State of California
The Resources Agency
Department of Water Resources
Bay-Delta Office



DESCRIPTION OF DEPARTMENT OF WATER RESOURCES COMPLIANCE WITH STATE WATER RESOURCES CONTROL BOARD WATER RIGHT DECISION 1641

Response to Senate Bill 1155
Enacting California Water Code Section 138.10

JANUARY 2006

Arnold Schwarzenegger, *Governor*
State of California

Mike Chrisman, *Secretary for Resources*
The Resources Agency

Lester A. Snow, *Director*
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Foreword

The Department of Water Resources (DWR) operates the State Water Project (SWP) subject to several water right permits issued by the State Water Resources Control Board (SWRCB). Water Right Decision 1641 (D-1641), issued by the SWRCB on December 29, 1999, and amended March 15, 2000, amends five of DWR's water right permits to add terms and conditions that are intended to protect municipal and industrial, agricultural, and fish and wildlife beneficial uses of the Sacramento-San Joaquin Delta. This report describes how DWR operates the SWP to comply with the terms and conditions contained in D-1641.

DWR must obtain authorization for any taking of threatened or endangered species that would result from any act authorized by D-1641. In 2004, the federal fishery agencies issued updated biological opinions for operations of the Central Valley Project (CVP) and SWP which cover impacts and incidental take of the listed salmonid species and delta smelt. In addition, DWR continues to obtain incidental take coverage for endangered species pursuant to the California Fish and Game Code Section 2081.1, based on agreements and memorandums entered into with the Department of Fish and Game (DFG) prior to April 10, 1997. DWR is working with DFG to update this coverage by developing a Natural Community Conservation Plan for the SWP.

The SWP and the CVP, operated by the U.S. Bureau of Reclamation (Reclamation), are operated in coordination to meet the terms in D-1641 relevant to each project. Operating these projects to meet specific numerical criteria at specific locations in the Delta is a daunting task. The Delta is a dynamic environment affected by natural forces such as tides, wind, and floods. Reservoir releases in the Sacramento River basin to support Delta water quality take one to five days to reach the Delta. Continual monitoring of Delta conditions and forecasting of future conditions are essential for assuring the daily decisions regarding reservoir releases and amounts pumped from the Delta will meet the water quality objectives of the Delta.

This report summarizes the compliance with Delta water right permits terms over the last five years and discusses some of the challenges facing DWR, especially in the southern Delta.

Levee breaks, unexpected high discharges of salts, limited circulation in some parts of the Delta, and other factors effecting water quality are beyond the control of the operation of the SWP. The water quality objectives for the stations in the south Delta (Old River at Tracy, Old River at Middle River, and Brandt Bridge on the San Joaquin River) are particularly difficult to meet through operating the SWP. The water quality at these locations is extremely dependent upon the upstream water quality of the San Joaquin River, local agricultural discharges and limited circulation in local channels; none of which is controlled by operating the SWP.

The CVP can control San Joaquin River water quality through releases to the San Joaquin River from New Melones Reservoir on the Stanislaus River. The water rights permits for New Melones Reservoir contain water quality objectives for the San Joaquin River at Vernalis and further downstream at Brandt Bridge, as well as the objectives for Old River. The permanent operable gates proposed by DWR and Reclamation in the South Delta Improvements Program, currently undergoing State and federal environmental review, will significantly improve the circulation and, therefore, the water quality in the south Delta channels, including Old River.

Since 1995, water quality conditions in the San Joaquin River have improved. This situation is due to measures being taken by local districts, DWR, Reclamation, and many collaborating agencies to decrease salt loads to the San Joaquin River. These measures are discussed in Appendix C. Given these improved conditions, DWR expects Reclamation to operate New Melones Reservoir to meet the water quality objectives of the San Joaquin River at Vernalis and Brandt Bridge. Approval of the proposed South Delta Improvements Program will lead to the construction of permanent, operable gates and greatly improve water quality conditions in the southern Delta by improving water circulation. Through these efforts, DWR will continue its commitment to meet the terms and conditions of the water rights of the SWP.

Lester A. Snow
Director

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Department of Water Resources
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Stephen W. Verigin
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Gerald E. Johns
Deputy Director

Leslie F. Harder
Acting Deputy Director

Raphael A. Torres
Acting Deputy Director

Peter S. Garris
Deputy Director

Brian E. White
Assistant Director Legislative Affairs

Nancy J. Saracino
Chief Counsel

Susan Sims-Teixeira
Assistant Director Public Affairs

Bay-Delta Office
Katherine F. Kelly
Chief

This Report Was Prepared Under the Direction of:

Mark A. Holderman ..... Project Manager, Bay-Delta Office

And the Following Work Team Leads:

Richard S. Breuer ..... Environmental Program Manager, Division of Environmental Services
Cathy L. Crothers ..... Staff Counsel, Office of the Chief Counsel
Jose I. Faria ..... Supervising Engineer, W.R., Division of Planning and Local Assistance, San Joaquin District
Gretchen C. Goettl ..... Research Writer, Division of Planning and Local Assistance
John W. Leahigh ..... Supervising Engineer W.R., Operations and Maintenance
Nancy Quan ..... Supervising Engineer, W.R., State Water Project Analysis Office
Tara A. Smith ..... Supervising Engineer, W.R., Bay-Delta Office

With Assistance From:

Mike K. Abiouli ..... Engineer, W.R., Bay-Delta Office
John M. Ford ..... Supervising Engineer, W.R., Operations and Maintenance
Sheila L. Greene ..... Staff Environmental Scientist
Tracy V. Hinojosa ..... Senior Engineer, W.R., Operations and Maintenance
Parviz Nader-Tehrani ..... Senior Engineer, W. R., Bay-Delta Office
Alan F. Olson ..... Engineer, W.R., Bay-Delta Office
Frederick A. Reyes ..... Senior Engineer, W.R., Bay-Delta Office
Maureen E. Sergent ..... Engineer, W.R., State Water Project Analysis Office
Mary L. Serrato ..... Research Analyst II (GIS), Bay-Delta Office

Cover Design:

Jennifer Highhill ..... Graphic Designer Intern, Public Affairs Office

Introduction and Purpose

The State Water Project (SWP), operated and maintained by the Department of Water Resources (DWR), is composed of 20 pumping plants, 4 pumping-generating plants, 5 hydroelectric power plants, 33 storage facilities, and more than 670 miles of aqueducts and pipelines. DWR operates the SWP to deliver water for municipal and agricultural purposes, provide flood control, generate power, provide recreational opportunities, enhance habitats for fish and wildlife, and provide water quality control in the Sacramento-San Joaquin Delta. The SWP serves more than two-thirds of the State's population and approximately 750,000 acres of irrigated farmland in the Feather River area, San Francisco Bay Area, San Joaquin Valley, Central California Coast, and Southern California. The SWP provides water to 29 agencies with long-term water supply contracts.

DWR operates the SWP in conformance with the terms and conditions contained in its water rights permits and licenses issued by the State Water Resources Control Board (SWRCB). The SWRCB issued Water Right Decision 1641 (D-1641) December 29, 1999 (amended March 15, 2000), which amended five of DWR's water rights permits to add terms and conditions intended to protect municipal and industrial, agricultural, and fish and wildlife beneficial uses of the Delta.

The purpose of this report is to describe how DWR complies with the water right permit obligations of the SWP as required by the terms and conditions of D-1641. This report includes discussions of the compliance history, compliance program enhancements, and future activities by DWR or other agencies that may aid in compliance or enhance compliance monitoring and management activities.

D-1641 contains flow and water quality objectives that must be measured at various compliance monitoring stations throughout the Delta. These compliance monitoring stations are shown in Figure A with a description of the stations in Table A.

Figure A. SWRCB Compliance Monitoring Stations

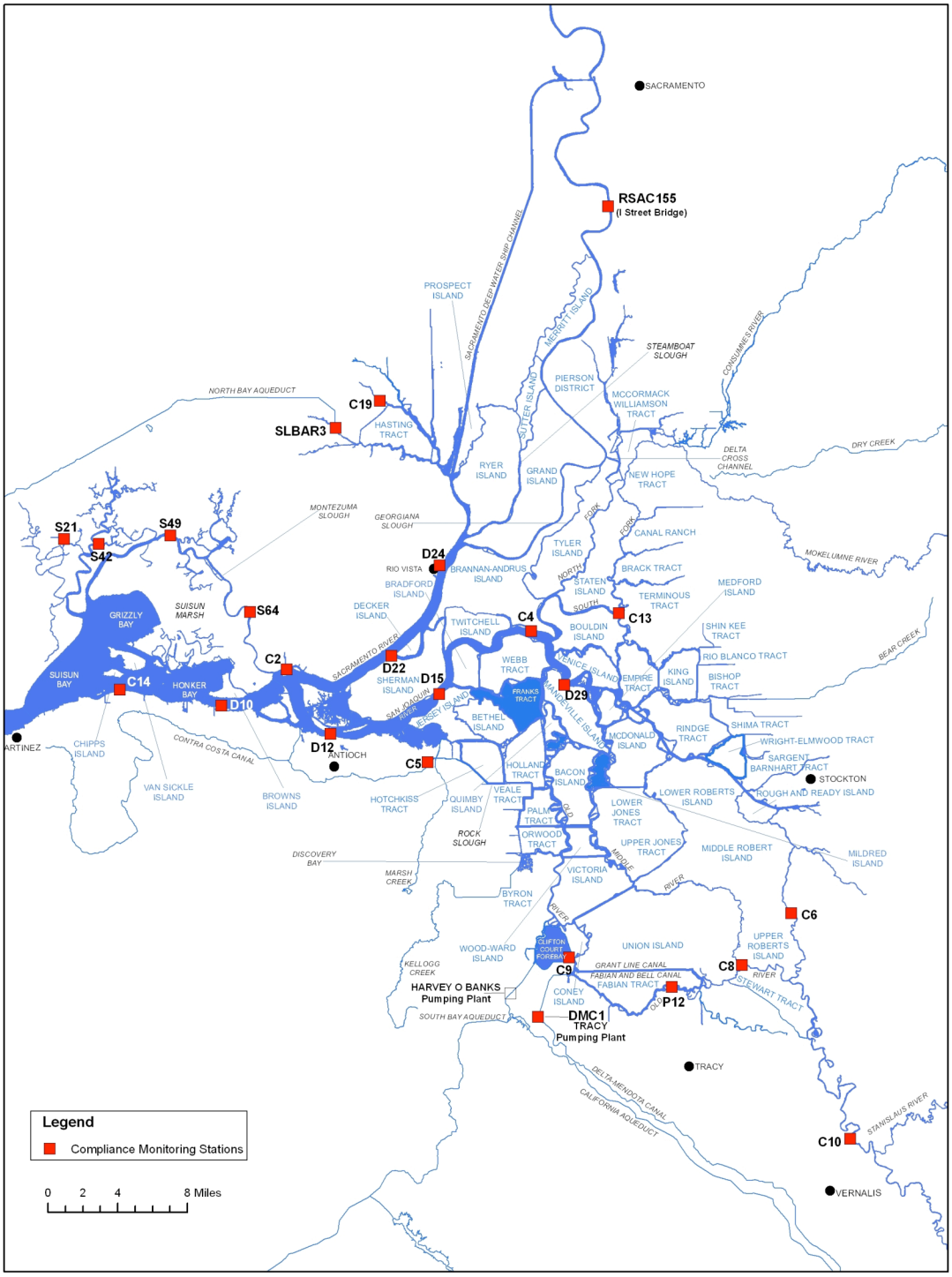

Table A. SWRCB Compliance Station Descriptions

Station Number	Station Description
C2	Sacramento River @ Collinsville
C4	San Joaquin River @ San Andreas Landing
C5	Contra Costa Canal @ Pumping Plan #1
C6	San Joaquin River @ Brandt Bridge
C8	Old River near Middle River
C9	West Canal @ mouth of Clifton Court Forebay Intake
C10	San Joaquin River near Vernalis
C13	Mokelumne River @ Terminous
C14	Sacramento River @ Port Chicago
C19	Cache Slough @ City of Vallejo Intake
D10	Sacramento River @ Chipps Island
D12	San Joaquin River @ Antioch Ship Canal
D15	San Joaquin River @ Jersey Point
D22	Sacramento River @ Emmaton
D24	Sacramento River below Rio Vista Bridge
D29	San Joaquin River @ Prisoners Point
DMC1	Delta-Mendota Canal @ Tracy Pumping Plant
P12	Old River @ Tracy Road Bridge
S21	Chadbourne Slough @ Sunrise Duck Club
S42	Suisun Slough 300 feet south of Volanti Slough
S49	Montezuma Slough near Beldon Landing
S64	Montezuma Slough @ National Steel
RSAC155	Sacramento River (I St. Bridge to Freeport)
SLBAR3	Barker Slough @ North Bay Aqueduct

Background

DWR's operation of the SWP is regulated by terms and conditions of the permits and licenses issued by the SWRCB. The SWRCB has issued numerous orders and decisions regarding water quality and water right objectives for the Delta. The current water quality objectives are set forth in the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (1995 Bay-Delta Plan), adopted May 22, 1995. D-1641 adopted by the SWRCB December 29, 1999 and revised in accordance with Order WR 2000-02 on March 15, 2000, implements portions of the 1995 Bay-Delta Plan with respect to the operation of the SWP and the Central Valley Project (CVP), operated by the US Bureau of Reclamation (Reclamation). In part, this decision assigns responsibility to DWR and Reclamation for specific water quality and flow objectives. A summary of Bay-Delta objectives contained in D-1641 is shown in Appendix A.

On September 21, 2004, Governor Arnold Schwarzenegger signed Senate Bill 1155 (Machado) which added Section 138.10 to the California Water Code. Section 138.10 requires by January 1, 2006, the Director of DWR, in collaboration with the Secretary of Interior or his or her designee (Reclamation), prepare a plan for meeting the existing permit and license conditions for which the Department has an obligation, as described in D-1641. The plan shall be submitted to the SWRCB and the California Bay-Delta Authority, prior to increasing the existing permitted diversion rate at the SWP's Harvey O. Banks Pumping Plant. The complete text of SB 1155 is contained in Appendix B.

Reclamation similarly was directed under federal law (HR 2828—Public Law 108-361) to develop and implement a program to meet all existing water quality objectives and objectives for which the CVP has responsibility.

Chapter 1. Water Quality Objectives for Municipal and Industrial Beneficial Uses

D-1641 includes water right permit terms and conditions to implement water quality objectives to protect Municipal and Industrial (M&I) beneficial uses in the Delta. DWR and Reclamation, pursuant to D-1641, have joint responsibility for achieving these M&I water quality objectives, as described below.

Contra Costa Canal at Pumping Plant No. 1, West Canal at Mouth of Clifton Court Forebay (CCF), Delta-Mendota Canal at Tracy Pumping Plant, Barker Slough at North Bay Aqueduct (NBA), and Cache Slough at City of Vallejo Intake

D-1641 requires DWR and Reclamation to meet a maximum mean daily chloride level at each of the above M&I diversion locations of 250 milligrams per liter (mg/l) year-round in all year types. The Cache Slough objective is effective only when diversions are being made from that location.

To meet D-1641 objectives in the Delta, the Projects rely on three principal "tools" to ensure compliance. These tools include increasing releases from upstream Project reservoirs, reduction in Project exports, and opening of the Delta Cross Channel (DCC) Gates. The upstream Project reservoirs include Lake Shasta and Folsom Lake operated by Reclamation and Lake Oroville operated by DWR. The Delta export facilities include the Tracy Pumping Plant operated by Reclamation and the Clifton Court Gate Structure operated by DWR. The DCC Gate which connects the Sacramento River with the Mokelumne River and the interior Delta is operated by Reclamation. The respective sharing of water costs between the Projects to meet these objectives is determined by the 1986 Agreement Between the United States of America and the State of California for Coordinated Operations of the Central Valley Project and the State Water Project or Coordinated Operations Agreement (COA).

Current Compliance History

For most of the year, the chloride objective is generally met as a consequence of DWR and Reclamation operating to meet other D-1641 objectives, such as salinity objectives for agricultural and fish and wildlife beneficial uses, as well as the X2 objectives, and Export/Inflow (E/I) ratios.

The 250 mg/L objective is most likely to control SWP and CVP (collectively "Projects") operations during late summer and fall. Operational experience has shown that compliance with this objective at the Contra Costa Canal at Pumping Plant No. 1 location generally ensures compliance at all other objective locations.

The ability of the Projects to meet the objective at Contra Costa Water District's Pumping Plant No. 1 (PP1) on the Contra Costa Canal has been complicated in recent years following the completion of CCWD's Los Vaqueros Reservoir and the new pumping facility on Old River. This new facility often pumps water that would have been pumped at Pumping Plant No. 1 during critical periods when salinity intrusion is greatest. The low pumping rates at PP1 during these critical periods has resulted in stagnant conditions in the adjoining Rock Slough whose water quality is degraded by local agricultural returns. The lack of sufficient circulation in Rock Slough limits the ability of SWP and CVP operations to influence water quality at PP1. As part of the current State Water Resources Control Board periodic review of the 1995 Bay-Delta Water Quality Control Plan (WQCP), DWR, Reclamation and CCWD are

attempting to reach an alternative method for measuring compliance at Pumping Plant No. 1 in light of this new hydraulic configuration.

Since D-1641 was adopted on December 29, 1999, DWR has met the 250 mg/L mean daily chloride objective 99.5 % of the time. The 250 mg/L chloride objectives were exceeded at PP1 on only 10 days out of a total of 2099 days, three days in October 2001 and on seven days in October 2002.

For each period during which there was an exceedence, DWR notified the SWRCB of the exceedance by letter. Based on the letters from DWR and CCWD explaining that the cause of the exceedance was beyond control of Projects operations, the SWRCB determined that no action was necessary by DWR or Reclamation.

Means for Improving Compliance

As mentioned above, the CCWD pumping regime has changed in recent years resulting in slack water conditions at the critical PP1 location. DWR and Reclamation are working with CCWD during the WQCP periodic review process in the hopes of identifying an alternate location for measuring compliance by DWR and Reclamation that is within the control of Project operations, given the change in hydrodynamics at this location since CCWD began utilizing Los Vaqueros Reservoir.

Other Activities to Improve Compliance Conditions

The CALFED Program has included funding for the relocation of an agricultural drain on Veale Tract to improve water quality in Rock Slough. The drain discharges agricultural runoff from the tract into Rock Slough. The drain has been relocated to Indian Slough, further south, to allow for more mixing of the return flow. The project was substantially complete December 2005, and start-up testing is to begin soon thereafter. The project is expected to be fully implemented by early 2006. In addition, a project to line the Contra Costa Canal or use a pipeline in lieu of the canal to prevent intrusion of salts from the high groundwater table is being evaluated. Both projects will improve local water quality conditions in the area of PP1 and assist in meeting the objectives at PP1.

Contra Costa Canal at Pumping Plant No. 1 or San Joaquin River at Antioch Water Works

In addition to the year round maximum chloride objective of 250 mg/l at PP1, D-1641 requires that chloride levels be maintained at or less than 150 mg/l at the Contra Costa Canal PP1 or Antioch Water Works locations for a specific number of days depending on the year type (Table 1-1).

Table 1–1. Minimum # of Days that Mean Daily Chlorides ≤ 150 mg/l

	Year Type				
	Wet	Above Normal	Below Normal	Dry	Critically Dry
# of Days	240	190	175	165	155

The minimum number of days on which the mean daily chlorides are less than or equal to 150 mg/l must be provided in intervals of not less than two weeks' duration. The objective applies at Contra Costa Canal Intake or at Antioch Water Works Intake.

Current Compliance History

DWR typically measures compliance with this objective at the Contra Costa Canal PP1 location. The "tools" for meeting this objective are similar to those required to meet the 250 mg/l objective described above—upstream release increases, Delta export reductions, and DCC gate closure.

There have been no exceedences of the 150 mg/l objective since D-1641 was adopted.

Means for Improving Compliance

As described above in the section regarding compliance with the 250 mg/l objective, the pumping regime has changed in recent years resulting in slack water conditions at the critical CCWD PP1 location. DWR and Reclamation are working with CCWD during the WQCP periodic review process to consider development of an alternate location for measuring compliance that is within the control of the Project operations, recognizing the change in hydrodynamics since CCWD began operating Los Vaqueros Reservoir.

Other Activities to Improve Compliance Conditions

As noted above, the CALFED program has included funding for the relocation of agricultural drainage from Veale Tract to improve water quality in Rock Slough. In addition, a project to line the Contra Costa Canal or use a pipeline in lieu of the canal to prevent intrusion of salts from the high groundwater table is being evaluated. Both projects will improve local water quality conditions in the area of PP1 and assist in meeting the objectives at PP1.

Chapter 2. Water Quality Objectives for Agricultural Beneficial Uses

D-1641 requires DWR and Reclamation to meet objectives at a number of locations in the Western, Interior, and Southern Delta to protect Agricultural beneficial uses, as described below.

To meet D-1641 objectives in the Delta, the Projects rely on three principal "tools" to ensure compliance. These tools include increasing releases from upstream Project reservoirs, reduction in Project exports, and opening of the Delta Cross Channel (DCC) Gates. The upstream Project reservoirs include Lake Shasta and Folsom Lake operated by Reclamation and Lake Oroville operated by DWR. Delta export facilities include the Tracy Pumping Plant operated by Reclamation and the Clifton Court Gate Structure and Harvey O. Banks pumping plant operated by DWR. The DCC Gate, which connects the Sacramento River with the Mokelumne River and the interior Delta, is operated by Reclamation. The respective sharing of water costs between the two Projects to meet these objectives is determined by the 1986 Agreement Between the Unites States of America and the State of California for Coordinated Operations of the Central Valley Project and the State Water Project or Coordinated Operations Agreement (COA).

Western Delta

Sacramento River at Emmaton

D-1641 sets forth maximum values for the 14-day running average of mean daily EC (mmhos/cm) from April 1 through August 15 on the Sacramento River at Emmaton in the Western Delta. Beginning April 1, this maximum value is 0.45 EC for all but Critically Dry year types. The value continues through August 15 in Wet years, but increases later in this period for Above Normal, Below Normal, and Dry years, as shown in the Table 2-1 below. In Critically Dry years, the maximum value is set at 2.78 EC from April 1 to August 15.

Table 2–1. Maximum 14-day Running Average of Mean Daily EC at Emmaton

Year Type	0.45 EC from April 1 to date shown	EC value from date shown to August 15
Wet (W)	August 15	
Above Normal (AN)	July 1	0.63
Below Normal (BN)	June 20	1.14
Dry (D)	June 15	1.67
Critically Dry (C)		2.78

Current Compliance History

All EC objectives at this location have been met since D-1641 was adopted.

San Joaquin River at Jersey Point

D-1641 establishes maximum values for the 14-day running average of mean daily EC (mmhos/cm) from April 1 through August 15 on the San Joaquin River at Jersey Point in the Western Delta. Beginning April 1, the maximum EC value is 0.45 EC in all but Critically Dry year types. At this location, the 0.45 EC objective is effective through August 15 in both Wet and Above Normal years, but increases from the

date shown in Table 2-1 in Below Normal and Dry years. In Critically Dry years, the maximum value is 2.20 EC from April 1 to August 15.

Table 2–2. Maximum 14-day Running Average of Mean Daily EC at Jersey Point

Year Type	0.45 EC from April 1 to date shown	EC value from date shown to August 15
Wet (W)	August 15	
Above Normal (AN)	August 15	
Below Normal (BN)	June 20	0.74
Dry (D)	June 15	1.35
Critically Dry (C)		2.20

Current Compliance History
All EC objectives at this location have been met since D-1641 was adopted.

Interior Delta

South Fork Mokelumne River at Terminous

D-1641 establishes maximum values for the 14-day running average of mean daily EC (mmhos/cm) from April 1 through August 15 on the South Fork of the Mokelumne River at Terminous in the Interior Delta. April 1 through August 15, the maximum EC value is 0.45 EC for all but Critically Dry year types as shown in Table 2-3 below. In Critically Dry years, the maximum value is 0.54 EC April 1 through August 15.

Table 2–3. Maximum 14-day Running Average of Mean Daily EC at Terminous

Year Type	0.45 EC from April 1 to date shown	EC value from date shown to August 15
Wet (W)	August 15	
Above Normal (AN)	August 15	
Below Normal (BN)	August 15	
Dry (D)	August 15	
Critically Dry (C)		0.54

Current Compliance History
All EC objectives at this location have been met since D-1641 was adopted.

San Joaquin River at San Andreas Landing

D-1641 establishes maximum values for the 14-day running average of mean daily EC (mmhos/cm) from April 1 through August 15 on the San Joaquin River at San Andreas Landing in the Interior Delta. Beginning April 1, the maximum allowable EC is 0.45 EC for all but Critically Dry year types. At this location, the 0.45 EC objective is effective through August 15 in Wet, Above Normal, and Below Normal years, but increases to 0.58 on June 25 in Dry years, as shown in the Table 2-4 below. In Critically Dry years, the maximum value is 0.87 EC April 1 to August 15.

Table 2–4. Maximum 14-day Running Average of Mean Daily EC at San Andreas Landing

Year Type	0.45 EC from April 1 to date shown	EC value from date shown to August 15
Wet (W)	August 15	
Above Normal (AN)	August 15	
Below Normal (BN)	August 15	
Dry (D)	June 25	0.58
Critically Dry (C)		0.87

Current Compliance History

All EC objectives at this location have been met since D-1641 was adopted.

Southern Delta

Decision 1641 includes salinity objectives at three locations in the southern Delta—San Joaquin River at Brandt Bridge, Old River at Middle River and Old River at Tracy Road Bridge. Under D-1641, through March 30, 2005, DWR and Reclamation were jointly responsible for maintaining a 30-day running average of 1.0 mmhos/cm (or Electrical Conductivity (EC)) year round at the three compliance locations. Beginning April 1, 2005, D-1641 specifies that DWR and Reclamation must maintain an EC of 0.7 EC from April through August, and 1.0 EC from September through March. D-1641 specifies that the 0.7 EC objective is effective unless permanent operable gates (also referred to as barriers) are constructed, or equivalent measures are implemented, in the southern Delta and an operations plan that reasonably protects southern Delta agriculture is prepared. Once these actions are completed the 0.7 EC objective is replaced by the 1.0 EC objective (D-1641, Table 2, Footnote 5).

In recognition of the limited influence of SWP operations on the water quality conditions in the southern Delta, D-1641 contains a special term specifying actions to be taken in the event of an exceedence of the objectives. “If the Permittee exceeds the objectives at stations C-6, C-8, or P-12, Permittee shall prepare a report for the Executive Director. The Executive Director will evaluate the report and make a recommendation to the SWRCB as to whether enforcement action is appropriate or the noncompliance is the result of actions beyond the control of the Permittee.” (D-1641, page 159)

On February 18, 2005, DWR and Reclamation jointly filed a petition with the State Water Resources Control Board (SWRCB) to change the effective date of the southern Delta water quality objective of 0.7 EC from April 1, 2005 to December 31, 2008 and to require that DWR and Reclamation continue to meet the 1.0 EC objective during these months. The request was made because installation of permanent operable gates in the south Delta has been delayed and the gates are necessary for DWR and Reclamation to effectively implement the objective. A draft initial study/ proposed negative declaration was submitted to the Office of Planning and Research on November 1, 2005. The SWRCB has not taken action on the change petition as of the date of this report.

San Joaquin River at Brandt Bridge

D-1641 requires DWR and Reclamation not exceed a maximum 30-day running average mean daily EC (mmhos/cm) at San Joaquin River at Brandt Bridge of 0.7 EC from April to August, and 1.0 EC from September to March. The 0.7 EC objective became effective on April 1, 2005. Prior to April 1, 2005, the EC objective was 1.0 year-round. If the Brandt Bridge objective is exceeded, DWR or Reclamation are to prepare a report to the SWRCB Executive Director documenting the cause of the exceedence. Following

review of the report, the Executive Director shall make a recommendation to the SWRCB as to whether enforcement action is appropriate or whether the exceedence is the result of actions beyond the control of DWR.

Current Compliance History

The EC objective at Brandt Bridge has been met 96 % of the time since the adoption of D-1641. The 1.0 EC objective was exceeded for 80 days in 2003. From January 27, 2003, to April 16, 2003, the 30-day average EC at the San Joaquin River at Brandt Bridge station fluctuated between approximately 1.05 and 1.1 EC, slightly above the objective of 1.0 EC.

DWR and Reclamation reported the 2003 exceedance to the SWRCB Executive Director in October 2005. The delay in reporting the exceedence was due to a lack of telemetry at two of the three southern Delta compliance stations. DWR became aware of the exceedence in late 2005 when reviewing data in preparation for a SWRCB hearing regarding the southern Delta objectives. At the time of the exceedance, only the Old River near Middle River station had a real-time gage and was telemetered. The data at this station indicated that salinity was within the required objective of 1.0 EC. Electrical conductivity data for the Brandt Bridge station was continuously recorded, but only downloaded from the field approximately monthly, after which this data was entered into a monitoring data base maintained by DWR's Central District. Unfortunately, DWR compliance staff relied on the data from the telemetered station to evaluate compliance. Consequently, the DWR compliance monitoring staff was not aware of this exceedance until 2005.

Salinity levels at the Tracy Pumping Plant were fairly stable during this period and were much lower than the salinity levels at the southern Delta compliance locations. The difference in water quality between that at the Tracy Pumping Plant and that near Brandt Bridge reflects differences in the mixes of source water. Tracy Pumping Plant water quality is reflective of a source mix of interior Delta and south Delta water quality, while the compliance stations water quality is reflective of a dominant source mix from the San Joaquin River at Vernalis and the degradation in water quality caused by local agricultural drainage. During this three-month period, Clifton Court salinity levels were low, and more reflective of salinity conditions in the western and interior Delta. This seems to indicate that the increase in salinity near Brandt Bridge is significantly influenced by local salt contributions discharged into the San Joaquin River between Vernalis and Brandt Bridge. These local discharges are the result of actions beyond the control of DWR or Reclamation, and contribute to degradation in water quality immediately downstream of Vernalis.

Means for Improving Compliance

DWR and Reclamation regret the delay in notifying the SWRCB of the exceedance at these two stations. This delay in notification will not occur in the future. In April 2005, DWR installed telemetry capability at both the Brandt Bridge and Tracy Road Bridge stations. Currently, data from all three southern Delta compliance station gages are transmitted on a real-time basis and posted on the California Data Exchange Center (CDEC) website (http://cdec.water.ca.gov). The compliance monitoring staff at DWR and Reclamation now monitors water quality at all southern Delta compliance stations in near real-time. In addition, DWR now reports the daily and 30-day average EC values for these stations in their daily water quality report, which is posted on the internet at:
http://wwwoco.water.ca.gov/cmplmon/reports/wqreport.html.

Other Activities to Improve Compliance Conditions

DWR, as a water right permittee for the SWP, has very little control over the salinity at the Brandt Bridge location. The SWP has no facilities on the San Joaquin River system, so it cannot affect salinity at Brandt Bridge by manipulating reservoir releases. Also, reduction of SWP exports does not benefit water quality at this location. However, as a water management agency, DWR participates in and helps fund numerous programs whose goal is to reduce the volume and concentration of saline discharges to the San Joaquin River upstream of the Delta. These programs contribute toward meeting the objective at Brandt Bridge. These programs are detailed in Appendix C.

In addition, DWR and Reclamation are participating in an informal stakeholder effort to develop a cooperative solution for resolving water quality problems in the lower SJR. The San Joaquin River Water Quality Management Group (SJRWQMG) completed a draft recommendation in the summer of 2005 (SJRWQMG 2005). The group evaluated a host of flow and load management measures seeking to achieve salinity and DO objectives. The summary recommendations regarding salinity appear below. Discussions are underway to form a task force and complete an implementation agreement. This agreement will help address water quality problems on the lower SJR.

SJRWQMG Recommendations:

- Fully implement the West Side Regional Drainage Plan (see Appendix C).
- Further evaluate and pursue managed wetland drainage management actions to mitigate impacts of February through April drainage releases.
- Develop a real-time water quality management coordination group involving lower SJR tributaries, lower SJR drainers and the DWR to coordinate reservoir release and SWP/CVP Project operations (head of Old River barrier and New Melones operations) to realize opportunities to improve water quality and increase the utility of stored water releases.

Old River Near Middle River

D-1641 requires DWR and Reclamation not exceed a maximum 30-day running average EC at Old River near Middle River of 0.7 EC from April to August, and 1.0 EC from September to March. The 0.7 EC objective became effective on April 1, 2005. Prior to April 1, 2005, the EC objective was 1.0 year-round. If the Old River near Middle River objective is exceeded, DWR or Reclamation is to prepare a report to the SWRCB Executive Director documenting the cause of the exceedence. Following review of the report, the Executive Director shall make a recommendation to the SWRCB as to whether enforcement action is appropriate or whether the exceedence is the result of actions beyond the control of DWR.

Current Compliance History

All EC objectives at this location have been met since D-1641 was adopted.

Means for Improving Compliance

Currently, data from all three southern Delta compliance station gages are transmitted on a real-time basis and posted on the CDEC website (http://cdec.water.ca.gov). The compliance monitoring staff at DWR and Reclamation monitor water quality at all southern Delta compliance stations in near real-time. In addition, DWR now reports the daily and 30-day average EC values for these stations in their daily water quality report, which is posted on the internet at:
http://wwwoco.water.ca.gov/cmplmon/reports/wqreport.html.

Other Activities to Improve Compliance Conditions

As a water management agency, DWR participates in and helps fund numerous programs whose goal is to reduce the volume and concentration of saline discharges to the San Joaquin River upstream of the Delta. These programs contribute toward meeting the objective at Old River near Middle River. These programs are detailed in Appendix C.

In addition, DWR and Reclamation are participating in an informal stakeholder effort to develop a cooperative solution for resolving water quality problems in the lower SJR. The San Joaquin River Water Quality Management Group completed a draft recommendation in the summer of 2005 (SJRWQMG 2005). The group evaluated a host of flow and load management measures seeking to achieve salinity and DO objectives. The summary recommendations regarding salinity appear below. Discussions are underway to form a task force and complete an implementation agreement. This agreement will help address the water quality problems on the lower SJR.

SJRWQMG Recommendations:

- Fully implement the West Side Regional Drainage Plan (see Appendix C).
- Further evaluate and pursue managed wetland drainage management actions to mitigate impacts of February through April drainage releases.
- Develop a real-time water quality management coordination group involving lower SJR tributaries, lower SJR drainers and the DWR to coordinate reservoir release and SWP/CVP Project operations (head of Old River barrier and New Melones operations) to realize opportunities to improve water quality and increase the utility of stored water releases.

To meet the water quality objectives within the south Delta, west of the SJR, components of the preferred alternative of the South Delta Improvement Program (SDIP) must be implemented. The SDIP includes installation of four permanent, operable gates in south Delta channels. Computer modeling suggests that using different configurations of these gates would increase circulation in south Delta channels and thereby improve local salinity conditions at this location.

Old River at Tracy Road Bridge

D-1641 requires DWR and Reclamation not exceed a maximum 30-day running average EC at Old River at Tracy Road Bridge of 0.7 EC from April to August, and 1.0 EC from September to March. The 0.7 EC objective became effective on April 1, 2005. Prior to April 1, 2005, the EC objective was 1.0 year-round. If the Old River at Tracy Road Bridge objective is exceeded, DWR or Reclamation is to prepare a report to the SWRCB Executive Director documenting the cause of the exceedence. Following review of the report, the Executive Director shall make a recommendation to the SWRCB as to whether enforcement action is appropriate or whether the exceedence is the result of actions beyond the control of DWR.

Current Compliance History

The EC objective at Old River at Tracy Road Bridge has been met 96 % of the time since the adoption of D-1641. The 1.0 EC objective was exceeded for 90 days in 2003. From January 23, 2003, to April 22, 2003, the 30-day average EC at the Old River at Tracy Road Bridge station fluctuated between approximately 1.05 and 1.1 EC, slightly above the objective of 1.0 EC.

DWR and Reclamation reported the 2003 exceedance to the SWRCB Executive Director in October 2005. The delay in reporting the exceedence was due to a lack of telemetry at two of the three southern

Delta compliance stations. DWR became aware of the exceedence in late 2005 when reviewing data in preparation for a SWRCB hearing regarding the southern Delta objectives. At the time of the exceedance, only the Old River near Middle River station had a real-time gage and was telemetered. The data at this station indicated that salinity in the southern Delta was within the required objective of 1.0 EC. EC data for the Old River at Tracy Road Bridge station was continuously recorded, but only downloaded from the field approximately monthly, after which this data was entered into a monitoring data base maintained by DWR's Central District. Unfortunately, DWR compliance staff relied on the data from the telemetered station to evaluate compliance. Consequently, the DWR compliance monitoring staff was not aware of this exceedance until 2005.

Salinity levels at the Tracy Pumping Plant were fairly stable during this period and were much lower than the salinity levels at the southern Delta compliance locations or channels. The difference in water quality between that at the Tracy Pumping Plant and that near Tracy Road Bridge reflects differences in the mixes of source water. Tracy Pumping Plant water quality is reflective of a source mix of interior Delta and south Delta water quality, while the compliance stations water quality is reflective of a dominant source mix from the San Joaquin River at Vernalis and the degradation in water quality caused by local agricultural drainage. During this three-month period, Clifton Court salinity levels were low, and more reflective of salinity conditions in the western and interior Delta. This seems to indicate that the salinity in the different Delta locations reflect that the increase in salinity near Tracy Road Bridge is significantly influenced by local salt contributions discharged into the San Joaquin River between Vernalis and Brandt Bridge and into the local southern Delta channels near Tracy Road Bridge. These local discharges are the result of actions beyond the control of DWR or Reclamation, and contribute to degradation in water quality immediately downstream of Vernalis.

Means for Improving Compliance

DWR regrets the delay in notifying the SWRCB of the exceedance at these two stations. This delay in notification will not occur in the future. In April 2005, DWR installed telemetry capability at both the Brandt Bridge and Tracy Road Bridge stations. Currently, data from all three southern Delta compliance station gages are transmitted on a real-time basis and posted on the CDEC website (http://cdec.water.ca.gov). The compliance monitoring staff at DWR and Reclamation monitor water quality at all the southern Delta compliance stations in near real-time. In addition, DWR now reports the daily and 30-day average EC values for these stations in their daily water quality report, which is posted on the internet at: http://wwwoco.water.ca.gov/cmplmon/reports/wqreport.html.

Other Activities to Improve Compliance Conditions

DWR, as a water right permittee for the SWP, has very little control over the salinity at the Tracy Road Bridge location. The SWP has no facilities on the San Joaquin River system, so it cannot affect salinity on Old River near Tracy Road Bridge by manipulating reservoir releases. Also, reduction of SWP exports does not reliably benefit water quality at this location. DWR modeling has shown that even drastic reductions in exports can sometimes improve or degrade salinity at Tracy Road Bridge, but it could not be controlled. The relationship between SWP exports and salinity at Tracy Road Bridge is complicated by other factors such as San Joaquin River inflows and water quality, local agricultural diversions and return flows, and tidal dynamics. As a water management agency, DWR participates in and helps fund numerous programs whose goal is to reduce the volume and concentration of saline discharges to the San Joaquin River upstream of the Delta. These programs contribute toward meeting the objective at Old River at Tracy Road Bridge. These programs are detailed in Appendix C.

In addition, DWR and Reclamation are participating in an informal stakeholder effort to develop a cooperative solution for resolving water quality problems in the lower SJR. The San Joaquin River Water Quality Management Group completed a draft recommendation in the summer of 2005 (SJRWQMG 2005). The group evaluated a host of flow and load management measures seeking to achieve salinity and DO objectives. The summary recommendations regarding salinity appear below. Discussions are underway to form a task force and complete an implementation agreement. This agreement will help address the water quality problems on the lower SJR.

SJRWQMG Recommendations:

- Fully implement the West Side Regional Drainage Plan (see Appendix C).
- Further evaluate and pursue managed wetland drainage management actions to mitigate impacts of February through April drainage releases.
- Develop a real-time water quality management coordination group involving lower SJR tributaries, lower SJR drainers and the DWR to coordinate reservoir release and SWP/CVP Project operations (head of Old River barrier and New Melones operations) to realize opportunities to improve water quality and increase the utility of stored water releases.

To meet the water quality objectives within the south Delta, west of the SJR, components of the preferred alternative of the South Delta Improvement Program (SDIP) must be implemented. The SDIP includes installation of four permanent, operable gates in south Delta channels. Computer modeling suggests that using different configurations of these gates would increase circulation in south Delta channels and thereby improve local salinity conditions at this location.

Export Area

West Canal at Mouth of CCF and Delta Mendota Canal at Tracy Pumping Plant

D-1641 requires DWR and Reclamation not exceed a maximum monthly average mean daily EC at West Canal at Mouth of Clifton Court Forebay of 1.0 EC.

Current Compliance History

All EC objectives at this location have been met since D-1641 was adopted.

Delta Mendota Canal at Tracy Pumping Plant

D-1641 requires DWR and Reclamation not exceed a monthly average mean daily EC at the Delta Mendota Canal at Tracy Pumping Plant of 1.0 EC.

Current Compliance History

All EC objectives at this location have been met since D-1641 was adopted.

Chapter 3. Water Quality Objectives for Fish and Wildlife Beneficial Uses

D-1641 includes water quality objectives to protect Fish and Wildlife beneficial uses. These objectives are discussed below.

San Joaquin River Salinity

San Joaquin River at and between Jersey Point and Prisoners Point

D-1641 requires that the 14-day average salinity in the San Joaquin River at and between Jersey Point (Station D15) and Prisoners Point (Station D29) remain below 0.44 EC in April and May of most year types. However, the objective does not apply in critical years, nor does it apply in May when the May 90% forecast of the Sacramento River Index, as defined in D-1641, is less than or equal to 8.1 million acre-feet.

Current Compliance History

All San Joaquin River salinity objectives have been met since D-1641 was adopted.

Eastern and Western Suisun Marsh Salinity

Sacramento River at Collinsville, Montezuma Slough at National Steel, and Montezuma Slough near Beldon (Eastern Stations); Chadbourne Slough at Sunrise Duck Club and Suisun Slough, 300 Feet South of Volanti Slough (Western Stations)

D-1641 requires compliance with water quality objectives (salinity objectives) at five locations in the Suisun Marsh for the protection of fish and wildlife beneficial uses. The numeric salinity objectives can be implemented either by ensuring that salinity does not exceed the numeric EC values, or by providing equivalent or better protection for fish and wildlife at the locations of the compliance stations.

In 1988, DWR and Reclamation began operating the Suisun Marsh Salinity Control Gate (SMSCG), a critical water quality control facility. The SMSCG has proven more effective for salinity control than originally expected. The SMSCG is located approximately two miles northwest of the eastern end of Montezuma Slough, near Collinsville. The SMSCG spans Montezuma Slough, a width of 465 feet. In addition to permanent barriers adjacent to each levee, the structure consists of the following components (from west to east): (1) a flashboard module, which provides a 68-foot-wide maintenance channel through the structure (the flashboards can be removed if emergency work is required, but removal requires a large, barge-mounted crane); (2) a radial gate module, 159 feet across, containing three radial gates, each 36 feet wide; and (3) a boat-lock module, 20 feet across, which is operated when the flashboards are in place. An acoustic velocity meter is located about 300 feet upstream (south) of the gates to measure water velocity in Montezuma Slough. Water level recorders on both sides of the structure allow operators to determine the difference in water level on both sides of the gates. Using the water level and velocity data, the three radial gates open and close automatically. Gate operation retards the upstream flow of higher-salinity water from Grizzly Bay during flood tides, while allowing the normal flow of lower-salinity water from the Sacramento River near Collinsville during ebb tides. During full operation, the gates open and close twice each tidal day. The net flow through the gates during full operation is about 1,800 cfs in the downstream direction when averaged over 1 tidal day. Typically, in summer, when the gates are not

operating and the flashboards are removed, the natural net flow in Montezuma Slough is low and often in the upstream direction from Grizzly Bay toward Collinsville.

D-1641 establishes maximum salinity objectives at the following three stations in the Eastern Suisun Marsh between October and May of all water year types: Sacramento River at Collinsville, Montezuma Slough at National Steel, and Montezuma Slough near Beldon. These salinity objectives are shown in Table 3-1 below.

Table 3-1. Maximum Monthly Average Salinities at Eastern Suisun Marsh EC Stations

Month	EC
Oct	19.0
Nov-Dec	15.5
Jan	12.5
Feb-Mar	8.0
Apr-May	11.0

D-1641 establishes slightly different maximum salinity objectives at two stations in the Western Suisun Marsh between October and May of all water year types: Chadbourne Slough at Sunrise Duck Club and Suisun Slough, 300 feet south of Volanti Slough. These salinity objectives are shown in Table 3-2 below.

Table 3-2. Maximum Monthly Average Salinities at Western Suisun Marsh EC Stations

Month	EC
Oct	19.0
Nov-Dec	16.5
Jan	12.5
Feb-Mar	8.0
Apr-May	11.0

Current Compliance History

The flow of fresh water from upstream of the Delta, particularly on the Sacramento River, helps DWR meet these objectives. In addition, during the control season from October through May, the SMSCG gates are opened and closed in response to tides. This opening and closing of gates produces an effect called "tidal pumping" i.e., during the ebb tide, when flow is going in the downstream direction, the gates are opened, but during the flood tide, when saltier water from the ocean flows inland, the gates are closed, thereby blocking saltier ocean water from entering the Suisun Marsh.

DWR uses outflow and tidal pumping, as described above, to meet the salinity objectives at the Suisun Marsh EC compliance locations.

All Suisun Marsh objectives in D-1641 have been met since D-1641 was adopted.

Delta Outflow

February through June

A major regulatory cornerstone of D-1641 is the implementation of water quality objectives based on the geographical position of the 2-parts-per-thousand (ppt) isohaline (a.k.a. X2). The geographical position of the 2-ppt isohaline was considered by the SWRCB to be significant to the biologically important

entrapment zone of the estuary and the resident fishery. D-1641 objectives create a systematic approach for CVP-SWP operations to influence the position of the X2 location. The key to the regulatory system is the concept of an "X2 day". An X2 day can be operationally accomplished by the CVP-SWP meeting one of three potential equivalents. The three potential equivalents are:

- 2.64 EC at the desired geographic compliance location for the day
- 14-day average of 2.64 EC at the desired geographic compliance location
- A pre-determined minimum daily net Delta outflow equivalent for the desired X2 compliance location for the day

If any of these conditions are met, the day is included as a potential compliance X2 day.

The determination of the desired geographic compliance location and the required number of X2 days per month in the February to June time period is defined by regulatory objective tables contained in D-1641 (see Appendix B). The tables determine the required number of X2 days based on the previous month's Eight River Index (8RI) which is the estimated full natural runoff of the largest eight streams in the Sacramento-San Joaquin watershed. Excess compliance days at the desired geographic compliance location from the previous month are counted toward meeting the current month's regulatory required days. D-1641 X2 objectives also contain a condition known as the "salinity starting gate" objective. In all but very dry January conditions, the CVP-SWP project must ensure that the actual X2 water quality (on a daily or 14-day mean) is west of Collinsville for a least one X2 day during the February 1st to 14th time period. This objective is conditional for some dry January conditions and is based on the CALFED Operations Group (Ops Group) discretion. The fishery significance of the salinity starting gate is considered to place X2 generally west of CVP-SWP export influence and into the Suisun Marsh habitat environment.

Current Compliance History

All February through June X2 objectives in D-1641 have been met since D-1641 was adopted.

July through January

D-1641 requires DWR and Reclamation implement a set of minimum monthly Delta outflow objectives. The objectives are designed for the months outside of the February to June X2 period and are segregated by hydrologic year type as shown in Table 3-4 below. D-1641 objectives use the Sacramento River 40-30-30 index methodology to designate the hydrologic year type. The objective is designed to be complementary to the X2 habitat objective by "regulating" the eastward movement of X2 during the summer timeframe based on hydrologic conditions. Wetter year types have higher outflow objectives in the July-August timeframe. The objective also sets a minimum outflow objective for fall/early winter, with minor relaxation for critical years or a dry December. The minimum monthly outflow objectives also contain sub-month running average objectives designed to moderate or elevate protection levels when the monthly hydrologic conditions are dominated by a single Delta inflow event.

Table 3-4. Minimum Monthly Average Delta Outflow (cfs)

Month	Year Type					
	All	Wet	Above Normal	Below Normal	Dry	Critically Dry
January	4,500*					
July		8,000	8,000	6,500	5,000	4,000
August		4,000	4,000	4,000	3,500	3,000
September	3,000					
October		4,000	4,000	4,000	4,000	3,000
Nov-Dec		4,500	4,500	4,500	4,500	3,500

*Increased to 6,000 cfs if the December 8RI is greater than 800 TAF (or 0.8).

For the July-January objectives in Table 3-4, D-1641 requires that if the minimum monthly average Delta outflow is less than or equal to 5,000 cfs, the 7-day running average shall not be less than 1,000 cfs below the Table 3-4 value; if the value is greater than 5,000 cfs, the 7-day running average shall not be less than 80% of the Table 3-4 value.

Current Compliance History

There has been one exceedance of the July through January objective since D-1641 was adopted. On December 27, 2004, the 7-day running average of Delta outflow was calculated to be 3,487 cfs when the objective specified it was to be at or greater than 3,500 cfs. The exceedance was due to the fact that more water was diverted into Clifton Court Forebay than the targeted diversion quantity.

Means for Improving Compliance

The single exceedance for one day occurred due to a lack of clear communication between the SWP Operations Control Office (OCO) and the Delta Field Division (DFD) (which operates the Clifton Court gates to take in water). This error has been corrected by keeping clear logs at both the OCO and the DFD which record the maximum daily amount that can be diverted and through improved communication procedures between OCO and DFD.

River Flows

Sacramento River at Rio Vista

D-1641 requires DWR and Reclamation implement objectives to maintain a monthly flow index at Rio Vista in the Sacramento River, as well as sub-month running average limitations. The flow index applies to the fall months and is designed to maintain a sufficient net downstream flow in the lower Sacramento River environment for salmon migration.

Table 3–5. Rio Vista Minimum Monthly Average Flow Rate (cfs)

Month	Year Type					
	All	Wet	Above Normal	Below Normal	Dry	Critically Dry
September	3,000					
October		4,000	4,000	4,000	4,000	3,000
Nov-Dec		4,500	4,500	4,500	4,500	3,500

Rio Vista flow is a calculated flow index sensitive to Sacramento River flows at Freeport, Yolo Bypass flow, estimated gross channel depletion, estimated rainfall reduction in gross channel depletion, and Delta Cross Channel (DCC) gate operations. Closure of the DCC gate increases the Rio Vista flow index by approximately 20 percent of the current Freeport flow rate. The Rio Vista flow index is not affected by CVP-SWP export operations. If the Rio Vista flow objective becomes a CVP-SWP operation controlling objective, project operators have the management option of increasing flows from upstream reservoirs or closing the DCC gates to maintain compliance.

Current Compliance History

All Rio Vista flow objectives in D-1641 have been met since D-1641 was adopted.

Export Limits

D-1641 requires DWR and Reclamation implement an export limit objective to restrict SWP and CVP export rates from the Delta. The E/I ratio is measured as the current average 3-day export rate for the SWP Clifton Court intake and CVP Tracy Pumping Plant divided by the estimated average inflow to the Delta over a 3- or 14-day period. The inflow parameter is required to be on a 14-day basis when hydrologic conditions are such that CVP-SWP exports are not supported by CVP-SWP reservoir storage withdrawals. This generally occurs during the winter and spring. When CVP-SWP exports are supported by CVP-SWP reservoir storage withdrawals, the inflow parameter is calculated on the 3-day basis. This generally occurs late spring through the first significant rains in the fall or winter. D-1641 objectives for the E/I ratio generally require a ratio of 35 percent during February to June and 65 percent in all other months. The E/I objective is relaxed to 45 percent in February after the driest of January runoff conditions (8 River Index < 1.0), or may be relaxed to 45 percent after a January for which the 8 River Index is in the range 1.0 to 1.5, after consultation within the CALFED Ops Group. Relaxation of the E/I ratio objective is also a management/water supply tool available to the Management Agencies (the US Fish and Wildlife Service, the National Marine Fisheries Service, and the California Department of Fish and Game) by the Environmental Water Account (EWA) Operating Principles Agreement (CALFED 2000b). The biological rationale for the E/I ratio objective is to ensure the CVP-SWP export operations avoid exporting the leading edge of increased inflows produced by rain events into the Delta environment.

Current Compliance History

Since D-1641 was adopted, this objective was exceeded for a total of three days: on September 20 and 21, 2000 (when the objective was 0.65 and the actual was 0.669) and on February 14, 2005 (when the objective was 0.35 and the actual was 0.352).

DWR informed the SWRCB of the September 2000 exceedence on September 25, 2000. The SWRCB waived enforcement actions provided DWR and Reclamation do one of three things:

- In consultation with the Department of Fish and Game (DFG), before April 20, 2001, release water from storage in Lake Oroville in an amount equal to the unauthorized diversion for fish and wildlife beneficial uses in the Delta.
- In consultation with the DFG, before April 20, 2001, forego pumping at the Harvey O. Banks pumping plant in the southern Delta in an amount equal to the unauthorized diversion at a time beneficial to fish.
- In consultation with the DFG, before April 20, 2001, contribute an amount of SWP water equal to the unauthorized diversion to an environmental restoration project beneficial to fish in the Delta.

DWR selected the second option to forego pumping in the amount of the exceedance.

In the case of the February 14, 2005 exceedance, DWR sent a letter to the SWRCB stating that due to operator error, the 14-day E/I ratio reached 35.2 %, and asked for clarification as to whether the 35% objective is to be interpreted as 35.0% exactly or if a number in the range 35.0-35.4% constitutes compliance with the objective (using standard rounding rules). As of this writing, the SWRCB has not responded to the letter.

Means for Improving Compliance

All three exceedences occurred due to a lack of clear communication between the SWP Operations Control Office and the Delta Field Division (which operates the Clifton Court gates to take in the water). This error has been corrected by keeping clear logs at both the OCO and the DFD which record the maximum daily amount that can be diverted and through improved communication procedures between OCO and DFD.

The regulatory combination of X2 objectives, E/I ratio export restrictions, or minimum Delta outflow objectives creates a dynamic regulatory environment of CVP and SWP operations controlling Delta objectives. When rain events change the anticipated hydrologic conditions to the Delta environment, the controlling Delta objective can quickly change from a minimum Delta outflow objective to an E/I ratio limitation and subsequently back to a minimum Delta outflow objective. The magnitude and duration of these sudden Delta inflow events, and the season in which they occur, make long-term projections of CVP and SWP exports difficult to do. Consequently, the value of projecting CVP and SWP export operations is limited to short time periods.

Chapter 4. Additional Permit and License Conditions

Water Quality Compliance and Baseline Monitoring (Condition 3, Page 147, Conditions 11.a-e, Page 149)

The Environmental Monitoring Program (EMP) for the Sacramento-San Joaquin Delta, Suisun Bay, and San Pablo Bay is conducted under the auspices of the Interagency Ecological Program (IEP).

The primary purpose of the IEP EMP is to provide necessary information for compliance with flow-related water quality objectives specified in the water right permits. In addition, the EMP also provides information on a wide range of chemical, physical and biological baseline variables. Discrete water quality stations are sampled monthly using a research vessel and a laboratory van. Several constituents are also measured continuously at eight stations. In addition, the EMP collects and analyzes benthos, phytoplankton, and zooplankton samples. Stations listed as "continuous recorder sites" in D-1641 are not part of the EMP.

The EMP was initiated in 1971 in compliance with California State Water Resources Control Board (SWRCB) Water Right Decision D-1379 and continued from 1978 through 1999 under D-1485. Currently, it is mandated by Water Right Decision D-1641. The program is carried out jointly by DWR and Reclamation. Assistance is provided by the California Department of Fish and Game (CDFG) and the United States Geological Survey (USGS), as well as the U.S. Fish and Wildlife Service (USFWS), the National Marine Fisheries Service (NMFS) and the SWRCB. Currently, the DWR part of EMP has a total budget of approximately 3.0 million dollars (2006) and up to 25 full and part time employees. EMP staff is responsible for carrying out the monitoring program and associated "special studies." This is a significant part of the total $10 million IEP monitoring program.

While some discrete sample processing is completed on board, most water quality sample analyses are conducted by the DWR Bryte Chemical Laboratory. The resulting data is entered in the DWR Field and Laboratory Information System (FLIMS). From there, it is transferred into the DWR Water Data Library and the EMP Discrete Water Quality database. Biological samples are processed at Bryte lab, as well as by staff at DWR Division of Environmental Services headquarters, laboratories at CDFG, and by private consultants.

After reviewing of the results for accuracy and completeness, data are sent to the publicly accessible Bay-Delta & Tributaries Database (BDAT). A subset of the continuous water quality data is available on a near real-time basis on-line through DWR's CDEC and, once they have been checked, through IEP Hydrologic Engineering Center Data Storage System (HEC-DSS). Monitoring results are routinely analyzed and summarized in annual and multi-year reports and in brief updates in the IEP newsletter.

The greatest revisions to the program came about in 1978 with the enactment of Water Right Decision D-1485 and after a major review of the program in 1995. The main goal of the 1995 revision was to streamline the existing program for more efficient budget and resource allocation. Consequently, discrete baseline sampling stations were reduced from 26 to 11 sites and contaminants monitoring was discontinued. In 2001-2002, the IEP EMP underwent another major programmatic review. Currently recommendations from that review are being implemented and any recommended changes to the program will be submitted to the SWRCB for approval.

Performing the Water Quality and Baseline Monitoring (Condition 11.a.)

All stations listed in D-1641 Table 5 and Table 4 are being monitored for the parameters specified. The baseline station for the Sacramento River has been moved from Greene's landing to Hood. Relocation of the monitoring station was approved by the SWRCB.

Conducting Ongoing and Future Monitoring Surveys (Condition 11.b.)

The IEP program maintains active participation from a number of agencies including those listed in this Condition. The annual IEP workplan includes the EMP activities, and is reviewed and approved by the above agencies. In addition, the IEP workplan contains many special studies aimed at assessing the possible impacts from water operations on the estuary. Currently the Pelagic Organism Decline (POD) is directing many of the special study and analyses activities. Of the possible factors contributing to the decline, effects from exports are being studied. These efforts also meet the spirit of this Condition. On November 14, 2005 a public workshop organized by the CBDA and held in the CAL EPA hearing room presented the current status of research into the POD.

Monitoring Reports and Data Posting (Condition 11.c.)

Between 1997 and 2000, there was a lack of compliance with the written annual report requirement. Staff turnover, state hiring freezes and a two-year period where there was no permanent program manager for the EMP program contributed to this discrepancy. Within the last 18 months, staff has completed the 1997-2000 report, and the 2001-2002 report which have been sent to the SWRCB; the 2003 draft report is in the final technical editing stage, and staff is currently writing the 2004 report which is expected to be completed in early 2006. DWR will provide the calendar year 2005 draft by the required date of December 1, 2006.

In addition, starting with the 2001-2002 report, reports are now being produced in cross media formatting, which will allow simultaneous production in hard copy form and a format for posting on the internet.

Discreet water quality data, continuously collected water quality data, and biological monitoring data are posted to the Bay Delta Tributaries Database (BDAT) after validation. Data from real time water quality monitoring station designated as compliance stations are telemetered real time to the CDEC. Current work is focusing on adding 4 new continuous water quality sites based on recommendations from the 2001-2002 programmatic review. Future work will be to provide a directory and URL links on the EMP web site to each type of data to assist the SWRCB and other interested parties in locating the data quickly.

As described above under the IEP workplan process, the Executive Director of the SWRCB is a member of the IEP Directors Committee. All EMP and IEP work plans are submitted to the Directors for review and approval.

Prompt Notification of Violations of Water Quality Objectives (Condition 11.d.)

This component of D-1641 compliance is executed by the DWR Operations and Maintenance (O&M) Division. The EMP program has responsibility to provide the information in an easily accessible form to O&M. Data from compliance and baseline water quality stations are currently telemetered real time to CDEC for access by O&M analysts. D-1641 requires DWR provide timely notification to the SWRCB Executive Director whenever objectives are exceeded.

DWR has been meeting the reporting requirements with one exception. The 1.0 EC objectives at San Joaquin River at Brandt Bridge and at Old River at Tracy Road Bridge compliance stations were exceeded for a three-month period in early 2003, as discussed above under water quality objectives for agriculture. However, the exceedences were not discovered until late 2005 while DWR was reviewing past data. Upon discovery, DWR promptly reported the exceedences to the SWRCB. DWR had already upgraded the monitoring equipment at these stations in early 2005 providing telemetry capability and transmitting data real-time for posting on CDEC. These changes will ensure delays in notification do not occur in the future.

Periodic Evaluation of Water Quality Monitoring and Baseline Monitoring (Condition 11.e.)

The last programmatic review was conducted in 2001-2002. Recommendations were implemented, including the recommendation to conduct special studies to examine the benthic component of the program. Results from these special studies are currently being analyzed to provide possible alteration of the benthic monitoring program. In addition, four new water quality monitoring sites are being established for continuous monitoring. Based on the required time schedule, DWR will begin a programmatic review in 2006.

Fishery Monitoring Plan for VAMP (Condition 4.a, b, Page 147)

In D-1641, the SWRCB requires Reclamation meet specific flows at Vernalis as described in the San Joaquin River Agreement (SJRA) (SJRGA 2000). D-1641 makes changes to water right permits and licenses of Merced Irrigation District, Oakdale ID, South San Joaquin ID, Turlock ID, and Modesto ID to require them to provide water to help meet flows for the SJRA. The SJRA is an agreement among DWR, Reclamation, agencies representing SWP and CVP water contractors, and several water districts within the San Joaquin River Basin that provides for a 12-year experimental program of specific flows and exports in the lower San Joaquin River during a 31-day pulse flow period during April-May. The SJRA also provides for the collection of experimental data during that time to further the understanding of the effects of flows, exports, and the barrier at the head of Old River on salmon survival. This experimental program is commonly referred to as the Vernalis Adaptive Management Program (VAMP).

D-1641, Condition 4, Page 147 requires DWR and Reclamation, in consultation with fishery and water agencies, prepare a fishery monitoring plan for the VAMP experiment consistent with the SJRA and with the findings in the D-1641. The initial plan was required within 60 days after the date of adoption of D-1641. This condition also requires the preparation of an annual report documenting implementation and results of the VAMP program. Both conditions have been met.

The full implementation of the VAMP 2000 program and the preparation and publication of the 2000 Annual Technical Report represented the first year of formal compliance with these conditions. VAMP is designed to protect juvenile Chinook salmon migrating from the San Joaquin River through the Sacramento-San Joaquin Delta. VAMP is also a scientifically recognized experiment to determine how salmon survival rates change in response to alterations in San Joaquin River flows and SWP/CVP exports and the installation of the Head of Old River Barrier. In addition to providing improved protection for juvenile Chinook salmon emigrating from the San Joaquin River system, specific experimental objectives of VAMP included:

- Quantification of Chinook salmon smolts survival between Durham Ferry and Jersey Point using recapture locations at Antioch and Chipps Island under a set of six San Joaquin River flow rates (3,200 to 7,000 cfs) at Vernalis, with an installed Head of Old River Barrier, and specific SWP/CVP export rates (1,500 to 3000 cfs).
- Comparison of juvenile Chinook salmon survival between Durham Ferry and Mossdale for use in comparing results with results from earlier survival studies where coded-wire tagged salmon releases occurred at Mossdale.

A secondary objective of the VAMP experimental salmon smolt survival studies is the comparison of the survival of juvenile Chinook salmon of Merced and Mokelumne River origin released at Jersey Point.

Since the implementation of the VAMP 2000 program, VAMP has employed an adaptive management strategy to use current knowledge of hydrology and environmental conditions to protect Chinook salmon smolt passage. Based on data gathered during the experimental mark recapture studies conducted in previous years, conclusions and recommendations have been developed to provide guidance and a foundation for design and implementation of future VAMP operations.

The VAMP 2005 program represents the sixth year of compliance with this condition of D-1641. Except for VAMP 2005, VAMP was fully implemented from years 2000 to 2004. The VAMP 2005 was not fully implemented due to high San Joaquin River flows that prevented installation of the Head of Old River Barrier. However, the salmon smolt mark recapture study was conducted.

As noted above, Condition 4, Page 147, of D-1641, directs DWR and Reclamation to send the SWRCB Executive Director of the SWRCB the results of the fishery monitoring studies on an annual basis. Condition 7, Page 168, of D-1641 directs Merced, Modesto, Turlock, South San Joaquin and Oakdale irrigation districts to submit a report detailing district operations as a result of the SJRA. By letter dated September 8, 2000, the SWRCB approved combining these two reports into a single comprehensive report.

The annual report comprising the consolidated annual SJRA Operations and the VAMP Monitoring Report is prepared and submitted to the SWRCB Executive Director by December 31 of each year. The report is a collective effort among various agencies. It includes the following information on the implementation of the SJRA: the hydrologic chronicle; the management of the additional SJRA water; installation, operation, and monitoring of the Head of Old River Barrier; results of the juvenile Chinook salmon smolt survival investigations; and, conclusions and recommendations.

Compliance with State and Federal ESA Requirements

D-1641 Condition 7, page 148, provides that DWR's water right permits do not authorize any act which results in the taking of a threatened or endangered species or any act which is now prohibited, or becomes prohibited in the future, under the California Endangered Species Act (CESA) or Federal Endangered Species Act (FESA). Under this condition, DWR must obtain authorization for any take that would result from any act authorized by D-1641 and must obtain such authorization prior to construction or operation of such action or project. DWR consults with the USFWS, NMFS, and the CDFG when its actions or projects may result in a take of an endangered species.

Prior to D-1641, biological opinions issued by USFWS and NMFS provided incidental take authorization for operation of the SWP related to impacts to winter run salmon and delta smelt. These species were listed under FESA in the early 1990s, after which, DWR and Reclamation consulted with USFWS and NMFS to obtain appropriate coverage for the take of these fish and the related impacts from CVP and SWP operations. DWR also entered into consultation with DFG and obtained a determination from the DFG Director that the NMFS biological opinion for winter-run salmon provided adequate protection to satisfy CESA. DWR and Reclamation also entered into additional consultations regarding CVP and SWP impacts to spring-run salmon and steelhead, which resulted in short term biological opinions. Subsequent to the federal opinion for spring-run salmon, DFG issued a determination finding that the federal opinion was consistent with CESA. During the mid-1990s, DWR and DFG continued to discuss delta smelt and requirements of CESA while DWR operated the SWP in compliance with the federal delta smelt opinion.

DWR continues to obtain incidental take coverage for endangered species under the existing federal biological opinions and pursuant to the California Fish and Game Code Section 2081.1, based on agreements and memorandums entered into with the DFG prior to April 10, 1997. In 2004, the federal fishery agencies issued updated biological opinions for operations of the CVP and SWP which covers impacts and incidental take of the listed salmonid species and delta smelt.

In the future, DWR will continue to operate to the federal biological opinions for salmonids and delta smelt. Some proposed DWR/Reclamation projects, such as the South Delta Improvement Project, have been subject to early federal consultations and preliminary biological opinions. The early consultations will be revisited and the biological opinions revised as appropriate after the proposed projects have completed environmental review. In addition, DWR is consulting with DFG regarding these proposed projects and requirements of CESA, which will ultimately result in appropriate permits or agreements to authorize incidental take pursuant to CESA for these new projects. In addition DWR is working with DFG to achieve updated CESA coverage for existing SWP operations under the new Natural Communities Conservation Plan legislation.

Joint Point Operations

D-1641 authorizes DWR to divert up to 4,600 cfs at Reclamation's Tracy Pumping Plant subject to approval by Reclamation if certain conditions are met. Similar provisions provide for the use of the Banks Pumping Plant under Reclamation's water rights permits, requiring Reclamation to meet similar terms and conditions as described for DWR. This shared use of export facilities is termed Joint Point of Diversion (JPOD).

The JPOD authorization contains three "stages" corresponding to export rates and limitations on the purpose of use of the particular JPOD action. The authorization contained in Reclamation's permits includes a similar staged implementation.

Stage 1 JPOD under DWR's water rights authorizes the diversion of water at the Tracy Pumping Plant to recover export reductions taken to benefit fish. Reclamation is authorized to use the Banks Pumping Plant under JPOD for diversion of CVP water for delivery to its Cross-Valley Canal contractors and Musco Olive. Recovery of export reductions shall not cause an increase in annual exports above that which would have been exported without the use of Tracy Pumping Plant.

Stage 2 JPOD authorizes the diversion of water at the Tracy Pumping Plant for any purpose authorized under DWR's existing water rights permits up to the limits specified in the current US Army Corps of Engineers (USACOE) permit.

Stage 3 JPOD authorizes the diversion of water at the Tracy Pumping Plant for any purpose authorized under DWR's existing water rights permits, up to the physical capacity of the Tracy Pumping Plant. Diversions under Stage 3 JPOD could increase SWP exports above current levels if permitted in the future by the USACOE.

All JPOD operations are subject to several specific criteria. JPOD is not authorized when the Delta is in excess conditions if the diversions would cause the position of X2 to shift above several specific locations. It also provides that JPOD diversions that would cause the Delta to shift from excess into balanced conditions will be junior to diversions by Contra Costa Water District. In order to use JPOD, DWR is required to have an approved water level and water quality response plan to protect beneficial uses within the southern and central Delta, and shall meet all other provisions of its water rights permits. Stage 1 operations also contain objectives that JPOD shall not increase total exports above that which would have occurred without the use of Tracy Pumping Plant. In addition, the recovery must take place within one year of the reductions, and DWR must consult with the resource agencies prior to conducting JPOD operations. In addition to the provisions of Stage 1, implementation of Stage 2 JPOD requires the development of a Fishery Protection Plan which must include measures to ensure the protection of fish and wildlife and other beneficial uses from negative impacts by JPOD. JPOD operations under Stage 3 require all the provisions of Stage 1 and Stage 2 and the construction of the Permanent Operable Gates in the southern Delta. Each of the plans must be approved by the Chief of the Division of Water Rights at the SWRCB prior to use of JPOD.

DWR and Reclamation have jointly developed both a Water Level Response Plan and a Water Quality Response Plan. A Fishery Protection Plan, required for Stage 2 and 3 JPOD, has been drafted, but has not yet been reviewed by all the fishery agencies at the writing of this report. Any use of JPOD will be consistent will all provisions contained in D-1641.

DWR has not yet utilized the JPOD provisions authorized under D-1641. DWR did pump 11,000 acre-feet of water at the Tracy Pumping Plant during June 2001, however that pumping was required due to a outage of the California Aqueduct and was authorized under the provisions of Water Rights Order 2001-09 approving DWR's Temporary Urgency Change petition.

Compliance with Remaining Elements of Decision 1485

Annual Modeling Progress Report to SWRCB (Condition 8, Page 148 [Condition 9, D1485])

Since the adoption of D-1485, the DWR has released an annual progress report detailing the scientific methods used in determining flow, water level, and water quality throughout the Sacramento-San Joaquin Delta estuary system to the SWRCB. These reports have been transmitted to the SWRCB on time every year since 1979.

The early reports focused on simple numerical and statistical methods used to better understand and define basic concepts such as Delta outflow and salinity. As more complex flow and water quality relationships and computer simulation models were developed to aid the DWR in both its short- and long-

term activities in the estuary, the scope of the annual reports increased to include chapters summarizing these new methodologies. By the 1990s the annual reports included detailed chapters documenting DWR's work in related areas such as estimating Delta island consumptive use, carriage water, disinfection by-product formation potentials, particle tracking, modeling water quality parameters such as dissolved oxygen, temperature, or dissolved organic carbon, assessing climate change impacts, model database management, urban drinking water quality forecasting, and more.

In addition to submitting an annual progress report to the SWRCB, DWR sends copies of the report to California libraries and various individuals and stakeholders with an interest in the Delta. In order to make copies of the report available to the general public, the report has been archived on the following DWR Web page: http://baydeltaoffice.water.ca.gov/modeling/deltamodeling/annualreports.cfm

Suisun Marsh Water Quality Annual Report to SWRCB (Condition 10, Page 149)

The Department has consistently met all objectives in the Suisun Marsh since the adoption of D-1641 and has provided annual reports to the SWRCB in compliance with this condition. The Department has sought to improve agency and public access to its annual reports by posting them on the web. The annual reports currently available on the web date back to 1997. The web site containing these reports is located at: http://iep.water.ca.gov/suisun/dataReports/index.html.

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5. San Joaquin River Water Quality Management Group. June 2005. *Summary Recommendations of the San Joaquin River Water Quality Management Group for Meeting the Water Quality Objectives for Salinity Measured at Vernalis and Dissolved Oxygen in the Stockton Deep Water Ship Channel.* Sacramento (CA): San Joaquin River Water Quality Management Group.
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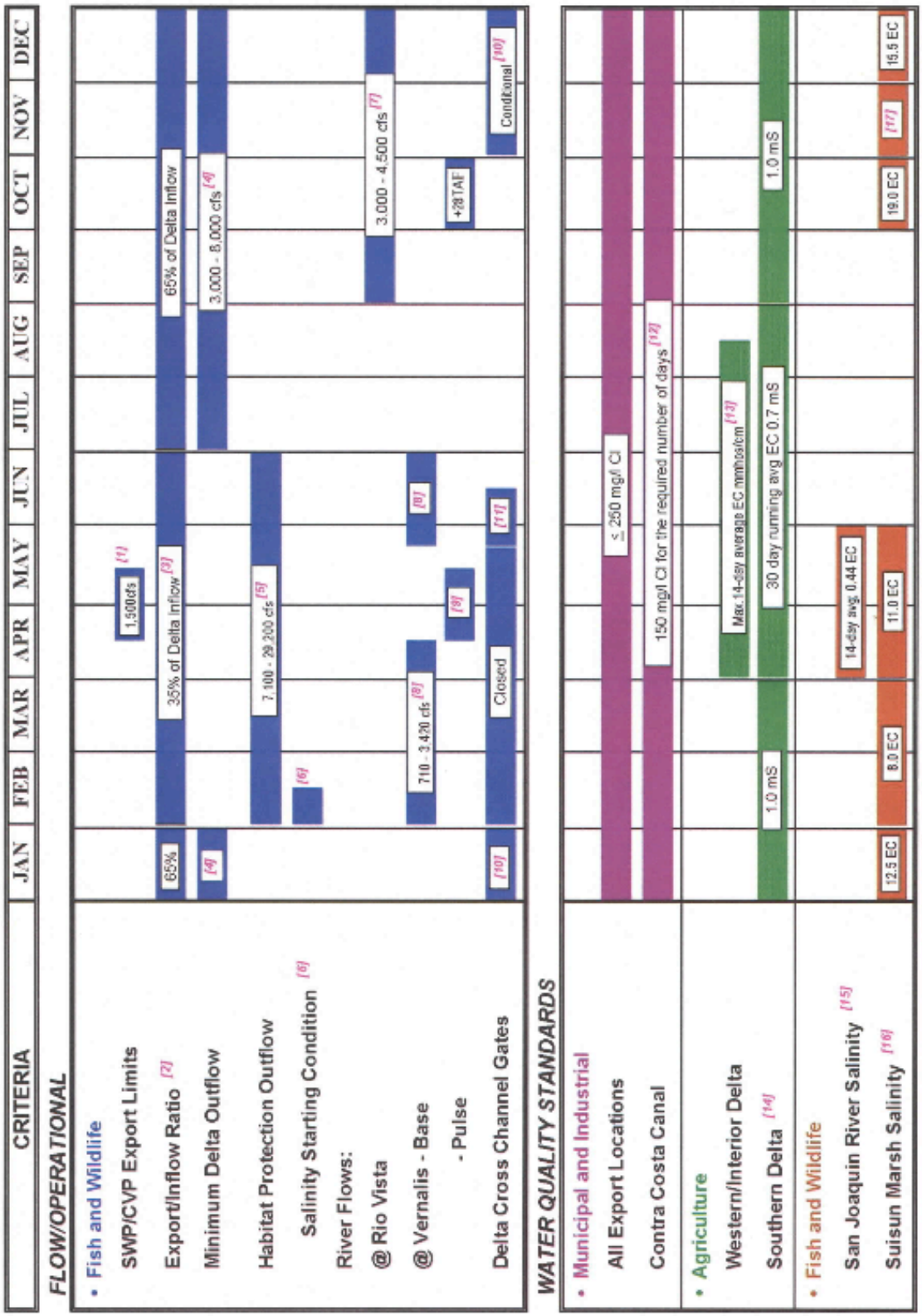
8. _____. 1999. *Water Right Decision 1641, Implementation of Water Quality Objectives for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary*, Revised. Sacramento (CA): State Water Resources Control Board.
9. _____. November 21, 2005. Personal communication with SWRCB representative Ms. Gita Kapahi.

Appendix A. Summary of Bay-Delta Standards



Footnotes

[1] Maximum 3-day running average of combined export rate (cfs) which includes Tracy Pumping Plant and Clifton Court Forebay Inflow less Byron-Bethany pumping.

Year Type	All
Apr15 - May15*	The greater of 1,500 or 100% of 3-day avg. Vernalis flow

* This time period may need to be adjusted to coincide with fish migration. Maximum export rate may be varied by CalFed Op's group.

[2] The maximum percentage of average Delta inflow (use 3-day average for balanced conditions with storage withdrawal, otherwise use 14-day average) diverted at Clifton Court Forebay (excluding Byron-Bethany pumping) and Tracy Pumping Plant using a 3-day average. (These percentages may be adjusted upward or downward depending on biological conditions, providing there is no net water cost.)

[3] The maximum percent Delta inflow diverted for Feb may vary depending on the January 8RI.

Jan 8RI	Feb exp. limit
≤ 1.0 MAF	45%
between 1.0 & 1.5 MAF	35%-45%
> 1.5 MAF	35%

[4] Minimum monthly average Delta outflow (cfs). If monthly standard ≤ 5,000 cfs, then the 7-day average must be within 1,000 cfs of standard; if monthly standard > 5,000 cfs, then the 7-day average must be ≥ 80% of standard.

Year Type	All	W	AN	BN	D	C
Jan	4,500*					
Jul		8,000	8,000	6,500	5,000	4,000
Aug		4,000	4,000	4,000	3,500	3,000
Sep	3,000					
Oct		4,000	4,000	4,000	4,000	3,000
Nov-Dec		4,500	4,500	4,500	4,500	3,500

* Increase to 6,000 if the Dec 8RI is greater than 800 TAF

[5] Minimum 3-day running average of daily Delta outflow of 7,100 cfs OR: either the daily average or 14-day running average EC at Collinsville is less than 2.64 mmhos/cm (This standard for March may be relaxed if the Feb 8RI is less than 500 TAF. The standard does not apply in May and June if the May estimate of the SRI IS < 8.1 MAF at the 90% exceedence level in which case a minimum 14-day running average flow of 4,000 cfs is required.) For additional Delta outflow objectives, see **TABLE A**.

[6] February starting salinity: If Jan 8RI > 900 TAF, then the daily or 14-day running average EC @ Collinsville must be ≤ 2.64 mmhos/cm for at least one day between Feb 1-14. If Jan 8RI is between 650 TAF and 900 TAF, then the CalFed Op's group will determine if this requirement must be met.

[7] Rio Vista minimum monthly average flow rate in cfs (the 7-day running average shall not be less than 1,000 below the monthly objective).

Year Type	All	W	AN	BN	D	C
Sep	3,000					
Oct		4,000	4,000	4,000	4,000	3,000
Nov-Dec		4,500	4,500	4,500	4,500	3,500

[8] BASE Vernalis minimum monthly average flow rate in cfs (the 7-day running average shall not be less than 20% below the objective). Take the higher objective if X2 is required to be west of Chipps Island.

Year Type	All	W	AN	BN	D	C
Feb-Apr14 and May16-Jun		2,130 or 3,420	2,130 or 3,420	1,420 or 2,280	1,420 or 2,280	710 or 1,140

[9] PULSE Vernalis minimum monthly average flow rate in cfs. Take the higher objective if X2 is required to be at or west of Chipps Island.

Year Type	All	W	AN	BN	D	C
Apr15 - May15		7,330 or 8,620	5,730 or 7,020	4,620 or 5,480	4,020 or 4,880	3,110 or 3,540
Oct	1,000*					

* Up to an additional 28 TAF pulse/attraction flow to bring flows up to a monthly average of 2,000 cfs except for a critical year following a critical year. Time period based on real-time monitoring and determined by CalFed Op's group.

[10] For the Nov-Jan period, Delta Cross Channel gates may be closed for up to a total of 45 days.

[11] For the May 21-June 15 period, close Delta Cross Channel gates for a total of 14 days per CALFED Op's group. During the period the Delta cross channel gates may close 4 consecutive days each week, excluding weekends.

[12] Minimum # of days that the mean daily chlorides ≤ 150 mg/l must be provided in intervals of not less than 2 weeks duration. Standard applies at Contra Costa Canal Intake or Antioch Water Works Intake.

Year Type	W	AN	BN	D	C
# Days	240	190	175	165	155

[13] The maximum14-day running average of mean daily EC (mmhos/cm) depends on water year type.

	WESTERN DELTA				INTERIOR DELTA			
	Sac River @ Emmaton		SJR @ Jersey Point		Mokelumne R @ Terminous		SJR @ San Andreas	
Year Type	0.45 EC from April 1 to date shown	EC value from date shown to Aug15 *	0.45 EC from April 1 to date shown	EC value from date shown to Aug15 *	0.45 EC from April 1 to date shown	EC value from date shown to Aug15 *	0.45 EC from April 1 to date shown	EC value from date shown to Aug15 *
W	Aug 15		Aug 15		Aug 15		Aug 15	
AN	Jul 1	0.63	Aug 15		Aug 15		Aug 15	
BN	Jun 20	1.14	Jun 20	0.74	Aug 15		Aug 15	
D	Jun 15	1.67	Jun 15	1.35	Aug 15		Jun 25	0.58
C		2.78		2.20		0.54		0.87

* When no date is shown, EC limit continues from April 1.

[14] As per D-1641, for San Joaquin River at Vernalis: however, the April through August maximum 30- day running average EC for San Joaquin River at Brandt Bridge,Old River near Middle River, and Old River at Tracy Road Bridge shall be 1.0 EC until April 1, 2005 when the value will be 0.7 EC.

[15] Compliance will be determined between Jersey Point & Prisoners Point.
Does not apply in critical years or in May when the May 90% forecast of SRI ≤ 8.1 MAF.

[16] During deficiency period, the maximum monthly average mhtEC at Western Suisun Marsh stations as per SMPA is:

Month	mhtEC
Oct	19.0
Nov	16.5
Dec-Mar	15.6
Apr	14.0
May	12.5

[17] In November, maximum monthly average mhtEC = 16.5 for Western Marsh stations and maximum monthly average mhtEC = 15.5 for Eastern Marsh stations in all periods types.

Number of Days When Max. Daily Average Electrical Conductivity of 2.64 mmhos/cm Must Be Maintained at Chipps Island and Port Chicago. (This can also be met with a maximum 14-day running average EC of 2.64 mmhos/cm, or 3-day running average Delta outflows of 11,400 cfs and 29,200 cfs, respectively.) Port Chicago Standard is triggered only when the 14-day average EC for the last day of the previous month is 2.64 mmhos/cm or less. PMI is previous month's 8RI. If salinity/flow objectives are met for a greater number of days than required for any month, the excess days shall be applied towards the following month's requirement. The number of day's for values of the PMI between those specified below shall be determined by linear interpolation.

PMI (TAF)	Chipps Island (Chipps Island Station D10) FEB	MAR	APR	MAY	JUN
≤ 500	0	0	0	0	0
750	0	0	0	0	0
1000	28*	12	2	0	0
1250	28	31	6	0	0
1500	28	31	13	0	0
1750	28	31	20	0	0
2000	28	31	25	1	0
2250	28	31	27	3	0
2500	28	31	29	11	1
2750	28	31	29	20	2
3000	28	31	30	27	4
3250	28	31	30	29	8
3500	28	31	30	30	13
3750	28	31	30	31	18
4000	28	31	30	31	23
4250	28	31	30	31	25
4500	28	31	30	31	27
4750	28	31	30	31	28
5000	28	31	30	31	29
5250	28	31	30	31	29
≥ 5500	28	31	30	31	30

*When 800 TAF < PMI < 1000 TAF, the number of days is determined by linear interpolation between 0 and 28 days.

PMI (TAF)	Port Chicago (continuous recorder at Port Chicago) FEB	MAR	APR	MAY	JUN
0	0	0	0	0	0
250	1	0	0	0	0
500	4	1	0	0	0
750	8	2	0	0	0
1000	12	4	0	0	0
1250	15	6	1	0	0
1500	18	9	1	0	0
1750	20	12	2	0	0
2000	21	15	4	0	0
2250	22	17	5	1	0
2500	23	19	8	1	0
2750	24	21	10	2	0
3000	25	23	12	4	0
3250	25	24	14	6	0
3500	25	25	16	9	0
3750	26	26	18	12	0
4000	26	27	20	15	0
4250	26	27	21	18	1
4500	26	28	23	21	2
4750	27	28	24	23	3
5000	27	28	25	25	4
5250	27	29	25	26	6
5500	27	29	26	28	9
5750	27	29	27	28	13
6000	27	29	27	29	16
6250	27	30	27	29	19
6500	27	30	28	30	22
6750	27	30	28	30	24
7000	27	30	28	30	26
7250	27	30	28	30	27
7500	27	30	29	30	28
7750	27	30	29	31	28
8000	27	30	29	31	29
8250	28	30	29	31	29
8500	28	30	29	31	29
8750	28	30	29	31	30
9000	28	30	29	31	30
9250	28	30	29	31	30
9500	28	31	29	31	30
9750	28	31	29	31	30
10000	28	31	30	31	30
> 10000	28	31	30	31	30

Appendix B. Senate Bill No. 1155

Senate Bill No. 1155
CHAPTER 612

An act to add Section 138.10 to the Water Code, relating to water.
[Approved by Governor September 21, 2004. Filed with Secretary of State September 21, 2004.]

LEGISLATIVE COUNSEL'S DIGEST

SB 1155, Machado. Water quality standards: Sacramento-San Joaquin Delta.

Under existing law, the Department of Water Resources operates the State Water Project, which includes state water facilities, as defined. Under existing law, the State Water Resources Control Board administers a water rights program pursuant to which the state board grants permits and licenses to appropriate water.

The bill would require the Director of Water Resources, in collaboration with the Secretary of Interior or his or her designee, and on or before January 1, 2006, to prepare a plan to meet the existing permit and license conditions for which the department has an obligation, as described in a specified decision adopted by the state board. The bill would require the director to prepare the plan, and submit copies of the plan to the state board and California Bay-Delta Authority, prior to increasing the existing permitted diversion rate at a specified pumping plant.

The people of the State of California do enact as follows:

SECTION 1. Section 138.10 is added to the Water Code, to read:

138.10. (a) On or before January 1, 2006, the director, in collaboration with the Secretary of Interior or his or her designee, shall prepare a plan to meet the existing permit and license conditions for which the department has an obligation, as described in the State Water Resources Control Board Decision No. 1641.

(b) The plan shall be designed to achieve compliance with the permit and license conditions described in subdivision (a). The director shall prepare the plan, and submit copies of the plan to the board and the California Bay-Delta Authority, prior to increasing the existing permitted diversion rate at the State Water Project's Harvey O. Banks Pumping Plant.

(c) Nothing in this section limits or restricts the department in its operation of the State Water Project due to failure of other water rights permittees or licensees to meet water quality conditions of their respective permits or licenses.

Appendix C. DWR Actions to Control Salinity in the San Joaquin River Upstream of Vernalis

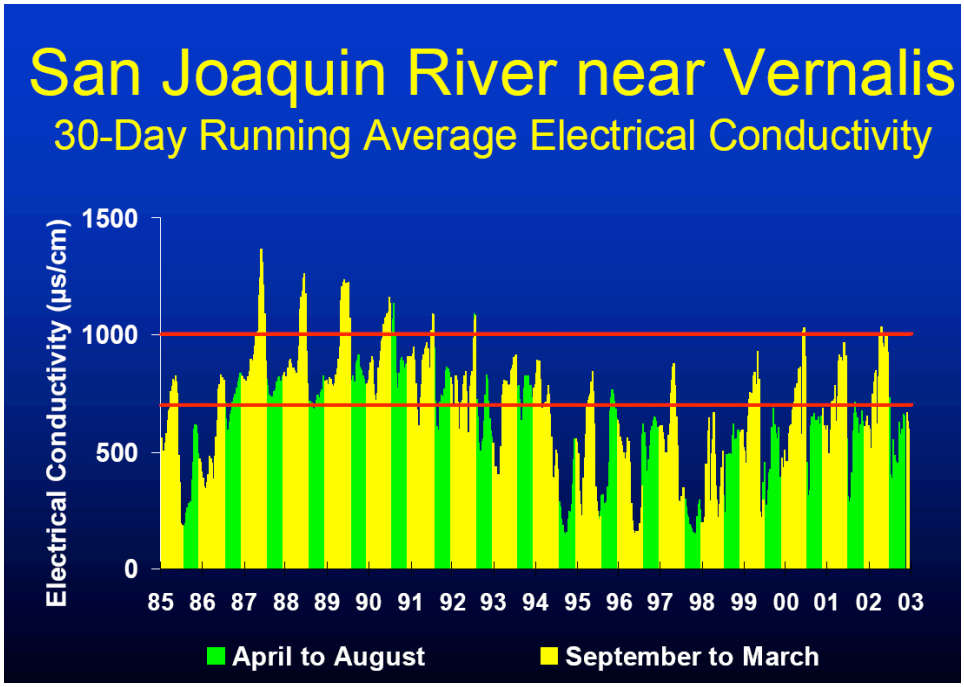
This appendix summarizes the many programs and extensive funding that DWR has engaged in to order to reduce the volume and concentration of saline discharges to the San Joaquin River (SJR). This information demonstrates the actions that DWR in cooperation with Reclamation and local agencies has taken and plans to take to help meet water quality objectives in the lower SJR.

In D-1641, the SWRCB allocates responsibility for the Vernalis flow and salinity objectives to Reclamation because it is one of the largest diverters of water from the SJR and because the CVP exports Delta water to farmers on the west side of the San Joaquin Valley. The reduction in SJR flows from tributaries streams in combination with discharges of saline surface and subsurface drainage water results in increases of salt loads in the river at Vernalis. Although DWR is not responsible for meeting Vernalis objectives established by the SWRCB, it was given co-responsibility for meeting salinity objectives at the three interior south Delta stations. Improvements in SJR water quality help achieve water quality objectives at these locations.

Many agencies with interests in the Delta recognize the value of improving SJR water quality. The CALFED Bay-Delta Program includes actions to address drainage problems in the San Joaquin Valley to improve downstream water quality (CALFED 2000). In December 1991, Reclamation, U.S. Fish and Wildlife Service (USFWS), U.S. Natural Resources Conservation Service (NRCS), U.S. Geological Survey (USGS), the California Department of Fish and Game (DFG), California Department of Food and Agriculture (DFA), the SWRCB and DWR signed a Memorandum of Understanding (MOU) to implement a management plan for agricultural subsurface drainage and related problems in the Westside of the San Joaquin Valley (SWRCB 1995). Many actions have been funded subsequent to the MOU.

It is important to note historical hydrologic conditions for the SJR near Vernalis. Figure C-1 data from the Central Valley Regional Water Quality Control Board (CVRWQCB) graphs the 30-day running average electrical conductivity respectively for the SJR near Vernalis while Figure C-2 illustrates the annual average flow and the10-year average annual flow for the same location. Figure C-1 also demonstrates that, in general, Reclamation has complied with salinity objectives since 1985, with the exception of the drought years 1987 to 1992. Figures C-1 and C-2 clearly indicate that hydrological conditions directly affect the water quality and flow regime of the river; however, water quality objectives apply regardless of hydrological conditions. Since 1995, conditions have improved partly due to improved hydrologic conditions and because of additional measures taken by DWR, Reclamation, and many collaborating agencies. These measures include: 1) providing fresh water to dilute saline discharges and to increase flows upstream of Vernalis from New Melones reservoir (Table C-1) and through the Vernalis Adaptive Management Program (VAMP) agreement (Table C-2), and 2) controlling discharge of saline water into the SJR upstream of Vernalis.

Figure C- 1. San Joaquin River at Vernalis, Electrical Conductivity



Source: Central Valley Regional Water Quality Control Board

Figure C-2. San Joaquin River Average Annual Flows at Vernalis

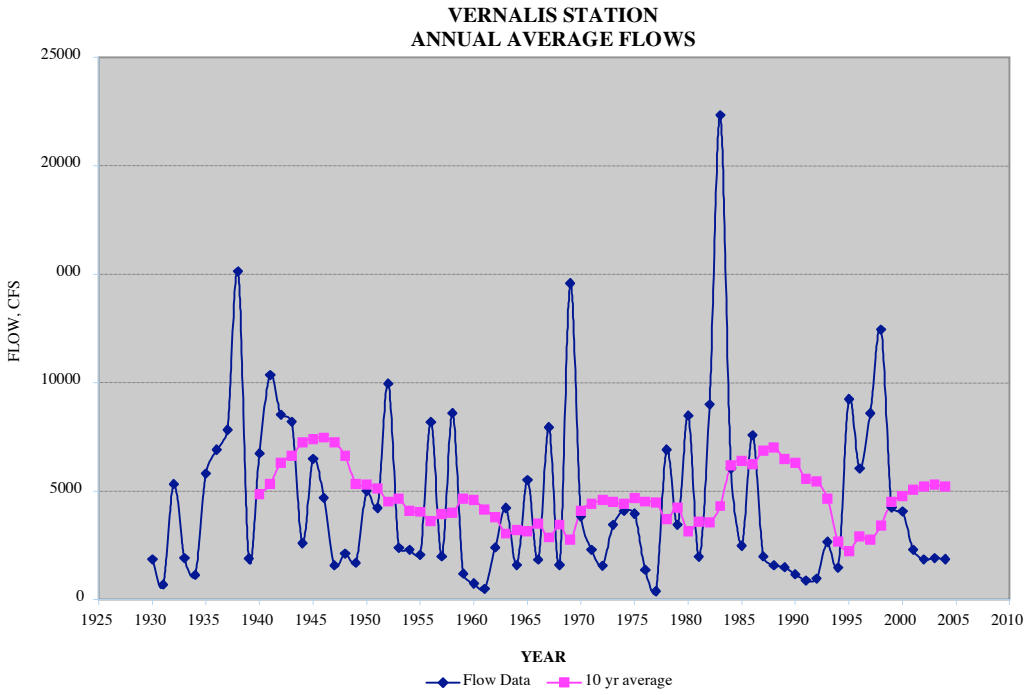


Table C-1. New Melones Reservoir – 1991-2003 Average Monthly Flow Releases to Meet Salinity and Flow Objectives at Vernalis

WQ Release	AF/Month
January	1,894
February	30,675
March	97,758
April	109,971
May	39,904
June	128,782
July	143,753
August	71,077
September	33,304
October	2,255
November	0
December	0
TOTAL	659,373
Average monthly release	50,721

Table C-2. Vernalis Adaptive Management Plan 2000-2004

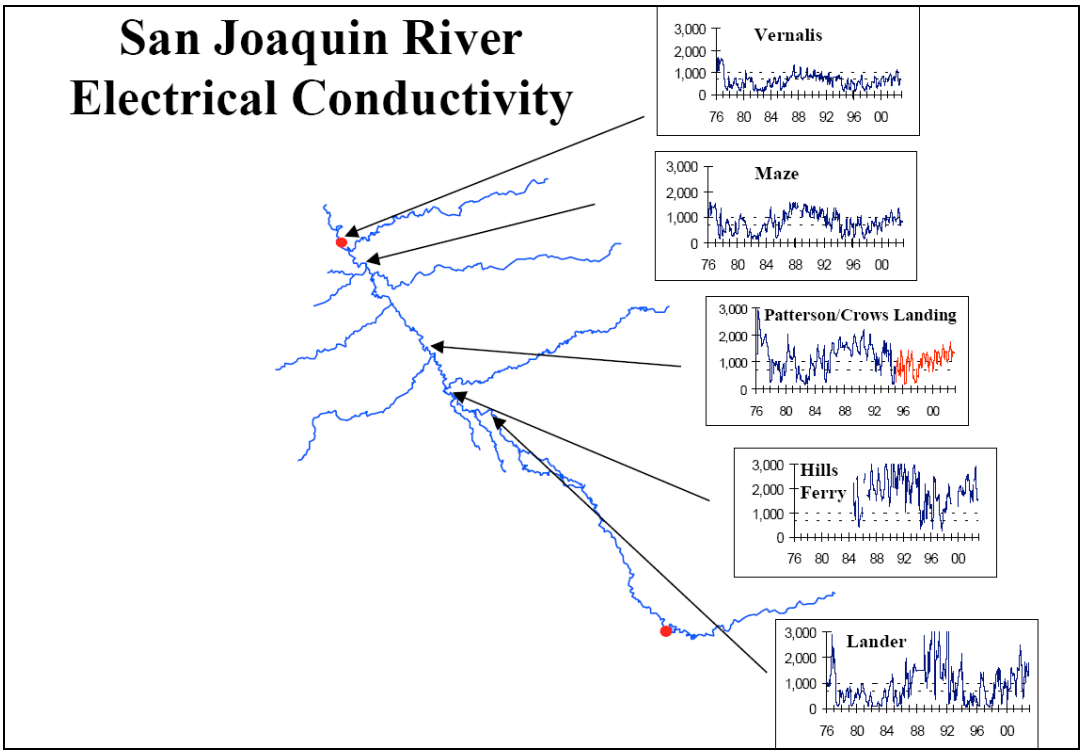
Year	VAMP Pulse Period	Target Vernalis/Export Flows (cfs)	Observed Vernalis/Export Flows (cfs)	VAMP Supplemental Water (acre-feet)
2000	4/15-5/15	5,700/2,250	5,869/2,155	77,680
2001	4/20-5/20	4,450/1,500	4,224/1,420	78,650
2002	4/15-5/15	3,200/1,500	3,301/1,430	33,430
2003	4/15-5/15	3,200/1,500	3,235/1,446	58,065
2004	4/15-5/15	3,200/1,500	3,155/1,331	65,591

Source: San Joaquin River Agreement-VAMP technical report

Measures to Provide Fresh Water for Dilution of Saline Flows Above Vernalis

New Melones Reservoir releases plus the VAMP flow contributions averaged 722,000 acre-feet per year. The San Joaquin River Agreement (SJRA) (SJRGA 2000) commits DWR to fund water purchases to meet flow objectives on the SJR for VAMP. Under the SJRA; the Reclamation and DWR agreed to spend up to $3 million and $1 million, respectively, per year to purchase VAMP water. Figure C-3 shows the water quality benefits of New Melones and VAMP flow releases at Vernalis when compared with other upstream SJR stations.

Figure C-3. San Joaquin River Electrical Conductivity at Vernalis and Other Stations



Source: Central Valley Regional Water Quality Control Board

Measures to Control Salinity in the San Joaquin River Upstream of Vernalis

In D1641, the SWRCB recognizes that regional management of drainage water is the preferred method to meet the SJR objectives (D-1641, Page 84). The DWR, Reclamation, and CVRWQCB, as well as many local, public and private agencies have made tremendous efforts to achieve salinity objectives in this area. A significant amount of public and private money has been, and continues to be invested in salinity reduction efforts for the SJR. In order to understand the salinity reduction measures taken, it is important to describe the sources of the salt load that averages one million tons per year in the SJR at Vernalis. In an average year, CVP water supplies carry more than 800,000 tons of salt into the northern portion of the San Joaquin Valley. Most of this salt load originates from the Delta and approximately 350,000 tons of this salt load are ultimately recycled back to the Delta through agricultural surface and subsurface returns and wetland discharges (DWR 2001). Tables C-3 and C-4 contain CVRWQCB information describing the sources of salt and the corresponding loads, while Figure C-4 defines the lower San Joaquin River (lower SJR) areas that contribute salts.

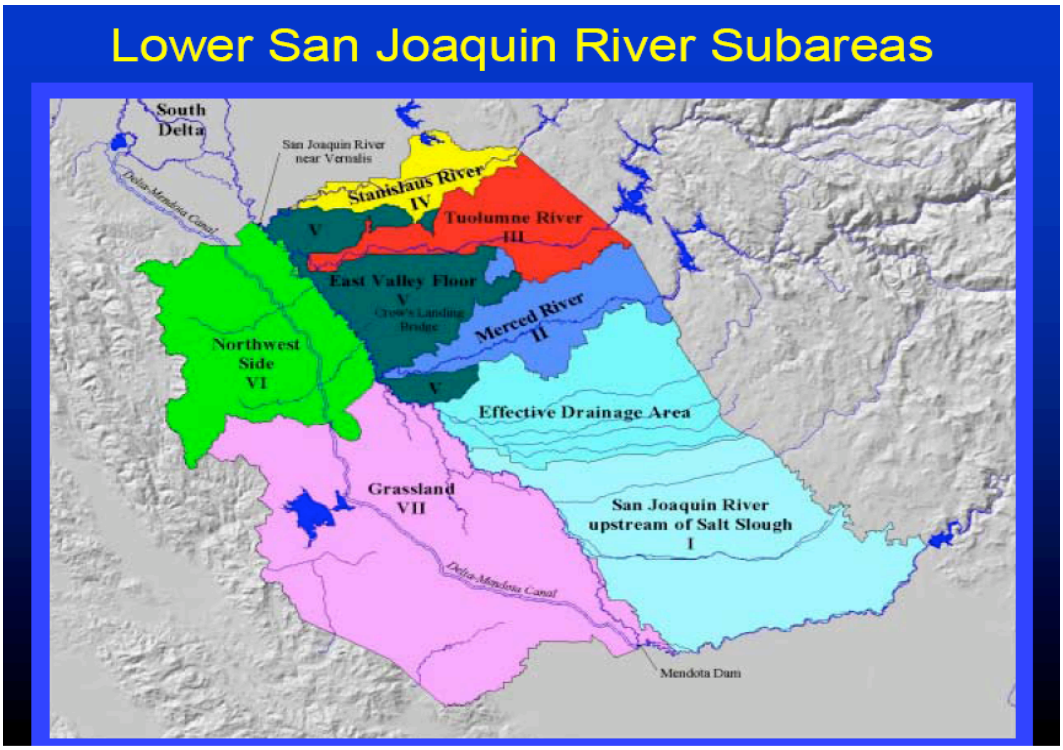
Table C-3. San Joaquin River at Vernalis

Approximate Sources of Salt	Load
Sierra Nevada Tributaries	18%
Groundwater	28%
Agricultural Surface Returns	26%
Agricultural Subsurface Returns	17%
Managed Wetlands	9%
Municipal and Industrial	2%

Table C-4. San Joaquin River at Vernalis

Approximate Sources of Salt	Area of Contribution
I SJR Upstream Salt Slough	9%
II Merced	
III Tuolumne	19%
IV Stanislaus	
V East Valley Floor	5%
VI Northwest Side	30%
VII Grasslands	37%
Total	100%

Figure C-4. Salt Source Contribution Areas of the Lower San Joaquin River



Measures to control salinity upstream of Vernalis include: a) on-farm management activities to reduce subsurface drainage, b) real-time water quality management to maximize the assimilative capacity of the SJR, and c) efforts to improve wetlands discharges.

On-Farm Drainage Management Activities

Drainage management activities involving source control have proven to be effective in reducing salt loads in the SJR. These measures include:

- irrigation water conservation such as use of improved irrigation systems;
- tiered Water Pricing, based on increased water cost for increased water use;
- agricultural tailwater and tilewater control and recycling; and
- agricultural subsurface drainage water reuse through the SJR Improvement Project.

A good example of the effectiveness of these measures has been demonstrated by the efforts of the Grasslands Area farmers as a part of the Grasslands Bypass Project (GBP). Figures C-5 and C-6 shows the reductions achieved in terms of volume of discharge and salt loads. Since the implementation of the

GBP, drainage discharges have decreased from 58,000 AF to about 30,000 AF and salt loads have been reduced from 210,000 tons to 117,000 tons. Funding sources and expenditures for implementation of the components of the GBP are outlined in Table C-5. Table C-6 summarizes some of the DWR grants targeting drainage source control in the Grasslands Area. Many components of the Grasslands Bypass Project, including the San Joaquin River Improvement Project, are also a part of the Westside Regional Drainage Plan. The West Side Regional Drainage Plan is an integrated plan to eliminate irrigated agricultural drainage water from and enhance water supply reliability for about 100,000 acres in the Grasslands Drainage area.

Figure C-5. Grasslands Drainage Area, Drainage Discharges

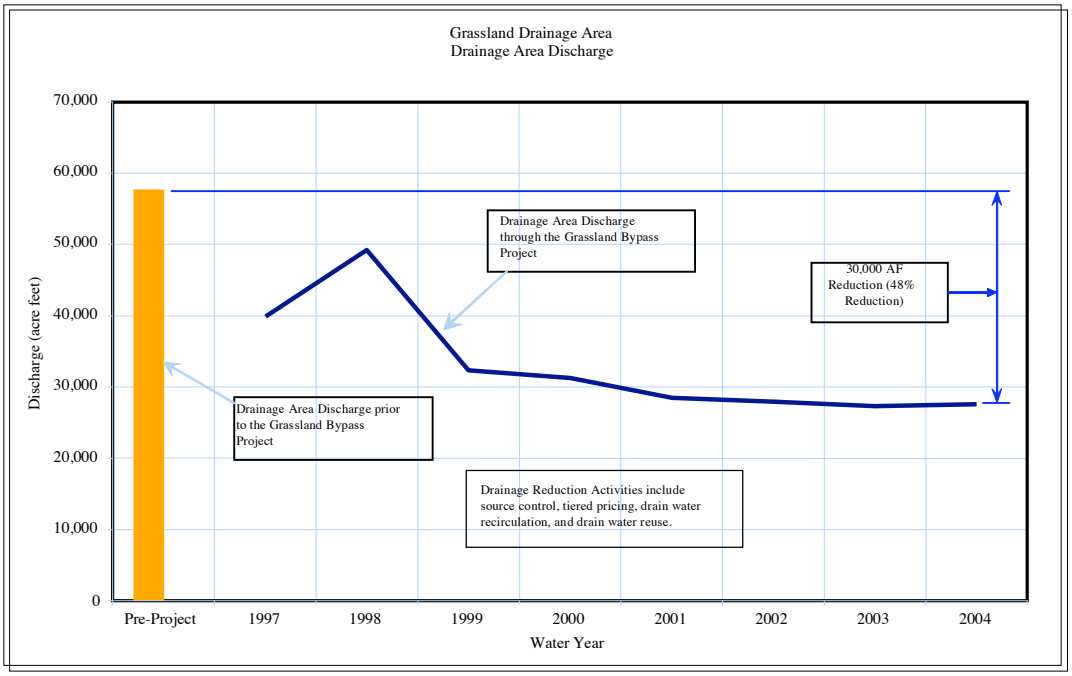


Figure C-6. Grasslands Drainage Area, Drainage Salt Load

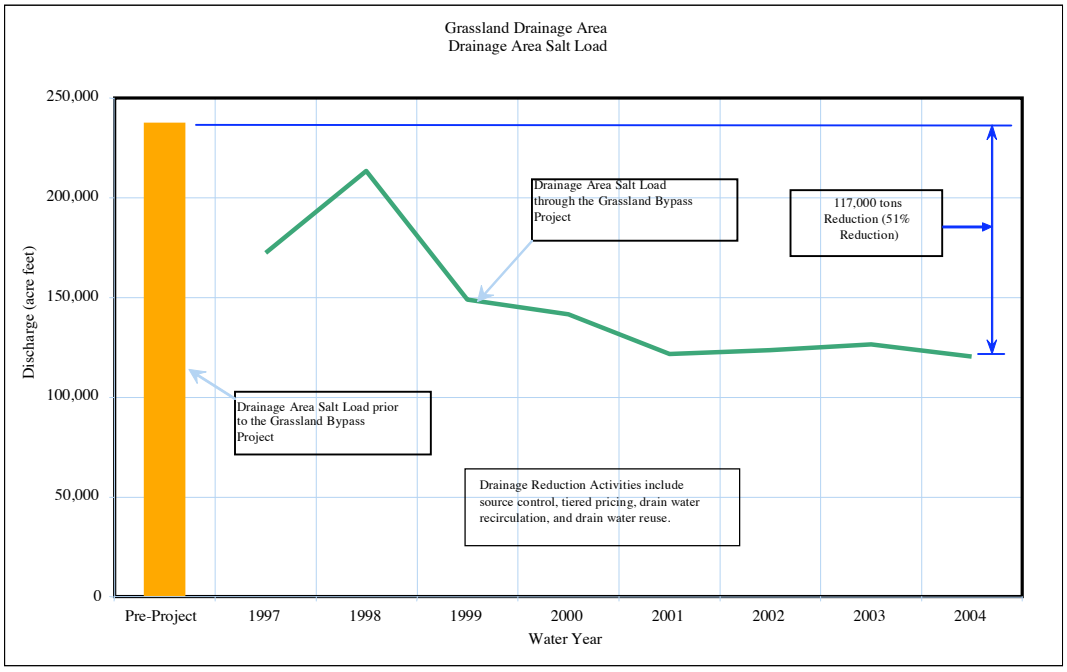


Table C-5. Grassland Drainage Area, Previous Funding for the In-Valley Drainage Solution

Project	Funding Source	Grant Funding	Loan Funding	District Funding	Total
Grassland Bypass Construction	SWRCB State Revolving Fund		$ 600,000		$ 600,000
Charleston D.D. Recirculation System	SWRCB State Revolving Fund		$ 320,000		$ 320,000
Charleston D.D. Recirculation System : CH-3	Charleston D.D.			$ 71,200	$ 71,200
Firebaugh Canal W.D. Recirculation Systems	Firebaugh Canal W.D.			$ 271,100	$ 271,100
Pacheco W.D. Drainwater Recirculation System	SWRCB State Revolving Fund		$ 1,375,000		$ 1,375,000
Panoche W.D. Drainwater Recirculation System	SWRCB State Revolving Fund		$ 4,228,000		$ 4,228,000
Pacheco W.D. Acquisition of Improved Irrigation Eq.	SWRCB State Revolving Fund		$ 737,500		$ 737,500
Panoche D.D. Acquisition of Improved Irrigation Eq.	SWRCB State Revolving Fund		$ 4,997,294		$ 4,997,294
Panoche D.D. Road Watering Project	Panoche D.D.			$ 12,000	$ 12,000
San Joaquin River Improvement Project (SJRIP)					
Land Purchase & Initial Development	Prop 13 (Directed Action)	$ 17,500,000			$ 17,500,000
2004-05 Development Project	USBR	$ 904,100		$ 95,900	$ 1,000,000
Halophyte Development Project	USBR	$ 290,000		$ 15,000	$ 305,000
Grassland Integrated Drainage Management Proj.	Prop 13	$ 987,200		$ 246,800	$ 1,234,000
PE-5 Pump Station	Panoche D.D.			$ 13,200	$ 13,200
Algal-Bacterial Selenium Reduction Proj. (ABSR)	USBR/DWR/CalFed	$ 3,352,000		$ 225,000	$ 3,577,000
USBR: RO Pilot Plant		$ 440,000		$170,000	$ 610,000
	Subtotal	**$ 23,473,300**	**$ 12,257,794**	**$ 1,120,200**	**$ 36,851,294**
March 2005 Update:					
Panoche D.D. SJRIP Reuse Development Project	SWRCB - Prop 50	$ 389,500		94,800	$ 484,300
SJRIP Reuse Expansion Project	USBR	$ 890,000			$ 890,000
Panoche W.D. Ag Drainage Loan Project - Irri. Impr.	SWRCB		$ 1,800,000		$ 1,800,000
	Subtotal	**$ 24,752,800**	**$ 14,057,794**	**$ 1,215,000**	**$ 40,025,594**
Source Summers Enginnering					

Even though the San Joaquin Valley Drainage Implementation Program (SJVDIP) has been idled since 2003, DWR continues to implement many of its recommendations through its Agricultural Drainage program and working in partnership with California universities, CALFED, Reclamation, resource conservation districts, watershed groups, water and drainage districts and many other local, State and federal entities. These activities include:

- providing grants for control of agricultural drainage water and reduction of its toxic elements using (Propositions 13, 50, and 204) and DWR Project Funds,
- developing, educating, and promoting the use of Integrated On-Farm Drainage Management Systems (IFDM) in the San Joaquin Valley,
- providing technical assistance and collaborating with water and drainage districts, and local entities to reduce and control surface subsurface agricultural drainage water,
- maintaining research and demonstration projects to develop drainage reuse systems, including development of cost effective salt tolerant crops, drainage treatment and disposal technologies, and salt separation and utilization, and
- monitoring the quality and distribution of shallow groundwater water levels in drainage impaired areas of the San Joaquin Valley.

Table C-6 summarizes grants directly and indirectly related to the activities described above. To date, more than 72 million dollars in grants have been distributed by DWR through Project Funds and bond money from Propositions 13, 50, and 204 (drainage sub-account).

Additional efforts proposed to control saline water discharges into the SJR include the West Side Regional Plan, Reclamation's San Luis Drainage Feature Re-evaluation to provide drainage service to the San Luis Unit of the Central Valley Project and the Integrated On-Farm Drainage Management Program that DWR and collaborating agencies maintain. In addition, the San Joaquin River Management Group, of which DWR is a member, recently completed its report regarding controlling salinity in the SJR. Recommendations include:

- fully implementing the West Side Regional Drainage Plan,
- further evaluating and pursuing managed wetland drainage management action to mitigate impacts of February through April drainage releases, and
- developing a real-time water quality management coordination group involving lower SJR tributaries, lower SJR drainers and DWR to coordinate reservoir release and SWP/CVP Project operations (head of Old River barrier and New Melones operations) to realize opportunities to improve water quality and increase the utility of stored water releases.

Table C-6. DWR Grants

Year	Local Agency	Project	Cost
		Prop. 13	
2000	Vernalis Adaptive Managenemt Plan	Purchase water for pulse flows to meet SWRCB standards	$5,000,000
2000	Friant Water Users Authority and NRDC	San Joaquin River Restoration Program	$15,700,000
2000	Panoche Drainage District	San Joaquin River Water Quality Improvement Project	$17,500,000
2000	Environmental Water Account	Water Transfers	$6,250,000
2000	San Luis & Delta Mendota WA*	Water Transfer	$6,250,000
2000	Westlands Water District	Irrigation Systems Improvement	$5,000,000
2000	San Luis Water District	Relift Canal Lining Project	$1,000,000
2000	Del Puerto Water District	Irrigation Systems Improvement	$500,000
2001	Westside RCD	Total Utilization of Drainage & Minimization of Evaporation	$111,280
2001	USDA/Ag. Research Serv.	Salt-Tolerant Crops Evaluation	$69,600
2001	San Joaquin Valley Drainage Auth.	SW Stanislaus Co. Regional Drainage Water Mgt.	$616,200
2001	Stanislaus RCD, West	Irrigation Mgmt. & Dormant Spray Reduction	$160,523
2001	WaterTech	Irrigation Scheduling	$200,000
2001	Columbia Canal Co.	On-farm Irrigation System Improvements	$152,823
2001	Panoche Water District	Grassland Integrated Drainage Management Proj.	$987,200
2002	Panoche Water District	Herndon Avenue Lateral Feasibility Study	$54,545
2002	Banta Carbona Irrigation District	Banta-Carbona Irrigation District Modernization Feasibility Study	$99,204
2002	Westlands Water District	Water Measurement Enhancement Project	$82,500
		Prop. 50	
2004	Patterson Irrigation District	Agricutural Water Reuse Best Management Practices	$1,053,000
2004	California State University - Fresno	Improve District-Level Irrigation Efficiency	$1,027,779
2004	Modesto Irrigation District	Ditch Pipeline to Improve Water Quality	$500,000
2004	Oakdale Irrigation District	Irrigation District Tailwater Recovery Program	$731,500
2004	USDA	Improved Water Use Efficiency for Vegetables grown in the SJV	$248,000
2004	San Joaquin County RCD	Expanded Mobile Irrigation Lab and Irrigation Workshops	$60,000
2005	San Joaquin RIver Exchange Contractors	Upper San Joaquin River Conceptual Restoration Plan	$499,952
		Prop. 204	
2000	UC Riverside	IFDM Present Status and Further Research	$51,303
2000	DWR	Red Rock Ranch IFDM Monitoring	$317,000
2000	UC Davis	Producing Forage Crops Using Drainage	$45,990
2000	Westside Resources Conservation District	Various IFDM Start-Up Proposals	$267,797
2000	SJV Drainage Authority	Planning and Design for Grasslands Drainage Reuse	$150,000
2000	DWR	Conceptual Planning and Design for Grasslands Drainage Reuse	$60,000
2000	DWR-USFWS	Development of IFDM Wildlife Management Criteria	$75,000
2000	DWR	Monitoring Wildlife Impacts at IFDM Demonstration Projects	$105,000

Table C-6. DWR Grants (continued)

Year	Local Agency	Project	Cost
2000	Buena Vista Water Storage District	Buena Vista Desalination Pilot Demonstration	$100,000
2000	DWR-WRCD	Water and Salt Recovery Through Solar Distillation	$120,000
2000	UC-Davis	Investigate Systems of Salt Separation, Utilization, and Purification	$60,000
2000	UC-Davis	Salt Utilization in Glass Making	$33,000
2000	DWR	Survey of Location and Acreage of Westside SJV Irrigation Methods	$75,000
2000	DWR	Contracts and Program Management/Fund Administration	$160,000
2000	DWR	Contribution to SJV Drainage Implementation Program (2001 and 2002)	$44,000
2001	UC Davis	Using Forages and Livestock to Manage Drainage Water in the SJ Valley	$169,950
2001	USDA	Crop Production with In-situ Use of Shallow Saline Groundwater	$402,600
2001	WRCD	Expanded Demonstration Projects for Integrated On-Farm Drainage Mgmt	$335,000
2001	UC Berkeley	Grassland Drainage Area Algal-Bacterial Selenium Removal Facility	$125,000
2002	CSU-Fresno	Evaluate Cumulative Water Use (ET) for Salt Tolerant Forages in RRR	$90,030
2002	Westlands Water District	Removal of Selenium from Drainage Water in Lined Reduction Channels	$100,000
2002	Tulare Lake Drainage DIstrict	Develop Biological Design Criteria for a Wetland Located Within the TLDD	$120,000
2002	Patterson Water District	Compare Salinity Mass Balance on Patterson WD and West Stanislaus ID	$121,000
2002	DWR-UTEP	Feasibility of Salinity Gradient Solar Pond Technology in SJ Valley	$180,000
2002	USDA	Biofuels - Biofuel and Se-enriched Forage from Canola	$65,500
2002	UC Davis	Utilizing the Saline Biomass for Energy and Producing Value-added Products	$175,346
2002	UC Davis	Mass Balance on Water and Se on TLDD and Lost Hills Evaporation Ponds	$202,500
2002	DWR	Real Time Water Quality Measurements in the San Joaquin River	$87,226
2002	UC Riverside	Economic Analysis of Implementing Evaporation Pond vs a Solar Evaporator	$36,196
2003	UC Davis - CSU Fresno	Yield/animal Acceptability of Forages Grown under Drainage Water Irrigation	$247,272
2003	UC Davis	Efficacy of Reducing Se Load by Intensive Harvest of Brine Shrimp	$176,588
2003	UCLA	Evaluate Drainage WQ for Membrane Desalination Across the SJ Valley	$167,456
		Construct/test Ion Exchange Processes in a Pilot on Farm Ion Exchange Plant	$93,500
2005	UCLA	Concentration of Salts from Membrane Desalting of Ag Drainage in the SJV	$159,116
2005	UC Merced	Wetland Drainage Mgmt Technology Development for SJR Real-time WQ Mgmt	$199,807
2005	UC Davis	Water Use, Crop Growth, Quality of Bermuda Grass w/Saline Irrigation	$175,533
		DWR-Project	
2000	UC Davis	Mycrophyte-Mediated Se Bigeochemistry role in Bioremediation of Se Toxicity	$134,200

Table C-6. DWR Grants (continued)

Year	Local Agency	Project	Cost
2000	UC Davis	TLDD - Flow Trough Wetland Systems for Removal of Se in Irrigation Waters	$60,000
2000	UC Davis	In Situ Se. Volatilization and From Measurements at SJV Evaporation Ponds	$14,200
2000	UC Davis	Assessing Efficacy of Macroinvertebrate Harvest and Algal Se Volatilization	$159,000
2000	UC Davis	Recovery of Sodium Sulfate from Drainage Water	$50,000
2000	UC Davis	Utilization of Agricultural Drainage Salt in Textile Processing	$50,000
2000	UC Davis	Recovery, Purification, Utilization of Salts From Ag Subsurface Drainage	$155,616
2001	Broadview Water District	Active Land Managemet Program to Reduce Drainage Water	$130,000
2003	USDA	Direct ET Determination of Grass and Truckload Crops by Lysimeter for CIMIS	$110,000
2003	Buena Vista Water Storage District	Buena Vista Ag Drainage Desalination Pilot Demonstration	$270,000
2000	UCLA	Optimizing Processes for Desalination of Agricultural Drainage Water	$300,000
		DWR and Partners	
1988	Westlands Water District	Demonstration of Emerging Irrigation	$552,408
1988	Westlands Water District & Broadview Water District	Demonstration of Improved Furrow Irrigation	$568,000
1991	Central California Irrigation District	Grasslands Drainage Basin Water Conservation Coordinator	$64,286
1987	Panoche Water & Drainage District	Irrigation Efficiency & Regional Subsurface Drain Flow on Westside of SJV	$171,000
1990	Panoche Water & Drainage District	Contaminant Loads vs Drain Flows for Drain Systems on Westside of SJV	$175,000
1988	USGS	Groundwater Quantity & Quality into the San Joaquin River	$140,000
1988	Broadview Water District	Tiered-Block Water Pricing	$175,000
1988	Westlands Water District	Agroforestry Systems for Sequential Reuse of Drainage Water	$324,863
1992	Broadview Water District	Shallow Groundwater Management	$175,000
1995	USDA	Growth vs Water of Plant Species Suitable for Saline Drainage Water Reuse	$218,800
1995	Regents of UC	Selenium Mgmt in Integrated On-farm Drainage Mgmt Systems by Volatilization	$107,741
N/A	Regents of UC	Boron Accumulation and Toxicity in Integrated On-farm Drainage Mgmt	$40,000
N/A	CSU, Fresno	Survey of Linear Move Irrigation Systems in California	$6,000
1998	Pond-Shafter-Wasco RCD	Irrigation Workshops and Training Manuals	$31,770
1999	CSU, Fresno	Integrated On-Farm Drainage Management Workshops	$80,000
1996	Regents of UC	Advances in Irrigation Symposium	$8,000
		Total	**$73,218,700**

Real-Time Water Quality Monitoring Program

The Real-time Water Quality Monitoring Program (RTWQMP) provides information on existing water quality conditions and forecasts flow and water quality conditions to SJR water managers and stakeholders. The information provided is important for improving management and coordination of reservoir releases, agricultural and wetlands drainage flows, and eastside tributary releases to achieve water quality objectives at the SJR compliance points. DWR is collaborating with the San Joaquin River Water Quality Management Group to realize opportunities to achieve these goals using the RTWQMP and other stakeholder tools.

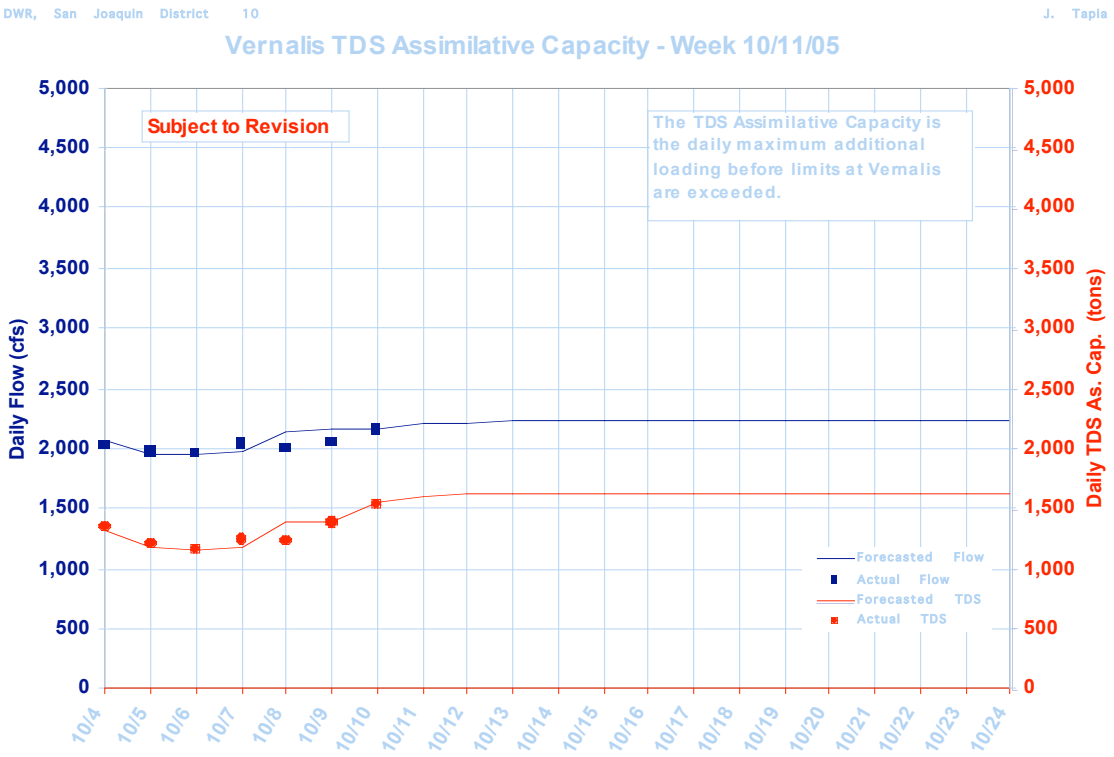
DWR operates and maintains 25 river monitoring stations and shares responsibility with United States Geological Survey USGS) for another three stations along the lower SJR System. For this effort, DWR currently expends over one million dollars. In the early stages, the RTWQMP was funded by Reclamation and then by CALFED. Currently, DWR has assumed responsibility for funding most of the RTWQMP for the SJR. Table C-7 lists the lower SJR surface water monitoring stations including DWR stations as well as other cooperating agency stations in the RTWQMP.

Table C-7. San Joaquin River and Reservoir Station Meta Data

								Real-time Monitoring								Bi-annually Analysis							
Station ID	CDEC ID	River Stations	Elev ft	Latitude	Longitude	County	Operator	Telemetered	Stage	Flow	EC	H2O Temp	DO	Chlorophyll		Minerals (lab)	Nutrients (lab)	Minor Elements (lab)	EC (field)	pH (field)	DO (field)	H2O Temp (field)	
B00416		Eastside Bypass Below Mariposa Bypass				Merced	DWR		X	X													
B03115		Stanislaus R. At Koetitz Ranch	30	37° 42' 00" N	121° 10' 12" W	Stanislaus	DWR		X	X						X	X	X	X	X	X	X	
B05516		Bear Creek Below Eastside Canal	20			Merced	DWR		X	X													
B07040		San Joaquin River At Maze Road Bridge	39	37.642N	121.228W	Stanislaus	DWR		X	X						X	X	X	X	X	X	X	
	BDT	San Joaquin River at Brandt Bridge	0	37.8650 N	121.3231 W	San Joaquin	DWR	X	X		X	X											
B07802	CBP	Chowchilla Bypass	170	36.774N	120.285W	Madera	DWR	X	X	X													
B05155	CRS	Merced River At Cressey	165	37.4250N	120.6630W	Merced	DWR	X	X	X	X	X											
B04130	DCM	Dry Creek near Modesto	88	37.657N	120.923W	Stanislaus	DWR	X	X	X						X	X	X	X	X	X	X	
	DNB	San Joaquin River at Donny Bridge	239	36.834N	119.966W	Madera	USBR	X	X	X	X	X											
B00435	ELN	Eastside Bypass Near El Nido	100	37.133N	120.567W	Merced	DWR	X	X	X													
B07375	FFB	San Joaquin R @ Fremont Ford Bridge	65	37.310N	120.930W	Merced	USGS	X	X	X	X					X	X	X	X	X	X	X	
	GRF	San Joaquin River At Gravelly Ford	170	36.798N	120.16W	Fresno	DWR	X	X	X	X	X											
	LDC	Little Dry Creek (USBR)	350	36.942N	119.683W	Fresno	USBR	X	X	X													
B04175	LGN	Tuolumne River Below La Grange Dam	170	37.6660N	120.4410W	Stanislaus	USGS	X	X	X													
B05525	MCK	Bear Creek At McKee Road	187	37.309N	120.444W	Merced	USACE	X	X	X													
B07710	MEN	San Joaquin River Near Mendota	170	36.783N	120.367W	Fresno	USGS/DWR	X	X	X						X	X	X	X	X	X	X	
B05184	MMF	Merced River Below Merced Falls	310	37.522N	120.331W	Merced	Merced Co.	X	X	X													
B04120	MOD	Tuolumne River At Modesto	90	37.6500N	121.0010W	Stanislaus	DWR	X	X	X	X	X											
B95820	MSD	San Joaquin River At Mossdale Bridge	31	37.786N	121.306W	San Joaquin	Co.	X	X		X	X	X	X									
	MSG	Mud Slough Near Gustine	70	37.263N	120.906W	Merced	USGS	X	X	X	X	X											
	MSGCR	Mud Slough At Gun Club Road		37.231N	120.899W	Merced	Grasslands		X	X	X	X											
B05170	MSN	Merced River Near Snelling	260	37.5020N	120.4510W	Merced	DWR	X	X	X													
B05125	MST	Merced River Near Stevinson	82	37.3710N	120.9310W	Fresno	DWR	X	X	X	X	X				X	X	X	X	X	X	X	
B07300	NEW	San Joaquin River At Newman	90	37.3500N	120.9770W	Merced	USGS/DWR	X	X	X													
B03175	OBB	Stanislaus River At Orange Blossom Bridge	117	37.7830N	120.7500W	Stanislaus	DWR	X	X	X	X	X											
	OCL	Orestimba Creek Near Crows Landing	65	37.414N	121.015W	Stanislaus	USGS	X	X	X	X	X											
	OH1	Old River at Head	15	37.8080N	121.3290W	San Joaquin	DWR	X	X	X		X											
B87100	ORE	Orestimba Creek Nr Newman		37.316N	121.124W	Stanislaus	USGS	X	X	X													
B03125	RIP	Stanislaus River At Ripon		37.7300N	121.1090W	San Joaquin	USGS	X	X	X													
	RPN	Ripon	35	37.7300N	121.1090W	San Joaquin	USBR	X			X	X	X										
	RR1	Rough and Ready Island	15	37.9630N	121.3650W	San Joaquin	DWR	X	X	X	X	X		X									
B07250	SCL	San Joaquin River At Crows Landing Bridge	60	37.428N	120.003W	Stanislaus	USGS	X	X	X	X	X											
B07798	SJB	San Joaquin River Below Bifurcation	170	36.773N	120.286W	Madera	DWR	X	X	X													
B07885	SJF	San Joaquin River Below Friant	294	36.984N	119.723W	Fresno	USGS	X	X	X	X	X											
	SJL	San Joaquin R Below Old River Nr Lathrop	10	37.810N	121.323W	San Joaquin	DWR	X	X														
B07200	SJP	San Joaquin River At Patterson Bridge	97	37.4940N	121.0810W	Stanislaus	DWR	X	X	X	X	X				X	X	X	X	X	X	X	
B07400	SJS	San Joaquin River Near Stevinson	82	37.2950N	120.8510W	Merced	DWR	X	X	X	X	X				X	X	X	X	X	X	X	
B03185	SKF	Stanislaus R Bl Goodwin Nr Knights Ferry	253	37.854N	120.637W	Calaveras	USGS	X	X	X													
B03160	SOK	Stanislaus River At Oakdale	120	37.777N	120.852W	Stanislaus	USGS	X				X											
B00470	SSH	Salt Slough Near Stevinson	75	37.248N	120.851W	Merced	USGS	X	X	X	X	X				X	X	X	X	X	X	X	
B07020	VER	Vernalis (USBR)	35	37.6670N	121.2670W	San Joaquin	USBR	X			X	X											
	VNS	San Joaquin River At Vernalis	35	37.6670N	121.2670W	San Joaquin	USGS/DWR	X	X	X													
NIGEL'S STATIONS																							
	DEL	Del Puerto Creek		37° 32' 29.3" N	121° 07' 2.0" W	Stanislaus	SJVDA	X	X	X	X	X											
		Grayson Drain																					
	HOS	Hospital Creek		37° 36' 37.7" N	121° 13' 50.8"	Stanislaus	SJVDA	X	X	X	X	X											
	ING	Ingram Creek		37° 36' 0.8" N	121° 13' 30.2"	Stanislaus	SJVDA	X	X	X	X	X											
	MSM	Marshall-Spanish -Moran Drains		37° 26' 10.7" N	121° 02' 10.2"	Stanislaus	SJVDA	X	X	X	X	X											
	NJD	New Jerusalem Drain		37° 43' 36.1"	121° 17' 58.4"	San Joaquin	SJVDA	X	X	X	X	X											
	RAM	Ramona Lake		37° 24' 49.9" N	121° 00' 53.6"	Stanislaus	SJVDA	X	X	X	X	X											
	WES	Westley Wasteway		37° 33' 27.3" N	121° 09' 36.3"	Stanislaus	SJVDA	X	X	X	X	X											
ADDITIONAL STATIONS																							
B00770.00		Delta-Mendota Canal to Mendota Pool	160	36° 47' 12" N	120° 23' 04" W	Fresno					X	X	X			X	X	X	X	X	X	X	
B00400.00		Mud Slough at Hwy 140	60	37° 17' 28" N	120° 56' 40" W	Merced					X	X	X			X	X	X	X	X	X	X	
B08735.00		Orestimba Creek at Hwy 33	106	37° 22' 42" N	121° 03' 18" W	Stanislaus					X	X	X			X	X	X	X	X	X	X	
B07080.00		San Joaquin River at Grayson (of Laird Sl.)	30	37° 33' 48" N	121° 09' 06" W	Stanislaus										X	X	X	X	X	X	X	
B04105.00		Tuolumne River at Tuolumne City	40	37° 36' 12" N	121° 07' 00" W	Stanislaus										X	X	X	X	X	X	X	

One important activity of this program is forecasting flow and salinity conditions on the SJR so that decision makers can take advantage of assimilative capacity of the river when available. For this purpose, DWR collects data from the network of stations and inputs it into the San Joaquin River Input-Output Day (SJRIODAY) model. The model forecasts salinity and flow conditions on the River near Vernalis, and other upstream stations on a biweekly basis. DWR publishes the information on its website on a weekly basis. Figure C-7 shows an example of the information displayed:

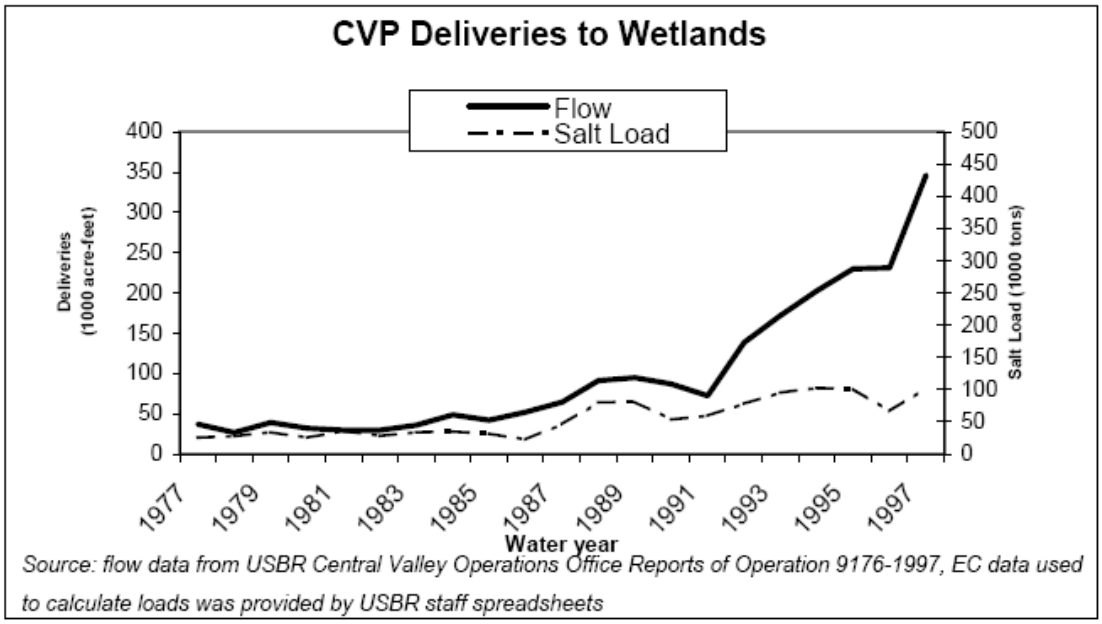
Figure C-7. San Joaquin River Input-Output Day Modeling Forecasts



Efforts to Improve Wetlands Discharges

As per 1998 data, wetlands discharges contributed about 9% of the total salt load in the SJR at Vernalis. The contribution is likely to be higher today as additional water supply and land are acquired for wetlands wildlife refuges (Figure C-8) through CVPIA, EWA, and other programs. Timing of wetland releases with assimilative capacity of the SJR will result in significant water quality improvements. However, little has been done in this regard due to concerns over disrupting existing, proven wetland management practices.

Figure C-8. Central Valley Project Wetlands Water Deliveries



Source: Central Valley Regional Water Quality Control Board

Research is needed to determine if improved wetlands management practices can be achieved for the benefit of both wildlife and SJR water quality. Current research has focused on real-time water quality monitoring and adaptive management. Research goals are to coordinate timing of wetland discharges when assimilative capacity is available. Multiple grants have been provided for these purposes (Table C-8).

Table C-8. CALFED Grant Funded Projects

Project	Year Funded	Amount	Recipient
Effect of Delayed Wetland Drawdown On Moist Soil Plants	2005	$200,000	California Department of Fish and Game
Adaptive Real-Time Monitoring & Management of Seasonal Wetlands in the San Luis National Wildlife Refuge to Quantify Contaminant Sources & Improve Water Quality in the SJR	2002	$320,000	Berkeley National Labs
Vernalis Real-Time Water Quality Monitoring Station	2002	$615,000	DWR
Adaptive Real-Time Water Quality Management of Seasonal Wetlands in the Grassland Water District.	2000	$671,900	Grassland Water District
SJR Real-Time Water Quality Management Program	1997	$931,857	DWR, San Joaquin District

In addition to funds provided by CALFED for the study on the Effect of Delayed Wetland Drawdown on Moist Soil Plants, staff from DWR and DFG are discussing the possibility of conducting a joint study to assess other aspects of delayed wetland drawdown. The study will complement DFG's current wetland drawdown research. DWR, DFG and U.C. Davis staffs are working cooperatively on preparing the study plan.

The studies on delayed wetland drawdown will be are complemented with a study funded by DWR under Proposition 204 (drainage sub-account). The study is a part of the Real-time Water Quality Monitoring Program.

The CVRWQCB has also given grants to wetlands operators supported by funds from Propositions 40, and 50. These grants are shown in Table C-9.

Table C-9. Regional Water Quality Board Funded Projects

Project	Year Funded	Proposition Number	Amount	Recipient
Monitoring Constructed Wetlands to Improve Water Quality of Irrigation Return Flows	2005	40	$500,000	UC Davis
Adaptive, Coordinated Real-Time Management of Wetland Drainage	2005	50	$998,029	Grasslands Water District

Degradation of Water Quality at the San Joaquin River Between Vernalis and Brandt Bridge

While salinity objectives at Vernalis are met most of time at Vernalis (Figure C-1), SJR water quality is subject to significant degradation from wastewater discharges from the cities of Manteca, Lathrop, Tracy, and Mountain House and by tailwater and subsurface drainage discharges from agricultural operations in the South Delta. A DWR analysis indicates that there is approximately an 8% increase in salinity in the SJR between Vernalis and Brandt Bridge stations. This increase represents an addition of approximately 80,000 tons of salt annually between these two stations, which are 26 miles apart.

As with the Grasslands Area farmers, specific salt load contributions from each responsible party need to be quantified in order to appropriately determine responsibility for water quality objectives compliance. A good example of how this can be accomplished is referenced to the work performed by the CVRWQCB leading to the establishment of TMDLs for Salinity and Boron in the lower SJR. Tables C-3 and C-4 and Figure C-4 show how salt load allocations can be established by type and area.

It is important to note that while the EC 0.7 mmhos/cm objective in the SJR was developed to protect beneficial agricultural uses in the South Delta, farmers in the Grasslands Drainage Area representing Panoche, Pacheco, Charleston, and Firebaugh Canal water districts, have implemented successful measures to reuse tailwater and reduce subsurface drainage discharges by blending tilewater with their irrigation water supply to EC levels equal or exceeding 1 mmhos/cm. These water districts have received many grants and loans to implement these measures. Table C-10 describes the crops these districts raised in 2002. A portion of crops was grown with blended drainage and irrigation water. With careful irrigation management practices, these farmers continue to contribute more than $140 million to the California economy.

Table C-10. Crops Grown in Selected Water Districts that Recycle Irrigation Water

Water District:	Firebaugh Canal	Panoche	San Luis	Charleston	Pacheco
Irrigated Crop Survey 2002	**Acreage**	**Acreage**	**Acreage**	**Acreage**	**Acreage**
Alfalfa	3,890	1,547	1,662	401	1
Almonds/Pistachio	24	622	10,660	26	
Corn	63	3	652	40	
Cotton	10081	15402	10645	2421	732
Cucurbits	2334	5967	3879	547	1487
Dry Beans		128	141		
Grain	846	918	575	242	179
Onions & Garlic	334	1,196	914		108
Other Deciduous Trees	74		1,468		
Other Field Crops	257	128			
Other Truck Crops	2	2335	491	183	217
Pasture	32	167	28	8	
Rice					
Safflower	78	449			100
Sugar Beets	889	509	459		
Tomatoes	2087	6773	4466	433	1325
Vineyard		686	306		
Citrus			261		
Total	**20,991**	**36,830**	**36,607**	**4,301**	**4,149**

Conclusion

This appendix demonstrates that DWR has taken proactive measures to help meet water quality objectives at the lower SJR compliance points. These contributions include the purchase of VAMP flows, implementing recommendations of the interagency San Joaquin Valley Drainage Program through DWR's Agricultural Drainage Program and working cooperatively with other agencies, and by providing and administering grants monies from its own Project Funds and Propositions 13, 50, and 204 (drainage sub-account) in projects for salinity control in the SJR. DWR also operates and maintains a network of over 25 real-time water quality monitoring stations along the lower SJR and provides flow and water quality information to stakeholders. In addition, DWR provides at its website weekly forecasts of the assimilative capacity of the SJR at key locations. DWR is also participating in, and funding research that could improve management wetlands saline discharges into the SJR. DWR is also actively involved in the SJR Management Program (SJRMP) activities and with various watershed groups that among other things are working towards improving water quality in the river.

The information also points out that while water quality objectives in the Delta are currently set at 0.7 mmhos/cm EC for part of the year to protect agriculture beneficial uses, other water districts upstream the SJR are irrigating crops with blended tail and tile water at EC's 1.0 mmhos/cm or above in order to meet salt and boron objectives in the SJR. The information provided also points out a clear need to quantify and identify the sources of water quality degradation downstream of Vernalis as the CVRWQCB has done upstream. The information will help regulatory agencies to allocate responsibility for mitigating water quality impacts to the appropriate responsible parties.