State of California **The Resources Agency**

M e m o r a n d u m

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Subject: Modeling of a Delta Cross Channel Gate Extension

Introduction

The Delta Cross Channel (DCC) Project is one of the CALFED conveyance improvements to address water quality and fishery protection. This memorandum provides model study results for widening the gate structure at the DCC and supplementary dredging to increase the net north Delta transfer flow, conveyance of high quality Sacramento River water to the central Delta, thereby reducing salinity at the State Water Project (SWP) and the Central Valley Project (CVP) export pumps. The 2007 Value Engineering team report included widening of the DCC intake structure as an alternative for further model evaluation. This alternative proposed the construction of one additional radial gate adjacent to the existing two radial gates in order to increase the structure width from 120 feet to 180 feet. The proposed gate would be operated simultaneously with the other two gates as they were operated historically.

Methodology

DWR contracted RMA, Inc. to model the DCC expansion as well as the historical DCC structure with the Delta Simulation Model (DSM2). DSM2 is a one dimensional hydrodynamic-water quality model calibrated to the Sacramento-San Joaquin Delta (Nader-Tehrani). The base run is the historical simulation as constructed by DWR's Delta Modeling Section. The time period of the base simulation is June 1990 through March 2007. In the base simulation all boundary conditions and Delta operations approximate historical data. These would include the Sacramento River Delta inflow at Freeport, the San Joaquin River Delta inflow at Vernalis, the boundary stage at Martinez, export pumping, Clifton Court Forebay gate operations, south Delta barrier operations, and the Delta Cross Channel configuration and operations.

The DCC with three gates was modeled using the input files for the base model simulation without any changes to the base boundary conditions or operations
As shown in the results below, the resulting salinity benefit was marginal and DWR directed RMA to explore possible channel constraints downstream of the DCC. The mouth of Snodgrass Slough and the adjacent reach of the Mokelumne River at the North and South Fork split were dredged in the model to -12 to -20 feet NGVD 29, 5 to 8 feet deeper than surveyed depths, thereby increasing conveyance capacity (Figure 1).

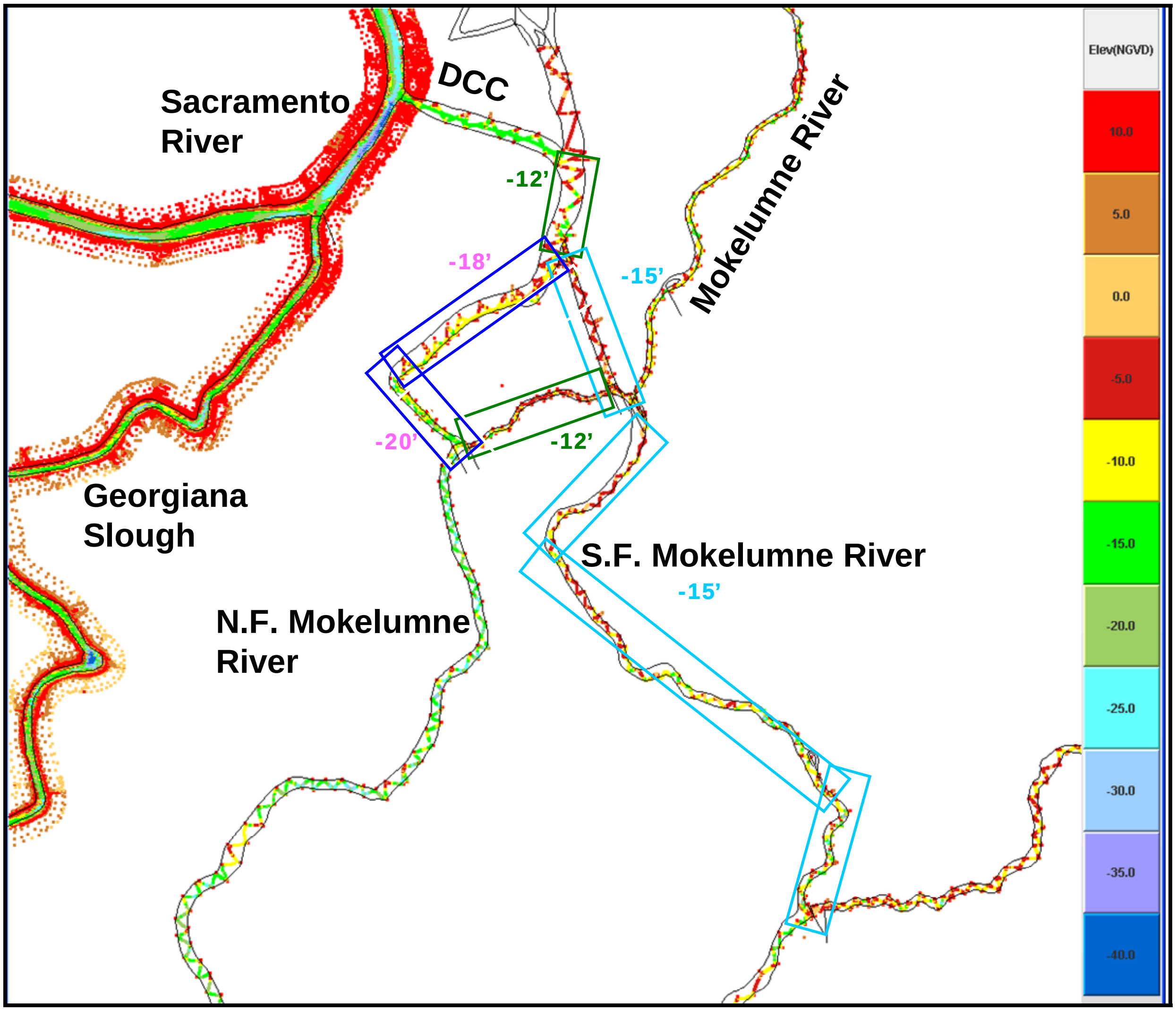

Figure 1 – Locations and depths of channels following dredging (NGVD 29) to increase conveyance capacity through the Mokelumne River region

Model results

Flows

Modeled flows in the Mokelumne River and Delta Cross Channel region show the expansion of the intake structure at most increases the north Delta transfer flow 500 cfs. Dredging of the constricting channels, as shown in Figure 1, allowed more gravity fed flow to move across the northern Delta and increase the cross Delta flow by over 1000 cfs in the late summer (Figure 2).

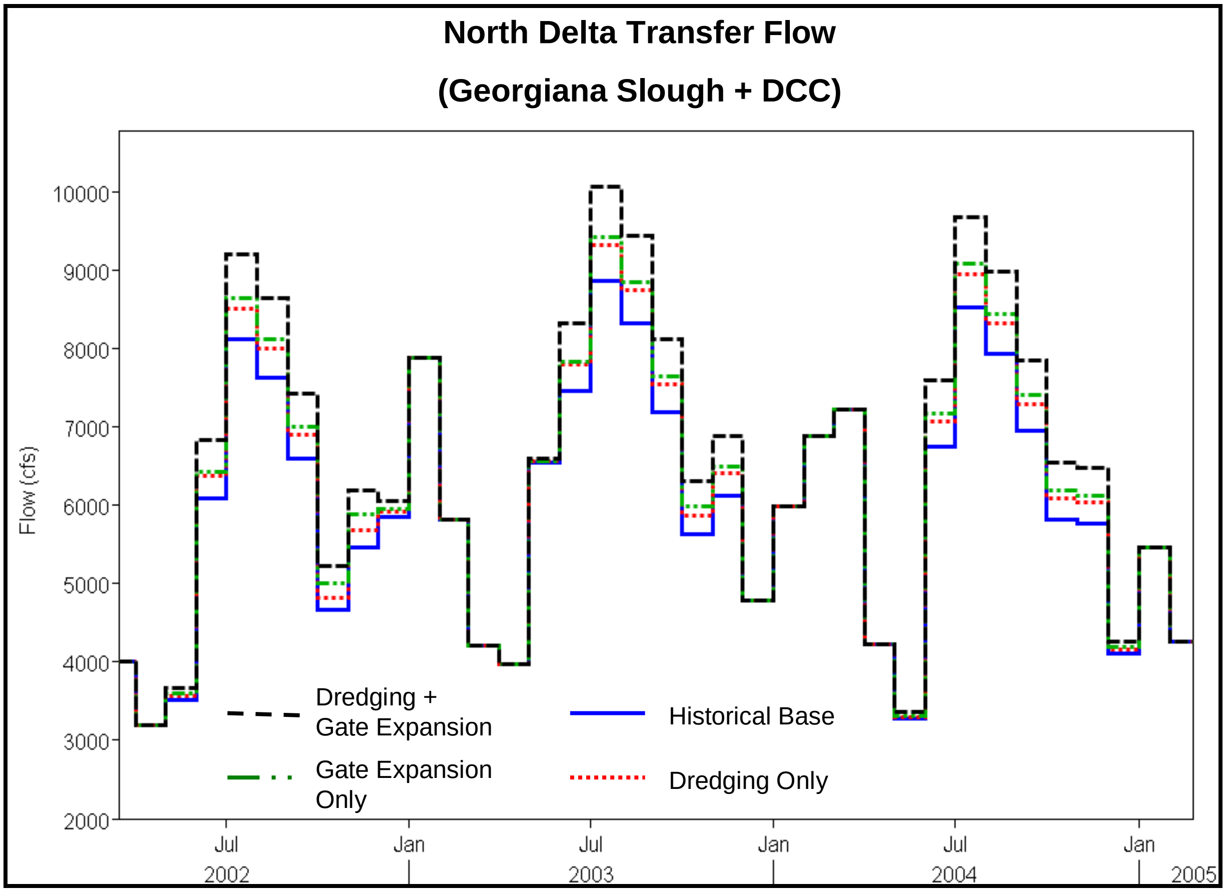

Figure 2 – North Delta Transfer Flow as modeled with DSM2

Salinity

The analyses of the DSM2 simulations indicate there would be decreased salinity at Clifton Court Forebay with either a DCC intake expansion or downstream dredging to alleviate conveyance constrictions (Figure 3). Although model simulations of each action independently showed improvement in salinity at the exports, the improvement was roughly half the improvement of combining the actions. This is shown graphically in Figure 4 where the percent of average monthly salinity improvement in the summer and fall range from 6 to 11% with the additional gate plus dredging, while each action taken independently improves salinity by 3 to 6% for the same period. The combined intake expansion and dredging resulted in the mean monthly average salinity improvement at Clifton Court Forebay of 21 uS/cm with a maximum of 101 uS/cm (Table 1). Noticeably larger improvements were found in late summer and fall for the combined actions.

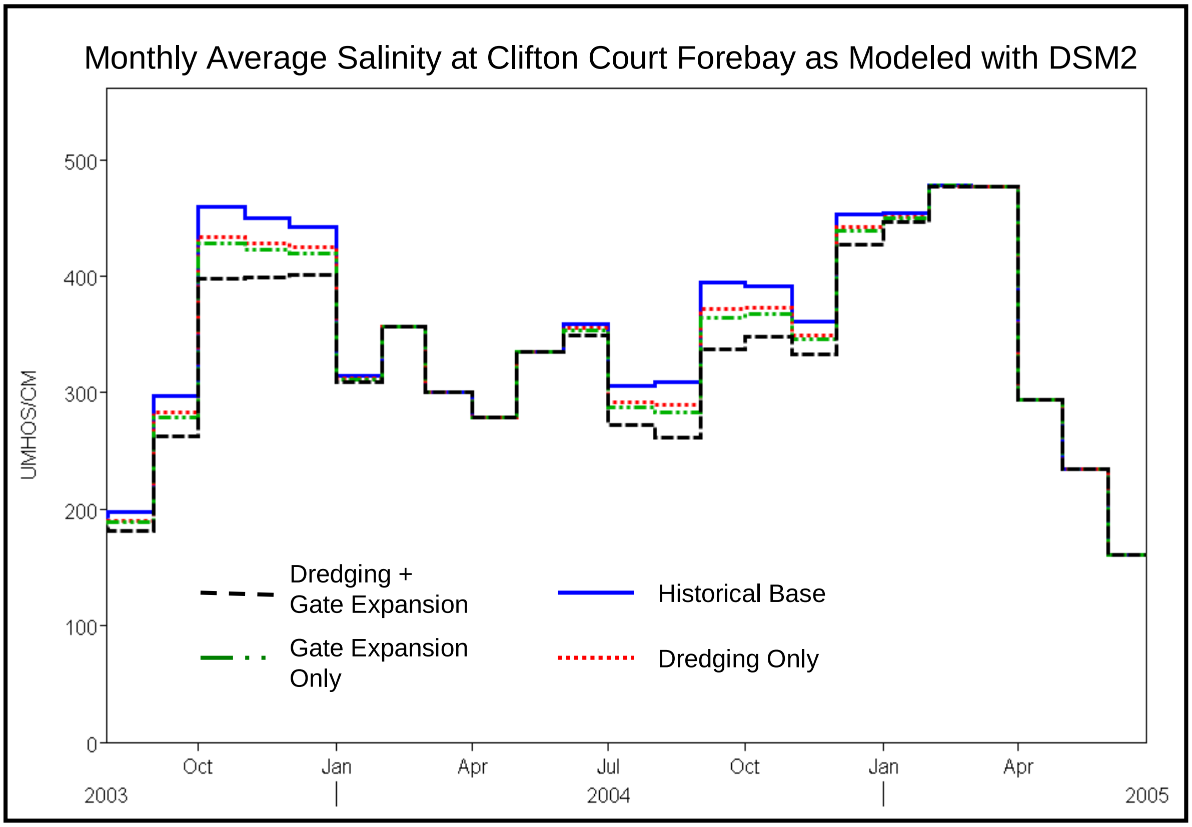

Figure 3 – DSM2 Modeled Salinity at Clifton Court Forebay with DCC Expansion and Dredging

Table 1 – Average Monthly Clifton Court Forebay Salinity Modeled with DSM2 (uS/cm)

	Historical		Historical with Dredging		Historical with Gate Expansion		Historical with Gate Expansion and Dredging	
month	average	maximum	average	maximum	average	maximum	average	maximum
January	404	559	397	541	396	537	389	524
February	406	572	403	549	403	548	399	528
March	375	616	374	595	374	593	372	570
April	348	575	347	575	347	574	347	574
May	335	484	335	483	335	484	334	483
June	319	548	316	538	316	540	312	529
July	300	628	293	607	293	611	286	587
August	341	728	327	692	325	694	308	655
September	401	851	381	803	377	801	355	749
October	433	770	412	732	408	725	385	683
November	465	792	446	751	443	755	422	711
December	471	684	455	650	453	654	436	618
Average	384	851	374	803	373	801	362	749

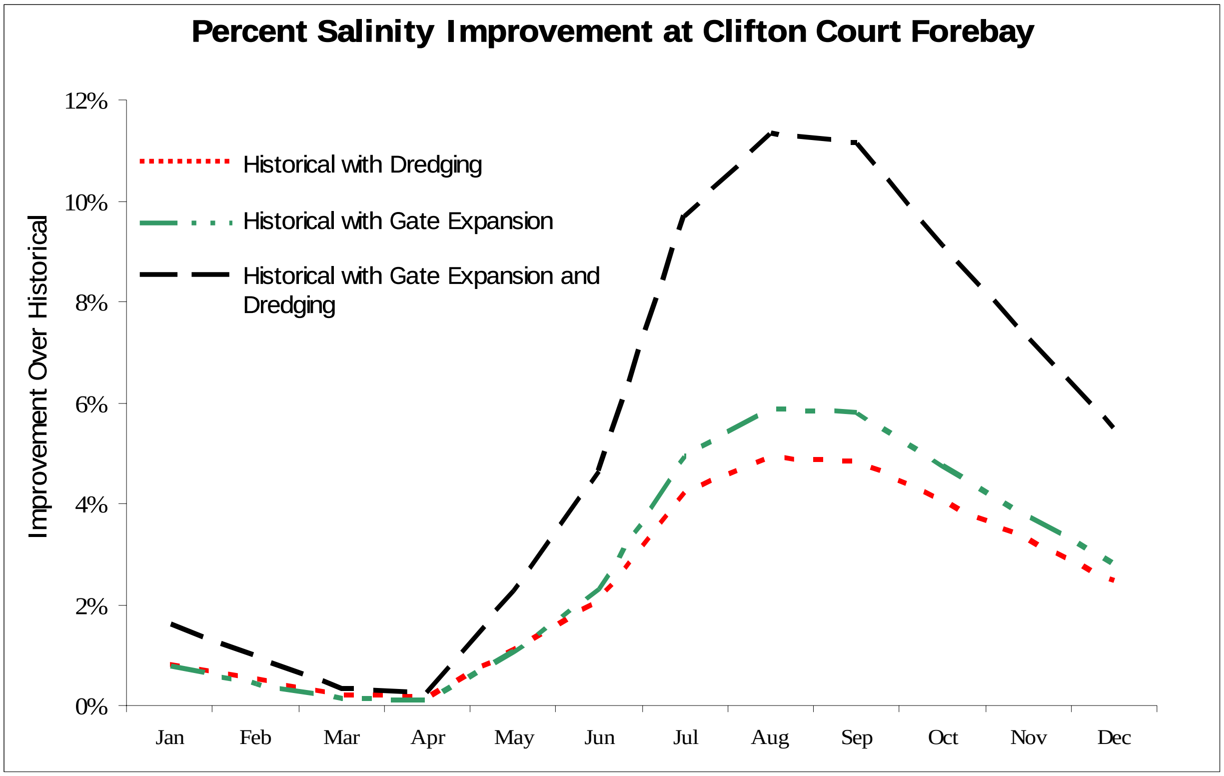

Figure 4 – Average Monthly Percent Salinity Improvement at Clifton Court Forebay

Conclusion

The expanded intake at the Delta Cross Channel improves export water quality, but only up to an average monthly 6% improvement and only in late summer. DSM2 model results indicate combining the expansion of the DCC intake with opening constricted conveyance pathways in the lower Mokelumne River region is critical to maximizing improvements to water quality at the SWP export facility. A combined effort will provide an appreciable salinity reduction, 11% on average in the late summer, at Clifton Court Forebay. Further review of the channel capacities in the lower Mokelumne River will be considered to aid the conveyance capacity of north Delta transfer flow as it directly influences the water quality at the project exports. Further modeling will also be directed to examine, as recommended by the VE team, the additional gate structure be screened enabling a gate opening during the winter salmon run when flows are below flood level.

References

SVS, Inc (2007) – Strategic Value Solutions. "Value Planning Study – Franks Tract Pilot Project." Independence, MO. Prepared for DWR – Delta Conveyance Branch, Sacramento

Nader-Tehrani, P (2001). "Chapter 2: DSM2 Calibration and Validation." *Methodology for Flow and Salinity Estimates in the Sacramento-San Joaquin Delta and Suisun Marsh. 22nd Annual Progress Report to the State Water Resources Control Board*. Sacramento, CA: California Department of Water Resources, Office of State Water Project Planning. http://modeling.water.ca.gov/delta/reports/annrpt/2001/2001Contents.pdf