal wetlands and forage in cropland and irrigated pasture (rice, corn, wheat, barley, oats, rye, sorghum, buckwheat, legumes). Particularly drawn to alfalfa. 11,101 observed during Audubon Christmas Count near Stockton; 45 observed in East Contra Costa County (Audubon 2008).
Lesser scaup	*Aythya affinis*	GBBDC	September-May in estuarine, lacustrine habitat in California. 2 observed during Audubon Christmas Count near Stockton and 192 in East Contra Costa County (Audubon 2008).

[1] Status definitions are on p. 7.

Table 1 (continued). Special-Status Avian Species Potentially Occurring in the Delta-Mendota Canal/California Aqueduct Intertie Project Area (continues on next pages).

Common Name	Scientific Name	Status[1]	Habitat/Occurrence
Lewis's woodpecker	*Melanerpes lewis*	BCC	Breeds May-July eastern slope Coast Ranges, Sierra Nevada, Klamath Mountains, Cascades. Winter migrant in Central Valley. Open oak savannahs, broken deciduous, and coniferous habitats. Observed during Audubon Christmas Count (Audubon 2008).
Loggerhead shrike	*Lanius ludovicianus*	CSC, BCC	Year-round resident. Lays eggs March-May, young become independent July-August. Open-canopied valley foothill woodland, valley foothill riparian, hardwood-conifer, pinyon-juniper, desert riparian. Observed during USGS Breeding Bird Survey Tracy route (Sauer *et al.* 2008) and Audubon Christmas Count (Audubon 2008).
Long-billed curlew	*Numenius americanus*	WL, BCC	Early July-early April. Estuarine, grassland, wet meadows, cropland, salt ponds. Observed during Audubon Christmas County (Audubon 2008).
Long-eared owl	*Asio otus*	CSC	Year-round resident or winter visitor. Breeds early March-late July. Riparian habitat required; also uses live oak thickets and other dense stands of trees.
Mallard	*Anas platyrhynchos*	GBBDC	Year-round resident. Nest late February-June (peak in early April). Young fly 40-60 days after hatching. Fresh emergent wetlands, estuarine, lacustrine, and riverine habitats, ponds, pastures, croplands, and urban parks. Observed during USGS Breeding Bird Survey Tracy route (Sauer *et al.* 2008) and Audubon Christmas Count (Audubon 2008).
Merlin	*Falco columbarius*	WL	September-May. Coast, open grassland, savannah, woodland, lacustrine, wetland. 4 observed near Stockton and 2 in East Contra Costa County (Audubon 2008).
Modesto song sparrow	*Melospiza melodia maillliardi*	CSC	Year-round resident, nesting begins in April. Woody riparian habitat. Observed during USGS Breeding Bird Survey Tracy route (Sauer *et al.* 2008) and Audubon Christmas Count (Audubon 2008).
Mountain plover	*Charadrius montanus*	CSC, BCC	September-March. Wintering habitat consists of sparse, short, grasslands, and plowed fields in the Central Valley.
Northern harrier	*Circus cyaneus*	CSC, BCC	Year-round or winter resident. Breeds April-September. Riparian, wetland, grassland, shrubland, agricultural. Observed during USGS Breeding Bird Survey Tracy route (Sauer *et al.* 2008) and Audubon Christmas Count (Audubon 2008).
Northern pintail	*Anas acuta*	GBBDC	July-April. Lacustrine and estuarine habitats, fresh and saline emergent wetlands, and wet croplands, pastures, grasslands, and meadows. 3,270 observed during Audubon Christmas Count near Stockton and 500 in East Contra Costa County (Audubon 2008).
Nuttall's woodpecker	*Picoides nuttalli*	BCC	Year-round resident. Breeds late March-early July. Low-elevation riparian deciduous and oak habitats. Requires snags and dead limbs for nest excavation. Observed during USGS Breeding Bird Survey Tracy route (Sauer *et al.* 2008) and Audubon Christmas Count (Audubon 2008).
Oak titmouse	*Baeolophus inornatus*	BCC	Year-round resident. Breeds March-June (peak in April-May). Montane hardwood-conifer, montane hardwood, blue, valley, and coastal oak woodlands, and montane and valley foothill riparian habitats Observed during USGS Breeding Bird Survey Tracy route (Sauer *et al.* 2008) and Audubon Christmas Count (Audubon 2008).
Osprey	*Pandion haliaetus*	WL	Year-round resident or summer visitor. Breeds March-September. Observed during Audubon Christmas Count (Audubon 2008).

[1] Status definitions are on p. 7.

Table 1 (continued). Special-Status Avian Species Potentially Occurring in the Delta-Mendota Canal/California Aqueduct Intertie Project Area (continues on next pages).

Common Name	Scientific Name	Status[1]	Habitat/Occurrence
Prairie falcon	*Falco mexicanus*	WL, BCC	Year-round resident. Breeds mid-February-mid-September (peak in April-early August). Shrubland and grassland. Requires sheltered cliff ledges for cover. Observed during USGS Breeding Bird Survey Tracy route (Sauer *et al.* 2008) and Audubon Christmas Count (Audubon 2008).
Redhead	*Aythya americana*	CSC, GBBDC	Winter or year-round resident. Breeds April-August. Nests in fresh emergent wetland bordering open water. 2 observed during Audubon Christmas Count near Stockton (Audubon 2008).
Ring-necked duck	*Aythya collaris*	GBBDC	September-May. Freshwater lacustrine. 224 observed during Audubon Christmas Count near Stockton and 33 near East Contra Costa County (Audubon 2008).
Sharp-shinned hawk	*Accipiter striatus*	WL	Winters downslope, summers upslope or north of California. Breeds April-August (peak in late May-July). Riparian, ponderosa pine, black oak, deciduous, mixed conifer. 8 observed near Stockton and 3 in East Contra Costa County (Audubon 2008).
Short-eared owl	*Asio flammeus*	CSC, BCC	Winter or year-round resident. Breeds early March-July. Grasslands, dunes, meadows, irrigated lands, saline and freshwater emergent wetlands. Observed during Audubon Christmas Count (Audubon 2008).
Snowy egret	*Egretta thula*	USBCW	Year-round resident. Breeds late April-late August. Estuarine, fresh and saline emergent wetlands, ponds, lacustrine, irrigation ditches, croplands, pastures, salt ponds, riverine. 111 observed near Stockton and 18 near East Contra Costa County (Audubon 2008).
Swainson's hawk	*Buteo swainsoni*	CT,BCC	March-October. Breeds late March-late August. Riparian, wetlands, grassland, agricultural. Observed during USGS Breeding Bird Survey Tracy route (Sauer *et al.* 2008).
Tricolored blackbird	*Agelaius tricolor*	CSC, BCC	Year-round resident. Breeds mid-April-late July. Riparian, wetlands, ponds, grasslands, croplands. Observed during Audubon Christmas Count (Audubon 2008).
Western burrowing owl	*Athene cunicularia hypugea*	CSC, BCC	Year-round resident. Breeds March-August with peak April-May. Grasslands. Nests in small mammal burrows. Observed during USGS Breeding Bird Survey Tracy route (Sauer *et al.* 2008) and Audubon Christmas Count (Audubon 2008).
Western grebe	*Aechmophorus occidentalis*	BCC/c, CSC/c	Winters October-May along coast, estuaries, and large inland lakes at low elevations. Breeds May-September on large marshy lakes (e.g., Sacramento River NWR, Lake Havasu, Salton Sea, Goose Lake, Sweetwater Reservoir). Prefer large, open waters for courtship, feeding, and flocking, and frequent extensive beds of tall, emergent vegetation such as tules or cattails for nesting, but some nests reported in open water or on shore. Observed during Audubon Christmas Count (Audubon 2008).
White-tailed kite	*Elanus leucurus*	CFP	Year-round resident. Breeds February-October with peak May-August. Open grassland, open woodland, agriculture, emergent wetland. Observed during USGS Breeding Bird Survey Tracy route (Sauer *et al.* 2008) and Audubon Christmas Count (Audubon 2008).

[1] Status definitions are on p. 7.

Table 1 (continued). Special-Status Avian Species Potentially Occurring in the Delta-Mendota Canal/California Aqueduct Intertie Project Area.

Common Name	Scientific Name	Status[1]	Habitat/Occurrence
Wood duck	*Aix sponsa*	GBBDC	Year-round resident or winter migrant. Breeds April-August. Lacustrine, slow-moving riverine, and emergent wetland habitats bordered by willows, cottonwoods, or oaks. Nests in cavities in trees, pileated wood pecker nest-cavities, or old, rotted flicker cavities near water. 21 observed during Audubon Christmas Count near Stockton (Audubon 2008).
Yellow-billed magpie	*Pica nuttalli*	BCC	California Central Valley and Central Coast ranges endemic. Year-round resident. Breeds late February-mid July (peak in May-June). Valley foothill hardwood, valley foothill hardwood-conifer, valley foothill riparian, orchard, vineyard, cropland, pasture, and urban habitats. Population numbers have dropped by 49% over two years since the West-Nile virus was established in California in 2004 (Crosbie *et al.* 2008). Frequently observed during USGS Breeding Bird Survey Tracy route (Sauer et al. 2008) and Audubon Christmas Count (Audubon 2008).

Sources: (Zeiner *et al.* 1988-1990; Sauer *et al.* 2008; National Audubon Society [Audubon] 2008; CDFG 2009).

[1] STATUS

State

CE = California Endangered
CT = California Threatened
CFP = California Fully Protected Species
CPD = California Proposed Delisting
CSC = California Species of Special Concern
WL = California Department of Fish and Game Watch List
CSC/c = recommended to be added to the list of California Species of Special Concern (Ivey 2004)

Federal

FE = Federal Endangered
FT = Federal Threatened
FC = Federal Candidate
FPD = Federal Proposed Delisting
BGE = Bald and Golden Eagle Protection Act
BCC = Bird of Conservation Concern at the national or regional scale (Service 2008)
BCC/c = recommended to be added to the Service's Birds of Conservation Concern list (Ivey 2004)
GBBDC = Game Bird Below Desired Condition (Service Bird of Management Concern)
USBCW = United States Bird Conservation Watch List (Partners in Flight Watch List, the United States Shorebird Conservation Plan Watch List, and the Waterbird Conservation for the Americas Watch List)
-- = No special-status but protected by the Migratory Bird Treaty Act.

listing under the California Endangered Species Act (CESA); 3) a California Fully Protected Species; 4) a California Species of Special Concern or on the CDFG Watch List; 5) protected under the Bald and Golden Eagle Protection Act; 6) listed by the Service as a Bird of Management Concern under the Migratory Bird Treaty Act (50 CFR 10.13) (*e.g.*, Bird of Conservation Concern at the national or regional level or a Game Bird Below Desired Condition [Service 2008]); or 8) on the United States Bird Conservation Watch List (*e.g.*, Partners in Flight Watch List, the United States Shorebird Conservation Plan Watch List, and the Waterbird Conservation for the Americas Watch List). Common migratory bird species are those that are protected by the Migratory Bird Treaty Act, but are not special-status bird species as defined above.

The 4.5-mile long 69-kV transmission line currently proposed in the March 2009 Administrative Draft EIS (Reclamation 2009) could result in additional impacts to migratory birds and bats that were not identified in the April 2005 FWCA report (Service 2005) and December 2004 EA/IS (Reclamation 2004). The Avian Power Line Interaction Committee [APLIC] reports, "Of the 31 species of diurnal raptors and 19 species of owls that regularly breed in North America, 29 have been reported as electrocution victims. Electrocutions have also been reported in over 30 non-raptor North American species, including crows, ravens, magpies, jays, storks, herons, egrets, pelicans, gulls, woodpeckers, sparrows, kingbirds, thrushes, starlings, pigeons and others (p. 24, APLIC 2006)." Raptors, particularly golden eagles, bald eagles, red-tailed hawks, ferruginous hawks, Swainson's hawks, rough-legged hawks, and great horned owls, having the highest incidence of electrocution (APLIC 2006). PacificCorp (unpubl. data) reported 103 avian electrocutions during systematic line surveys in southern Oregon and northern California in 2004 and 2005; 37 percent of the avian mortalities were red-tailed hawks, 5 percent were golden eagles, 5 percent were bald eagles, and 2 percent were magpies (APLIC 2006). Electrocution has been documented as the cause of death in 16 percent of golden eagles radio-tagged and recovered from 1994-1997 in California (Predatory Bird Research Group 1999).

Migratory birds are also frequently killed by colliding with transmission lines. These collisions typically occur in foggy and windy conditions and result in mortality (Tacha *et al.* 1978, Lewis 1974, Nesbitt and Gilbert 1976, Littlefield and Ivey 2000). Conservative estimates report tens of thousands of avian fatalities in the United States per year due to collisions with transmission lines (Manville 2000). However, another report estimates, based on bird collisions data from the Netherlands (Koops 1987), as many as 130 million to 170 million birds are killed in the United States each year due to colliding with transmission lines (National Wind Coordinating Committee 2001). The risk of collision is highest for waterfowl and waterbirds (*e.g.*, ducks, geese, herons and cranes) due to their inability to quickly maneuver around the lines (National Wind Coordinating Committee 2001). Collisions occur most often in areas where a transmission line intersects bird breeding and feeding areas, such as water bodies or wetlands. In upland habitats, passerines and raptors are most susceptible to collisions (National Wind Coordinating Committee 2001).

In the Proposed Action, waterfowl, waterbirds, raptors, and passerines, would all be at risk of colliding with the transmission line due to its proposed location adjacent to aquatic (canal) and upland (annual grassland) habitat. Greater sandhill crane collisions with power lines have been reported by several authors (Pogson and Lindstedt 1988, Tacha *et al.* 1978, Walkinshaw 1956, Drewien 1973, Lewis 1974, Nesbitt and Gilbert 1976, California Energy Commission 1995). Collisions with power lines accounted for 37 percent of the observed sandhill crane mortality in the study population (Drewien 1973). Power line collisions seem to be the largest source of

unnatural mortality for California's Central Valley sandhill crane population (Pogson and Lindstedt 1988). In one collision incident in Texas (*i.e.*, one day), 52 sandhill cranes were found dead or dying from impacts with distribution lines (Tacha *et al.* 1978). At Modoc National Wildlife Refuge in northeastern California, 22 sandhill cranes are known to have been killed in a single day (CDFG 1994). With the use of power line markers (particularly bright orange spheres), power line mortalities have been virtually eliminated at some crane high-use areas in Oregon, Colorado, New Mexico, Wyoming, and the Modoc National Wildlife Refuge (CDFG 1994). However, it is not known how successful the power line markers are in preventing or reducing power line mortalities for other bird species.

Inclusion of the Proposed Action in the Revised Operations Criteria and Plan (OCAP) Biological Opinions

The Intertie project was included in the 2008 Operating Criteria and Plan (OCAP) Biological Assessment, which addresses system-wide operations for Central Valley Project (CVP) and State Water Project (SWP) facilities. To ensure consistency between NEPA and ESA analysis for the Intertie, modeling assumptions for the Intertie analysis in the EIS were based on modeling assumptions used in the OCAP. The subsequent biological opinions issued by the Service and NOAA Fisheries include operational constraints that affect how and when the Intertie is operated. The analysis contained in the EIS includes the maximum effects of operating the Intertie (*i.e.*, no OCAP restrictions). It is likely that the actual effects of the Intertie will be less because of the OCAP operational constraints that will be in place.

Additional Recommendations

The Service initially provided recommendations in the April 2005 FWCA report (Service 2005) for avoiding, minimizing, and compensating for impacts to fish and wildlife resources from the Proposed Action. The additional recommendations below are intended to supplement the Service's recommendations in the April 2005 FWCA report.

1. Incorporate the avoidance and minimization measures identified for migratory birds in the March 2009 Administrative Draft EIS (Reclamation 2009).
2. Minimize impacts to annual grassland habitat that is temporarily disturbed by reseeding with native grasses and forbs only.
3. Compensate for permanent impacts to 1.4 acres of annual grassland habitat (and temporary impacts as a result of the project including maintenance and operation of the transmission line) by restoring a minimum of 1.4 acres of agricultural fields to native grassland near the project area.
4. Minimize the impacts of light pollution on migratory birds and bats (Fure 2006) by following the measures proposed in the March 2009 Administrative Draft EIS (Reclamation 2009) and below:
    a. Avoid illuminating bat roosting areas (*e.g.*, suitable crevices in overcrossings along canals).
    b. Use low-pressure sodium lamps instead of high-pressure sodium or mercury lamps; fit mercury lamps with UV filters.
    c. Maintain the brightness as low as possible (less than 2000 lumens (150 watts) are generally needed for security lights).
    d. Limit the times during which the lighting can be used to provide some dark periods.

e. Direct the lighting to where it is needed to avoid light spillage; minimize upward lighting to avoid light pollution; limit the height of lighting columns to 26 feet; use plantings to screen out light.
f. Enhance bat roosting habitat by installing bat boxes away from artificial light sources.
g. Minimize the impacts of the project on bat foraging by restricting the use of insecticides.

5. Minimize the impacts of the proposed 4.5-mile long 69-kV transmission line on migratory birds and bats by placing the transmission line underground. If this is not feasible or would result in significant impacts to federally- or State-listed species (ESA or CESA), then follow the recommendations and suggested practices in the power line guidelines published by the Avian Power Line Interaction Committee (APLIC) and the Service to minimize impacts from existing facilities and in the construction of new utility and energy systems and associated infrastructure (APLIC 1994, 1996, and 2006; APLIC and Service 2005).
    a. Develop an Avian Protection Plan that minimizes the risk of electrocution, collision, and nest disturbance for migratory birds (APLIC and Service 2005).
    b. Use a horizontal and vertical separation between energized and/or grounded parts that allows sufficient clearance for wrist-to-wrist (flesh-to-flesh) and head-to-foot (flesh-to-flesh) clearance for the largest migratory birds in the project area. The standard 60 inches of horizontal separation and 40-48 inches of vertical separation between energized and/or grounded parts are generally recommended for eagles but may not be sufficient for wading birds, white pelicans, and California condors, which have a larger height and greater wingspan (APLIC 2006). In particular areas (*i.e.* areas with concentrations of wading birds and pelicans), vertical separation may need to be increased to 65 inches, and horizontal separation may need to be increased to 120 inches (APLIC 2006).
    c. Cover exposed grounded or energized parts to prevent avian contact.
    d. Minimize the risk of collision by removing the overhead ground wire, or marking the line to increase visibility (*e.g.*, marker balls, swinger markers, or bird flight diverters).
    e. Monitor and report to the Service and CDFG any bird mortalities associated with the transmission line. Retrofit or modify power poles where a protected bird has died. Modifications should be in accordance with APLIC guidelines.
    f. Inventory and monitor bird populations and habitats, as appropriate and feasible, to facilitate decisions about the need for, and effectiveness of, conservation efforts.
    g. The Avian Protection Plan should also include measures to minimize the negative effects of increasing artificial perches for raptors in areas containing sensitive prey species (*e.g.*, California red-legged frog, California tiger salamander, western spadefoot toad, coast horned lizard, and western burrowing owl). Monitor the effects of increasing artificial perches for raptors on sensitive prey populations in the area and the effectiveness of measures to prevent increased predation.
    h. Avoid disturbing sensitive habitats (*e.g.*, wetlands) during construction and operation and maintenance within the transmission line right-of-way.
    i. Compensate for the impacts of the transmission line on migratory birds and bats by collaborating with the California Public Utility Commission and funding the retrofitting of existing transmission and distribution lines that have the highest risk of avian and bat mortalities.

6. The Service recommends working toward making the proposed project carbon neutral. Consistent with the Intergovernmental Panel on Climate Change (IPCC) (2007) adaptation strategies/mitigation recommendations, the Service recommends compensating for the proposed project's carbon footprint (1,726.13 metric tons of carbon dioxide) by purchasing carbon offsets. Alternatively, carbon offsets could be achieved through implementation of recommendation # 3 above (sequester carbon by converting tilled agricultural fields near the project area to native grasslands).
7. Continue to include in all of the project alternatives the new rules for OCAP identified in the Service's and NOAA Fisheries' revised biological opinions.
8. Consult with the Service under ESA for impacts to federally-listed species (*e.g.*, California red-legged frog, California tiger salamander, San Joaquin kit fox, longhorn fairy shrimp, vernal pool fairy shrimp, and vernal pool tadpole shrimp).
9. Consult with CDFG under CESA and the California Environmental Quality Act (CEQA) for impacts to State-listed and Fully Protected species and Species of Special Concern.
10. Consult with the Service under the Bald and Golden Eagle Protection Act for impacts to the bald eagle and golden eagle from the transmission line and habitat disturbance. Consult with CDFG under CESA for impacts to the State-listed endangered and Fully Protected bald eagle and the Fully Protected golden eagle.

Any questions or comments regarding this report should be directed to Mark Littlefield or Joseph Terry at (916) 414-6600.

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REFERENCES

Avian Power Line Interaction Committee (APLIC). 1994. Mitigating bird collisions with power lines: the state of the art in 1994. Edison Electric Institute. Washington, D.C.

Avian Power Line Interaction Committee (APLIC). 1996. Suggested practices for raptor protection on power lines: the state of the art in 1996. Edison Electric Institute/Raptor Research Foundation. Washington, D.C. 125 pp.

Avian Power Line Interaction Committee (APLIC). 2006. Suggested practices for avian protection on power lines: the state of the art in 2006. Edison Electric Institute, Avian Power Line Interaction Committee, and the California Energy Commission. Washington, D.C., and Sacramento, CA. Accessed on January 9, 2009, from http://www.aplic.org/SuggestedPractices2006(LR-2watermark).pdf

Avian Power Line Interaction Committee (APLIC) and U.S. Fish and Wildlife Service (Service). 2005. Avian Protection Plan (APP) Guidelines. April 2005. Washington, D.C. 88 pp.

California Department of Fish and Game (CDFG). 1994. 5-Year Status Review: Greater Sandhill Crane (*Grus canadensis tabida*). CDFG Wildlife Division, Nongame Bird and Mammal Program. Sacramento, California.

California Department of Fish and Game (CDFG). 2009. California Natural Diversity Database (CNDDB). Version 3.1.1. March 2009.

California Energy Commission. 1995. Avian Collision and Electrocution: An Annotated Bibliography. Publ. No. P700-95-001. Sacramento, CA.

Central Valley Joint Venture. 2006. Central Valley Joint Venture Implementation Plan–Conserving Bird Habitat. U.S. Fish and Wildlife Service, Sacramento, CA. Accessed on January 7, 2009, from http://www.centralvalleyjointventure.org/materials/CVJV_fnl.pdf

Crosbie, S.P, W.D. Koenig, W.K. Reisen, V.L. Kramer, L. Marcus, R. Carney, E. Pandolfino, G.M. Bolen, L.R. Crosbie, D.A. Bell, and H.B. Ernest. 2008. Early impact of West Nile Virus on the Yellow-billed Magpie (*Pica nuttalli*). The Auk 125(3):542-550.

Drewien, R. 1973. Ecology of Rocky Mountain greater sandhill cranes. Dissertation. Univ. of Idaho, Moscow. 82 pp.

Fure, A. 2006. Bats and lighting. The London Naturalist. 85:1-20. Accessed on April 6, 2009, from http://www.furesfen.co.uk/bats_and_lighting.pdf

Intergovernmental Panel on Climate Change (IPCC). 2007. Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Core Writing Team, R.K. Pachauri and A. Reisinger (eds.). IPCC, Geneva, Switzerland, 104 pp. Accessed on February 3, 2009 from http://www.ipcc.ch/ipccreports/ar4-syr.htm.

Koops, F.B.J. 1987. Collision victims of high-tension lines in the Netherlands and effects of marking. KRMA Report 01282-MOB 86-3048.

Lewis, J.C. 1974. Ecology of the sandhill crane in the southeastern central flyway. Dissertation. Oklahoma State University, Stillwater. 214 pp.

Littlefield, C.D., and G.L. Ivey. 2000. Conservation assessment for Greater Sandhill Cranes wintering on the Cosumnes River Floodplain and Delta Regional of California. The Nature Conservancy.

Manville, A. 2000. Briefing statement published on the World Wide Web dated April 7, 2000. U.S. Fish and Wildlife Service.

National Audubon Society (Audubon). 2008. The Christmas Bird Count Historical Results [Online]. Stockton and East Contra Costa County Count Circles. Accessed on April 6, 2009, from http://www.audubon.org/bird/cbc

National Wind Coordinating Committee. 2001. Avian Collisions with Wind Turbines: A Summary of Existing Studies and Comparisons to Other Sources of Avian Collision Mortality in the United States. National Wind Coordinating Committee, Washington, D.C. Accessed on April 16, 2009, from http://www.nationalwind.org/publications/wildlife/avian_collisions.pdf

Nesbitt, S.A. and D.T. Gilbert. 1976. Powerlines and fences: hazards to birds. Florida Naturalist 49(2):23.

PacifiCorp. 2005. Unpubl. data.

Pogson, T.H., and S.M. Lindstedt. 1988. Abundance, distribution, and habitat of Central Valley Population Greater Sandhill Cranes during winter. Unpublished report. Biology and Wildlife, University of Alaska, Fairbanks.

Predatory Bird Research Group. 1999. A population study of golden eagles in the Altamont Pass Wind Resource Area: Population trend analysis 1994-1997. National Renewable Energy Laboratory, Golden, CO.

Sauer, J.R., J.E. Hines, and J. Fallon. 2008. The North American Breeding Bird Survey, Results and Analysis 1966 - 2007. Version 5.15.2008. Tracy Route. U.S. Cited with permission. Accessed on April 6, 2009, from http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

Shuford, D.W., G.W. Page, and J.E. Kelmyr. 1998. Patterns and dynamics of shorebird use of California's Central Valley. The Condor 100:227-244.

Tacha, T.D., D.C. Martin, and C.G. Endicott. 1978. Mortality of sandhill cranes associated with utility highlines. Pages 175-176 in: J.C. Lewis, ed. Proceedings of 2nd crane workshop, Rockport, Texas. National Audubon Society. Colorado State University Printing Service, Ft. Collins, Colorado.

U.S. Bureau of Reclamation (Reclamation). 2004. Delta-Mendota Canal/California Aqueduct Intertie Environmental Assessment/Initial Study. December. U.S. Bureau of Reclamation, Sacramento, California.

U.S. Bureau of Reclamation (Reclamation). 2009. Administrative Draft Delta-Mendota Canal/California Aqueduct Intertie Environmental Impact Statement. March. U.S. Bureau of Reclamation, Sacramento, California.

U.S. Fish and Wildlife Service (Service). 2005. Fish and Wildlife Coordination Act Report for Delta-Mendota Canal/California Aqueduct Intertie Project. April. Sacramento Fish and Wildlife Office, Sacramento, California.

U.S. Fish and Wildlife Service (Service). 2007. National Bald Eagle Management Guidelines. May 2007. Service. Washington, DC. Accessed on January 31, 2008, from http://www.fws.gov/migratorybirds/issues/BaldEagle/NationalBaldEagleManagementGuidelines.pdf

U.S. Fish and Wildlife Service (Service). 2008. Birds of Conservation Concern 2008. December 2008. U.S. Fish and Wildlife Service. Division of Migratory Bird Management. Arlington, Virginia.

Walkinshaw, L.H. 1956. Sandhill cranes killed by flying into power line. Wilson Bulletin 68(4):325-326.

Zeiner, D.C., W.F. Laudenslayer, Jr., K.E. Mayer, and M. White, eds. 1988-1990. California's Wildlife. Vol. I-III. California Department of Fish and Game, Sacramento, California.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825-1846

In reply refer to:

Memorandum

APR 26 2005

To: Regional Director, U.S. Bureau of Reclamation, Sacramento, California

From: Acting Field Supervisor, Sacramento Fish and Wildlife Office, Sacramento, California

Subject: Fish and Wildlife Coordination Act Report for the Delta-Mendota Canal/California Aqueduct Intertie Project: Bureau of Reclamation and Delta-Mendota Canal Authority

This memorandum transmits the Fish and Wildlife Service's Fish and Wildlife Coordination Act Report for the Delta-Mendota Canal/California Aqueduct Intertie Project. This report has been coordinated with California Department of Fish and Game and National Oceanic and Atmospheric Administration National Marine Fisheries Service. The project's effects on federally listed species, pursuant to section 7 of the Endangered Species Act of 1973, as amended, was completed on February 15, 2005 and is attached.

If you have any questions, please contact John Brooks at (916) 414-6726 or Ryan Olah at (916) 414-6625.

Attachment

cc:
CNO, Sacramento, California
Brian Kinnear, NMFS, Sacramento, California
Gary Hobgood, CDFG, Rancho Cordova, California

United States Department of the Interior
Fish and Wildlife Service

Fish and Wildlife Coordination Act Report

Delta-Mendota Canal/California Aqueduct Intertie Project

Bureau of Reclamation and San Luis & Delta-Mendota Water Authority

Sacramento Fish and Wildlife Office
Sacramento, California

April 2005

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INTRODUCTION

This document constitutes the U. S. Fish and Wildlife Service's (Service) Fish and Wildlife Coordination Act (FWCA) Report (Report) to the U.S. Bureau of Reclamation (Reclamation) for the Delta-Mendota Canal/California Aqueduct Intertie Project (Project). The FWCA requires Federal agencies to consult with the Service before undertaking or approving projects carried out under Federal permits and licenses that control or modify any bodies of water for any purpose, and that fish and wildlife resources receive equal consideration and be coordinated with other features of the projects. The purpose of FWCA consultation is to conserve fish and wildlife resources by preventing their loss or damage, and by developing and improving these resources. The Report addresses expected beneficial and adverse effects on fish and wildlife resources due to project alternatives, and provides recommendations for implementing the Project.

The San Luis and Delta-Mendota Water Authority is the State lead agency and Reclamation is the Federal lead agency for the Project, pursuant to the California Environmental Quality Act and the National Environmental Policy Act (NEPA), respectively. The Project purposes in Reclamation's May 2004 administrative draft Environmental Assessment/Initial Study (EA/IS) include:

- avoid the Delta-Mendota Canal (DMC) conveyance constriction that reduces the Tracy Pumping Plant's permitted 4,600 cubic feet per second (cfs) Sacramento-San Joaquin River Delta (Delta) pumping capacity to 4,200 cfs,
- help provide unmet Central Valley Project (CVP) water supply demands south of the Delta, and
- provide system flexibility should conveyance capacities be reduced either upstream on the DMC or downstream on the California Aqueduct.

Information provided by Reclamation addresses both constructing and operating the proposed project and describes terrestrial resource conservation measures. Reclamation has stated that implementing the proposed action would improve CVP capability to provide contract water deliveries south of the Delta while meeting water quality requirements and fishery pumping limitations.

This Report:

- assesses project alternatives (fish and wildlife conservation perspective),
- analyzes fish and wildlife effects (project construction and use), and
- recommends measures to avoid, minimize, and compensate for direct, indirect, and cumulative impacts

This Report incorporates the Service's findings pursuant to the Endangered Species Act of 1973 as amended, contained in a memorandum dated February 15, 2005 (Attached). In the Service's February 15, 2005, memorandum, the Service concurred that project construction is not likely to adversely affect the red-legged frog and San Joaquin kit fox, because these species are not likely

to be present in the project area and the Project's proposed avoidance measures will further avoid impacts to the species and their habitats. These avoidance measures include barrier fencing between potential frog habitat and project site and maintaining a San Joaquin kit fox migration corridor during and after construction. Furthermore, to avoid adversely affecting the delta smelt, the project would operate under parameters described in the Operational Criteria and Plan (OCAP) Biological Opinion.

SERVICE MITIGATION POLICY

The Mitigation Policy provides Service personnel with guidance in making recommendations to protect or conserve fish and wildlife resources. The policy helps ensure consistent and effective Service recommendations, while allowing agencies and developers to anticipate Service recommendations and plan early for mitigation needs. The intent of the policy is to ensure protection and conservation of the most important and valuable fish and wildlife resources, while allowing reasonable and balanced use of the Nation's natural resources.

Under the Mitigation Policy, resources are assigned to one of four distinct Resource Categories, each having a mitigation planning goal which is consistent with the fish and wildlife values involved. The Resource Categories cover a range of habitat values from those considered to be unique and irreplaceable to those believed to be much more common and of relatively lesser value to fish and wildlife. The Mitigation Policy does not apply to threatened and endangered species, Service recommendations for completed Federal projects or projects permitted or licensed prior to enactment of Service authorities, or Service recommendations related to the enhancement of fish and wildlife resources.

In applying the Mitigation Policy during an impact assessment, the Service first identifies each specific habitat or cover-type that may be impacted by the project. Evaluation species which utilize each habitat or cover-type are then selected for Resource Category analysis. Selection of evaluation species can be based on several rationale, as follows: (1) species known to be sensitive to specific land- and water-use actions; (2) species that play a key role in nutrient cycling or energy flow; (3) species that utilize a common environmental resource; or (4) species that are associated with Important Resource Problems, such as anadromous fish and migratory birds, as designated by the Director or Regional Directors of the Fish and Wildlife Service. Based on the relative importance of each specific habitat to its selected evaluation species, and the habitat's relative abundance, the appropriate Resource Category and associated mitigation planning goal are determined.

Mitigation planning goals range from "no loss of existing habitat value" (i.e., Resource Category 1) to "minimize loss of habitat value while minimizing loss" (i.e., Resource Category 4). The planning goal of Resource Category 3 (Table 1) is "no net loss of habitat value while minimizing loss of in-kind habitat value."

Table 1. Summary of Resource Categories, Designation Criteria and Mitigation Planning Goals under the Service Mitigation Policy.

Resource Category	Designation Criteria	Mitigation Planning Goal
1	High value for evaluation species and unique and irreplaceable	No loss of existing habitat value
2	High value for evaluation species and scarce or becoming scarce	No net loss of in-kind habitat value
3	High to medium value for evaluation species and abundant	No net loss of habitat value while minimizing loss of in-kind habitat value
4	Medium to low value for evaluation species	Minimize loss of habitat value

In addition to mitigation planning goals based on habitat values, Region 1 of the Service, which includes California, has a mitigation planning goal of no net loss of acreage for wetland habitat. This goal is applied in all impact analyses.

In recommending mitigation for adverse impacts to fish and wildlife habitat, the Service uses the same sequential mitigation steps recommended in the Council on Environmental Quality's regulations. These mitigation steps (in order of preference) are: avoidance, minimizing, rectification measures, measures to reduce or eliminate impacts over time, and compensation.

BACKGROUND

Westlands Water District (WWD) and Reclamation studied an intertie connecting the DMC and California Aqueduct in 1989. The study included a 600 cfs capacity pumping plant on the DMC with a pipeline connector to the California Aqueduct. WWD withdrew its support for the project and the project was discontinued. In the spring of 2001, the California Aqueduct's canal lining was damaged and needed repair. Because of the damage and necessary repairs, flows in the California Aqueduct were interrupted. In order to continue water deliveries during the emergency, flows were transferred from the DMC to the California Aqueduct. This was accomplished through the installation of an emergency pump station and a connector pipeline from the DMC at milepost 7.69 to the California Aqueduct. The temporary facility operated for about 30 days before its removal.

The Service has been a participant in this project since early 2002. The Service participated in the "Value Planning Study (dated September 9, 2002), attended a site visit, and submitted a Planning Aid Memorandum (dated February 3, 2003). The EA/IS incorporated the Service's recommendations regarding measures to avoid and minimize impacts to fish and wildlife resources and their habitat.

PROJECT AREA

The proposed DMC-California Aqueduct Intertie project site is located in Alameda County due west of the City of Tracy and north of the Highway 205/580 interchange between the DMC and California Aqueduct alignments (Figures 1, 2 and 3). A 500-foot-long buried pipeline would connect the two canals. A pumping plant adjacent to the DMC would provide the ability to divert up to 400 cfs from the DMC to the California Aqueduct.

PROJECT DESCRIPTION

The alternatives target avoiding a DMC conveyance design constriction that reduces the Tracy Pumping Plant capacity from the permitted 4,600 cfs to 4,200 cfs. Project use would help provide unmet CVP water supply demands south of the Delta. Reclamation evaluated a No Action alternative and five action alternatives in their NEPA document, with Alternative 2 identified as the Proposed Action. Alternatives 3, 4, and 5 would meet the project need, but were not selected due to safety, cost, and/or permit concerns. Alternative 2 proposes a pump station and a 500-foot-long pipeline connection (Intertie) from milepost 7.2 on the DMC to milepost 9.1 on the California Aqueduct. Up to 400 cfs could be transferred from the DMC to the California Aqueduct for delivery south of the Delta. The Intertie design also includes reverse operation, utilizing gravity flow, to convey up to 950 cfs from the California Aqueduct to the DMC. The reverse flow option gives the system flexibility should conveyance capacities be reduced either upstream on the DMC or downstream on the California Aqueduct.

As described by Reclamation, using the Intertie would depend on meeting all applicable export pumping restrictions for water quality and fishery protections. The final decision on operations depends on the regulatory constraints from the Water Quality Control Plan Decision 1641 which are included in CVP OCAP. Water quality, fishery, and endangered species constraints would limit Intertie use.

BIOLOGICAL RESOURCES

Aquatic and Wetland Resources

Water resources in the immediate project vicinity include the DMC and California Aqueduct. Aquatic and wetland resources potentially affected by Intertie use include the entire CVP system and the Bay/Delta environment. Based upon observations during the Service's site visit, there are no wetlands or aquatic habitats within the footprint of the proposed construction area. However, there are two wetted areas within 1,000 feet of the project site.

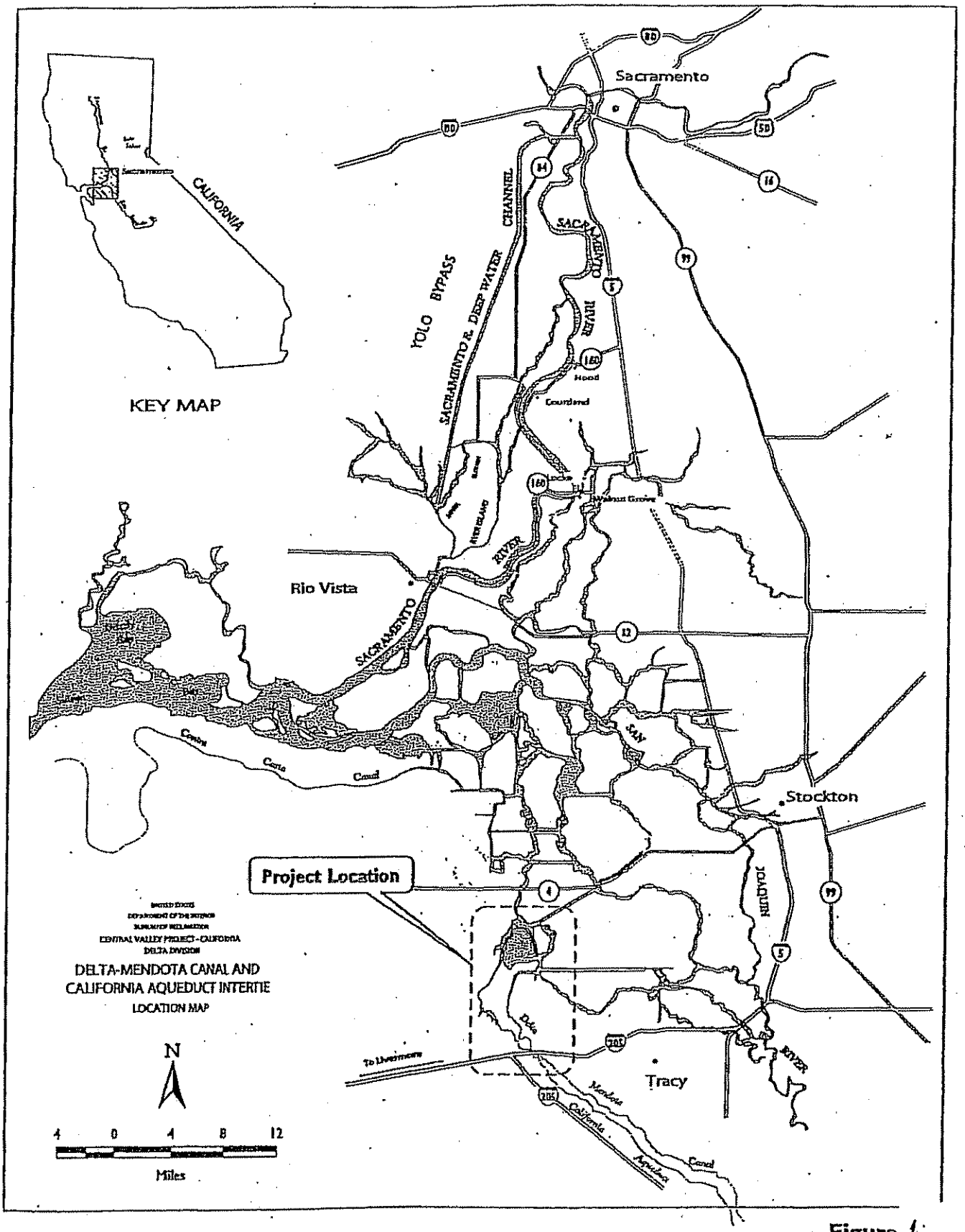

Figure 1
Regional Location Map

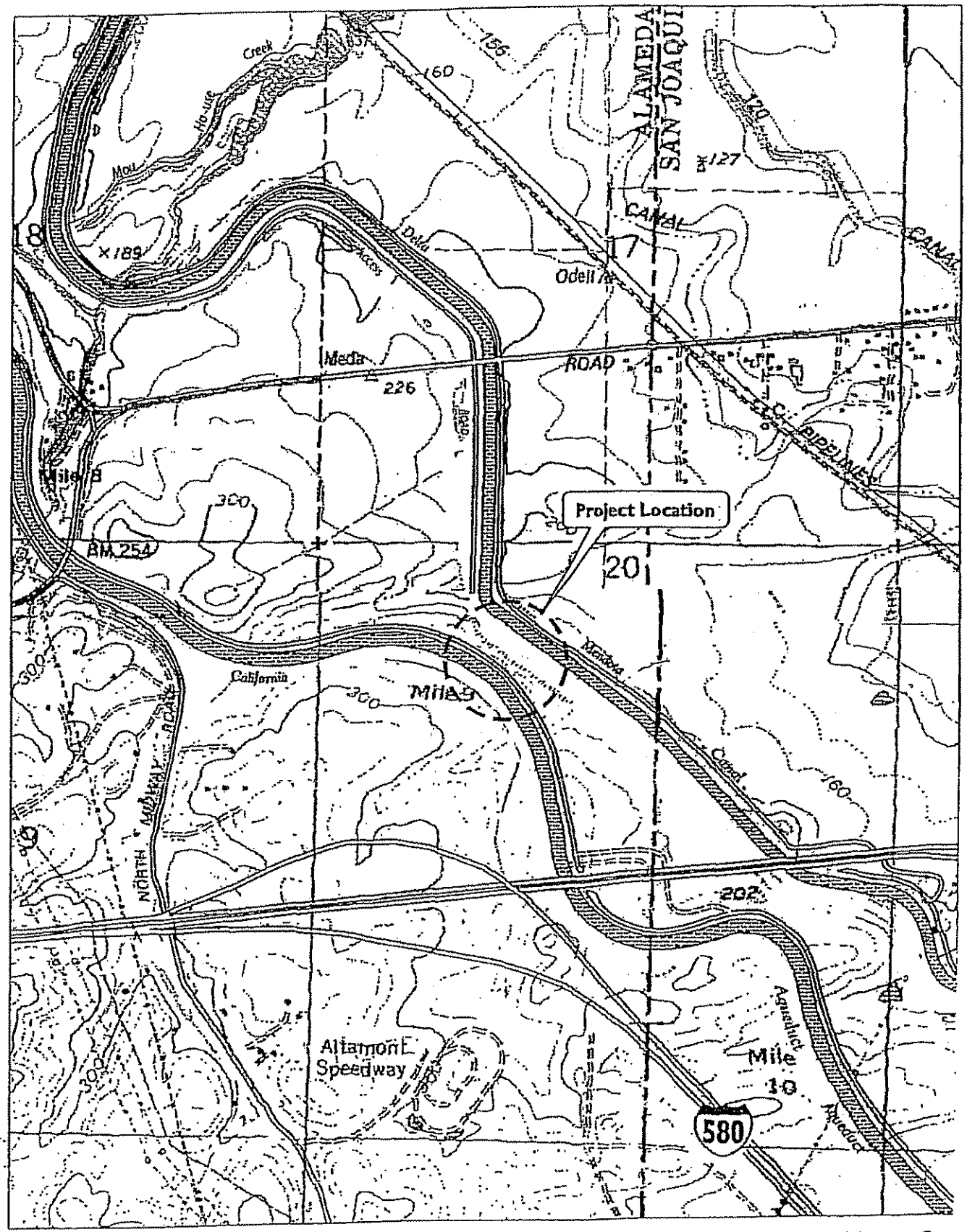

Figure 2
Detailed Location Map

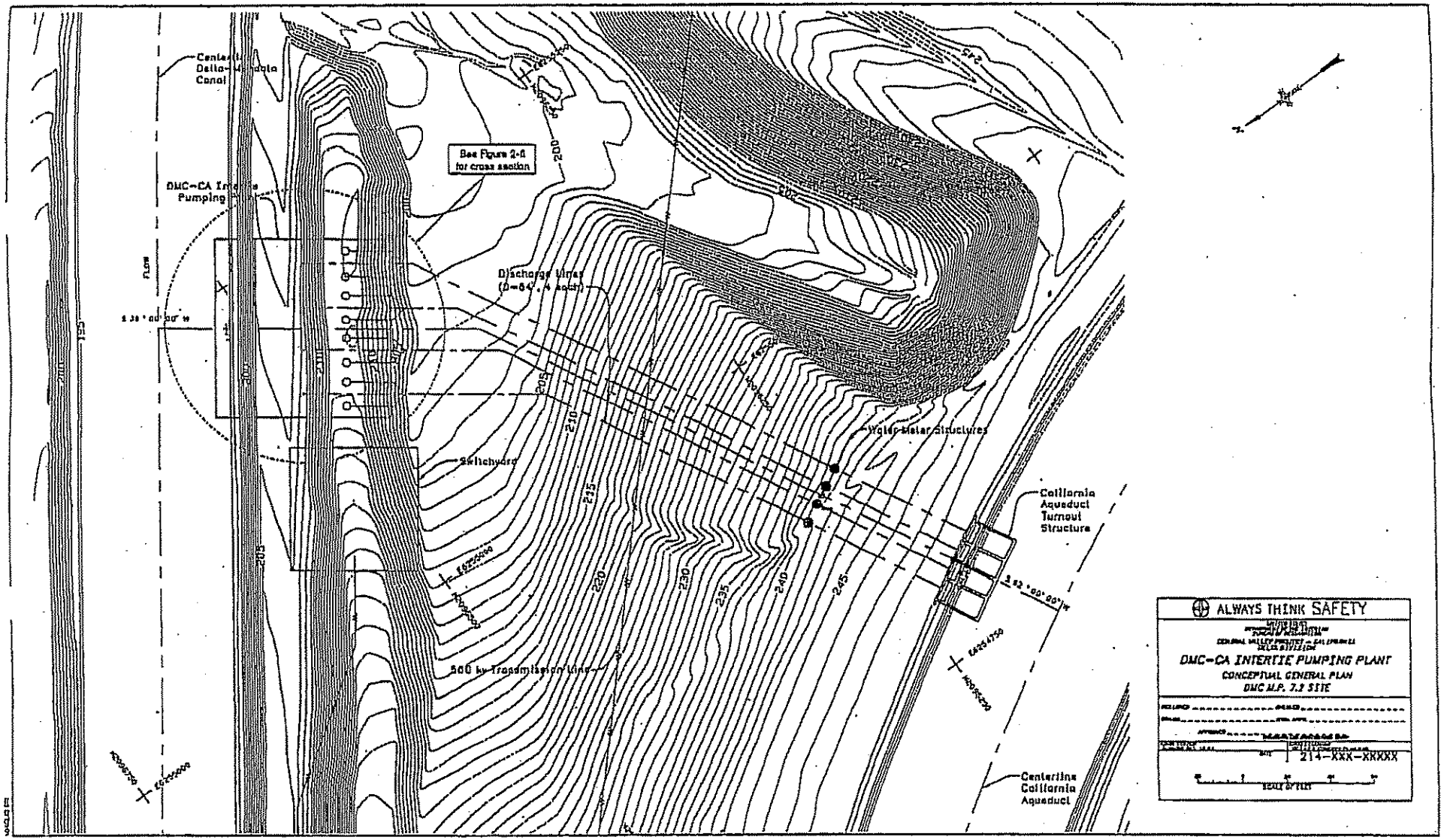

Figure 3
Proposed Action Site Plan

Terrestrial Resources

The affected terrestrial resources include about 5.0 acres of annual grassland. Although grasslands are not regionally scarce, they are being converted to urban and agricultural uses at an alarming rate. Annual grassland is a surrogate for California prairie habitat that now covers less than 1 percent of its historical acreage in the San Joaquin Valley (Moore et al. 1990). Annual grassland communities are dominated by introduced annuals such as oats (*Avena fatua*), soft chess (*Bromus mollis*), ripgut brome (*Bromus rigidus,*), red brome (*Bromus rubens*), barley (*Hordeum spp.*), and foxtail fescue (*Festuca megalura*).

Grasslands support numerous wildlife species including badgers (*Taxidea taxus*), coyotes (*Canis latrans*), blacktailed jackrabbits (*Lepus californicus*) and several species of small mammals. Small mammals provide an important prey base for raptors in the area, including golden eagles (*Aquila chrysaetos*), Swainson's hawks (*Buteo swainsoni*), northern harriers (*Circus cyaneus*), red-tailed hawks (*Buteo jamaicensis*), and white-tailed kites (*Elanus leucurus*). In addition, many birds, such as California horned larks (*Eremophilia alpestris actia*), western burrowing owls (*Athene cunicularia hypugea*) and western meadowlarks (*Sturnella neglecta*) depend on grassland habitats for feeding, foraging, and nesting. The project area also functions as a wildlife migration corridor.

Special Status Species

San Joaquin kit fox (*Vulpes macrotis mutica*) may travel through the project site, but it is unlikely that the area would support a viable population. Red-legged frog (*Rana aurora draytonii*) may occupy the wetted areas near the project site. Biologists will survey the area for kit fox dens or activities and for red-legged frog presence in the wetted areas. CVP-wide aquatic resource evaluations for federally listed species were included in the OCAP Biological Opinion.

PROJECT EFFECTS

Aquatic and Wetland Resources

Reclamation used the CALSIM model to simulate what effect Intertie operations would have on Bay-Delta aquatic resources as compared to existing conditions. Modeling results showed that during some water year types, Intertie operations (i.e. increasing pumping at the Tracy pumping facility from 4,200 cfs to 4,600 cfs) would result in an increase in delta smelt salvage, a shift of delta smelt X2 water quality standards upstream as much as 1 kilometer, and an increase in Chinook salmon entrainment. Although the CALSIM model showed the potential for environmental effects due to Intertie operations, existing pumping constraints at the Tracy Pumping Plant would in practice limit Intertie use during periods of potential effect.

The Service believes the CALSIM results show using the Intertie without existing environmental pumping constraints would result in increased delta smelt and winter-run salmon take. As such, Intertie operations could trigger the need for additional fish protection through pumping

curtailments during some water year types. However, with environmental pumping restrictions applied to the Tracy pumps and Intertie operations, as proposed by Reclamation and OCAP, the effects would be avoided when Delta smelt and Chinook salmon take limits or water quality constraints are reached.

Terrestrial Resources

Project construction would affect about 5.0 acres of annual grassland between the DMC and California Aqueduct. The proposed pumping plant and parking area would permanently impact about 0.5 acre permanently. The remaining 4.5 acres would be used for a staging area and spreading excavated soils. The spreading area is a former disposal site used to spread spoil material from DMC and California Aqueduct construction. Following Intertie construction, the soil spreading area, equipment staging site, and buried pipeline alignment would be replanted.

Special Status Species

The San Joaquin kit fox could use or pass through the project site. Red-legged frogs could occupy wetted areas near the project site. Qualified biologists will survey for species presence prior to construction. Reclamation will provide survey results to the Service and California Department of Fish and Game to determine if additional avoidance measures are needed. Existing project design features to avoid impacts will remain as project actions.

DISCUSSION

We appreciate that Reclamation included the Service in the project's early planning stages and incorporated our recommendations as project components. We believe that incorporating terrestrial resource impact avoidance and compensation measures in the project will avoid potential adverse effects.

Through application of our Mitigation Policy, the Service determined the following mitigation planning goal applies to the proposed project, as represented by the Resource Categories defined on page 3:

- Resource Category 3 for *annual grasslands*. This determination includes grassland open space values and foraging areas provided for species such as Swainson's hawk. The mitigation goal is no net loss of habitat value while minimizing loss of in-kind habitat value.

Direct effects from constructing the pump station, diversion facilities and pipeline could be minimized through implementation of appropriate mitigation measures such as reserving the top 6 inches of soil (along with its seed bank) during trenching operations and ensuring this material is placed on top of any subsoil material during site restoration. This construction method would help ensure a viable seed source and seed bed. By incorporating restoration components into

the proposed project and its design, adverse construction effects would be limited to short-term (less than two growing seasons) and temporary effects.

OCAP Analysis

The OCAP dated July 30, 2004, included the Intertie as a functional project component. The Service's biological opinion on OCAP analyzed the effects to delta smelt due to the Intertie operations.

RECOMMENDATIONS

Proposed revegetation measures following project construction provide some minimization of affects to the San Joaquin kit fox as well as other terrestrial species present on the proposed project site. Direct permanent habitat losses would be limited to the area occupied by the pumping facility.

The Draft EA/IS analysis shows a shift upstream of X2, a delta smelt salvage increase, and a Chinook salmon take increase. Because the Intertie operation will comply with all Delta pumping restrictions, the CALSIM results do not reflect the final Intertie use periods. The Service believes that to accurately determine Intertie use periods the CALSIM model should include all Delta environmental pumping constraints as limits to Intertie use. The Service understands that the Intertie would operate only during periods when adverse environmental effects would not occur.

The Service recommends:

Terrestrial Resources

1. continue to include avoidance and compensation measures as proposed project components.
2. complete red-legged frog and San Joaquin kit fox preconstruction surveys and reinitiate section 7 consultation pursuant to the Endangered Species Act if frogs or kit fox are present in the project area [avoidance measures are described in the EA/IS and evaluated in the Service's February 15, 2005 memorandum (Attached)].

Aquatic Resources

3. continue to comply with all delta pumping constraints under OCAP.

REFERENCES

Moore, S.B., J. Winckel, S.J. Detwiler, S.A. Klasing, P.A. Gaul, N.R. Kanim, B.E. Kesser, A.B. DeBevec, K. Beardsley, and L. K. Puckett. 1990. Fish and Wildlife Resources and Agricultural Drainage in the San Joaquin Valley, California, Volume I and II, San Joaquin Valley Drainage Program, Sacramento, California.

U.S. Bureau of Reclamation. September 9, 2004. Value Planning Final Report on the Delta-Mendota Canal California Aqueduct Intertie.

U.S. Bureau of Reclamation and San Luis & Delta Mendota Water Authority. May 2004. Delta-Mendota Canal/California Aqueduct Intertie, Administrative Draft Environmental Assessment/Initial Study.

U.S. Fish and Wildlife Service. 2004. Biological Opinion on the Central Valley Project Operating Criteria and Plan. Sacramento, California.

U.S. Fish and Wildlife Service. February 3, 2003. Planning Aid Memorandum for the Delta-Mendota Canal/California Aqueduct Intertie Investigation. Sacramento, California.

RECLAMATION
Managing Water in the West

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In reply refer to:

NOV 18 2004

Memorandum

To: Regional Director, U.S. Bureau of Reclamation, Sacramento, California

From: Field Supervisor, Sacramento Fish and Wildlife Office, Sacramento, California

Subject: Draft Fish and Wildlife Coordination Act Report for the Delta-Mendota Canal/California Aqueduct Intertie Project: Bureau of Reclamation and Delta-Mendota Canal Authority

The Fish and Wildlife Service (Service) reviewed the *Draft Environmental Assessment/Initial Study for the Delta-Mendota Canal/California Intertie Project* in Alameda County, California. This memorandum transmits the Service's Draft Fish and Wildlife Coordination Act Report. We submit this Report under the authority of, and in accordance with, the provisions of section 2(b) of the Fish and Wildlife Coordination Act (48 stat. 401, as amended: 16 U.S. C. 661 et seq.). The draft report assesses potential project effects on fish and wildlife resources and provides our recommendations to reduce potential adverse effects. This report has been submitted to California Department of Fish and Game and National Oceanic and Atmospheric Administration National Marine Fisheries Service. The project's effects on federally listed species, pursuant to section 7 of the Endangered Species Act of 1973, as amended, are being addressed separately.

If you have any questions, please contact John Brooks at (916) 414-6726.

Attachment

cc:
AES, Portland, Oregon
Gary Hobgood, CDFG, Rancho Cordova, California
Brian Kinnear, NMFS, Sacramento, California

United States Department of the Interior
Fish and Wildlife Service

Draft Fish and Wildlife Coordination Act Report

Delta-Mendota Canal/California Aqueduct Intertie Project

Bureau of Reclamation and San Luis & Delta-Mendota Water Authority

Sacramento Fish and Wildlife Office
Sacramento, California

November 2004

EXECUTIVE SUMMARY

This document constitutes the U. S. Fish and Wildlife Service's (Service) draft Fish and Wildlife Coordination Act (FWCA) Report (Report) to the U.S. Bureau of Reclamation (Reclamation) for the Delta-Mendota Canal/California Aqueduct Intertie Project (Project). This Report includes recommendations to provide fish and wildlife equal consideration with other Project purposes.

The Project is intended to avoid the Delta-Mendota Canal (DMC) conveyance constriction that reduces the Tracy Pumping Plant permitted 4,600 cubic feet per second (cfs) Sacramento-San Joaquin River Delta (Delta) pumping capability to 4,200 cfs. This improved operational flexibility would help provide unmet Central Valley Project (CVP) water supply demands south of the Delta. The draft Environmental Assessment/Initial Study (EA/IS, Reclamation May 2004) describes a No Action alternative and five action alternatives with Alternative 2 identified as the Proposed Alternative. Alternatives 3, 4, and 5 would meet the Project need, but were not selected due to safety, cost, and/or permit concerns. Alternative 2 proposes a pump station and a 500-foot-long pipeline connection (Intertie) from milepost 7.2 on the DMC to milepost 9.1 on the California Aqueduct. Up to 400 cfs could transfer from the DMC to the California Aqueduct for delivery south of the Delta. The Intertie could operate in reverse, per gravity flow, to convey up to 950 cfs from the California Aqueduct to the DMC. The reverse flow option gives the system flexibility should conveyance capacities be reduced either upstream on the DMC or downstream on the California Aqueduct.

The San Luis & Delta-Mendota Water Authority is the State lead agency and Reclamation is the Federal lead agency for the Project, pursuant to the California Environmental Quality Act and the National Environmental Policy Act (NEPA), respectively. The draft EA/IS describes the proposed alternative's construction and measures to avoid and compensate for potentially adverse terrestrial resource effects. The document describes the Intertie's operations generally and notes that its operation is subject to all applicable export pumping restrictions for water quality and fishery protections. Intertie operations will follow the final CVP Operational Criteria and Plan (OCAP) and OCAP Endangered Species Act, section 7 Biological Opinion (BO). OCAP and its BO identify final Delta water quality targets and fishery restrictions that are in the Water Quality Control Plan Decision 1641 which will be used as limits to Intertie operations. The draft EA/IS analysis shows potential terrestrial and aquatic effects as "less than significant." From the terrestrial resources concern, providing for site revegetation following project construction and maintaining a wildlife migration corridor helps ensure this project's impacts to terrestrial resources are "less than significant." From the aquatic resource perspective, the EA/IS used the CALSIM model to simulate what effects using the Intertie would have on Bay-Delta resources. The results showed that during some years the use of the Intertie increased delta smelt salvage, shifted delta smelt X2 water quality up to 1 kilometer upstream, and increased Chinook salmon entrainment. Although the CALSIM model showed potential environmental effects due to simulated Intertie operations, OCAP and BO operational constraints will limit Intertie operations to meet Delta environmental requirements. However, Intertie operations may trigger fishery protections using the Environmental Water Account sooner during some water year types.

CALSIM results show Delta maximum pumping during periods when potential regulatory restrictions are likely. CALSIM demonstrates the potential effects of Intertie operations compared to existing conditions under NEPA and CEQA analysis. The Service believes that the CALSIM results are a consequence of the simulation and do not represent actual operations during regulatory pumping constraint periods. If we assume Delta restrictions will apply to Intertie use, then the effects will be avoided by not using the Intertie when additional water quality or fishery effects would occur. All existing pumping restrictions for water quality and fishery constraints that will be used to determine Intertie use.

The Service recommends:

Terrestrial Resources

- continue to include avoidance and compensation measures as Proposed Project components.
- request a "concurrence in findings" under the Endangered Species Act consultation requirement prior to issuing a "Finding of No Significant Impact."

Aquatic Resources

- follow all existing pumping constraints to determine Intertie use periods.

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INTRODUCTION

This document constitutes the U. S. Fish and Wildlife Service's (Service) draft Fish and Wildlife Coordination Act (FWCA) Report (Report) to the U.S. Bureau of Reclamation (Reclamation) for the Delta-Mendota Canal/California Aqueduct Intertie Project (Project). The FWCA provides that Federal agencies consult with the Service before undertaking or approving projects carried out under Federal permits and licenses that control or modify any bodies of water for any purpose, and that fish and wildlife resources receive equal consideration and be coordinated with other features of the projects. The purpose of FWCA consultation is to conserve fish and wildlife resources by preventing their loss or damage, and by developing and improving these resources. The Report addresses expected beneficial and adverse effects on fish and wildlife resources due to Project alternatives, and provides recommendations for implementing the Project.

The San Luis and Delta-Mendota Water Authority is the Project's State lead agency and Reclamation is the Federal lead agency for the Project, pursuant to the California Environmental Quality Act and the National Environmental Policy Act, respectively. The Project purposes in Reclamation's May 2004 administrative draft Environmental Assessment/Initial Study (EA/IS) include:

- avoid the Delta-Mendota Canal (DMC) conveyance constriction that reduces the Tracy Pumping Plant's permitted 4,600 cubic feet per second (cfs) Sacramento-San Joaquin River Delta (Delta) pumping capacity to 4,200 cfs.
- help provide unmet Central Valley Project (CVP) water supply demands south of the Delta.
- provide system flexibility should conveyance capacities reduce either upstream on the DMC or downstream on the California Aqueduct.

The EA/IS presented a No Action alternative and five action alternatives with Alternative 2 identified as the proposed action. The EA/IS addresses both constructing and operating the proposed action and describes terrestrial resource conservation measures. As identified in the EA/IS, implementing the proposed action would improve CVP capability to provide contract water deliveries south of the Delta while meeting water quality and fishery pumping requirements.

This Report:

- assesses project alternatives (fish and wildlife conservation perspective)
- analyzes fish and wildlife effects (project construction and use)
- recommends measures to avoid, minimize, and compensate for direct, indirect, and cumulative impacts

The Service will be forwarding the draft Report to the California Department of Fish and Game (CDFG) and the National Oceanic and Atmospheric Administration (NOAA) Fisheries for review and comment. Comments provided by CDFG or NOAA Fisheries may be incorporated

into the Service's final Report. If the proposed action changes significantly from that described in the Project's administrative draft EA/IS, this Report will need updating.

Threatened and endangered species effects are outside the draft Report's scope. The Service will address these species in Reclamation's consultation under the Endangered Species Act of 1973, as amended (ESA). If needed, a biological opinion resulting from this consultation would describe Reclamation's responsibilities under ESA, and would be provided to Reclamation under separate cover.

SERVICE MITIGATION POLICY

The recommendations provided herein for the protection of fish and wildlife resources are in accordance with the Service's Mitigation Policy as published in the Federal Register (46:15; January 23, 1981).

The Mitigation Policy provides Service personnel with guidance in making recommendations to protect or conserve fish and wildlife resources. The policy helps ensure consistent and effective Service recommendations, while allowing agencies and developers to anticipate Service recommendations and plan early for mitigation needs. The intent of the policy is to ensure protection and conservation of the most important and valuable fish and wildlife resources, while allowing reasonable and balanced use of the Nation's natural resources.

Under the Mitigation Policy, resources are assigned to one of four distinct Resource Categories, each having a mitigation planning goal which is consistent with the fish and wildlife values involved. The Resource Categories cover a range of habitat values from those considered to be unique and irreplaceable to those believed to be much more common and of relatively lesser value to fish and wildlife. The Mitigation Policy does not apply to threatened and endangered species, Service recommendations for completed Federal projects or projects permitted or licensed prior to enactment of Service authorities, or Service recommendations related to the enhancement of fish and wildlife resources.

In applying the Mitigation Policy during an impact assessment, the Service first identifies each specific habitat or cover-type that may be impacted by the project. Evaluation species which utilize each habitat or cover-type are then selected for Resource Category analysis. Selection of evaluation species can be based on several rationale, as follows: (1) species known to be sensitive to specific land- and water-use actions; (2) species that play a key role in nutrient cycling or energy flow; (3) species that utilize a common environmental resource; or (4) species that are associated with Important Resource Problems, such as anadromous fish and migratory birds, as designated by the Director or Regional Directors of the Fish and Wildlife Service. Based on the relative importance of each specific habitat to its selected evaluation species, and the habitat's relative abundance, the appropriate Resource Category and associated mitigation planning goal are determined.

Mitigation planning goals range from "no loss of existing habitat value" (i.e., Resource Category 1) to "minimize loss of habitat value while minimizing loss " (i.e., Resource Category 4). The planning goal of Resource Category 3 (Table 1) is "no net loss of habitat value while minimizing loss of in-kind habitat value ."

Table 1. Summary of Resource Categories, Designation Criteria and Mitigation Planning Goals under the Service Mitigation Policy.

Resource Category	Designation Criteria	Mitigation Planning Goal
1	High value for evaluation species and unique and irreplaceable	No loss of existing habitat value
2	High value for evaluation species and scarce or becoming scarce	No net loss of in-kind habitat value[1]
3	High to medium value for evaluation species and abundant	No net loss of habitat value while minimizing loss of in-kind habitat value
4	Medium to low value for evaluation species	Minimize loss of habitat value

In addition to mitigation planning goals based on habitat values, Region 1 of the Service, which includes California, has a mitigation planning goal of no net loss of acreage for wetland habitat. This goal is applied in all impact analyses.

In recommending mitigation for adverse impacts to fish and wildlife habitat, the Service uses the same sequential mitigation steps recommended in the Council on Environmental Quality's regulations. These mitigation steps (in order of preference) are: avoidance, minimizing, rectification measures, measures to reduce or eliminate impacts over time, and compensation.

BACKGROUND

Westlands Water District (WWD) and Reclamation studied an intertie connecting the DMC and California Aqueduct in 1989. The study included a 600 cfs capacity pumping plant on the DMC with a pipeline connector to the California Aqueduct. WWD withdrew its support for the project and the project was discontinued. In the spring of 2001, the California Aqueduct's canal lining was damaged and needed repair. Because of the damage and necessary repairs, flows in the California Aqueduct were interrupted. In order to continue water deliveries during the

[1] Unavoidable losses of habitat value would need to be replaced in-kind. In-kind replacement means providing or managing substitute resources to replace the habitat value of the resources lost, where such substitute resources are physically and biologically the same or closely approximate to those lost.

emergency, flows were transferred from the DMC to the California Aqueduct. This was accomplished through the installation of an emergency pump station and a connector pipeline from the DMC at milepost 7.69 to the California Aqueduct. The temporary facility operated for about 30 days before its removal.

The Service has been a participant in this Project since early 2002. The Service participated in the "Value Planning Study (dated September 9, 2002), attended a site visit, and submitted a Planning Aid Memorandum (dated February 3, 2003). The EA/IS incorporated the Service's recommendations regarding measures to avoid and minimize impacts to fish and wildlife resources and their habitat.

PROJECT AREA

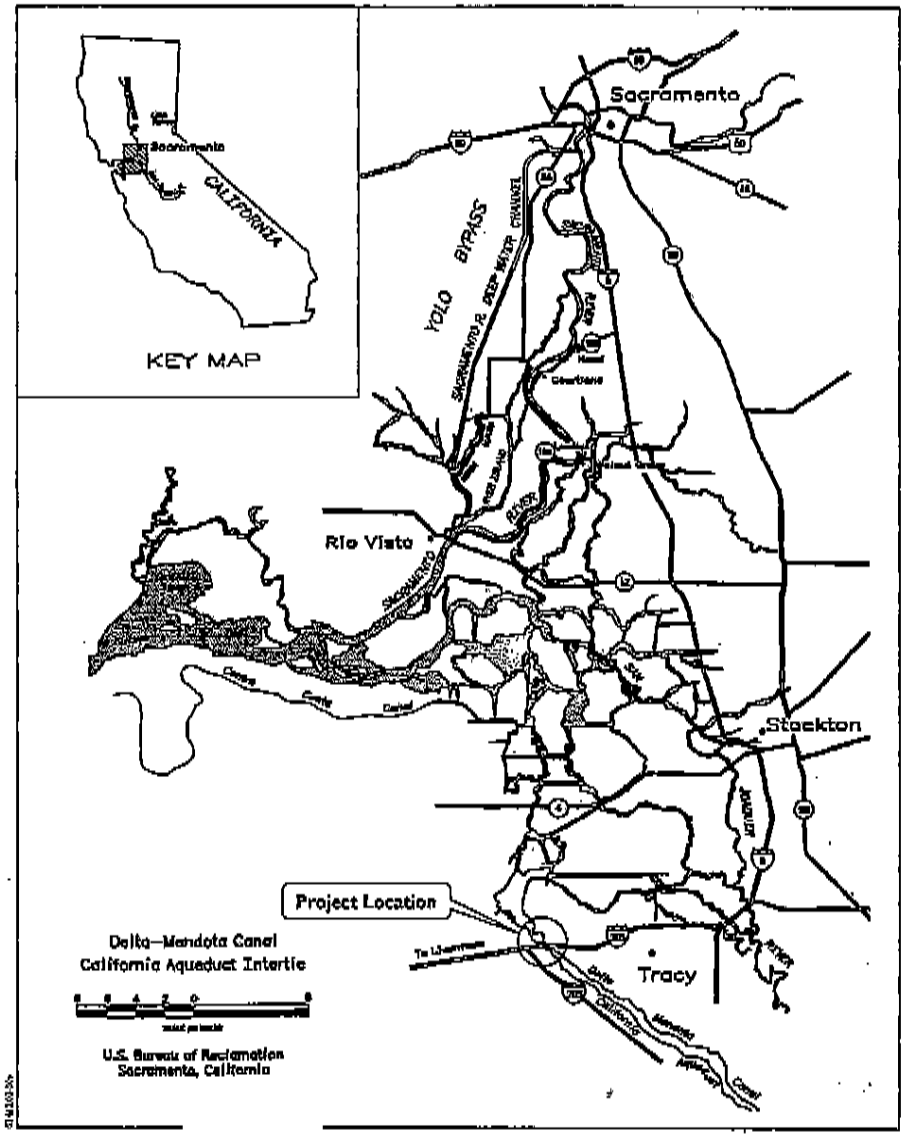
The proposed DMC-California Aqueduct Intertie project site is located in Alameda County due west of the City of Tracy and north of the Highway 205/580 interchange between the DMC and California Aqueduct alignments (Figures 1 and 2). A 500-foot-long buried pipeline would connect the two canals. A pumping plant adjacent to the DMC would provide the ability to divert up to 400 cfs from the DMC to the California Aqueduct.

PROJECT DESCRIPTION

The EA/IS alternatives target avoiding a DMC conveyance design constriction that reduces the Tracy Pumping Plant capacity from the permitted 4,600 cfs to 4,200 cfs. Project use would help provide unmet CVP water supply demands south of the Delta. The EA/IS describes a No Action alternative and five action alternatives with Alternative 2 identified as the Proposed Action. Alternatives 3, 4, and 5 would meet the Project need, but were not selected due to safety, cost, and/or permit concerns. Alternative 2 proposes a pump station and a 500-foot-long pipeline connection (Intertie) from milepost 7.2 on the DMC to milepost 9.1 on the California Aqueduct. Up to 400 cfs could be transferred from the DMC to the California Aqueduct for delivery south of the Delta. The Intertie design also includes reverse operation, utilizing gravity flow, to convey up to 950 cfs from the California Aqueduct to the DMC. The reverse flow option gives the system flexibility should conveyance capacities be reduced either upstream on the DMC or downstream on the California Aqueduct.

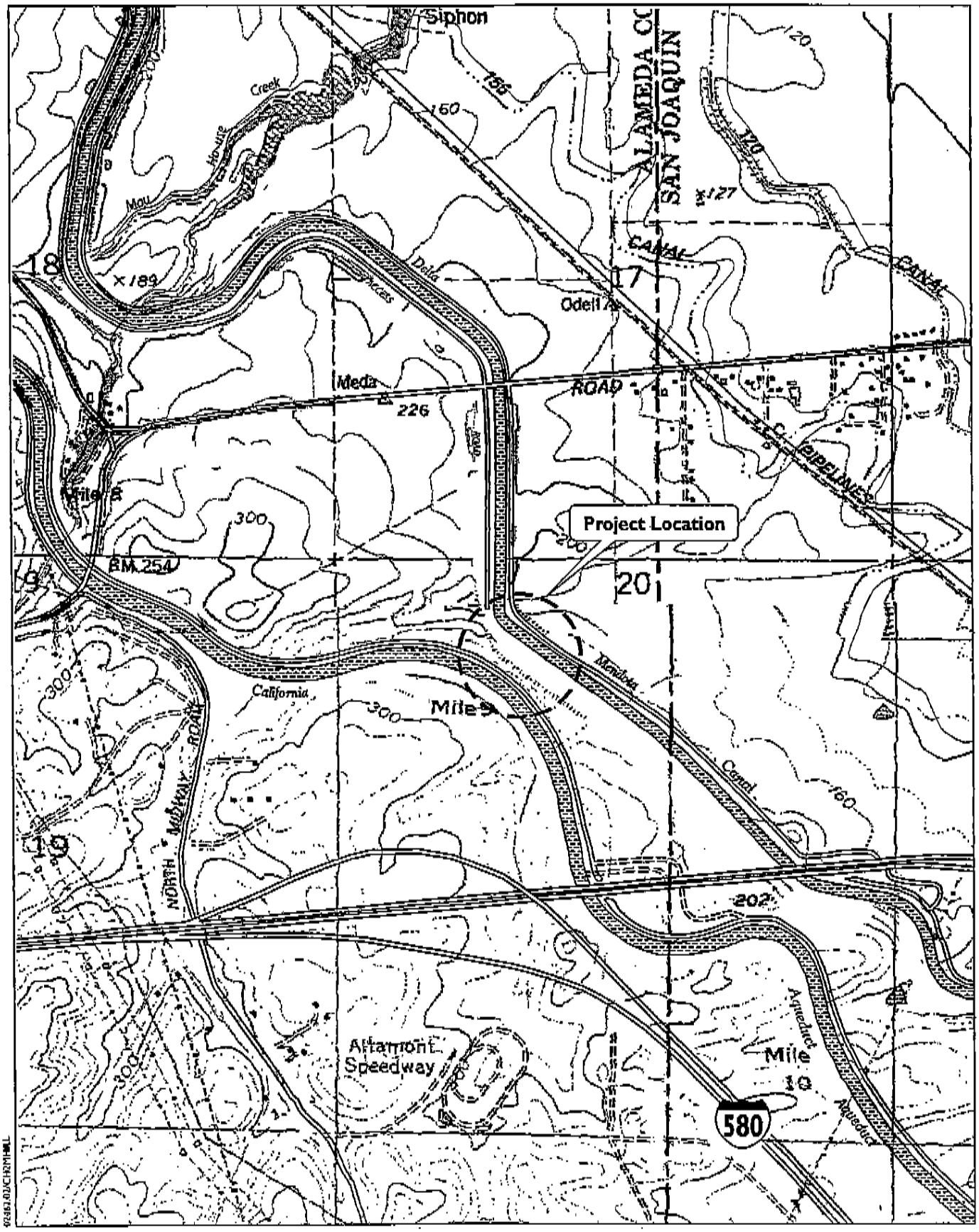
As noted in the EA/IS, using the Intertie would depend on meeting all applicable export pumping restrictions for water quality and fishery protections. The final decision on operations depends on the regulatory constraints from the Water Quality Control Plan Decision 1641 which are

Figure 1



Regional Location Map

Figure 2



Detailed Location Map

included in CVP Operational Criteria and Plan (OCAP). Water quality, fishery, and endangered species constraints will determine Intertie use.

BIOLOGICAL RESOURCES

Aquatic and Wetland Resources

Water resources in the immediate project vicinity include the DMC and California Aqueduct. Aquatic and wetland resources potentially affected by Intertie use include the entire CVP system and the Bay/Delta environment. Based upon observations during the Service's site visit, there are no wetlands or aquatic habitats within the footprint of the proposed construction area.

Terrestrial Resources

The affected terrestrial resources include about 5.0 acres of annual grassland. Although grasslands are not regionally scarce, they are being converted to urban uses and agricultural at an alarming rate. Annual grassland is a surrogate for California prairie habitat that now covers less than 1 percent of its historical acreage in the San Joaquin Valley (Moore et. al. 1990). Annual grassland plant communities are dominated by introduced annuals such as oats (*Avena fatua*), soft chess (*Bromus mollis*), ripgut brome (*Bromus rigidus,*), red brome (*Bromus rubens*), barley (*Hordeum spp.*), and foxtail fescue (*Festuca megalura*).

Grasslands support numerous wildlife species including badgers (*Taxidea taxus*), coyotes (*Canis latrans*), blacktailed jackrabbits (*Lepus californicus*) and several species of small mammals. Small mammals provide an important prey base for raptors in the area, including golden eagles (*Aquila chrysaetos*), Swainson's hawks (*Buteo swainsoni*), northern harriers (*Circus cyaneus*), red-tailed hawks (*Buteo jamaicensis*), and white-tailed kites (*Elanus leucurus*). In addition, many birds, such as California horned larks (*Eremophilia alpestris actia*), western burrowing owls (*Athene cunicularia hypugea*) and western meadowlarks (*Sturnella neglecta*) depend on grassland habitats for feeding, foraging, and nesting. The project area also functions as a wildlife migration corridor.

Special Status Species

San Joaquin kit fox (*Vulpes macrotis mutica*) may travel through the project site, but it is unlikely that the area would support a viable population. The project proponents will survey the site for kit fox dens or activities. CVP-wide aquatic resource evaluations for federally listed species were included in the OCAP consultation process.

PROJECT EFFECTS

Aquatic and Wetland Resources

The EA/IS used the CALSIM model to simulate what effects using the Intertie would have on Bay-Delta aquatic resources. The results showed that during some years Intertie use increased delta smelt salvage, shifted delta smelt X2 water quality up to 1 kilometer upstream, and increased Chinook salmon entrainment. Although the CALSIM model showed potential environmental effects due to simulated Intertie operations, existing pumping constraints will limit Intertie use during potential effect periods. Still Intertie operations may trigger fish protections using the Environmental Water Account sooner during some water year types. The Service believes the CALSIM results show increased Delta pumping without applying restrictions prior to identifying Intertie use. If we assume Delta restrictions would apply to Intertie use, then the effects would be avoided by not using the Intertie when negative effects could occur.

Terrestrial Resources

Project construction would affect about 5.0 acres of annual grassland between the DMC and California Aqueduct. The proposed pumping plant and parking area would cover about 0.5 acre permanently. The remaining 4.5 acres would be used for a staging area and spreading excavated soils. The spreading area is former disposal site used for soils from DMC and California Aqueduct construction. Following Intertie construction the soil spreading area, equipment staging site, and buried pipeline alignment would be revegetated.

Special Status Species

The Project site has the potential to support both the San Joaquin kit fox and California tiger salamander (*Ambystoma californiense*). Both of these species have been recorded in close proximity to the proposed action. The proposed project has incorporated construction measures which could be expected to reduce impacts to these species, however residual affects impacts may still impact these federally listed species.

DISCUSSION

We appreciate that Reclamation included the Service in the Project's early planning stages and incorporated our recommendations as project components. We believe that incorporating terrestrial resource impact avoidance and compensation measures in the project should minimize potential adverse effects. The Service believes that when the Delta water quality constraints and Delta outflow requirements included in the OCAP project description are applied to the project, the Intertie's use period will be clearer.

Through application of our Mitigation Policy, the Service determined the following mitigation planning goal applies to the proposed Project, as represented by the Resource Categories defined on page 3:

- Resource Category 3 for *annual grasslands*. This determination includes grassland open space values and foraging areas provided for species such as Swainson's hawks. The mitigation goal is no net loss of habitat value while minimizing loss of in-kind habitat value.

Direct effects from constructing the pump station, diversion facilities and pipeline could be minimized through implementation of appropriate mitigation measures such as reserving the top 6 inches of soil (along with its seed bank) during trenching operations and ensuring this material is placed on top of any subsoil material during site restoration. This simple construction method would help ensure a viable seed source and seed bed. By incorporating restoration components into the proposed Project and its design, adverse construction effects would be limited to short-term (less than two growing seasons) and temporary effects.

OCAP Analysis

The updated OCAP CALSIM modeling simulation included the Intertie operations and water supplies. Pumping restrictions include Environmental Water Account and B(2) actions to avoid negative environmental effects. The Service's Biological Opinion (BO) has been completed for OCAP. The OCAP simulation and the BO determined that CVP and State Water Project operations, when Water Quality Control Plan Decision 1641 requirements and Environmental Water Account are used, would not jeopardize delta smelt.

RECOMMENDATIONS

Proposed revegetation measures following Project construction provides for some minimization of affects to the San Joaquin kit fox and California tiger salamander as well as other terrestrial species present on the proposed project site. Direct permanent habitat losses would be limited to the area occupied by pumping facility.

The Draft EA/IS analysis shows a shift upstream of X2, a delta smelt salvage increase, and a Chinook salmon take increase. Because the Intertie operation will comply with all Delta pumping restrictions, the CALSIM results do not reflect the final Intertie use periods. The Service believes that to accurately determine Intertie use periods the CALSIM model should include all Delta environmental pumping constraints as limits to Intertie use. The Service understands that the Intertie would operate only during periods when adverse environmental effects would not occur.

The Service recommends:

Terrestrial Resources

- continue to include avoidance and compensation measures as proposed Project components.

- Reclamation should initiate consultation pursuant to section 7(a) of the Endangered Species Act, as amended (16 U.S.C. 1531 et seq.).

Aquatic Resources

- apply existing pumping constraints before deciding final Intertie use.

REFERENCES

Moore, S.B., J. Winckel, S.J. Detwiler, S.A. Klasing, P.A. Gaul, N.R. Kanim, B.E. Kesser, A.B. DeBevec, K. Beardsley, and L. K. Puckett. 1990. Fish and Wildlife Resources and Agricultural Drainage in the San Joaquin Valley, California, Volume I and II, San Joaquin Valley Drainage Program, Sacramento, California.

U.S. Bureau of Reclamation. September 9, 2004. Value Planning Final Report on the Delta-Mendota Canal California Aqueduct Intertie.

U.S. Bureau of Reclamation and San Luis & Delta Mendota Water Authority. May 2004. Delta-Mendota Canal/California Aqueduct Intertie, Administrative Draft Environmental Assessment/Initial Study.

U.S. Fish and Wildlife Service. 2004. Biological Opinion on the Central Valley Project Operating Criteria and Plan. Sacramento, California.

U.S. Fish and Wildlife Service. February 3, 2003. Planning Aid Memorandum for the Delta-Mendota Canal/California Aqueduct Intertie Investigation. Sacramento, California.