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

April 10, 2003

Ms. Jane Kelly
California Office Director
Public Citizen
1615 Broadway, Ninth Floor
Oakland, California 94612

Dear Ms. Kelly:

This is in response to your letter of November 1, 2002 supporting the comments made by Robert C. Wilkinson on the Draft State Water Project Delivery Reliability Report.

The SWP Delivery Reliability Report will be finalized 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. In addition, a peer review will be conducted by the CALFED Science Program to assess the adequacy of using CALSIM II for this purpose. We encourage the exploration of alternative methods of evaluating State Water Project delivery ability or different ways of using CALSIM II for this evaluation. The Department of Water Resources is committed to working with all interested parties with the expectation that the next report will have greater support.

Attached is DWR's response to Mr. Wilkinson. All comment letters and DWR's responses to them will be included in an appendix to the final report. In addition, they will be posted on the State Water Project Delivery Reliability Report website (http://swpdelivery.water.ca.gov).

If you wish to discuss this further, please call Katherine Kelly, Chief of DWR's Bay-Delta Office, 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,

Thomas M. Hannigan

Thomas M. Hannigan
Director

Attachment

cc: (See attached list.)

Mr. Steve Verigin, Acting Chief Deputy Director
Department of Water Resources
1416 Ninth Street
Sacramento, California 95814

Mr. Jonas Minton, Deputy Director
Department of Water Resources
1416 Ninth Street
Sacramento, California 95814

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DEPARTMENT OF WATER RESOURCES
1416 NINTH STREET, P.O. BOX 942836
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April 2, 2003

Mr. Robert C. Wilkinson
1428 West Valerio
Santa Barbara, California 93101

Dear Mr. Wilkinson:

This is in response to your letter of October 31, 2002 commenting on the Draft State Water Project Delivery Reliability Report.

Thank you for commenting on the report. We appreciate your acknowledgement of the significance of this effort to provide clear information on the delivery ability of the State Water Project and to seek public discussion of the draft document. Beyond these points, you present significant criticisms which center on the use of a single computer simulation model (CALSIM II) for the analyses contained in the report. You strongly state that the Department of Water Resources should withdraw the draft report and start over with a more thorough assessment of system reliability.

DWR released the report to assist local water and planning agencies and the State Water Project contractors in part to assist in meeting the requirements of Senate Bills 221 (Chapter 642, Statutes of 2001) and 610 (Chapter 643, Statutes of 2001). As you know, these laws link certain land-use decisions with the determination of local water supply sufficiency. For the 29 SWP water contractors and the many water agencies receiving water from them, information contained in the report is an important component of the analyses necessary to determine this sufficiency. The SWP Delivery Reliability Report provides the SWP contractors and the general public with the best information available on the delivery ability of the SWP.

DWR plans to finalize the SWP Delivery Reliability Report in the near future. DWR does not see an inconsistency between the issuance of the report and the discussions regarding the use of models being run for the California Water Plan Update 2003 effort. We recognize that this is an ongoing process and plan to revise the report frequently. We have committed to involving the public in the discussions and analyses regarding the sufficiency of CALSIM II. In addition, a peer review will be conducted by the CALFED Science Program to assess the adequacy of using CALSIM II for this purpose. We encourage the exploration of alternative methods of evaluating SWP delivery ability or different ways of using CALSIM II for this evaluation. DWR is committed to working with all interested parties and the Modeling Work Group associated with the California Water Plan Update 2003 with the expectation that the next report will be improved and have greater support.

The following discussion addresses your specific comments:

Integrate the Reliability Assessment of the SWP and the CVP into One Document.

DWR and the Bureau of Reclamation, in coordination with public agencies, have spent over two years developing CALSIM II. For years, the Bureau and DWR used different computer models to conduct planning analyses. Now, the Bureau and DWR agree CALSIM II sufficiently represents the operation of the Central Valley Project and the State Water Project and is the best model of its type for analyzing proposed projects.

DWR (the operating entity of the SWP) issued the Draft State Water Project Reliability Report. The corresponding information on CVP Delta exports for the model studies used for the draft report is presented in the 2001 and 2020 benchmark reports released on May 17, 2002. These reports can be downloaded from the modeling information linked to the report's website (http://swpdelivery.water.ca.gov).

Address SWP Water Rights and Environmental Constraints on Water Extraction.

The thrust of your concern is that the report may overestimate future SWP deliveries as a result of senior appropriators and upstream users exercising their legal claims to water or due to water quality, environmental, and other legal requirements.

Most of the water rights that could affect the SWP are subject to settlement agreements where the rights and obligations of users relative to the SWP are quantified and fixed. Riparian uses are inherently limited both by the ratcheting downward of the area under riparian ownership under the source-of-title doctrine and by the doctrinal limitation of riparian rights to non-municipal uses or to uses which do not require seasonal storage. Hence, riparian rights in the aggregate will never get materially larger and will likely only get smaller.

A reduction of supply available to the SWP from the exercise of Area-of-Origin water rights is possible. Implementing such a claim is expected to require new storage facilities, for which local beneficiaries have historically been reluctant to pay. Water users on the Sacramento River have recently agreed to share in the responsibility of meeting Delta water quality objectives, which will relieve some of the responsibility of SWP of this purpose. Under the related program, projects will be developed to provide water for farms, cities and fish and wildlife in the Sacramento Valley while also helping to meet environmental needs and improve water supplies and quality in other parts of the State.

It is possible that additional restrictions to protect fish could cause reductions in the delivery ability of the SWP. It is also possible that improvements in fish populations due to habitat improvements and greater coordination of SWP and CVP operations to protect fish could relax existing restrictions or that the construction of improved fish protection facilities at the SWP and CVP export facilities will allow more water to be delivered. These activities are being pursued under the CALFED Program.

DWR will continue to monitor the status of upstream water use and fish populations to assess the reasonability of the delivery reliability forecasts and adjust assumptions as appropriate. Possible changes in assumed future conditions can be explored by the CALSIM II sensitivity analyses. This effort will be done in close coordination with the Modeling Work Group.

Computer Models and Assertions of Reliability.

As mentioned earlier, DWR does not view issuance of the report as being inconsistent with the discussions within the Water Plan Update 2003 effort regarding the use of models. The peer review and plan for analyses regarding the adequacy of CALSIM II have been developed in coordination with the Modeling Work Group. The current evaluation of the CALSIM II model includes the development of a historical project operations study, which will be used to compare the model's water supply estimates to the historical 1975-1998 period. A description of the model evaluation process is attached (see Attachment 1).

The Illogic of "Demand Constrained" Deliveries.

You conclude the rationale put forth in the draft report, that lower demand for SWP deliveries is an important reason for less water being delivered in the past, is unfounded based upon an examination of SWP deliveries over the past 10 years. You assert the restrictions upon what can be exported would prevent the projected amounts of water from being delivered.

The studies contained in the report analyze 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 maf/yr 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 too large to be credible, given the operational experience over the past 10 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 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.

One way to investigate how well CALSIM II models the current operational rules and restrictions is to analyze a period when supply, not demand, defines the amount of water to be delivered. A comparison of adjusted historical and CALSIM II deliveries for the 1987-1992 dry period is attached (see Attachment 2). 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, once the prior 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 study concludes the average water deliveries estimated by CALSIM II are very close to the actual historic amounts (50,000 acre-feet per year lower).

This is an important observation 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.

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 will be posted on the State Water Project Delivery Reliability Report website.

We welcome your continued involvement in assessing the adequacy of CALSIM II. If you wish to discuss these responses further, please call Katherine Kelly,

Chief of DWR's Bay-Delta Office, at (916) 653-1099 or Francis Chung, Chief of DWR's Bay-Delta Office Modeling Support Branch, at (916) 653-5924.

Sincerely,

Thomas M. Hannigan

Thomas M. Hannigan
Director

Attachments

cc: Mr. Steve Verigin, Acting Chief Deputy Director
Department of Water Resources
1416 Ninth Street
Sacramento, California 95814

Mr. Jonas Minton, Deputy Director
Department of Water Resources
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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 within the next few months.

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's 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.

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, as shown in 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, as shown in Figure 4.

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

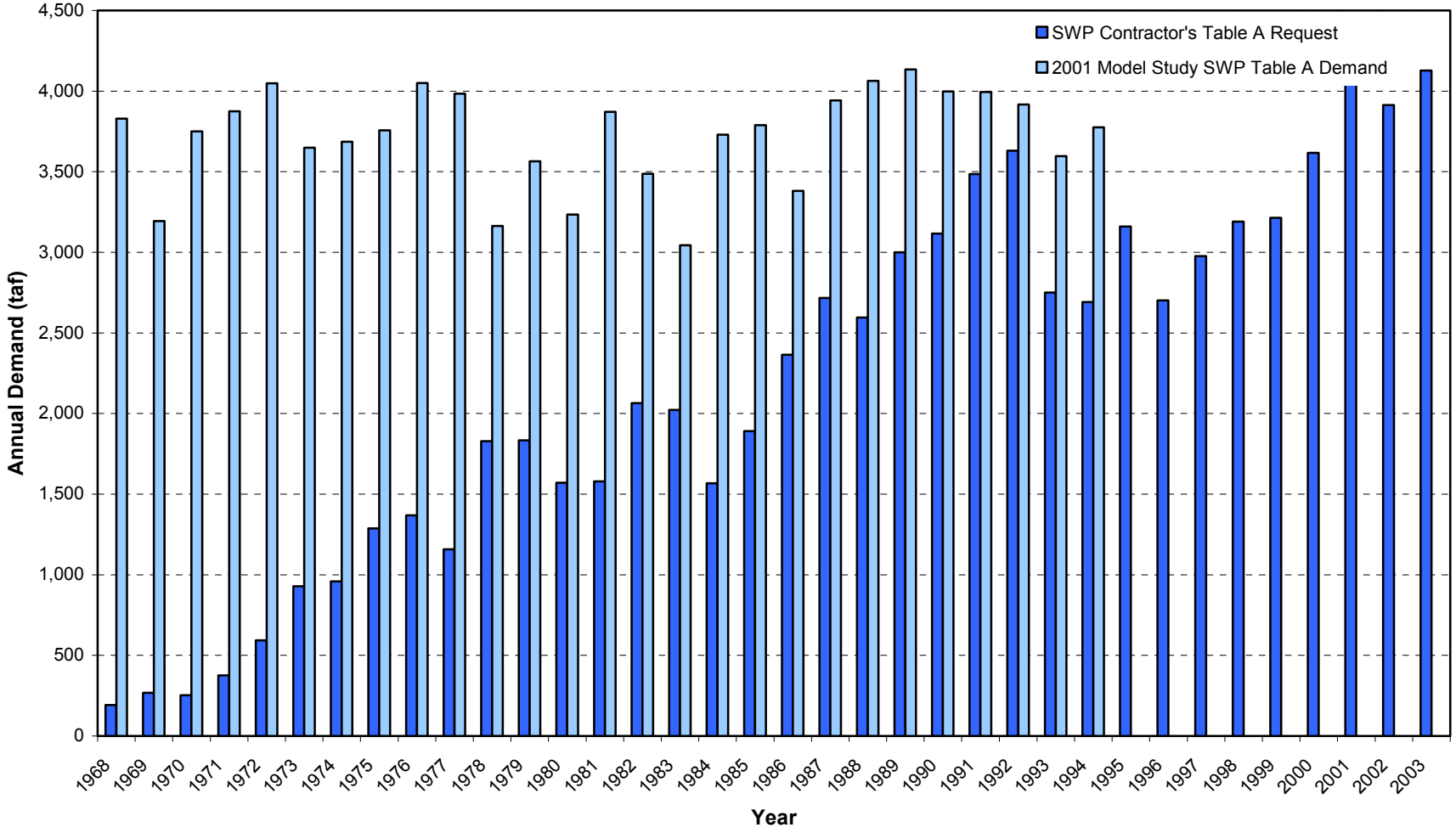

Figure 2
Historical SWP Table A Delivery versus 2001 Model Study SWP Table A Delivery
1987 - 1992 Dry Period

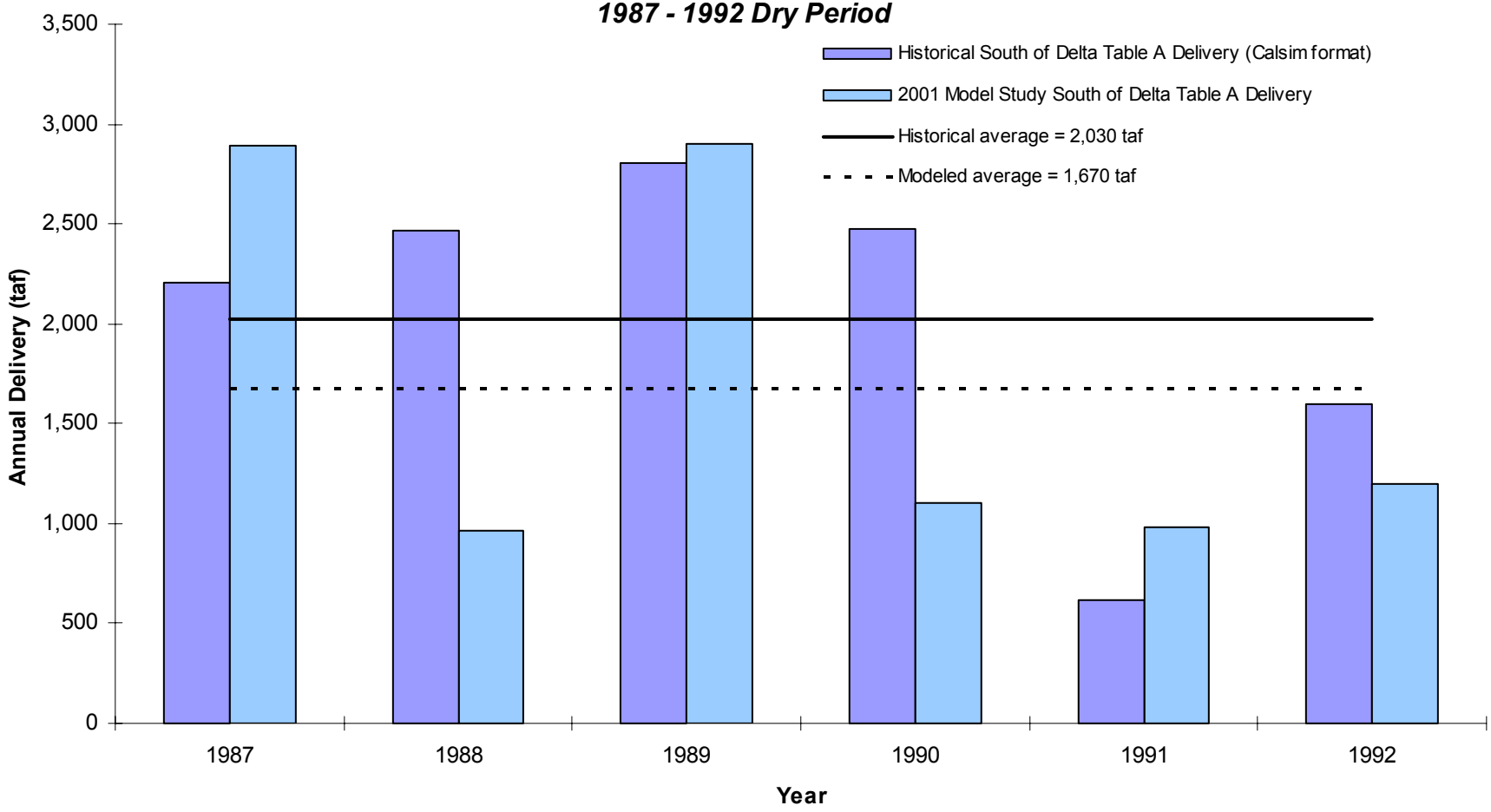

Figure 3
Historical SWP Table A Delivery versus 2001 D-1485 Model Study SWP Table A Delivery
1987 - 1992 Dry Period

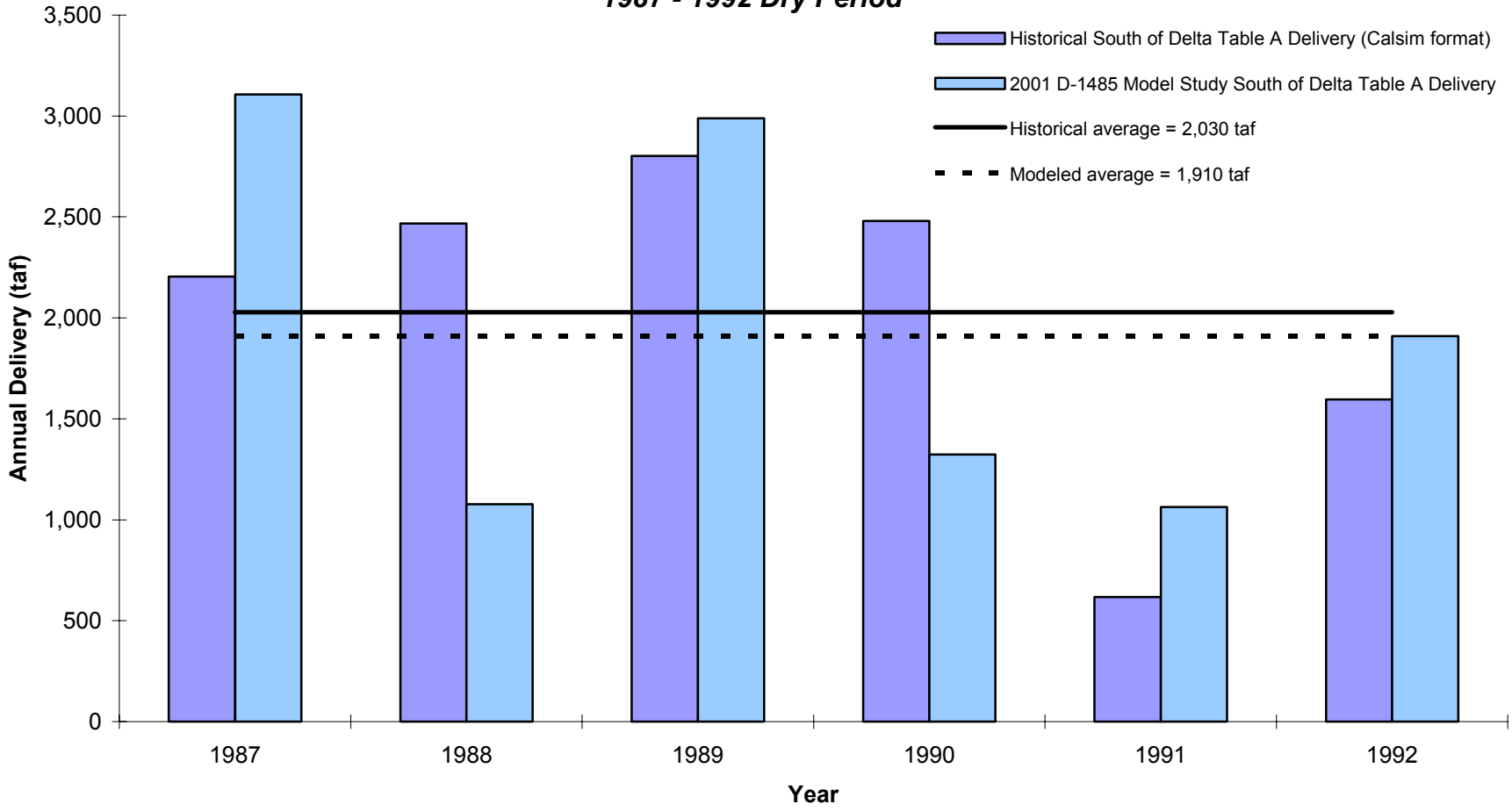

Figure 4
Historical SWP Table A Delivery v. Adjusted 2001 D-1485 Model Study SWP Table A Delivery
1987 - 1992 Dry Period