

- DRAFT -
CALFED Bay-Delta Program
System Operation and Delta Simulation Model
Studies and Activities Summary
July 18, 1998

PROGRAM GOALS

Evaluate potential storage facilities, Delta conveyance facilities, and operational considerations that might contribute to the multiple Program objectives of improving ecosystem health, water quality, water supply reliability, and levee system integrity. Refine system operation and Delta simulation studies to provide additional information regarding potential benefits and support impact analysis of various Program elements.

PREVIOUS DWRSIM STUDIES

Any water resource planning evaluation must be initiated by making some assumption about concepts for diverting, releasing, and allocating water in the system. For a complete evaluation of CALFED alternatives, it is necessary to fully explore the interaction of storage and conveyance components as measured by the full range of CALFED goals. Input from the CALFED agencies and stakeholder community as to the appropriate range of operating concepts was integrated into the operation modeling the Alternatives starting from the summer of 1996 to the release of the Draft EIS/EIR.

Initial EIS/EIR Studies. Efforts to model the various potential CALFED storage and conveyance components using DWRSIM began in the fall of 1996 with model programming modifications and preliminary sensitivity studies. To complete the system operations modeling for the CALFED evaluation of alternatives, extensive DWRSIM program modifications and DWRSIM operation studies were needed. CALFED staff prepared a "CALFED Bay-Delta Program Operation Modeling Plan", finalized on July 23, 1997, which characterized the modeling assumptions and program modifications. New facility components and ERPP flow targets were added to DWRSIM along with operation studies with specific combinations of storage and conveyance facilities to represent each CALFED alternative.

This information was provided in several reports in the fall of 1997. This preliminary work represented combinations of the following alternative components using DWRSIM Version 9.06 model:

- ♦ 5,000 cfs and 15,000 cfs Isolated Facility
- ♦ Environmental Sacramento River tributary offstream surface storage
- ♦ Environmental San Joaquin offstream surface storage
- ♦ Agricultural/Urban Sacramento River tributary offstream surface storage
- ♦ South of Delta off-aqueduct surface storage
- ♦ In-Delta surface storage
- ♦ Sacramento Valley and San Joaquin Valley groundwater storage

Interagency Development Team (IDT). In an effort to refine the CALFED Program Alternatives and recommend a preferred draft alternative, CALFED organized an Interagency Development Team (IDT) in mid-October. Several new operation criteria were devised by IDT to further refine CALFED Program Alternatives and were modeled by DWR and CALFED staff. For predicting the water supply consequences of the alternatives, two specific operation criteria were analyzed to represent a range of possible operational rules that might be necessary to protect the Delta ecosystem for each alternative. System operation studies were completed for each alternative both with and without storage.

DEIS/EIR and Phase II Report. In general the DEIS/EIR and Phase II reports provide estimated system operations and water supply opportunities. To provide an evaluation of this range of storage, CALFED modeled scenarios with no additional storage for each alternative and a second with approximately 6 MAF of storage of new storage for each alternative. In modeling the upper end (6 MAF), CALFED assumed that additional in-stream flows included in the draft Ecosystem Restoration Program (ERP) would be provided by a portion of the new storage to the extent possible. The remaining storage, 4.75 to 4.95 MAF depending on the alternative, was assumed to be available for agricultural and urban water supply.

In addition, the Phase II report shows how the different alternatives might respond to changes in standards. CALFED included two simplified "sensitivity analyses" of how the water supply opportunities associated with each of the alternatives might respond to changes in the major regulatory standards. The first of these sensitivity analysis looks at the minimum Delta outflow requirements and the second considered changes in the "Export-Inflow Ratio" (E/I ratio) requirement.

CURRENT DWRSIM ACTIVITIES

Ongoing DWRSIM tasks are categorized here as Core Tasks, Program Tasks, 404(b)(1) Tasks, and Research and Development Tasks. Core tasks are essential to revise the original EIS/EIR studies and maintain coordination with other Program activities. Program tasks are special studies that have a high level of interest from the different resource groups in CALFED, especially the Diversion Effects on Fisheries Team (DEFT). 404(b)(1) tasks are reservoir yield studies needed to complete a 404 Permit for new facilities. Finally, the research and development tasks are special studies that are necessary to support the development of an artificial neural network flow relationship into a system operations model. The additional information of these studies could be critical for completion of Phase II.

Core Tasks

1. Update Core Operation Studies in DEIR/EIS and Phase II Report. System modeling in the DEIS/EIR and Phase II reports provided information regarding potential water supply benefits for environmental enhancement and urban and agricultural uses. However, the existing operation studies are based on some outdated operating assumptions. Changes are required in the Delta B2 actions and Stanislaus River operations. VAMP settlement agreements on the San Joaquin River must be incorporated. In addition, modeling enhancements are necessary to model the ERPP flow targets with these modeling changes. A summary of the core operation studies which require updating is listed below:

<u>Study</u>	<u>Description</u>
558	Existing Conditions
516	No Action
518	Alternative 1A & 1B
609	Alternative 1C (Storage)
528	Alternative 2A
532a	Alternative 2B, 2E (Storage)
530	Alternative 2D (2 MAF SDSS only)
578	Alternative 3A (5k I.F.)
579	Alternative 3B (5k I.F. w/Storage)
595	Alternative 3 - 10k I.F.
567	Alternative 3 - 10k I.F. w/ Storage
580	Alternative 3 - 15k I.F.
581	Alternative 3E & 3I (15k I.F. w/ Storage)

Program Tasks

1. Support DEFT Process. One of the primary problems presently encountered in the Delta is the conflict between the need to maintain water deliveries and the sensitive fish species in the Delta which are drawn into the pumps of the CVP/SWP. Currently, there are requirements for pumping activities to be curtailed during periods when sensitive species are present in the Delta. Future evaluations may indicate the need for further restrictions. Currently, CALFED has created a Diversion Effects on Fisheries Team to determine which CALFED Alternatives provides for better fisheries recovery, including possible suggestions for improving the fisheries benefits of the current CALFED alternatives. To support this process, several operation studies will be required to determine if CVP/SWP operations can further reduce the direct effects of diversions from the Delta by the Projects. The effort will be similar to the Interagency Development Team (IDT) process, which evaluated changes in regulatory standards for the various alternatives.

404(b)(1) Tasks

1. Reservoir Yield Studies. Section 404 of the Clean Water Act requires that a project proponent obtain from the Corps of Engineers. The Section 404 required that the issuance of a permit by the Corps comply with EPA's Section 404(b)(1) Guidelines. Under the Corps evaluation, an analysis of practicable alternative is a screening mechanism used to determine the appropriateness of permitting. To comply with the 404(b)(1) guidelines, CALFED is conducting an initial reservoir screening process. Several reservoir sites are currently being evaluated, including reservoir yield studies. DWR is currently conducting reservoir yield studies for several south of Delta reservoirs for CALFED and several north of Delta reservoirs for DWR under Prop. 204.

Research and Development Tasks

1. System Operations Incorporation of ANN. CALFED has been supporting the development of an artificial neural salinity flow relationship into DWRSIM. Preliminary results of a No Action operation study with the G model and ANN have been completed. Several iterations between the system operations and Delta hydrodynamic models are required to complete the incorporation of ANN into DWRSIM.

PREVIOUS DSM STUDIES

DWRSIM and the spreadsheet models can only estimate in the broadest terms the effects on conditions in the Delta. Delta modeling is required to evaluate the effects of flows, stages, velocities, salinities, mass transport in the Delta due to Delta conveyance configurations and new facilities. As part of this work, Delta modeling with DWRSIM1 and later DWRSIM2 were conducted to address various hydrodynamic issues associated with analysis of Delta impacts using computer simulations.

Using DWRDSM1, simulations of eight CALFED Delta configuration alternatives were completed by November 1997. Delta conditions for the CALFED alternatives were simulated using a 16 water year period (1975-91) under a common hydrology from DWRSIM operation study 472B. Study 472B assumed a 1995 level of development and a 2020 level of water demands under the SWRCB 1995 water Quality Control Plan with permit allowing up to 10,300 cfs pumping at Banks Pumping Plant. A summary description of the Delta alternatives configurations are:

- ♦ *Alternative 1A* – Existing Delta geometry with no changes to any Delta channels or structure
- ♦ *Alternative 1C* – Delta change consistent with the preferred alternative for the Interim South Delta Program
- ♦ *Alternative 2B* – North Delta improvements, a 10,000 cfs screened Hood intake, and south Delta improvements
- ♦ *Alternative 2D* – 10,000 cfs screened Hood intake, eastern Mokelumne River floodway, east Delta habitat, and south Delta habitat
- ♦ *Alternative 2E* – Tyler Island Habitat, western Mokelumne River floodway, Dead Horse floodway, east Delta habitat, and south Delta habitat.
- ♦ *Alternative 3A* - 5,000 cfs isolated facility and South Delta flow control structures
- ♦ *Alternative 3B* - 5,000 cfs isolated facility, South Delta flow control structures and in-Delta storage
- ♦ *Alternative 3E* – 15,000 cfs isolated facility at Hood and joined at Clifton Court Forebay south of Victoria Canal

Using DWRDSM2, simulations of five CALFED Delta configuration alternatives were completed by February 1998. Delta conditions for the CALFED alternatives were simulated using a 16 water year period (1975-91), using DWRSIM-produced Delta hydrologies 558, 516, 531, 532, 551, and 567 respectively. A summary description of the Delta alternatives configurations are:

- ♦ *Alternative 1A* – Existing Delta geometry with no changes to any Delta channels or structure
- ♦ *Alternative 1C* – Delta change consistent with the preferred alternative for the Interim South Delta Program
- ♦ *Alternative 2B* – North Delta improvements, a 10,000 cfs screened Hood intake, and south Delta improvements
- ♦ *Alternative 3E* – 15,000 cfs isolated facility at Hood and joined at Clifton Court Forebay south of Victoria Canal with Delta agricultural surface water diversion from the isolated facility

♦ *Alternative 3X* – 10,000 cfs isolated facility at Hood and joined at Clifton Court Forebay south of Victoria Canal

Delta modeling studies for CALFED alternatives 1C, 2B, and 3X were re-evaluated and completed by June, 1998. Geometry, general modeling assumption and delta facility operations for these was identical to the earlier studies. However, the hydrology used for evaluating Delta impact came for DWRSIM study 532a for alternative 1C and 2B. The hydrology used for alternative 3X was DWRSIM 636, which contains the same storage components as study 532a. The "In Delta Storage" component for alternative 3X was removed.

CURRENT DSM ACTIVITIES

Current, DSM tasks are categorized here as Core Tasks, Stakeholder Tasks, Program Tasks, and Research and Development Tasks. Core tasks are essential to revise the original EIS/EIR studies and maintain coordination with other Program activities. Stakeholder tasks are special studies that have a high level of interest from stakeholders. Program tasks are special studies that have a high level of interest from the different resource groups in CALFED. Finally, the research and development tasks are special studies that are necessary to support the development of an artificial neural network flow relationship into a system operations model. The additional information of these studies could be critical for completion of Phase II.

Core Tasks

1. Alternative 2 with Georgiana Slough Hydraulic Barrier. Hydrology used for this alternative would be DWRSIM study 532a. The geometry and the delta facility operation for this study would be identical to the June 1, 1998 study of Alternative 2B. However, the 10,000 cfs screened Hood intake on the Sacramento River should discharge the required flow at the head of Georgiana Slough to maintain a positive flow to the Sacramento River during critical fishery periods. Any remaining screened diversion from Hood would discharge to Snodgrass Slough. The North Fork Mokelumne river system would be enlarged to accommodate the increased cross-Delta flow.
2. Existing Conditions, No Action, Alt 1C, 2B and 3X Mass Tracking. CALFED alternatives 1C, 2B, and 3X along the existing conditions and no action need mass tracking modeling. This process gives an indication of the residence time of fish egg or larvae as affected by these alternatives. The mass would be introduced at discrete locations in the Delta to determine its fate under different CALFED alternative. Mass would be injected at Vernalis, Terminous, Freeport, Rio Vista, San Andreas Landing, and Prisoners Point. The mass fate 30 days and 60 days after injection would be evaluated from water year 1976-91.

Stakeholder Tasks

1. Alternative 2 with South Fork Mokelumne Improvements. This study is being conducted at the request of South Delta Irrigation District (Alex Hildebrand). Hydrology used for this alternative should be DWRSIM study 532a. The geometry and the delta facility operation for this study should be identical to the June 1, 1998 study of Alternative 2B. The 10,000 cfs screened Hood intake on the Sacramento River would still discharge to Snodgrass Slough. However, the South Fork Mokelumne river system would be enlarged to accommodate the increased cross-Delta flow instead of the North Fork. Western New

Hope Track, Bouldin Track, and Empire Track along the South Fork of the Mokelumne River would be set back at 2000 ft.

2. Alternative 3 with a 7,500 cfs Isolated Facility. The study is being conducted at the request of Ag/Urban and SWRI (Dave Schuster). Hydrology used for this alternative is being provided by SWRI, which reflects a 7,500 cfs isolated facility under different Hood diversion assumptions using a CALFED 2020 hydrology and demand pattern. The geometry and the delta facility operation for this study should be identical to the June 1, 1998 study of Alternative 3X. However, no interie would be assumed in connecting the Clifton Court Forebay to Tracy Pumping Plant.

Program Tasks

1. Bromide and Selenium Water Quality using Superposition Technique. To support the Water Quality Program, Delta simulations would be conducted using a superposition approach to evaluate specific water quality constituents, such as bromides and selenium, for existing conditions, no action, Alt 1C, 2B and 3X. The salinity concentrations at various locations in the Delta would be determined by the following salinity sources: 1) Sacramento River, 2) San Joaquin River, 3) Delta agricultural and soil, and 4) sea/brackish. The analysis would be conducted for specific water years, such as 1989.

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2. Salinity Gradients based on Levee Failure Scenarios. To support the Levee Program, Delta simulations would be conducted for specific levee failures, such as Sherman Island, to determined the salinity impacts. The analysis would be conducted for non steady-state and steady-state conditions under different hydrologic conditions and system operations. The specific study scenarios are still being devised for the purposes of the Levee Program and the Draft EIS/EIR. Information regarding levee failure locations and break sizes are currently being prepared by CALFED staff.

Deferred

Research and Development Tasks

1. System Operations Incorporation of ANN. CALFED has been supporting the development of an artificial neural salinity flow relationship into DWRSIM. Preliminary results of a No Action operation study with the G model and ANN have been completed. A comparison of the two operation studies against the Delta water quality standards is required at Emmation, Jersey Point, Terminous, San Andreas Landing, Prisoners Point, Brandt Bridge, Old River near Middle River, Old River at Tracy Road, Clifton Court Forebay, DMC at Tracy Pumping Plant, Collinsville, and Chipps. The analysis would be conducted for the entire 16-year hydrologic period from water year 1976-91.