STATE OF CALIFORNIA -- THE RESOURCES AGENCY **GRAY DAVIS,** *Governor*

DEPARTMENT OF WATER RESOURCES
1416 NINTH STREET, P.O. BOX 942836
SACRAMENTO, CA 94236-0001
(916) 653-5791

March 24, 2003

Ms. Carolee K. Krieger, Co-Chair
Citizen's Planning Association's Water Committee
of Santa Barbara County, Inc.
916 Anacapa Street
Santa Barbara, California 93101

Dear Ms. Krieger:

Thank you for your comments of October 19, 2002, on the Draft State Water Project Delivery Reliability Report. We welcome the interest this draft report has generated and are pleased to provide responses to your questions and concerns.

In general, you believe the draft report misleads planners and the public by presenting estimates of the delivery ability of the State Water Project that are much higher than deliveries that have been made in the past. The studies contained in the report use a computer simulation model, CALSIM II. The simulation covers a 73 year period, 1922-1994, which contains a wide range of wet periods and dry periods. The studies account for current environmental regulation of exports and, depending upon the study, contain estimates for current or projected levels of SWP demand. I believe that you would agree that more water would be delivered in a wet year now, when SWP demand is near the 4 million acre-feet per year level, than in a wet year in the late 1970s, when the demand was near 2 maf/yr. Your point is that the estimated amounts are just too large to be credible, given the operational experience over the past 10 to 20 years.

During the late 1980s and much of the 1990s, there was great operational uncertainty for the SWP. The reductions in SWP exports due to "take" limitations for fish protected under the Endangered Species Act had a very significant impact on the delivery ability of the SWP. This uncertainty was so great that it led to the signing of the Bay-Delta Accord (1994), which defined measures for environmental protection and regulatory stability, and the implementation of the CALFED Program. Since 1994, the Department of Water Resources and the associated CALFED agencies have implemented actions to significantly reduce SWP operational uncertainties. These include additional operational requirements for fish protection, implementation of the Environmental Water Account, and greatly improved coordination between DWR, the Bureau of Reclamation, the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, and the Department of Fish and Game.

2001 is the first year that contractors' requests exceeded 4.0 maf. Since the 2001 model study includes water demands that are significantly higher than historical levels, modeled water deliveries often exceed historical deliveries. The demands assumed in the model simulations serve as the upper limit for SWP deliveries. The simulation will export as much as allowable to meet the assumed demand. Therefore, during wet times, the amount of delivery is often controlled by the assumed demand. During dry periods, the assumed demands do not control the amount of delivery because water supply is the limiting factor. A good way to analyze how well CALSIM II simulates water system operations and other legal uses of water within the Sacramento Valley, therefore, is to compare the results of the 2001 study to a recent dry period.

A comparison of adjusted historical and CALSIM II deliveries for the 1987-1992 dry period is attached (Attachment 1). It illustrates two things. First, the Delta protection standards currently in place, per the State Water Resources Control Board's Decision 1641, are more restrictive to operations and reduce the allowable amount of SWP export when compared to those in place prior to 1994. Secondly, the study shows, once the previous standards (SWRCB Decision 1485) are used by CALSIM II to simulate the system and the results are adjusted for differences between the actual and modeled values for storage at the beginning and end of the period, the average water deliveries estimated by CALSIM II are very close to the actual historic amounts (50 taf/yr lower). This is an important conclusion that should help improve general confidence in using CALSIM II as an analytical tool. It does not, however, address the accuracy of the results for other hydrologic periods. This task will be undertaken in the model evaluation effort.

In the draft report, DWR committed to an evaluation of the adequacy of using CALSIM II for estimating SWP delivery ability. This effort is underway and consists of the simulation of the recent drought period (1987-1992), a simulation of a longer historic period (described in Attachment 2), a sensitivity analysis of the key parameters of CALSIM II, and a peer review conducted by the CALFED Science Program. The entire evaluation is expected to be completed within a year.

Attachment 3, "Model Water Accounting and Water Rights," addresses your question regarding the method used in CALSIM II to track water sources and uses. Attachment 4 responds specifically to other questions and comments contained in your letter.

DWR plans to finalize the SWP Delivery Reliability Report in the near future. We recognize that this is an ongoing process and plan to revise the report frequently. We commit to involving the public in the discussions and analyses regarding the sufficiency

of CALSIM II. We encourage the exploration of alternative methods of evaluating SWP delivery ability or different ways of using CALSIM II for this evaluation. DWR will work with all interested parties with the expectation that the next report will have greater support.

Your letter, as well as all others, commenting on the draft report and the corresponding responses will be included in an appendix to the final report. In addition, they are posted on the State Water Project Delivery Reliability Report website (http://swpdelivery.water.ca.gov).

Thank you for your comments. If you wish to discuss this further, please call me at (916) 653-1099. For technical information, please contact Francis Chung, Chief of DWR's Bay-Delta Office Modeling Support Branch, at (916) 653-5924.

Sincerely,

Katherine F. Kelly

Katherine F. Kelly, Chief
Bay-Delta Office

Attachments

Comparison of Historical and CALSIM II Deliveries for 1987-1992

As explained on page 6 of the draft report, past deliveries cannot accurately predict future deliveries. There have been continual, significant changes in the factors that determine State Water Project water delivery, including water demand. SWP Water contractors' requests for water have increased in recent years and 2001 is the first year that requests exceeded 4.0 million acre-feet per year (as shown in the attached Figure 1).

The 2001 model study used for the draft report assumes that current water-use conditions, including water demands, exist for each year analyzed in the 73-year model study. Since the 2001 model study includes water demands that are significantly higher than historical levels, modeled water deliveries often exceed historical deliveries. One exception to this would be during dry periods because supply, not demand, determines the amount of water delivery.

Historical values for SWP Table A deliveries from the Delta have been compared to the Table A delivery values of the 2001 model study for the dry period of 1987 through 1992 to assess how well CALSIM II simulates supply-limited conditions for a recent period. This comparison requires three adjustments to be made for the results to be comparable. One adjustment is made to the historical delivery data and two are made to the conditions assumed for CALSIM II.

The historical delivery data are adjusted to be comparable to the model results as follows. Historically, a portion of the annual water allocation is carried over in SWP storage facilities and delivered in the following year. The CALSIM II model does not currently have criteria and procedures to allow carryover of allocated water from one year to the next. To make the historical data comparable to model data, the historical Table A delivery data was adjusted to show all the "carryover water" being delivered in the year of allocation rather than the following year. The adjusted historical and 2001 model study deliveries for the 1987 through 1992 dry period are compared in Figure 2.

The modeled average delivery for this period is 1,670 taf/yr compared to the historical average of 2,030 taf/yr in CALSIM II format.

The two adjustments made to CALSIM II are 1) changing the regulatory requirements for Delta operation to match the ones in place during 1987-92, and 2) adjusting the reservoir storages at the beginning of the period to match those that actually existed at that time.

The 2001 model study in the draft report includes regulatory constraints that were not applicable to the 1987-1992 period (State Water Resources Control Board Decision 1641). For comparison purposes, a special 2001 model study was completed with the regulations that were in effect at that time (Decision 1485). As shown in Figure 3, this study produces higher SWP deliveries than the original study with the D-1641

constraints. The study's modeled average delivery for this period is 1,910 taf/yr, compared to the average of 1,670 taf/yr for the original study. A comparison of the revised study results with the historical deliveries is shown as Figure 3.

Modeled SWP demand for 1986, a wet year just before the dry period, is 3,345 taf compared to the historical request of 2,364 taf. As a result of this higher model demand, modeled SWP storage at the beginning of the dry period is approximately 420 taf lower than the historical SWP storage. The modeled storage at the end of the dry period is essentially the same as the historical value. There is, therefore, an additional 420 taf of supply that would have been delivered in the model and the CALSIM delivery amounts during the dry period should be adjusted accordingly. To adjust for the 420 taf difference in storage, 70 taf was added to the modeled delivery for each of the six years in the dry period. This adjustment raises the average model delivery for the dry period to 1,980 taf/yr, 50 taf/yr lower than the historical average of 2030 taf/yr (Figure 4).

Figure 1
SWP Contractor's Table A Request versus 2001 Model Study SWP Table A Demand

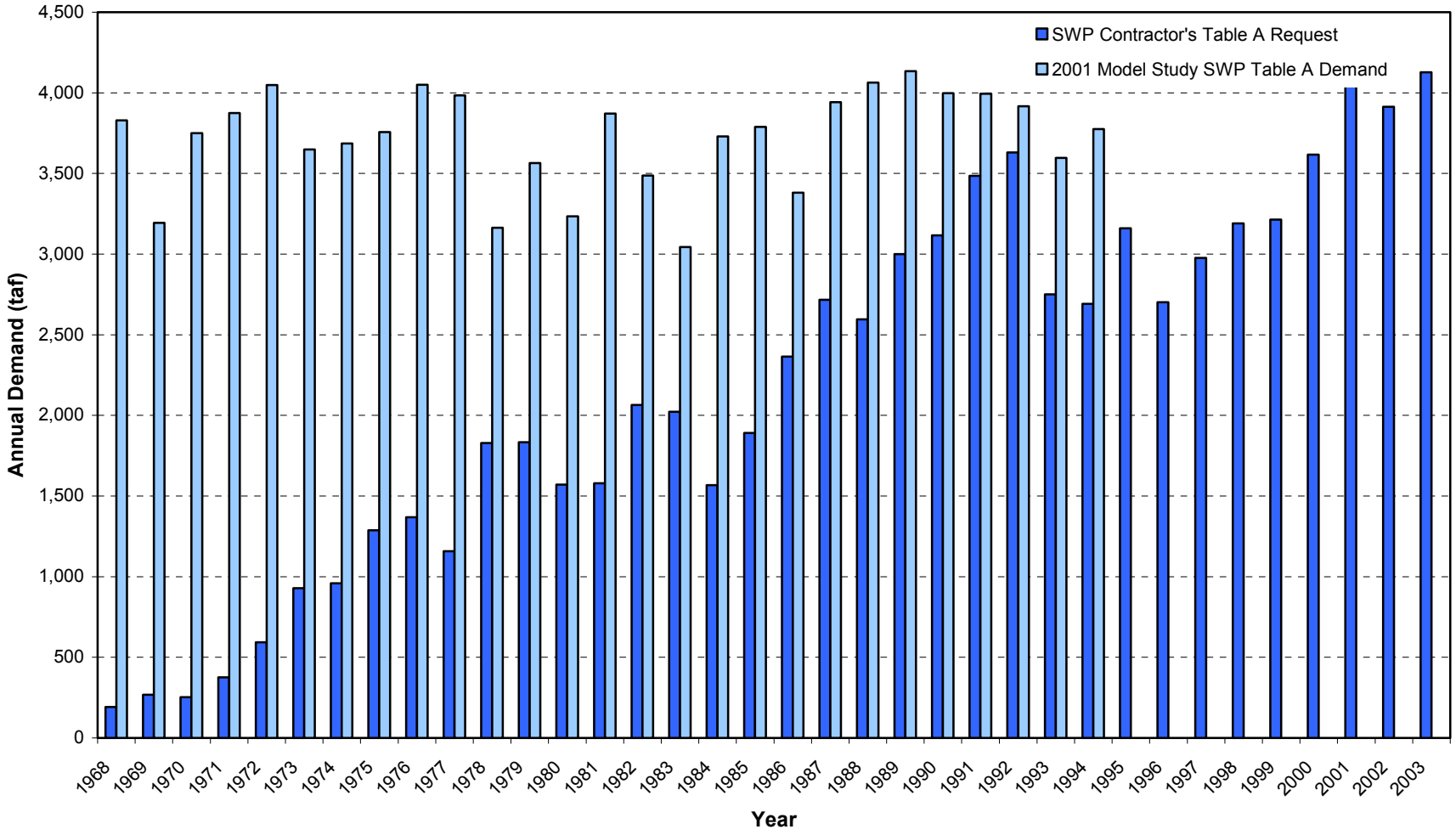


Figure 2
Historical SWP Table A Delivery versus 2001 Model Study SWP Table A Delivery
1987 - 1992 Dry Period

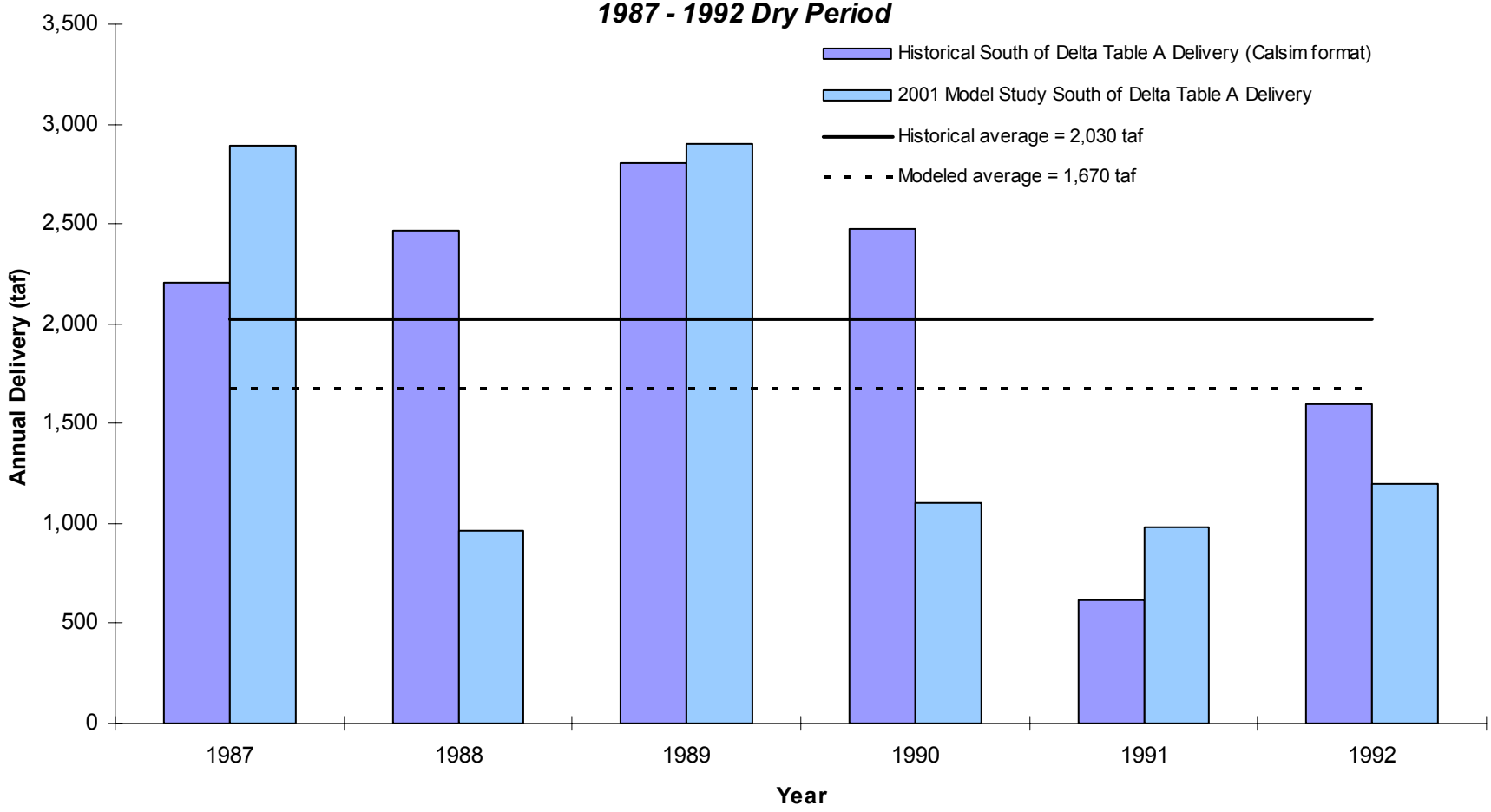


Figure 3
Historical SWP Table A Delivery versus 2001 D-1485 Model Study SWP Table A Delivery
1987 - 1992 Dry Period

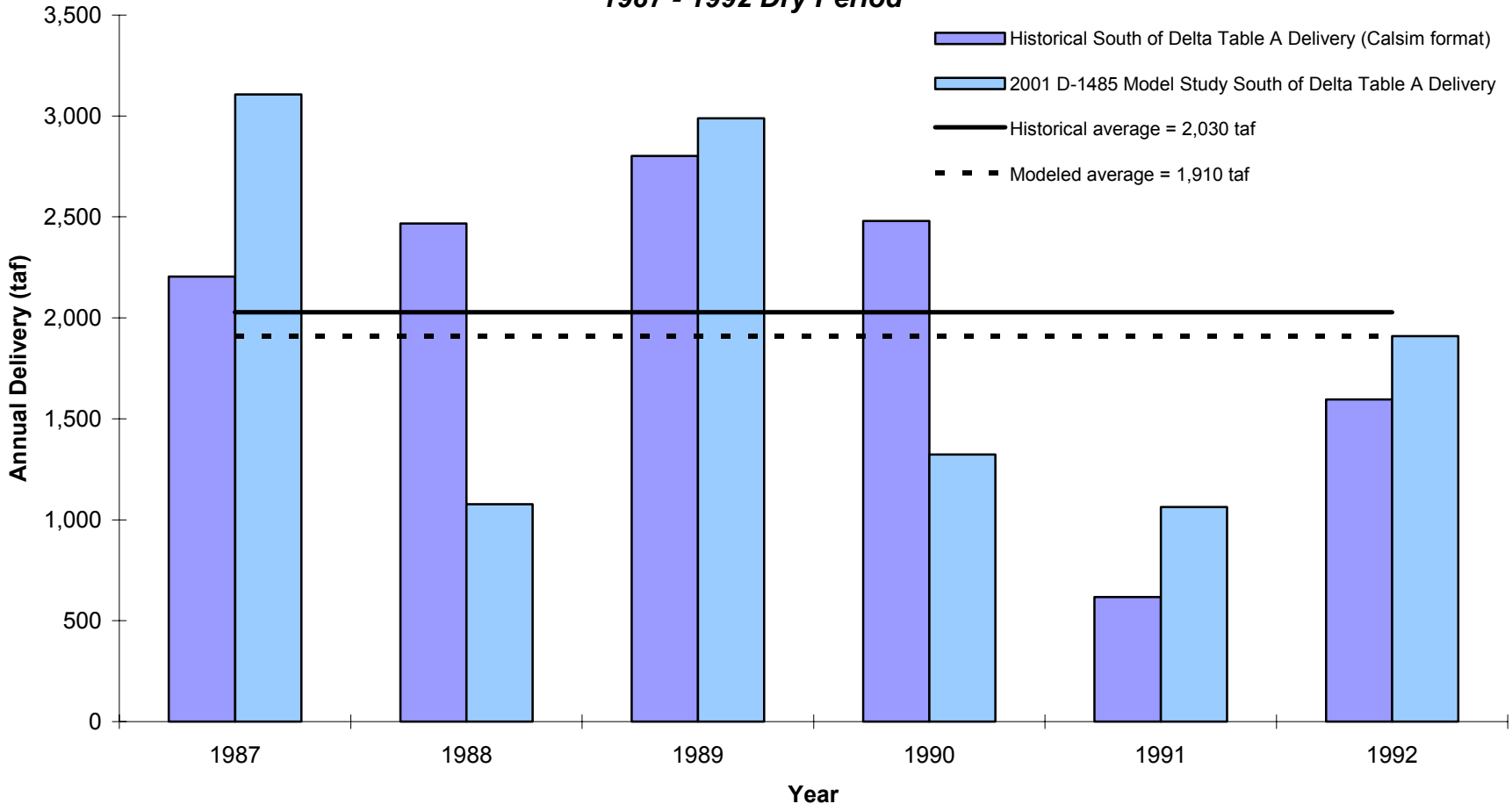
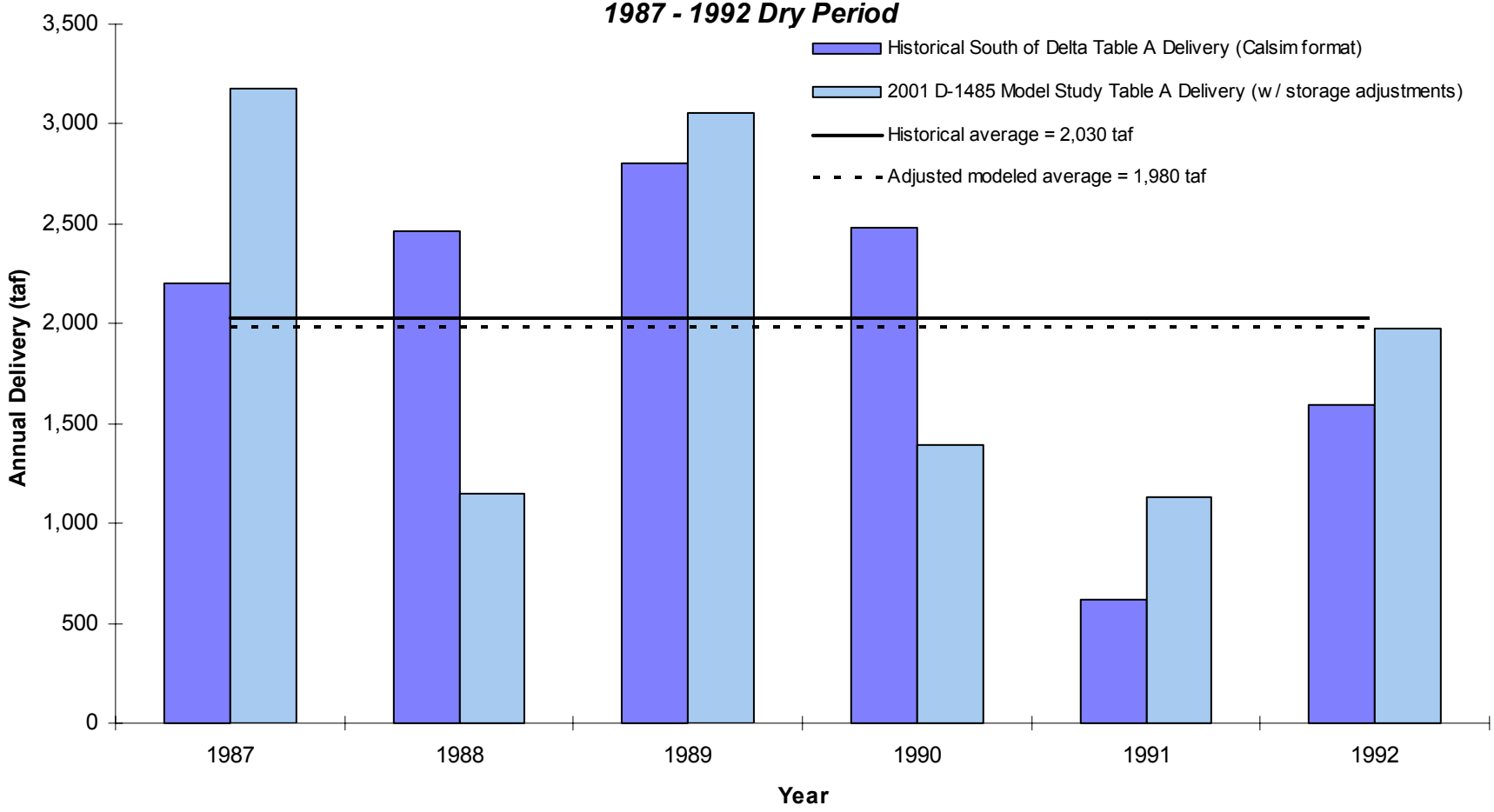


Figure 4
Historical SWP Table A Delivery v. Adjusted 2001 D-1485 Model Study SWP Table A Delivery
1987 - 1992 Dry Period



CALSIM II Evaluation

DWR's Bay-Delta Office is currently undertaking a "historical project operations study" to investigate the accuracy of the model's water supply estimates. The purpose of the historical project operations study is to compare CALSIM II results with historical operations and investigate the source of any differences in historical and simulated performance. The historical project operations studies is part of a larger CALSIM II evaluation process. Other components of this evaluation will include a survey of stakeholders; a model peer review by leading academics and practitioners; and a sensitivity analysis on model inputs and parameters. Initial results from the historical project operations study are expected to be available by March 2003.

The historical project operations study, conducted by DWR, will compare CALSIM II model results to recent historical operations for water years 1975 to 1998. This 24-year period includes both the 1976-77 and 1987-92 droughts. It also includes water year 1998 that is one of two years for which detailed analysis of historical water supply and demand is being conducted as part of the California Water Plan Update 2003 (Bulletin 160-03).

For the historical project operations study, input to the current CALSIM II model will be changed to reflect historical conditions. The inflow hydrology will be revised to reflect historical rather than current or projected level of development. Demand will be calculated for the historical land use, based on DWR's land surveys and county commissioners' reports, rather than a fixed level of development. Project contracts and entitlements will be changed to their historical level. Lastly operation logic will be changed to reflect the changing regulatory base line such as the release of the State Water Resources Control Board 1995 Water Quality Control Plan and State and federal biological opinions for Delta smelt and Chinook salmon.

The study will be limited in geographical scope to a dynamic operation of the Sacramento Valley, the Delta, and CVP-SWP facilities south of the Delta. Delta inflows from the San Joaquin Valley and the East Side Streams will be fixed at their historical level. In dry years when the system is system is supply limited, the SWP target demands will be set equal to the historical requests. In wet years when the system is demand driven, target demands will be set equal to historical deliveries. Similarly for the CVP, historical requests or annual contract amounts will be an upper bound on CVP deliveries.

Modeling of the CVP-SWP system and areas contributory to the Sacramento-San Joaquin Delta requires considerable input data. The majority of the data relates to either system inflows or demand data for the 73-year period of simulation. As described in page 7 of the report, DWR has committed to undertake a sensitivity analysis on SWP water delivery reliability. This analysis would examine the effects of certain assumptions, parameters and input data on model results. The aim of the sensitivity analysis is to identify the input data that most strongly affect model results so that future

work within the Department can be focused on refining estimates of these key determinants.

The current representation of groundwater in CALSIM II is only a first step towards developing a fully integrated groundwater surface water model. The Department is currently developing the Central Valley Groundwater Surface water Model with the eventual aim of linking this model to CALSIM II to study impacts of surface water operations, groundwater pumping and land use change on groundwater elevations. The current groundwater model component of CALSIM II affects surface water operations through the calculation of the stream-groundwater interaction. There is considerable uncertainty about the magnitude of this interaction. In areas with high groundwater levels, groundwater inflow to streams is a function of groundwater head. In areas of low groundwater elevation where stream seepage flows to the groundwater, there is an assumed hydraulic disconnect between the stream and the aquifer so that seepage is independent of groundwater elevation. It is acknowledged that groundwater elevations are not accurately modeled in CALSIM II. As calculated by CALSIM II, groundwater inflows to the stream system in the upper Sacramento Valley average 255 taf/yr. Stream losses to groundwater in the lower Sacramento Valley average 40 taf/yr. This compares with an average annual Sacramento River inflow to the Delta (at Freeport) of approximately 16 maf/yr.

In any discussion on model “calibration” it is important to remember that CALSIM II is a mass-balance accounting model and ***not*** a distributed hydrologic model that simulates a physical process. It is also important to understand that the hydrology development is based on historical gage data. Valley floor accretions and depletions are calculated as closure terms in a hydrologic mass balance calculated for each Depletion Study Area. The accretions represent local ungaged runoff into the stream system and are calculated based on gage data for stream inflows and outflows across the hydrologic boundary and estimates of urban and agricultural consumptive use of applied water within the region. The accretions and depletions also contain all the errors in the mass balance stemming from poor gage data or incorrect estimates of groundwater extraction or agricultural and urban water use. True calibration techniques can only be applied to a few components of the CALSIM II model, such as the Artificial Neural Network used for determining flow-salinity relationships in the Delta and the multi cell groundwater model.

Model Water Accounting and Water Rights

CALSIM II has the ability to track water throughout the system by splitting network arcs into sub-arcs. For example a delivery to a certain region within the Sacramento Valley may be sub-divided into deliveries to Central Valley Project water service contractors and senior water right holders (Settlement contractors). Once water reaches the Sacramento-San Joaquin Delta there is no differentiation between different water types or sources. Water available for export at the Delta is calculated as Delta inflow less the required Delta outflow to meet regulatory standards, less in-Delta consumptive use. Water available for export is shared between the CVP and State Water Project according to the formula defined in the Coordinated Operations Agreement.

The COA, authorized by U.S. Congress and signed in 1986, is a permanent agreement between Reclamation and The Department of Water Resources to coordinate the operations of the CVP and SWP. Its purpose is to ensure each project obtains its share of water from the Delta while meeting obligations to protect other beneficial uses of water in the Sacramento Valley and the Delta. Coordinated operations also increase the overall efficiency of the projects. The agreement was negotiated in the context of regulatory requirements stipulated by SWRCB D-1485. Both projects have responsibilities to meet “in-basin use” within the Sacramento Basin and must share the available water for export at the Delta. In-basin use covers all legal use of water in the Sacramento Basin including project storage withdrawals to meet contract demands, in-Delta consumptive use and required Delta outflow for maintaining Delta water quality standards.

Balanced water conditions exist in the Delta when upstream releases from project storage plus unregulated flows equals the water supply needs of the basin plus project exports. Under these conditions COA defines a sharing formula for meeting in-basin use and for the partition of excess flow. The responsibility for meeting in-basin use with storage withdrawals is shared 75 percent for the CVP, 25 percent for the SWP. The capture and/or export of excess flows are shared 55 percent for the CVP, 45 percent for the SWP. A project’s share of surplus flows includes project storage increase (after accounting for Trinity River imports into the Sacramento River) and Delta exports. Any water that is not used by one project is available for use by the other project or flows into San Francisco Bay as Delta surplus. Implementation of COA is simplified in CALSIM II. The model operates to COA sharing formulas to the extent possible within each time-step. Imbalances may occur due to pumping or capacity restrictions but are not carried forward to the next time step. In reality, CVP and SWP operators will track and attempt to reconcile these imbalances later in the year.

Areas upstream of the Sacramento-San Joaquin Delta are divided into hydrologic basins or units known as Depletion Study Areas. Sacramento Valley

demands are calculated for each DSA based on current or projected land use estimates. With the exception of the Greater Sacramento metropolitan area, agricultural demands are lumped together with outdoor urban water demand. Indoor urban water use is only modeled in the Sacramento region. Elsewhere indoor urban water use is not modeled as it is non-consumptive. Demands are classified as CVP project, SWP project, or non-project. Non-project demands correspond to riparian and appropriative water right holders. CVP project demands are sub-divided into several classes based on contract type; service contractors are differentiated from settlement contractors (senior water right holders). Similarly, SWP senior water rights holders on the Feather River are differentiated from SWP contractors. Demands may be represented as a time series, varying by month and year, or more simply as twelve repeating monthly values.

The split between project and non-project demands in CALSIM II was determined by comparing the project acreage within each DSA to the total crop acreage within each DSA. These ratios are then applied to the total demand to determine the project and non-project demand components. The following table lists the percent project / non-project spilt for each Sacramento Valley DSA:

Project/non-project split

DSA	Project % by land area	Non-project % by land area
10	19	81
12	75	25
15	66	34
58	90	10
65	12	88
69	70	30
70	71	29

Project and non-project water is separately tracked within the Sacramento Valley. Non-project demands cannot be met from water released from storage in project reservoirs. Otherwise surface water availability is the only limiting factor in meeting non-project demands. Diversions to meet project demands are limited by the contract amount less any imposed annual deficiencies or cuts in allocation as specified in the terms of contract and dynamically calculated each year by CALSIM II.

Groundwater pumping is only available to meet local agricultural and municipal and industrial demands. In the Sacramento Valley minimum annual groundwater pumping is specified for each of the seven DSAs to represent farmers and urban municipalities that do not have access to surface water. Otherwise groundwater is treated as a secondary or contingent supply to surface water. Source water to meet local demands is allocated according to the following priorities:

- Demands are first met by groundwater pumping, up to the minimum specified volume;
- Demands are subsequently met by surface water diversions:
  - up to the contract amount for project demands;
  - and up to surface water availability for riparian demands (unimpairing river flow for project storage operations);
- Any difference between supply and demand is met by additional pumping, no shortages occur.

Minimum groundwater pumping volumes for each DSA are based on historical groundwater pumping for water years 1981-1993 as estimated by the Central Valley Groundwater Surface water Model.

Responses to Comments of Carolee K. Krieger
Citizen's Planning Association of Santa Barbara County, Inc.
(Letter dated October 19, 2002)

Comment: A reliability of 50 percent should be used for planning new housing developments.

Response: The State Water Project Delivery Reliability Report contains the best information currently available on the delivery capability of the State Water Project. It does not analyze how specific local water agencies integrate SWP water into the management of their water supply. Integration of the various supplies available to a local area involves decisions traditionally done at the local level. The Department of Water Resources believes it is appropriate that local officials continue to fill this role.

Comment: Include 1991 deliveries in Appendix D.

Response: Historical deliveries for all years beginning in 1968 will be included in Appendix D of the final report.

Comment: The 1991 delivery of 0.5 million acre feet reflects the true minimum delivery.

Response: The SWP Table A delivery of 549 taf in 1991 is lowest amount the project has delivered in a drought period. Future minimum deliveries will depend not only on the severity of the drought but also the allocation process in effect at that time and decisions regarding carryover storage.

Comment: The modeling did not assume the appropriate demand for Metropolitan Water District (50 percent of total).

Response: The MWD demands for the 2001 Study and the 2021A Study were obtained from MWD and are often less than their Table A amount. The 2021B Study assumes that MWD demand is at their maximum Table A amount of 2,011.5 taf every year.

Comment: The effect of the Monterey amendments and Articles 18(a) and 18(b) is not taken into account.

Response: The SWP will be operated pursuant to the Monterey Amendments and new amendments pending completion of a new EIR addressing the Monterey Amendments and termination of the related litigation. If the operational rules change at that time, they

will be reflected in future analyses. The impact of the amendments upon the delivery ability of the SWP will be analyzed in the Environmental Impact Report.

Comment: What determines when Article 21 water is available, over and above the 4 conditions listed on page 11?

Response: All conditions related to the delivery of Article 21 water are contained on page 11 of the draft report.

Comment: How many times (please give specific dates) has there been Article 21 water actually not taken?

Response: From 1994 through 2001, the availability of Article 21 supplies exceeded the SWP contractors' requests for this type of supply. During 2002, all available Article 21 supply was allocated amongst participating contractors.

Comment: What are the actual historical deliveries of Article 21 water from 1977 to 2001?

Response: The historical annual SWP Article 21 deliveries for 1968-2002 will be included in the final report.

Comment: How does the Environmental Water Account affect Article 21 water?

Response: The EWA program cannot adversely impact SWP operations, including the availability of Article 21 water, as stated in the CALFED Record of Decision.

Comment: If Article 21 water were stored in the Kern Fan Element (owned by DWR pre Monterey amendments), would this increase the SWP overall reliability to all South of Delta contractors?

Response: During excess conditions any additional storage downstream of the Delta would increase the overall delivery capability of the SWP.

Comment: How does the 1994 Bay-Delta Accord agreement affect the reliability of SWP water?

Response: During the late 1980s and most of the 1990s there was great operational uncertainty for the SWP. The reductions in SWP exports due to "take" limitations for fish protected under the Endangered Species Act had a significant impact on the delivery ability of the SWP. This uncertainty lead to the signing of the Bay-Delta Accord

(1994), which defined measures for environmental protection and regulatory stability, and the implementation of the CALFED Program. Since 1994, DWR and the associated CALFED agencies have implemented actions to significantly reduce SWP operational uncertainties. These include additional operational requirements for fish protection, implementation of the Environmental Water Account and greatly improved coordination between DWR, the Bureau of Reclamation, the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, and the Department of Fish and Game.

Comment: If DWR is not accurate and contractors base Urban Water Management Plans and other plans on faulty information, is DWR liable? Who is accountable for accurate information?

Response: DWR puts out information that is, to the best of its ability, accurate. DWR takes pains to set forth the tools and assumptions it employs in making its estimates, and expressly recognizes the inherently speculative nature of predicting future water supply. There is no legal basis for liability under these circumstances.

Comment: Where does the water for the SWP originate? What are all the sources of water used in the simulation and models for this report?

Response: SWP water originates from project water rights on the Feather River, surplus water in the Delta and Kern River inflow to the California Aqueduct. These are also the sources of SWP water for model simulations described in the report.