Meeting Information Packet
for
May 5, 1997, 1:30PM
Rm. 1142, Resources Building

- Storage and Conveyance Component Configuration (for all configuration 3B)
- Operating Parameters
- DWR Planning Simulation Model (DWRSIM) Assumtion for CALFED Benchmark Study (1995CF6-CALFED-472)

DRAFT MARCH 1997

STORAGE AND CONVEYANCE COMPONENT CONFIGURATIONS FOR THE PROGRAMMATIC EIR/EIS ALTERNATIVE ANALYSIS

Introduction

During Phase I, the CALFED Bay-Delta Program has identified three alternative solutions. Each alternative may be implemented in a wide range of potential configurations. This report documents the various configurations of storage and conveyance components suggested as a basis for programmatic impact evaluation. These alternative configurations for each of the three CALFED alternatives are suggested in order to explore a reasonable range of facilities, costs, and impacts in the Programmatic EIR/EIS. Each of the alternative configurations are designed to be consistent with the Program mission statement, the primary solution principles, and the program objectives.

It is important to emphasize that the configurations described in this report are subject to change based on input from stakeholders and the public prior to initiation of formal impact evaluation.

The mission of the CALFED Bay-Delta Program is to develop a long-term comprehensive plan that will restore ecological health and improve water management for beneficial uses of the Bay-Delta system. The primary objectives of the Program are:

- To provide good water quality for all beneficial uses;
- To improve and increase aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta to support sustainable populations of diverse and valuable plant and animal species;
- To reduce the mismatch between Bay-Delta water supplies and current and projected beneficial uses dependent on the Bay-Delta system; and
- To reduce the risk to land use and associated economic activities, water supply, infrastructure, and the ecosystem from catastrophic breaching of Delta levees.

In Phase II, from June 1996 to September 1998, the Program will conduct a broad-based environmental and pre-feasibility review of the three alternative solutions and will identify the one preferred alternative.

D-006157

The Solution principles state that a Bay-Delta Solution must:

- Reduce conflicts in the system,
- Be equitable,
- Be affordable,
- Be durable,
- Be implementable, and
- Have no significant redirected impacts.

The objectives of the program are to improve:

- Ecosystem quality,
- Water quality,
- Water supply reliability, and
- Levee system integrity.

All three alternatives include the four common programs related to:

- Water use efficiency,
- Ecosystem restoration,
- Water quality, and
- Levee system integrity.

Overview of Alternative Configurations

The three Alternatives differ according to the type of Delta storage and conveyance configuration they have.

Alternative 1 - Existing System Conveyance where little or no modifications are made to flow capacity of the existing Delta channels. The alternative has three configuration numerated from 1A to 1C.

Alternative 2 - Through Delta Conveyance where a variety of modification to Delta channels could be made to increase the conveyance efficiency and capacity. The alternative has five configurations numerated from 2A to 2E.

Alternative 3 - Dual Delta Conveyance where a combination of improved through Delta conveyance and isolated facility conveyance are used to increase the flexibility of the conveyance efficiency. The alternative has seven configurations from 3A to 3G.

Chart 1A and 1B show tables listing the components of the different configurations of each alternative. Chart 2 shows the physical components in a matrix format. Detailed alterrnative descriptions follow the charts.

CHART 1-A
COMPONENT CONFIGURATIONS A-D

	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3
CONFIGURATION A	Re-Operation	North Delta Improvements 10,000 cfs Hood Intake South Delta Improvements	5,000 cfs Open Channel IF North Delta Improvements South Delta Improvements
CONFIGURATION B	Re-Operation CVP-SWP Improvements	North Delta Improvements 10,000 cfs Hood Intake South Delta Improvements CVP-SWP Improvements 3.0 MAF Upstream Sto. (Sac River Tribs.) 2.0 MAF Aqueduct Sto. 200 TAF In-Delta Sto. 500 TAF Groundwater Sto. (Sac Valley) 500 TAF Groundwater Sto. (San Joaquin Valley)	5,000 cfs Open Channel IF North Delta Improvements South Delta Improvements CVP-SWP Improvements 3.0 MAF Upstream Sto. (Sac River Tribs.) 500 TAF Upstream Sto. (San Joaquin Tribs.) 2.0 MAF Aqueduct Sto. 200 TAF In-Delta Sto. 500 TAF Groundwater Sto. (Sac Valley) 500 TAF Groundwater Sto. (San Joaquin Valley)
CONFIGURATION C	Re-Operation South Delta Improvements CVP-SWP Improvements 3.0 MAF Upstream Sto. (Sac River Tribs.) 1.0 MAF Aqueduct Sto. 500 TAF Groundwater Sto. (Sac Valley) 500 TAF Groundwater Sto. (San Joaquin Valley)	Western 15,000 cfs Isolated South Delta Intake Northern 15,000 cfs Isolated South Delta Intake Eastern 15,000 cfs Isolated South Delta Intake CVP-SWP Improvements	5,000 cfs Pipe IF North Delta Improvements South Delta Improvements
CONFIGURATION D	N/A	10,000 cfs Hood Intake Mokelumne River Floodway (East) East Delta Habitat South Delta Habitat CVP-SWP Improvements 2.0 MAF Aqueduct Sto.	5,000 cfs Pipe IF North Delta Improvements South Delta Improvements CVP-SWP Improvements 3.0 MAF Upstream Sto. (Sac River Tribs.) 2.0 MAF Aqueduct Sto. 200 TAF In-Delta Sto. 500 TAF Upstream Sto. (San Joaquin Tribs.) 500 TAF Groundwater Sto. (Sac Valley) 500 TAF Groundwater Sto. (San Joaquin Valley)

CHART 1-B
COMPONENT CONFIGURATIONS E-H

	ALT. 1	ALTERNATIVE 2	ALTERNATIVE 3
CONFIGURATION E	N/A	Tyler Island Habitat Mokelumne River Floodway (West) East Delta Habitat South Delta Habitat CVP-SWP Improvements 3.0 MAF Upstream Sto. (Sac River Tribs.) 500 TAF Upstream Sto. (San Joaquin Tribs.) 2.0 MAF Aqueduct Sto. 500 TAF Groundwater Sto. (Sac Valley) 500 TAF Groundwater Sto. (San Joaquin Valley)	15,000 cfs Open Channel IF North Delta Improvements CVP-SWP Improvements 3.0 MAF Upstream Sto. (Sac River Tribs.) 500 TAF Upstream Sto. (San Joaquin Tribs.) 2.0 MAF Aqueduct Sto. 200 TAF In-Delta Sto. 500 TAF Groundwater Sto. (Sac Valley) 500 TAF Groundwater Sto. (San Joaquin Valley)
CONFIGURATION F	N/A	N/A	Chain of Lakes North Delta Improvements CVP-SWP Improvements 3.0 MAF Upstream Sto. (Sac River Tribs.) 500 TAF Upstream Sto. (San Joaquin Tribs.) 2.0 MAF Aqueduct Sto. 500 TAF Groundwater Sto. (Sac Valley) 500 TAF Groundwater Sto. (San Joaquin Valley)
CONFIGURATION G	N/A	N/A	5,000 cfs Screened Deep Water Ship Channel and West Delta Tunnel North Delta Improvements CVP-SWP Improvements 3.0 MAF Upstream Sto. (Sac River Tribs.) 500 TAF Upstream Sto. (San Joaquin Tribs.) 2.0 MAF Aqueduct Sto. 200 TAF In-Delta Sto. 500 TAF Groundwater Sto. (Sac Valley) 500 TAF Groundwater Sto. (San Joaquin Valley)
CONFIGURATION H	N/A	N/A	5,000 cfs Open Channel IF Tyler Island Habitat Mokelumne River Floodway (West) East Delta Habitat South Delta Habitat CVP-SWP Improvements 3.0 MAF Upstream Sto. (Sac River Tribs.) 500 TAF Upstream Sto. (San Joaquin Tribs.) 2.0 MAF Aqueduct Sto. 500 TAF Groundwater Sto. (Sac Valley) 500 TAF Groundwater Sto. (San Joaquin Valley)

Groundwater Storage and Conjunctive Use Components

CALFED is committed to exploring opportunities for groundwater banking and in-lieu conjunctive use of groundwater resources. However, the potential for CALFED involvement in groundwater banking and in-lieu conjunctive use creates concerns for counties and for the local water agencies where the programs might be implemented. Although direct construction impacts are generally less than for surface storage facilities, there is a potential for affecting domestic well, farm operations, stream flow, habitat, towns and cities. In direct response to local concerns to this issue, the Program's first priority is to listen carefully to concerns and interests and look for opportunities where there is local interest, and the potential to combine local and statewide benefits. The second priority is to develop pilot programs which demonstrate that assurances can be established. The assurances must portect local interests while promoting common benefits to counties and local water agencies, hand-in-hand with system water supply reliability benefits. Therefore, although groundwater components are included in a number of alternative configurations, CALFED recognizes the ongoing need to coordinate closely with all affected parties in the alternative refinement process.

Linkages

CALFED staff has sought to incorporate a range of components broad enough to encompass the interests of CALFED agencies and stakeholders, without making any pre-determinations regarding preferred alternative configurations. At the same time, staff has given some consideration to linkages (i.e. potential benefits and impacts for a wide range of resource categories). Some of the key linkages are listed below, without regard to priority:

- Flood risk
- Water quality
- Water supply reliability
- Fisheries: First paradigm--Keep fish in the Sacramento River by screening diversions from the river
- Fisheries: Second paradigm-- Make the interior Delta more hospitable to anadromous fish by creating slow-moving cross-Delta flow with a large and diverse expanse of habitats
- Utilities: Pipelines, radio towers, gas wells, power lines, etc.
- Transportation: Highways and bridges
- Land use, agriculture, and wildlife habitat: First paradigm-- Minimize change in Delta configuration and loss of agricultural land from production. Preserve current agricultural land for its wildlife habitat value. Allow market forces and cooperative management agreements to dictate land use patterns.
- Land use, agriculture, and wildlife habitat: Second paradigm-- Seek extensive conversion of agricultural land to open water, shallow water habitat, riparian forest, wetlands, and dedicated wintering waterfowl habitat because it represents a net improvement in environmental quality. Recognize that current agricultural trends in Delta region include rapid loss of pasture and row crops to viticulture, decreasing concentrations of waste grain due to better harvesting techniques, and urbanization.
- Topography (Hills, land surface elevations, etc.)
- Geology: seismic risk, soils, foundation conditions, depth of peat

- Sociological impacts: Presence of cities, farms, and other infrastructure along facilities alignments. Compatibility with local land use plans (example: San Joaquin County plans for population growth on New Hope Tract)
- Recreation: Separation of recreationists from landowners, channel island destination sites, separation of fast and slow boat traffic, boat wakes, law enforcement
- Navigation: Preservation of navigation access for levee repair, commerce, and recreation
- Climatic effects: Wind waves, sea surface rise
- Seepage: Impacts on areas adjacent to flooded areas

Adaptive Management

The range of components described in the following pages offer various levels of flexibility in terms of incremental implementation and responding to changes in the Bay-Delta system and our understanding of it. Some physical and operational changes are readily implemented in small steps (i.e. creation of desirable habitats). Others, such as channel modifications for flood control, must be made with the total system response in mind, to prevent shifting a problem from one area to another. Adaptive management embodies these concepts, and should be kept in mind when refining components and alternative configurations. The reader may wish to ask:

- Is the component or alternative configuration amenable to incremental implementation?
- How easily can one backtrack or take a different approach if expected results do not occur?

Common Assumptions

In order to complete prefeasibility cost estimates with the appropriate level of effort, the following conceptual design assumptions are made:

- Levee slopes: 3:1 on land and water sides, unless otherwise noted
- On the water side of new setback levees it is assumed that a riparian berm of about 20-foot width, at +2 MSL, is provided.
- Water side slopes are protected against erosion by a layer of construction fabric and rip-rap, up to the 100-year flood design elevation, except for the water side berm horizontal surface, which is vegetated.
- Where new setback levees are constructed on unconsolidated peat, assume 50 % additional levee material is required to consolidate foundations
- For isolated open channel construction assume side slopes 1:8 to a depth of 3 feet below normal water surface elevation, then 1:3 side slopes to a maximum depth of 30 feet, 15 foot wide waterside berm, levees 1:3 side slopes, 20-foot crown width on levees.
- Wherever islands or tracts are permanently flooded, seepage interception wells are assumed to be required on adjacent islands or tracts to mitigate for increased seepage.
- Whenever existing levees are breached to create new channels and flooded areas it is assumed that they will remain in all areas except where the breaches are specified, to provide wave wash protection for adjacent islands, habitat areas, and recreation destination sites. The land side of the breached levees must be protected against erosion by using construction fabric and rip rap, up to 2 feet above mean high tide.

Alternative 3B

- 5,000 cfs Open Channel Isolated Facility
  - Screened Intake at Hood: Offstream folded "V"
    - Relocation of Highway 160 and new bridge over diversion
    - Trashrack
    - Flood Gates or stop logs
    - Crane
    - Levees
    - Sedimentation Basin
    - Pumping Plant and discharge pipes over levee
    - Fish Bypass System: Pump, Evaluation Facility, Return Pipe, Discharge Structure
    - Control Building, Parking, Access, Lighting, Fencing
  - Alternate Intake at Babel Slough (River Mile 30)
    - Relocation of South River Road and new bridge over diversion
    - Trashrack
    - Flood Gates or stop logs
    - Crane
    - Levees
    - Sedimentation Basin
    - Pumping Plant and discharge to open channel
    - Fish Bypass System: Pump, Evaluation Facility, Return Pipe, Discharge Structure
    - Control Building, Parking, Access, Lighting, Fencing
    - Open channel southeast Sacramento River at RM 25
    - Siphon under Sacramento River
    - Open channel south to Hood
    - Bridge, Hood-Franklin Road
  - Open Channel, Hood to Lambert Road along west side of SPRR embankment
    - Acquire land along alignment, 2000-foot swath
    - Open channel construction
    - Siphon under Snodgrass Slough
  - Open Channel, Glanville Tract
    - Acquire land along alignment, 2000-foot swath, include existing borrow pits 1-4
    - Open channel construction
    - Siphon under Mokelumne River floodway
    - Check structures as required

- Open Channel, New Hope Tract

  - Acquire land along alignment, 2000-foot swath, include existing borrow pit 5
  - Open channel construction
  - Barber Road bridge
  - Thornton-Walnut Grove bridge
  - Siphon under Beaver Slough
  - Check structures as required

- Open Channel, Canal Ranch

  - Acquire land along alignment, 2000-foot swath
  - Open channel construction
  - Siphon under Hog Slough
  - Check structures as required

- Open Channel, Brack Tract

  - Acquire land along alignment, 2000-foot swath
  - Open channel construction
  - Woodbridge Road bridge
  - Siphon under Sycamore Slough
  - Check structures as required

- Open Channel, Terminous Tract

  - Acquire land along alignment, 2000-foot swath, include existing borrow pits
  - Open channel construction
  - Highway 12 bridge
  - Check structures as required

- Open Channel, Shin Kee Tract

  - Acquire land along alignment, 2000-foot swath, include existing borrow pits 9-12
  - White Slough local drainage structures
  - Open channel construction
  - Check structures as required

- Open Channel, Rio Blanco Tract

  - Acquire land along alignment, 2000-foot swath, include existing borrow pit 13
  - Open channel construction
  - Telephone Cut, Relocate pumping station and cut off easterly end of Telephone Cut
  - Check structures as required

- Open Channel, Bishop Tract

  - Acquire land along NEW alignment, 2000-foot swath as shown
  - Open channel construction
  - Eightmile Road bridge
  - Siphon under Disappointment Slough
  - Check structures as required

- Open Channel, Rindge Tract

  - Acquire land along alignment, 2000-foot swath
  - Open channel construction
  - Siphon under San Joaquin River
  - Check structures as required

- Open Channel, Roberts Island

  - Acquire land along alignment, 2000-foot swath
  - Open channel construction
  - House Road bridge
  - Relocation, Mokelumne River Aqueduct
  - Jacobs Road bridge
  - Inland Road bridge
  - Atchison Topeka RR bridge
  - Highway 4 bridge
  - Kingston School Road bridge
  - Siphon under Middle River
  - Check structures as required

- Open Channel, Union Island

  - Acquire land along alignment, 2000-foot swath
  - Open channel construction
  - Bonetti Road bridge
  - Siphon under Old River
  - Check structures as required

- Open Channel, Coney Island

  - Acquire land along alignment, 2000-foot swath
  - Open channel construction
  - Siphon under West Canal

❖ *North Delta Channel Improvement*

➢ New Hope Tract Setback Channel

- Purchase 600 foot alignment along Mokelumne River, I-5 to New Hope Landing
- Construct new setback levees from I-5 to New Hope Landing, set back 500 feet from existing channel
- Relocate New Hope Landing and Wimpy's Marina to coincide with new setback levee
- Remove existing levee sections where they would obstruct new channel, west and south levee sections
- Construct new 500 foot bridge across setback channel, with sufficient elevation to allow small craft passage
- Rebuild existing New Hope Tract levee, New Hope Landing to
- Beaver Slough
- Construct new, relocated irrigation diversions and drainage pumps for New Hope Tract
- Convert existing levee into channel island; place rip-rap on previous land side to prevent erosion

➢ North Mokelumne Setback Channel

- Purchase 600 foot alignment along North Mokelumne River, New Hope Landing to south end of Tyler Island, alternating between Staten Island and Tyler Island sides as shown
- Construct new setback levees along North Mokelumne River, New Hope Landing to south end of Tyler Island, alternating between Staten Island and Tyler Island sides as shown
- Remove existing levee sections where they would obstruct new channel, at each junction of new setback levee with existing levee, as shown
- Construct new 500 foot bridge, Thornton-Walnut Grove Road across setback channel, with sufficient elevation to allow small craft passage
- Construct new, relocated irrigation diversions and drainage pumps for Staten Island and Tyler Island
- Convert existing levee into channel island; place rip-rap on previous land side to prevent erosion

- Lower Mokelumne Setback Channel

  - Purchase 600 foot alignment along lower Mokelumne River on western portion of Bouldin Island
  - Construct new setback levees along lower Mokelumne River on western portion of Bouldin Island, approximately 500 feet east of existing levees, as shown
  - Excavate existing levee sections where they would obstruct new channel, at each junction of new setback levee with existing levee, as shown
  - Convert existing levee into channel island; place rip-rap on previous land side to prevent erosion
  - Construct new 500 foot bridge, Highway 12 crossing of lower Mokelumne River across setback channel, with sufficient elevation to allow small craft passage
  - Construct new, relocated irrigation diversions and drainage pumps for western portion of Bouldin Island

❖ South Delta Improvements

- Clifton Court Forebay Intake Structure

  - 220' x 60' x 28' concrete structure
  - Six steel radial gates 30' x 29'
  - 2,600 linear feet of new levee section from West Canal to CCFB

- Channel Dredging Along a 4.9 mile Reach in Old River

  - Dredging of about 1.24 million cubic yards of material
  - Disposal of material
  - Berm creation with dried dredged material

- Old River Fish Control Structure

  - 415' x 35' concrete structure
  - Eight vertical lift gates 45' x 10'
  - Vertical gate storage area
  - Stationary crib crane
  - Docking facilities

- Middle River Flow Control Structure

  - Two 25' x 16' radial gates
  - Concrete bay structure
  - Boat ramps
  - Sheet pile wall
  - Permanent storage facility
  - Access road

- Grant Line Canal Flow Control Structure
  - Four 20' x 16' radial gates
  - Buried utility lines
  - Access road
  - Storage area
  - 50' x 105' boating dock
  - 50' flashboard emergency access and microwave tower
  - Control building

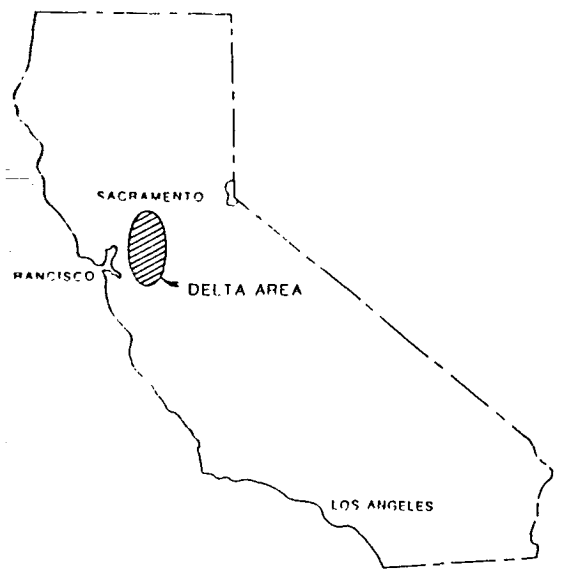
- Old River Flow Control Structure
  - Three 20' x 15' radial gates
  - Concrete control structure
  - Steel sheet-pile wall
  - Channel dredging
  - Buried utility lines
  - Access road
  - Storage area
  - 50' x 105' boat lock
  - 1,000 feet of new levee
  - 50' flashboard emergency access and microwave tower
  - Control building

- CVP-SWP Improvements
  - Clifton Court Forebay
    - Construct new, state-of-the-art fish screens at the Skinner Fish Facility
  - Tracy Pumping Plant
    - Construct interconnection with Clifton Court Forebay, with 2 sets of radial gates and 10,300 cfs capacity
    - Construct new, state-of-the-art fish screens at the Tracy Pumping Plant intake

- 3.0 MAF Upstream (Sacramento River Tributaries) Storage
- 500 TAF Upstream (San Joaquin River Tributaries) Storage
- 2.0 MAF Aqueduct Storage
- 200 TAF In-Delta Storage
- 500 TAF Groundwater Storage (Sacramento Valley)
- 500 TAF Groundwater Storage (San Joaquin Valley)

ALTERNATIVE 3B

5,000 CFS Open Channel I.F.
North Delta Improvements
South Delta Improvements
CVP-SWP Improvements
3.0 MAF Upstream Storage on Sac River Tributaries
500 TAF Upstream Storage on San Joaq River Tributaries
2.0 MAF Aqueduct Storage
200 TAF In-Delta Storage
500 TAF Groundwater Storage (Sacramento Valley)
500 TAF Groundwater Storage (San Joaquin Valley)



Setback Levees (typical)

Open Channel Isolated Facility

Channel Dredging

Flow Control Barriers

New Intake Structure

Fish Control Barrier

CVP-SWP Improvements : State of the Art Fish Screen Facilities and Intertie between CCFB-Tracy

LEGEND

Sacramento, San Joaquin and Mokelumne Rivers

Delta Waterways

SACRAMENTO - SAN JOAQUIN DELTA

2 0 2 4 6

SCALE IN MILES

81

D—006169

D-006169

Operating Parameters

DRAFT

Note: These operating parameters have been developed to provide a preliminary basis for conducting system and Delta model studies of CALFED alternatives. They do not reflect the culmination of the consensus process. A wide range of operating parameters will eventually be explored as part of the alternative evaluation process.

The operating Parameters and assumptions established for preliminary evaluation of the 3 CALFED alternatives with various configurations are as described in "DWR Planning Simulation Model (DWRSIM) Assumptions for CALFED Benchmark Study 1995C6F-CALFED-472, except as superseded or supplemented by the following:

1. All Surface and Groundwater Storage Components

All new surface storage facilities are operated to maximize average annual yield.

All new groundwater and conjunctive use facilities are operated to maximize average dry year yield.

- Tributary groundwater storage facilities have first priority for filling and fifth priority for discharging from storage.
- Aqueduct groundwater storage facilities have second priority for filling and fourth priority for discharging from storage.
- Aqueduct surface storage facilities have third priority for filling and third priority for discharging from storage.
- Tributary surface storage facilities have fourth priority for filling and second priority for discharging from storage.
- Delta storage facilities have fifth priority for filling and first priority for discharging from storage.

All new storage is assumed to be split evenly among the "three sectors", such that we have 1/3 for environmental purposes, 1/3 for urban purposes, and 1/3 for agricultural purposes.

For 500 TAF of groundwater storage, diversion capacity is 500 cfs. Discharge capacity is 500 cfs. No flow event target must be met for diversions to groundwater storage.

For Tributary Storage (Sacramento River System) diversions to storage:

All proposed in stream flow requirements must be met before diversions to new storage are allowed.

Assumed diversion and discharge capacity for off stream storage is 5,000 cfs.

For diversion points between Keswick and Chico Landing, no diversions allowed in any given water year until a flow event of at least 60,000 cfs, mean daily flow has occurred at Chico Landing. For the monthly time step used in modeling, a corresponding monthly volume of 1.5 million acre feet is required.

For diversion points at and downstream of Chico Landing, no flow event target is established.

For Tributary Storage (San Joaquin River System) diversions to storage:

New storage is assumed to be diverted from existing canal diversion locations or assumed to be an increase of existing on stream storage. No flow event targets set.

For Aqueduct Storage:

New storage is assumed to be connected to the California Aqueduct with 3,500 cfs diversion and discharge capacity.

2. In stream Flow Targets:

ERPP targets are to be met through purchase of existing water and use of the new storage allocated to environmental water supplies.

3. Delta Standards:

For isolated conveyance alternatives assume:

Rio Vista Flow Standard not to fall below 4,500 cfs all months, all year types.

Delta Cross Channel closed September through June, open July through August.

Isolated facilities should be operated to maximize isolated conveyance year round, consistent with the need to meet south Delta water quality objectives. The minimum levels of monthly export flows taken through the south Delta export facilities are suggested as follows:

October-March	1,000 cfs
April-June	0 cfs
July-September	1,000 cfs

Isolated flow is assumed to be exempt from both export and inflow in E/I ratio (with some

potential modification of the E/I ratio proposed by Dave Fullerton).

file buer\op_param.wpd, wp6.1, 4/25/97

CALFED
BAY-DELTA
PROGRAM

1416 Ninth Street, Suite 1155
Sacramento, California 95814

(916) 657-2666
FAX (916) 654-9780

Memorandum

Date: April 28, 1997

To: Bruce Herbold

From: Lester A. Snow
CALFED Bay-Delta Program

Subject: EPA meeting on March 18, 1997 regarding CALFED storage and conveyance analysis

Thank you for meeting with us on March 18, 1997 and discussing your concerns regarding our Bay-Delta Program storage and conveyance refinement process. This type of feedback from a diversity of CALFED agencies and stakeholders will allow us to shape our evaluation process to provide the analytical information required to make sound decisions as we prepare our Programmatic EIR/EIS documents.

As we understand it, your concerns are focused on our agricultural and urban water supply (CVP and SWP) demand assumptions and our methodology for evaluating water supply reliability. You suggested the development of specific goals for water supply reliability early in the CALFED process, with stakeholder concurrence. Based on this quantifiable water reliability goal (for example: 100% supply in average and above years, 80% supply in dry years, 70% supply in critical years), CVP/SWP demands and other model assumptions could be adjusted in the DWRSIM model to achieve the water reliability objective.

As we discussed in our meeting, a goal of the CALFED storage and conveyance refinement process is to provide a broad-base analysis of system operations for the three CALFED alternatives with multiple storage and Delta conveyance configurations. The storage and conveyance analysis will eventually include consideration of a matrix of variable physical components and operation assumptions, including varying levels of CVP/SWP demand, environmental outflow, capacities of storage and conveyance facilities, and operational goals. DWRSIM can also apply variable demand patterns, reflecting historical patterns of reduced demand during wet years as local agencies tap their local and other supplies of water. In addition, systemwide planning efforts use an economic model (linked with DWRSIM) which evaluates the effect that decisions made by water agencies relative to

local water supply options have on improvements to the system. The information developed through this process will be linked to the four common programs related to water use efficiency, water quality, levee system integrity and ecosystem quality to measure water supply reliability under each alternative.

Analysis of this matrix of operation assumptions will provide important information for selecting a preferred Program alternative; however, the amount of detail provided by this approach may be overwhelming to those not intimately involved in the Program. To provide a starting point for evaluation of alternatives, Program staff have been working to develop an initial set of specific operation assumptions. This initial operational criteria is intended to represent a reasonable, balanced approach for meeting the multiple Program objectives. A draft description of this set of initial operation assumptions is attached.

If you have additional questions or comments, please call me at (916) 657-2666 or Stein Buer at (916) 653-6628.

APPENDIX II
DWR PLANNING SIMULATION MODEL (DWRSIM) ASSUMPTIONS FOR CALFED BENCHMARK STUDY
1995C6F-CALFED-472

Study 472 meets SWRCB'S May 1995 Water Quality Control Plan (Plan) and includes selected upstream ESA requirements and CVPIA flow prescriptions (see Item III). Assumptions are identical to Study 471 (B160-98 Public Draft) except than 2020 level South-of-Delta demands are assumed.

I. New Model Features

A new DWRSIM version with the following enhancements is employed:

A. A new SWP and CVP south-of-Delta delivery logic uses (i) runoff forecast information and uncertainty (not perfect foresight), (ii) a delivery versus carryover risk curve and (iii) a standardized rule (Water Supply Index versus Demand Index Curve) to estimate the total water available for delivery and carryover storage. The new logic updates delivery levels monthly from January 1 through May 1 as water supply parameters become more certain. Refer to Leaf and Arora (1996) for additional information on the new delivery logic.

B. An expanded network schematic includes more details in the Delta and along the DMC and SWP-CVP Joint Reach facility.

C. A network representation of the San Joaquin River basin was adapted from USBR's SANJASM model. The San Joaquin River basin schematic was expanded to include (i) the Tuolumne River upstream to Hetch Hetchy and Cherry/Eleanor Reservoirs, (ii) the Merced River upstream to Lake McClure, (iii) the Chowchilla and Fresno Rivers upstream to Eastman and Hensley Lakes, respectively, and (iv) the San Joaquin River upstream to Millerton Lake.

D. Contra Costa Water District's "G" model is used to relate Delta flows and salinities. Refer to Denton (1993) for additional information on the procedure.

E. References:

Leaf, R.T. and Arora, S.K. (1996). "Annual Delivery Decisions in the Simulation of the California State Water Project and Federal Central Valley Project using DWRSIM." *Proceedings 1996 North American Water and Environment Congress*, ASCE, C.T. Bathala, Ed.

Denton, R.A. (1993). "Accounting for Antecedent Conditions in Seawater Intrusion Modeling - Applications for the San Francisco Bay-Delta." *Proceedings 1993 National Conference on Hydraulic Engineering*, ASCE, H.W. Shen, Ed.

II. Instream Flow Requirements

A. Trinity River minimum fish flows below Lewiston Dam are maintained at 340 TAF/year for all years, based on a May 1991 letter agreement between the USBR and the U.S. Fish and Wildlife Service.

B. Sacramento River navigation control point (NCP) flows are maintained at 5,000 cfs in wet and above normal water years and 4,000 cfs in all other years. This criterion is relaxed to 3,500 cfs when Shasta carryover storage drops below 1.9 MAF and is further relaxed to 3,250 cfs when Shasta carryover storage drops below 1.2 MAF.

C. Feather River fishery flows are maintained per an agreement between DWR and the Calif. Dept. of Fish & Game (August 26, 1983). In normal years these minimum flows are 1,700 cfs from October through March and 1,000 cfs from April through September. Lower minimum flows are allowed in low runoff years and when Oroville storage drops below 1.5 MAF. A maximum flow restriction of 2,500 cfs for October and November is maintained per the agreement criteria.

D. Stanislaus River minimum fish flows below New Melones Reservoir range from 98 TAF/year up to 302 TAF/year, according to the interim agreement (dated June 1987) between the USBR and the Calif. Dept. of Fish & Game. The actual minimum fish flow for each year is based on the water supply available for that year. Additional minimum flow requirements are imposed in June through September (15.2 - 17.4 TAF per month) to maintain dissolved oxygen levels in the Stanislaus River. Channel capacity below Goodwin Dam is assumed to be 8,000 cfs. CVP contract demands above Goodwin Dam are met as a function of New Melones Reservoir storage and inflow per an April 26, 1996 letter from USBR to SWRCB.

E. Tuolumne River minimum fishery flows below New Don Pedro Dam are maintained per an agreement between Turlock and Modesto Irrigation Districts, City of San Francisco, Dept. of Fish & Game and others (FERC Agreement 2299). Base flows range from 50 cfs to 300 cfs. Base and pulse flow volumes depend on time of the year and water year type.

F. Instream flow requirements are maintained in accordance with CVPIA criteria (see Item III) at the following locations: below Keswick Dam on the Sacramento River, below Whiskeytown Dam on Clear Creek and below Nimbus Dam on the American River.

III. CVPIA Flow Criteria

The following CVPIA flow criteria are in accordance with an April 26, 1996 letter from USBR to SWRCB. (This information is preliminary. It is envisioned that when significant changes occur within the CVP/SWP system, the criteria will be reviewed and possibly revised):

A. Flow objectives between 3,250 cfs and 5,500 cfs are maintained below Keswick Dam on the Sacramento River. Flow requirements during October through April are triggered by Shasta carryover storage.

B. Flow objectives between 52 cfs and 200 cfs are maintained below Whiskeytown Dam on Clear Creek, depending on month and year type.

C. Flow objectives between 250 cfs and 4,500 cfs are maintained below Nimbus Dam on the American River. Flow requirements during October through February are triggered by Folsom carryover storage. Flow requirements in other months are triggered by previous month storage plus remaining water year inflows.

IV. Trinity River Imports

Imports from Clair Engle Reservoir to Whiskeytown Reservoir (up to a 3,300 cfs maximum) are specified according to USBR criteria. Imports vary according to month and previous month Clair Engle storage.

V. Hydrology (HYD-C06F)

A new 1995 level hydrology, HYD-C06F, was developed similar to HYD-C06B described in a June 1994 memorandum report entitled "Summary of Hydrologies at the 1990, 1995, 2000, 2010 and 2020 Levels of Development for Use in DWRSIM Planning Studies" published by DWR's Division of Planning. HYD-CO6B was based on DWR Bulletin 160-93 land use projections and simulates the 71 year period 1922-92. HYD-C06F, developed through consultation with USBR to address differences in San Joaquin basin hydrology, simulates two additional years (through 1994) and includes the following major modifications compared to HYD-C06B:

A. Stand-alone HEC-3 models of the American, Yuba and Bear River subsystems were updated and extended through 1994. Yuba River minimum fishery flows below Bullards Bar Dam were not modified to reflect new FERC requirements. According to consultants for the Yuba County Water Agency, water supply impacts of the new requirements are not substantially different from those modeled in HYD-C06B.

B. Mokelumne River minimum fishery flows below Camanche Dam are modeled in HYD-C06F per an agreement between EBMUD, U.S. Fish and Wildlife Service, and Calif. Dept. of Fish & Game (FERC Agreement 2916). Base flows range from 100 cfs to 325 cfs from October through June, depending on time of the year and water year type. Base flows are maintained at 100 cfs from July through September for all water year types. Water year types are determined by reservoir storage and unimpaired runoff. For the months of April through June, additional pulse flows are maintained up to 200 cfs depending on water year type and reservoir storage.

C. Historical 1993-94 land use was estimated by linear interpolation between 1990 and 2000 normalized projected levels.

VI. Pumping Plant Capacities, Coordinated Operation & Wheeling

A. SWP Banks Pumping Plant average monthly capacity with 4 new pumps is 6,680 cfs (or 8,500 cfs in some winter months) in accordance with USACE October 31, 1981 Public Notice criteria.

B. CVP Tracy Pumping Plant capacity is 4,600 cfs, but physical constraints along the Delta Mendota Canal and at the relift pumps (to O'Neil Forebay) can restrict export capacity as low as 4,200 cfs.

C. CVP/SWP sharing of responsibility for the coordinated operation of the two projects is maintained per the Coordinated Operation Agreement (COA). Storage withdrawals for in-basin use are split 75 percent CVP and 25 percent SWP. Unstored flows for storage and export are split 55 percent CVP and 45 percent SWP. In months when the export-inflow ratio limits Delta exports, the allowable export is shared equally between the CVP and SWP. (The COA sharing formula is based on D-1485 operations, not on May 1995 Water Quality Control Plan operations. The sharing formula will likely be modified to conform with Water Quality Control Plan operations. Such a change has unknown, but potentially significant, operational implications.)

D. CVP water is wheeled to meet Cross Valley Canal demands when unused capacity is available in Banks Pumping Plant.

E. Enlarged East Branch aqueduct capacities are assumed from Alamo Powerplant to Devil Canyon Powerplant.

VII. Target Reservoir Storage

A. Shasta Reservoir carryover storage is maintained at or above 1.9 MAF in all normal water years for winter-run salmon protection per the NMFS biological opinion. However, in critical years following critical years, storage is allowed to fall below 1.9 MAF.

B. Folsom Reservoir storage capacity was reduced from 1010 TAF down to 975 TAF due to sediment accumulation as calculated from a 1992 reservoir capacity survey.

C. Folsom flood control criteria are in accordance with the December 1993 USACE report "Folsom Dam And Lake Operation Evaluation". This criteria uses available storage in upstream reservoirs such that the maximum flood control reservation varies from 400 TAF to 670 TAF.

VIII. SWP Demands, Deliveries & Deficiencies

A. 2020 demand level is assumed to be fixed at full entitlement of 4.2 MAF. MWDSC's monthly demand patterns assume an Eastside Reservoir and an Inland Feeder pipeline in accordance with a July 26, 1995 memorandum from MWDSC.

B. Deficiencies are imposed as needed per the draft "Monterey Agreement" criteria and are calculated from the following Table A entitlements for year 2020:

Agricultural Entitlements	1,175 TAF/year
M & I Entitlements	2,958
Recreation & Losses	64
Total Entitlements	4,197 TAF/year

C. When available, "interruptible" water is delivered to SWP south-of-Delta contractors in accordance with the following assumptions based on the Monterey Amendment White Paper redraft dated September 28, 1995:

1. Interruptible water results from direct diversions from Banks Pumping Plant. It is not stored in San Luis Reservoir for later delivery to contractors.

2. A contractor may accept interruptible water in addition to its monthly scheduled entitlement water. Therefore, the contractor may receive water above its Table A amount for the year. Interruptible water deliveries do not impact entitlement water allocations.

3. If demand for interruptible water is greater than supply in any month, the supply is allocated in proportion to the Table A entitlements of those contractors requesting interruptible water.

IX. CVP Demands, Deliveries & Deficiencies

A. 2020 level CVP demands, including canal losses but excluding San Joaquin Valley wildlife refuges are assumed as follows (see Item IX.B below for refuge demands):

Contra Costa Canal	=	202 TAF/year
DMC and Exchange	=	1,561
CVP San Luis Unit	=	1,447
San Felipe Unit	=	196
Cross Valley Canal	=	128
Total CVP Delta Exports	=	3,534 TAF/year

Including wildlife refuges, total CVP demand is 3,822 TAF/year. The Contra Costa Canal monthly demand pattern assumes Los Vaqueros operations in accordance with a July 11, 1994 e-mail from CCWD.

B. Sacramento Valley refuge demands are modeled implicitly in the hydrology through rice field and duck club operations. Sacramento Valley refuges include Gray Lodge, Modoc, Sacramento, Delevan, Colusa and Sutter. Level II refuge demands in the San Joaquin Valley are explicitly modeled at an assigned level of 288 TAF/year. San Joaquin Valley refuges include Grasslands, Volta, Los Banos, Kesterson, San Luis, Mendota, Pixley, Kern and those included in the San Joaquin Basin Action Plan.

C. CVP south-of-Delta deficiencies are imposed when needed by contract priority. Contracts are classified into four groups: agricultural (Ag), municipal and industrial (M&I), Exchange and Refuge. Deficiencies are imposed in accordance with the Shasta Index and sequentially according to the following rules:

1. Ag requests are reduced up to a maximum of 50 percent.

2. Ag, M&I and Exchange requests are reduced by equal percentages up to a maximum of 25 percent. At this point, cumulative Ag deficiencies are 75 percent.

3. Ag, M&I and Refuge requests are reduced by equal percentages up to a maximum of 25 percent. At this point, cumulative Ag and M&I deficiencies are 100 percent and 50 percent, respectively.

4. M&I requests are reduced until cumulative deficiencies are 100 percent.

5. Further reductions are imposed equally upon Exchange and Refuge.

D. Deficiencies in the form of "dedicated" water and "acquired" water to meet 800 TAF/year CVPIA demands are not imposed.

X. Delta Standards

In the following assumptions related to Delta standards, reference is made to the SWRCB's May 1995 Water Quality Control Plan (Plan):

A. Water Year Classifications

1. The Sacramento Valley 40-30-30 Index (as defined on page 23 of the Plan) is used to determine year types for Delta outflow criteria and Sacramento River system requirements unless otherwise specified in the Plan.

2. The San Joaquin Valley 60-20-20 Index (page 24) is used to determine year types for flow requirements at Vernalis.

3. The Sacramento River Index, or SRI (Footnote 6, page 20), is used to trigger relaxation criteria related to May-June Net Delta Outflow Index (NDOI) and salinity in the San Joaquin River and western Suisun Marsh.

4. The Eight River Index (Footnote 13, page 20) is used to trigger criteria related to (i) January NDOI, (ii) February-June X2 standards and (iii) February export ratio.

B. M&I Water Quality Objectives (Table 1, page 16)

1. The water quality objective at Contra Costa Canal intake is maintained in accordance with the Plan. A "buffer" was added to insure that the standard is maintained on a daily basis. Thus, DWRSIM uses a value of 130 mg/L for the 150 mg/L standard and a value of 225 mg/L for the 250 mg/L standard.

2. The M&I water quality objectives at Clifton Court Forebay, Tracy Pumping Plant, Barker Slough and Cache Slough are not modeled.

C. Agricultural Water Quality Objectives (Table 2, page 17)

1. Water quality objectives on the Sacramento River at Emmaton and on the San Joaquin River at Jersey Point are maintained in accordance with the Plan.

2. Plan water quality objectives on the San Joaquin River at Vernalis are 0.7 EC in April through August and 1.0 EC in other months. These objectives are maintained primarily by releasing water from New Melones Reservoir. A cap on water quality releases is imposed per criteria outlined in an April 26, 1996 letter from USBR to SWRCB. The cap varies between 70 TAF/year and 200 TAF/year, depending on New Melones storage and projected inflow.

3. The interior Delta standards on the Mokelumne River (at Terminous) and on the San Joaquin River (at San Andreas Landing) are not modeled.

4. The export area 1.0 EC standards at Clifton Court Forebay and Tracy Pumping Plant are not modeled.

D. Fish & Wildlife Water Quality Objectives: Salinity (Table 3, page 18)

1. The 0.44 EC standard is maintained at Jersey Point in April and May of all but critical years. Per Footnote 6 (page 20), this criteria is dropped in May if the projected SRI is less than 8.1 MAF. The salinity requirement at Prisoners Point is not modeled.

2. The following EC standards are maintained at Collinsville for eastern Suisun Marsh salinity control:

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
EC - Ave. High Tide	19.0	15.5	15.5	12.5	8.0	8.0	11.0	11.0

The corresponding EC standards for other locations in the eastern and western Suisun Marsh are not modeled.

E. Fish & Wildlife Water Quality Objectives: Delta Outflow (Table 3, page 19)

1. Minimum required NDOI (cfs) is maintained as follows:

Year Type	Oct	Nov	Dec	Jan	Feb-Jun	Jul	Aug	Sep
Wet	4,000	4,500	4,500	*	**	8,000	4,000	3,000
Above Normal	4,000	4,500	4,500	*	**	8,000	4,000	3,000
Below Normal	4,000	4,500	4,500	*	**	6,500	4,000	3,000
Dry	4,000	4,500	4,500	*	**	5,000	3,500	3,000
Critical	3,000	3,500	3,500	*	**	4,000	3,000	3,000

* January: Maintain either 4,500 cfs or 6,000 cfs if the December Eight River Index was greater than 800 TAF (per Footnote 13 page 20).

** February-June: Maintain 2.64 EC standards (X2) as described below.

2. For February through June, outflow requirements are maintained in accordance with the 2.64 EC criteria (also known as X2) using the required number of days at Chipps Island (74 km) and Roe Island (64 km). See Footnote 14 for Table 3 (Table A) page 26.

a. At the Confluence (81 km), the full 150 days (February 1 - June 30) of 2.64 EC is maintained in all years, up to a maximum required flow of 7,100 cfs. This requirement is dropped in May and June of any year for which the projected SRI is less than 8.1 MAF. In those years when the criteria is dropped, a minimum outflow of 4,000 cfs is maintained in May and June.

b. The criteria -- "If salinity/flow objectives are met for a greater number of days than the requirements for any month, the excess days shall be applied to meeting the requirements for the following month" -- is not modeled. See Footnote "a" of Footnote 14 for Table 3 (Table A).

c. The Kimmerer-Monismith monthly equation is used to calculate outflow required (in cfs) to maintain the EC standard (average monthly position in kilometers). In this equation the EC position is given and Delta outflow is solved for.

$$\text{EC position} = 122.2 + [0.3278 * (\text{previous month EC position in km})] - [17.65 * \log_{10}(\text{current month Delta outflow in cfs})]$$

In months when the EC standard is specified in more than one location (e.g. 19 days at the confluence and 12 days at Chipps Island), required outflow for the month is computed as a flow weighted average of the partial month standards.

3. Additional details on the 2.64 EC criteria are modeled as follows:

a. The trigger to activate the Roe Island standard is set at 66.3 km from the previous month, as an average monthly value.

b. The maximum required monthly outflows to meet the 2.64 EC standard are capped at the following limits: 29,200 cfs for Roe Island; 11,400 cfs for Chipps Island; and 7,100 cfs for the Confluence.

c. Relaxation criteria for the February Chipps Island standard is a function of the January Eight River Index as follows:

(i) X2 days = 0 if the Index is less than 0.8 MAF
(ii) X2 days = 28 if the Index is greater than 1.0 MAF

(iii) X2 days vary linearly between 0 and 28 if the Index is between 0.8 MAF and 1.0 MAF

F. Fish & Wildlife Water Quality Objectives: River Flows (Table 3, page 19)

1. Minimum Sacramento River flow requirements (cfs) at Rio Vista are maintained as follows:

Year Type	Sep	Oct	Nov	Dec
Wet	3,000	4,000	4,500	4,500
Above Normal	3,000	4,000	4,500	4,500
Below Normal	3,000	4,000	4,500	4,500
Dry	3,000	4,000	4,500	4,500
Critical	3,000	3,000	3,500	3,500

2. From February 1 through June 30, minimum flows on the San Joaquin River at Vernalis are maintained per the table below. For each period, the higher flow is required whenever the 2.64 EC Delta outflow position is located downstream of Chipps Island (<74 km). If the 2.64 EC Delta outflow position is upstream of Chipps Island (>74 km), then the lower flow requirement is used.

	Minimum Flows at Vernalis (cfs)	
	Feb1-Apr14 &	
Year Type	May16-June30	April15-May15
Wet	2,130 or 3,420	7,330 or 8,620
Above Normal	2,130 or 3,420	5,730 or 7,020
Below Normal	1,420 or 2,280	4,620 or 5,480
Dry	1,420 or 2,280	4,020 or 4,880
Critical	710 or 1,140	3,110 or 3,540

3. For the month of October, the minimum flow requirement at Vernalis is 1,000 cfs in all years PLUS a 28 TAF pulse flow (per Footnote 19, page 21). The 28 TAF pulse (equivalent to 455 cfs monthly) is added to the actual Vernalis flow, up to a maximum of 2,000 cfs. The pulse flow requirement is not imposed in a critical year following a critical year. These two components are combined as an average monthly requirement as follows:

October Minimum Flows at Vernalis (cfs)

Base Flow	Required Flow
<1,000	1,455
1,000-1,545	Base Flow + 455
>1,545	2,000

4. The above flow requirements at Vernalis are maintained primarily by releasing additional water from New Melones Reservoir. In years when New Melones Reservoir

drops to a minimum storage of 80 TAF (per April 26, 1996 letter from USBR to SWRCB), additional water is provided equally from the Tuolumne and Merced River systems to meet the Vernalis flow requirements. If these sources are insufficient to meet objectives at Vernalis, nominal deficiencies will be applied to upstream demands.

G. Fish & Wildlife Water Quality Objectives: Export Limits (Table 3, page 19)

1. Ratios for maximum allowable Delta exports are specified as a percentage of total Delta inflow as follows:

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
65	65	65	65	45-35	35	35	35	35	65	65	65

a. In February the export ratio is a function of the January Eight River Index per Footnote 25, page 22 as follows:

(i) 45% if the Jan. 8-River Index is less than 1.0 MAF
(ii) 35% if the Jan. 8-River Index is greater than 1.5 MAF
(iii) Varies linearly between 45% and 35% if the January Eight River Index is between 1.0 MAF and 1.5 MAF.

b. For this ratio criteria, total Delta exports are defined as the sum of pumping at the SWP Banks and CVP Tracy Pumping Plants. Total Delta inflow is calculated as the sum of river flows from the Sacramento River, Yolo Bypass, total from the Eastside stream group, and San Joaquin River inflow. Delta area precipitation and consumptive uses are not used in this ratio.

2. Based on Footnote 22 page 21, April and May total Delta export limitations are modeled as follows:

a. April 15 - May 15 exports are limited to 1,500 cfs OR 100 percent of the San Joaquin River flow at Vernalis, whichever is greater.

b. April 1-14 and May 16-31 export limits are controlled by either the export/inflow ratio (35%) or pumping plant capacity, whichever is smaller.

H. Fish & Wildlife Water Quality Objectives: Delta Cross Channel (Table 3, page 19)

1. The Delta Cross Channel (DCC) is closed 10 days in November, 15 days in December and 20 days in January for a total closure of 45 days per Footnote 26, page 22.

2. The DCC is fully closed from February 1 through May 20 of all years and is closed an additional 14 days between May 21 and June 15 per Footnote 27, page 22.

APPENDIX III
CALFED STORAGE & CONVEYANCE COMPONENTS: OPERATIONS CRITERIA

I. Isolated Component of Dual Transfer Facility

The Isolated Component of the Dual Transfer Facility (i.e. the Isolated Facility) is operated to maximize water quality benefits. In other words, the maximum amount of water is diverted into the Facility regardless of any additional upstream releases that may be required. Diversion into the Isolated Facility is governed by the following operations criteria:

A. Minimum Thru-Delta Conveyance: This is a user-specified minimum export that must be diverted from Delta channels before diversions through the Isolated Facility can be made.

B. Maximum Allowable Conveyance Through the Isolated Facility: This is a user-specified fraction of the net export that can be transferred through the Isolated Facility. The net export does not include export that is obtained by a release from the In-Delta Storage Facility.

C. Isolated Facility Capacity Constraint: This is the user-specified physical capacity of the Isolated Facility.

D. Service to SWP Only: This is a user-specified option to operate the facility only for SWP net export. If selected, conveyance through the Isolated Facility is further limited to the SWP net export, excluding wheeling for the CVP.

E. Export Ratio Restrictions: This is a user-specified option that allows Isolated Facility conveyance to be included or excluded from Delta "inflow" and "export" computations for the February-June export restriction and the April-May export restriction.

II. In-Delta & North of Delta Storage Components

The In-Delta Storage facility (IDS), the North of Delta Surface Storage facility (NDSS), and the North of Delta Groundwater Storage facility (NDGS) are operated based on the following criteria:

A. Releases from IDS, NDSS and NDGS are restricted as follows:

1. Additional releases from IDS, NDGS, NDSS and Oroville storage are made only to satisfy the SWP share of Delta In-Basin requirements and SWP export.

2. Release is made first from IDS. The IDS release is limited by available storage and by a user-specified maximum release capacity. Releases are made only to reduce SWP releases from upstream storage facilities and only up to the amount that is required for SWP export. Releases from IDS are not considered in export ratio calculations. Releases are not made as an alternative to cutting export under the export ratio constraint.

3. Extraction/Releases are then made from NDGS, NDSS and Oroville storage. Extraction/Release from NDGS and NDSS are balanced with the Oroville release in the HEC III manner (i.e. balancing based on user specified logical levels). This balancing technique is flexible enough to consider a very wide range of priorities.

4. Extraction/Release from NDGS and NDSS are limited by the user-specified aquifer/reservoir extraction/outlet capacities..

B. Natural recharge of the NDGS is calculated as a user-specified percentage of the available storage capacity at the beginning of the month. The resulting recharge is considered as a Sacramento River basin requirement.

C. Artificial recharge of NDGS and filling of NDSS and IDS facilities is restricted as follows:

1. In each water year, artificial recharge of NDGS and filling of NDSS will not be permitted until a flushing volume of at least 550 TAF in one month occurs at the diversion point for filling of NDSS. In determining the artificial recharge of NDGS and the filling of NDSS for the month in which the flushing volume occurs, only Sacramento River flow in excess of the 550 TAF/month flow at each respective diversion will be considered for use in recharging/filling the facilities.

2. If any releases are being made to satisfy Delta In-Basin requirements, artificial recharge of NDGS and filling of NDSS and IDS will not be permitted.

3. Only Sacramento River inflow into the Delta that is in excess of the export ratio requirement and is also surplus Delta outflow is considered for use in the artificial recharge of NDGS and filling of NDSS and IDS.

4. The artificial recharge of NDGS is considered first. Artificial recharge of NDGS is limited to the excess Sacramento River flow above any required river flow between its diversion point and the point of inflow into the Delta. It is also limited to its available unfilled capacity and a user- specified maximum recharge rate.

5. The filling of NDSS is considered second. Filling of NDSS is limited to the excess Sacramento River flow above any required river flow between its diversion point and the point of inflow into the Delta minus the diversion for the artificial recharge of the NDGS. It is also limited to its available unfilled capacity and a user-specified maximum fill rate.

6. The filling of IDS is considered third. Filling of IDS is limited to its available unfilled capacity and a user-specified maximum fill rate.

7. The filling of IDS is considered an export and is, therefore, subject to the export ratio requirement. Since filling IDS is using only surplus water (CVP has taken all it can) it is not subject to COA sharing.

III. South of Delta Storage Components

The South of Delta Surface Storage facility (SDSS) and the South of Delta Groundwater Storage facility (SDGS) are operated based on the following criteria:

A. Storage capacities of SDSS and SDGS are user-specified.

B. Storage releases from SDSS and SDGS to meet downstream demands are restricted as follows:

1. The order of priority for storage releases is as follows: (a) SDGS, (b) SDSS and (c) SWP San Luis Reservoir.

2. Storage release capacities for SDSS and SDGS are user-specified.

C. Diversions to SDSS and SDGS are restricted as follows:

1. The order of priority for storage diversions is as follows: (a) SDGS, (b) SDSS and (c) SWP San Luis Reservoir.

2. Storage diversion capacities for SDSS and SDGS are user-specified.

D. SDSS operations (releases and diversions) are balanced with SWP San Luis operations.

E. SDSS and SWP San Luis operations are triggered by combined south of Delta target storage. This combined storage is filled during some high outflow periods and with storage transfers from upstream reservoirs.

F. Diversions (recharge) to SDGS are based on surplus outflow and storage transfer.

G. SDGS recharge and extraction are functions of SWP delivery and Oroville storage.