BUREAU OF RECLAMATION

Compliance Monitoring and Evaluation Plan

In compliance with the "Management Agency Agreement between the Central Valley Regional Water Quality Control Board and the Bureau of Reclamation" executed on December 22, 2008

U.S. Department of the Interior

Rev. November 2010

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Contents

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Abbreviations and Acronyms

Action Plan	Actions to Address the Salinity and Boron TMDL Issues for the Lower San Joaquin River
Basin Plan	Water Quality Control Plan for the Sacramento and San Joaquin River Basins, 4th Edition
Basin Plan Amendment	Salt and Boron Total Maximum Daily Load for the lower San Joaquin River
BMP	Best Management Practices
CALFED	CALFED Bay-Delta Program
CDEC	California Data Exchange Center
CDFG	California Department of Fish and Game
CVO	Central Valley Operations
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
DMC	Delta-Mendota Canal
DWR	California Department of Water Resources
Compliance Plan	Compliance Evaluation and Monitoring Plan
EC	electrical conductivity
GBP	Grassland Bypass Project
LSJR	Lower San Joaquin River
MAA	Management Agency Agreement
mg/L	milligrams per liter
µS/cm	micro Siemens per centimeter
QA/QC	quality assurance/ quality control

Reclamation	Bureau of Reclamation
Regional Water Board	Central Valley Regional Water Quality Control Board
RTMP	Real Time Management Program
Service	U.S. Fish and Wildlife Service
SLDMWA	San Luis and Delta-Mendota Water Authority
SWP	State Water Project
TAF	thousand acre-feet
TDS	total dissolved solids
TMDL	total maximum daily load
USGS	United States Geological Survey
VAMP	Vernalis Adaptive Management Plan
WAP	Water Acquisition Program
WCFSP	Water Conservation Field Services Program
WQO	water quality objective
WRDP	Westside Regional Drainage Plan
WUE	Water Use Efficiency

Purpose

The purpose of the "Compliance Monitoring and Evaluation Plan" (Compliance Plan) is to meet one commitment of the initial monitoring, reporting, and assessment program agreed to in the "Management Agency Agreement between the Central Valley Regional Water Quality Control Board and the United States Bureau of Reclamation" (MAA) executed on December 22, 2008. The MAA describes the cooperative actions Reclamation will take under the Salt and Boron Total Maximum Daily Load for the lower San Joaquin River (Basin Plan Amendment[1]) as described in the Water Quality Control Plan for the Sacramento and San Joaquin River Basins, 4th Edition (Basin Plan). The MAA states:

[The United States Bureau of] Reclamation will submit a Draft Compliance Monitoring and Evaluation Plan to the Regional Water Board. Where appropriate, the draft plan will propose the data and quantification methods used to evaluate the salt loads from Delta-Mendota Canal (DMC) operations and salinity offset credits to be applied to the various elements of Reclamation's Action Plan.

Data will include monitoring locations, parameters monitored, data collection methods, and data quality control. Included with the proposed quantification methods for salt load offset credits for each element of Reclamation's Action Plan will be a description of the salt mitigation benefit of each element and a clear explanation of how the proposed quantification method accurately quantifies the salt load effect.]

The MAA refers to Reclamation's Salinity Management Plan of Actions to Address the Salinity and Boron Total Maximum Daily Load Issues for the Lower San Joaquin River (Action Plan), which can be downloaded at http://www.waterboards.ca.gov/centralvalley/water_issues/tmdl/central_valley_projects/vernalis_salt_boron/draft_maa_plan.pdf

The MAA can be downloaded at http://www.waterboards.ca.gov/centralvalley/water_issues/tmdl/central_valley_projects/vernalis_salt_boron/signed_maa_22dec08.pdf.

Reclamation submitted the Draft Compliance Plan to the Central Valley Regional Water Quality Control Board (Regional Water Board) on July 1, 2009. On September 29, 2009 Regional Water Board staff submitted comments and suggested revisions on the Draft Plan. This Compliance

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[1] A total maximum daily load (TMDL) specifies the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards and allocates pollutant loadings among point and nonpoint pollutant sources. A TMDL is the sum of the individual wasteload allocations for point sources and load allocations for nonpoint sources and natural background (40 CFR 130.2) with a margin of safety (Clean Water Act section 303(d)(1)(c)). (US EPA TMDL Guidance, 2005)

Plan responds to those comments, and, upon acceptance by the Regional Water Board, will become the final version.[2]

[2] There is no requirement to produce a "Final Plan" in the MAA.

Organization of Plan

Regional Water Board staff proposed a phased approach to developing the Compliance Monitoring and Evaluation. The first phase lasts two-years, and has specific tasks designed to obtain the necessary information, develop quantification methods, and develop a draft report evaluating the performance of the Action Plan elements. The second phase would be prescribed in a revised MAA.

The Action Plan describes all of the actions contemplated by Reclamation to implement the MAA. Within the Action Plan, actions are divided into three major categories: Flow, Salt Load Reduction, and Mitigation. The Action Plan also described potential future actions. For each implementation action and for

salinity imported through the DMC this plan includes a brief description and status, quantification methodology and example, data sources, and current schedule. The quantification methodology and data sources for the compliance point are also described. An overall accounting methodology is described in order to summarize the amount of DMC excess salinity loads that are offset by the individual Action Plan actions. The status of potential future actions and estimated benefits will be described as they become relevant to the Action Plan. Quarterly reports will follow the described format and methodology.

Every effort has been made to use publicly available data, as requested by the Regional Water Board. Where public data is not currently available, but internal data is available and will eventually become publicly accessible, data sources are described and compared.

Flow Actions

Water Rights Decision 1641 ordered Reclamation to meet the Vernalis (salinity) objective by releasing water from New Melones, in conjuction with other measures to control salinity at Vernalis. Reclamation has provided dilution flows from the New Melones Project and through fall water purchases under the Water Acquisition Program. Flow actions include: dilution flows from New Melones Reservoir, water acquisitions, and DMC Recirculation Project.

New Melones Reservoir Operations – Provision of

Dilution Flow

Description: Congress authorized the construction and operation of New Melones Reservoir as a multi-purpose facility, which includes water quality.

Non-consumptive water released from New Melones Reservoir is of high quality and provides large dilution flows for salinity in the San Joaquin River. Releases are made for in-stream fishery benefits based on schedules requested by the California Department of Fish and Game (CDFG) under a water rights settlement agreement, as well as the U.S. Fish and Wildlife Service (Service) and National Marine Fisheries Service (NMFS) under the Central Valley Project Improvement Act of 1992 and under Central Valley Project biological opinions. Releases may also be made to maintain the dissolved oxygen level in the Stanislaus River at Ripon. If these releases are not sufficient to fully meet the salinity standard at Vernalis, then additional releases will be made from New Melones Reservoir until the salinity standard is satisfied. It is the total of these non-consumptive-use releases above the TMDL design flows which are counted as dilution flow for the purpose of compliance with the Basin Plan under the MAA.

The New Melones Reservoir Interim Plan of Operation was developed as a joint effort between Reclamation and the Service in conjunction with the Stanislaus River Basin stakeholders. This process began in 1995 with a goal to develop a management plan with clear operating criteria for available water supplies in the Stanislaus Basin on a long-term basis. That effort was continued with a group of Stanislaus stakeholders in 1996; however, the focus shifted to an interim plan for 1997 and 1998 operations. During a stakeholder’s meeting on January 29, 1997, a final interim plan of operation for the New Melones Reservoir was agreed upon in concept. Since June of 2009, New Melones has been operated to meet the National Marine Fisheries Service Biological Opinion to the Bureau of Reclamation on the effects of the continued operation of the Federal Central Valley Project (CVP) and the California State Water Project (SWP) on the various runs of Chinook salmon, Central Valley steelhead, and green sturgeon, and their designated critical habitat. The National Marine Fisheries Service has committed to reevaluating these particular Reasonable and Prudent Actions by 2012.

New Melones Reservoir currently provides dilution flows to meet the Vernalis water quality objectives (WQOs) under a water rights condition on CVP water rights– essentially diluting in-river salinity loads in real time. These dilution flows also, at times, offset salinity loads imported through the DMC. The combination of voluntary land retirement, increased level IV refuge water supply, and reduced salt loading from the Grasslands Bypass Project has altered the hydrology of the Basin and has improved the water quality of the San Joaquin River over the past ten years. New Melones Reservoir dilution flows currently provide the final action to ensure the water quality standard will be met. Public Law 108-361 section 103(d)(2)(D)(i) directs Reclamation to develop and initiate implementation of a the Program to Meet Standards prior to increasing export limits from the delta or increasing deliveries through an intertie. The Program to Meet Standards relies on federal authorities existing prior to Public Law 108-361 and has a stated purpose of providing “greater flexibility in meeting the existing water quality standards and objectives for which the Central Valley Project has responsibility, so as to reduce the demand on water from New Melones Reservoir used for that purpose and to assist the Secretary in meeting any obligations to Central Valley contractors from the New Melones Project Included in the Program to Meet Standards is the purchase of water from willing sellers, study of the Delta Mendota Recirculation, development of wetland best management practices, and an update to the plan of operation for the New Melones Reservoir. The status of these efforts will be updated in reports required by the MAA.

Quantification Methodology: Items 12 and 13 of the Control Program for Salt and Boron Discharges into the Lower San Joaquin River of the Basin Plan Amendment states:

12. Salt loads in water discharged into the Lower San Joaquin River (LSJR) or its tributaries for the express purpose of providing dilution flow are not subject to load limits described in this control program if the discharge:

    a. complies with salinity water quality objectives for the LSJR at the Airport Way Bridge near Vernalis;

    b. is not a discharge from irrigated lands; and

    c. is not provided as a water supply to be consumptively used upstream of the San Joaquin River at the Airport Way Bridge near Vernalis.

13. Entities providing dilution flows, as described in item 12, will obtain an allocation equal to the salt load assimilative capacity provided by this flow. This dilution flow allocation can be used to:

    a. offset salt loads discharged by this entity in excess of any allocation or;

    b. trade, as described in item 10. The additional dilution flow allocation provided by dilution flows will be calculated as described in table IV-8.

Item 12 describes water "discharged … for the express purpose of providing dilution flow" but does not define this expression beyond the conditions stated in 12a through 12c. Neither California water law, the Basin Plan nor the Bay-Delta Plan define the expression "dilution flow", therefore Reclamation can only rely on the evidence and words contained within the Basin Plan: the assumptions made in developing base flows for the Basin Plan Amendment (DWRSIM study 771) and on the three conditions 12a through 12c to interpret the phrase "express purpose of providing dilution flow."

Reclamation manages releases on the Stanislaus River to meet a variety of environmental and water quality outcomes. Reclamation accounts for these releases under water rights settlement requirements, flood control requirements, state and federal biological opinion requirements, and the Central Valley Project Improvement Act of 1992 (CVPIA), as well as through in-stream flow and quality conditions, in order to ensure state and federal regulatory compliance and to ensure it does not exceed federal authorities regulating the management of releases from New Melones Reservoir. Reclamation does not have any accounting requirements pertaining to releases made to comply with Water Rights Decision 1641. For the purposes of the Basin Plan Amendment, New Melones releases are a) of a salinity consistently and significantly below the Vernalis water quality objective, b) released from Goodwin Dam and not from irrigated lands, and c) designed to provide environmental flows in the lower Stanislaus River or at Vernalis, and are not intended for consumptive use above Vernalis. They therefore meet the conditions of "dilution flow" established by the Basin Plan Amendment.

In order to determine which of Reclamation's Stanislaus River flows are not included in the design flow at Vernalis (and to maintain the environmental integrity[3] of the salinity control program), Reclamation requested the DWRSIM study from which the Basin Plan Amendment design flows were obtained. Reclamation followed the procedures described in Appendix 1: Technical TMDL Report to the Basin Plan Amendment to recreate Table 4-2 in the Appendix (page 59). From this re-creation, Reclamation then determined the years corresponding to the design flow years, identified in Table 1.

Table 1. Basin Plan Amendment Design Flows (TAF) with Corresponding Calendar Year (Table 4-2 of Appendix 1, Item 41, Model Run 1921-1994)

Water Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	101	178	255	283	310	148	148	93	106	195	102	91
	1986	*1958*	*1993*	*1993*	*1993*	*1965*	*1937*	*1980*	*1965*	*1977*	*1977*	*1977*
Abv Normal	106	178	164	286	258	89	76	76	105	124	87	85
	1963	*1935*	*1963*	*1932*	*1932*	*1932*	*1932*	*1932*	*1932*	*1931*	*1931*	*1962*
Blw Normal	68	70	106	213	186	73	63	60	94	95	85	81
	1962	*1948*	*1948*	*1950*	*1966*	*1962*	*1962*	*1962*	*1928*	*1924*	*1961*	*1961*
Dry	79	99	95	149	141	39	34	44	71	78	73	77
	1926	*1972*	*1972*	*1933*	*1972*	*1933*	*1964*	*1926*	*1933*	*1925*	*1925*	*1933*
Critical	61	56	71	84	72	30	27	38	60	76	70	69
	1991	*1991*	*1977*	*1931*	*1931*	*1992*	*1992*	*1992*	*1992*	*1991*	*1988*	*1990*

Reclamation next used the month and years identified in Table 1 (corresponding to the month and year of the Basin Plan Amendment design flow), to identify the modeled releases from Goodwin Dam (node 16) contributing to the design flow at Vernalis. DWRSIM used CVPIA accounting terminology and priorities to model the Stanislaus River, and has a node 581 that modeled calls for additional water needed for Reclamation to meet the Vernalis salinity standard (specifically providing dilution flows). Since these flows count towards dilution flow allocations, the equivalent "design flow" for Goodwin Releases is the flow of node 16 minus the flow of 581. These calculated values are presented in Table 2.

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[3] Environmental integrity is a term used in respect to environmental pollutant trading programs (such as TMDLs)- it describes the goal of accounting methodology that ensures that the baseline used to define the regulations is maintained and that actions to reduce pollutants are real and not under or over counted. In this case, it was a principle Reclamation employed when determining how to best develop accounting methodologies, ensuring that New Melones dilution flows are *additional* to the base flows assumed by the Regional Board when they developed the Basin Plan Amendment.

Table 2. Equivalent "Design Flow" for Goodwin Releases, Thousand Acre-Feet (TAF)

Year Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	18	18	9	28	28	20	5	18	15	8	12	13
Abv Normal	9	8	11	29	29	2	2	2	15	8	12	13
Blw Normal	9	13	11	36	46	2	2	2	15	9	12	13
Dry	12	19	17	28	61	2	3	12	15	10	14	13
Critical	9	8	9	28	28	0	0	0	1	8	13	13

Table IV-8 in the Basin Plan Amendment states that dilution flow allocations are calculated as follows:

$A_{dil} = Q_{dil} * (C_{dil} – WQO) * 0.8293$

Where:

A_{dil} = dilution flow allocation in thousand tons[4] of salt per month
Q_{dil} = dilution flow volume in TAF per month
C_{dil} = dilution flow electrical conductivity in µS/cm
WQO = salinity water quality objective for the LSJR at Airport Way Bridge near Vernalis in µS/cm

Data Collection and Quality Assurance/Quality Control (QA/QC): Reclamation monitors flow operations at Goodwin Dam, where flows are released for multiple environmental purposes. Goodwin Dam is located at latitude 37.8750°N, longitude 121.6030°W. Flow operations are summarized on a monthly basis at www.usbr.gov/mp/cvo/reports.html. Goodwin Dam releases are also available on the California Data Exchange Center (CDEC) database at http://cdec.water.ca.gov/ (GDW sensor number 71). Monthly flow releases above the design flows are used for the value Qdil. Stanislaus River “design flows” derived from DWRSIM Study 771 are presented in Table 2 and will be referred to in quarterly and annual reports. (These design flows include spring VAMP pulse flows released from the Stanislaus River).

The closest measure of electrical conductivity (salinity) to Goodwin Dam is at the Orange Blossom Bridge on the Stanislaus River. This station is maintained by the California Department of Water Resources (DWR) and is located at latitude 37.7830°N, longitude 120.7500°W. Electrical conductivity (Cdil) is the monthly average of available daily measured electrical conductivity (EC in µS/cm), available on CDEC database at http://cdec.water.ca.gov/ (OBB sensor number 100).

Example: Data for the month of March 2008 is used as an example. Data for flow releases from Goodwin Dam, the Stanislaus River “design flows,” and salinity at Orange Blossom Bridge are

[4] This is a typographical error in the Basin Plan Amendment. The units are actually tons.

used to calculate the monthly dilution flow allocations. Table 3 presents this example data and the resulting dilution allocation calculation.

Table 3. WY 2008 Goodwin Dam Monthly Dilution Flow Allocation, tons

Month	Goodwin Dam Flow, TAF	Design Flow, TAF	Q_{dil}, TAF	WQO, µS/cm	C_{dil} (monthly average EC at Orange Blossom Bridge), µS/cm	Dilution Flow Allocation, A_{dil}, thousand tons
Mar	57	9	48	1000	82	-36.5

Water Acquisitions – Water Acquisitions Program

Description: The CVPIA modified priorities for managing water resources of the CVP. CVPIA altered the management of the CVP to make fish and wildlife protection, restoration, and enhancement as project purposes having equal priority with agriculture, municipal and industrial, and power uses. To meet water acquisition needs under CVPIA, the U.S. Department of the Interior has developed a Water Acquisition Program (WAP), a joint effort by Reclamation and the Service. The program purpose is to acquire water supplies to meet the habitat restoration and enhancement goals of the CVPIA.

Historically, the majority of WAP 3406(g) and b(3) expenditures in the San Joaquin River basin have supported the provision of VAMP flows. VAMP flows are non-consumptive releases primarily made to provide spring pulse flows for the salmon fishery, and are made in late April and early May (the VAMP period). VAMP flows also provide dilution capacity for salinity, as they meet the “dilution flow” requirements of the Basin Plan Amendment, but they were included as flow in the setting of “design flows” as the basis for calculating load allocations (therefore Reclamation cannot count VAMP flows as dilution flows). Through the San Joaquin River Agreement, however, Reclamation also purchases flows to provide pulse flows in October and these fall pulse flows meet the definition of dilution flows.

The VAMP Agreement is in effect through 2010. The State Water Resources Control Board is re-evaluating flow requirements for fishery protection on the San Joaquin River, which will establish the direction of post-VAMP fish flow obligations. The status of these efforts will be updated in reports required by the MAA.

Quantification Methodology: The discussion on dilution flow allocation presented in A-1 is pertinent here as well. Table IV-8 of the Basin Plan Amendment states that dilution flow allocations are calculated as follows:

$$A_{dil} = Q_{dil} * (C_{dil} – WQO) * 0.8293$$

Where:

A_{dil} = dilution flow allocation in thousand tons of salt per month
Q_{dil} = dilution flow volume in TAF per month
C_{dil} = dilution flow electrical conductivity in µS/cm

WQO = salinity water quality objective for the LSJR at Airport Way Bridge near Vernalis in µS/cm

Data Collection and QA/QC: WAP purchases and releases are tracked by Reclamation's Water Acquisitions Group and will be reported as monthly volumes along with the location from where the water is released. Fall pulse flows originate in the Merced River, and are accounted in annual reports on the VAMP program at the San Joaquin River Group Authority's website: www.sjrg.org/technicalreport/default.htm. Dilution flow salinity will be obtained from the Reclamation or CDEC-available EC monitoring station closest to the location of the WAP release point (or most downstream site), for fall pulse flows this location is Merced River near Stevinson, available on CDEC database at http://cdec.water.ca.gov/ (MST sensor number 100), averaged over the duration of the pulse flow.

Example: In October 2008, Reclamation purchased 12.5 TAF on the Merced River (Q_{dil}). The salinity (EC) of these flows was 87 µS/cm, so the dilution flow allocation is -9,460 tons.

DMC Recirculation – Provision of Dilution Water

Description: The DMC Recirculation Project is one project Reclamation is studying that could provide dilution water for salinity management. As part of the project studies, Reclamation conducted three pilot recirculation studies, in 2004, 2007, and 2008. The pilot studies included releases of water pumped from the Delta at Tracy and conveyed through the DMC to the Newman Wasteway, where it was then conveyed to the lower San Joaquin River. In October 2010, Reclamation released a Plan Formulation Report which found the project to be infeasible, so while the first Compliance Monitoring and Evaluation Report will include this element, future reports will not.

Quantification Methodology: For the quantification of dilution flow allocations, the Basin Plan prescribes the following equation[5] to calculate dilution flow allocation. Because recirculated water was provided specifically to offset salinity loads, it is dilution flow. The Basin Plan specifies that entities providing dilution flows obtain an allocation equal to the dilution provided by this flow, calculated as follows:

$$A_{dil} = Q_{dil} * (C_{dil} – WQO) * 0.8293$$

Where:

A_{dil} = dilution flow allocation in thousand tons of salt per month
Q_{dil} = dilution flow volume in TAF per month
C_{dil} = dilution flow electrical conductivity in µS/cm
WQO = salinity water quality objective for the LSJR at Airport Way Bridge near Vernalis in µS/cm

[5] ibid

0.8293 = Salinity unit conversion, to convert total dissolved solids (TDS) to tons, using the same EC:TDS as is used for the DMC

Data Collection and QA/QC: Recirculation flows were tracked by Reclamation's Central Valley Operations (CVO) office and reported as monthly volumes in the tables described in Section D of this report (CVO Table 25). Recirculation flows were monitored for a number of water quality constituents in the Newman Wasteway as part of the pilot study. EC was measured continuously (every 15 minutes) using YSI 600 XL sondes in several locations following the same QA/QC protocols as the existing Reclamation sampling program for the DMC, with an accelerated calibration schedule (every 2 weeks).

Example: In the 2008 pilot Recirculation study, flows were discharged from the Newman Wasteway into the San Joaquin River from July 28 through September 15. Available data at milepost 8.16 in the Wasteway was averaged over the days within each month that the study was in progress. In August 2008, 13,400 acre-feet of water were released into the Newman Wasteway. Average measured salinity of this water was 450 µS/cm and the applicable standard was 700 µS/cm. Using the dilution flow calculation, the dilution flow allocation is -3,900 tons.

Salt Load Reduction Actions

The Grassland subarea is listed as a high priority for implementing load allocations (Table IV-6 of the Basin Plan Amendment) due to the high unit area loading of salt to the LSJR. Much of the salt load in this area is due to the high salt loads brought into the Subarea through the DMC (quantified in Section D). The Grassland and Northwest subareas also provide the physical link between the majority of the DMC load and the lower San Joaquin River, as much of the load flows through this area (and some is concentrated through the use of the water) to reach the river. Reclamation has a long history of involvement with salinity and drainage in this area. As part of its efforts to provide drainage (the San Luis Drainage Feature Re-evaluation, http://www.usbr.gov/mp/sccao/sld/index.html), Reclamation has historically provided funding to support the Westside Regional Drainage Program (WRDP) activities that support implementation of the San Luis Drainage Feature Re-evaluation preferred alternative.

Within the Action Plan, Reclamation identified Salt Load Reduction Actions that include Grassland Bypass Project, a component of the WRDP, and conservation programs (Water Use Efficiency Grant Programs, Water Conservation Field Services Program (WCFSP), Water 2025/WaterSmart Grants Program, and the CALFED Water Use Efficiency Program).

Grassland Bypass Project

The Grassland Bypass Project (GBP) has significantly reduced contamination of the Grasslands subarea and lower San Joaquin River. The focus of the GBP has been to control selenium loading, but the project has also reduced salt loading through the control of agricultural drainage. The final phase of the GBP will include the construction of treatment facilities needed to maintain the long-term benefits to agriculture through use of the drainage reuse area and to meet the selenium and salinity loady reductions required in the 2019 Use Agreement. Reclamation currently submits quarterly and annual reports to the Regional Water Board in compliance with its Waste Discharge Requirements. For the purposes of calculating salinity loading and credits, the GBP is considered a part of the WRDP and is not separately characterized. Since 1997 (the end of the historic period upon which the Basin Plan is based), the GBP has reduced its salt load to the lower San Joaquin River by 72 percent.

Westside Regional Drainage Plan

Description: The Grassland Area Farmers formed a regional drainage entity in March 1996 under the umbrella of the San Luis and Delta-Mendota Water Authority (SLDMWA) to implement the GBP (http://www.usbr.gov/mp/grassland/). The Project consolidates subsurface drainage flows on a regional basis and utilizes a portion of the federal San Luis Drain to convey drainage flows around habitat areas, in order to reduce the high selenium concentrations due to the historic transport of subsurface drainage flows through the same channels as habitat supply water. Participants include the Broadview Water District[6], Charleston Drainage District, Firebaugh Canal Water District, Pacheco Water District, Panoche Drainage District, Widren Water District[7] and the Camp 13 Drainage District (located in part of Central California Irrigation District). This entity includes approximately 97,000 acres of irrigated farmland, an area referred to as the Grassland Drainage Area. The Grassland Area Farmers, with state and federal funding support, have implemented several activities aimed at reducing discharge of subsurface agricultural drainage waters to the San Joaquin River. These activities have included the GBP (to remove agricultural drainage waters from wetland channels) and the San Joaquin River Improvement Project (the purchase and planting of an area land for the reuse and concentration of agricultural drainage water on increasingly salt tolerant crops). These efforts collectively have evolved into the Grassland Drainage Area's portion of the WRDP.

The WRDP was developed by stakeholders to address the immediate actions that could be taken to assist Reclamation in meeting the goals of the San Luis Drainage Feature Reevaluation Program with an in-valley solution. The WRDP focuses on regional drainage projects that can be implemented on a short timeline. The chief components include land retirement, groundwater management, source control, regional re-use, treatment, and salt disposal. Reclamation has been providing consistent funding, with a 50 percent cost share requirement, since 2006; as well as varying degrees of funding since 1996.

The Grassland Bypass Project is in the 14th year of its implementation. Reclamation provided $3.5 million in grant funding in 2008 and expects to provide $6 million[8] in funding in 2009 to implement the GBP. The GBP is also incorporated into SLDMWA's Integrated Regional Water Management Plan, and has been awarded implementation funds through California Proposition 50 in 2007. These funds are being used to implement components of the WRDP by expanding

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[6] Broadview Water District lands were voluntarily retired in late 2004 and are only included in this report because the Compliance Monitoring and Evaluation Report covers data from 2000 to 2010.

[7] Widren Water District lands were voluntarily retired in late 2004 and are only included in this report because the Compliance Monitoring and Evaluation Report covers data from 2000 to 2010.

[8] Includes grants and assistance agreements with the Service, United States Geological Survey (USGS), and CDFG.

and developing the drainage reuse area, implementing groundwater pumping programs, and investigating salt disposal technologies. Specific funded activities and cost-shares will be reported through the Compliance Evaluation and Monitoring Reports Reclamation submits to the Regional Water Board in compliance with this Compliance Plan. The San Luis Drain Use Agreement was extended in December 2009 and an Environmental Impact Report/Statement was completed to cover the renewal of the Use Agreement.

Quantification Methodology: SLDMWA submits an annual report on discharges of selenium and salinity from the Grassland Drainage Area in compliance with Waste Discharge Requirements. SLDMWA also estimates the amount of reduced salt load annually based on the difference between current discharge volumes and historic (1995) discharge volumes. While the annual report on discharges of selenium and salinity are calculated on a monthly basis, the reduction of selenium and salinity are calculated on an annual basis (based on the reference year). Therefore, this data is reported directly at the end of each water year, rather than estimated on a monthly basis.

Through 2013, Reclamation will report on the total annual salinity reductions achieved by the WRDP. Starting in 2014, as SLDMWA agencies become regulated for salinity and boron, they will assume as much of the reduction as needed to meet their regulatory needs. Reclamation will reevaluate its ability to claim offsets not needed by SLDMWA agencies to meet their regulatory needs at that time.

Data Collection and QA/QC: Data collection and QA/QC is performed by the SLDMWA in a separate report to the Regional Board.

Example: On December 28, 2008, SLDMWA submitted its 2008 annual report to the Regional Board. This report states that the project reduced salt loads by 72% in Water Year 2008 when compared to Water Year 1995. Table 1 of the report states that in 1995 the area discharged 237,530 tons of salt and in 2008 the area discharged 66,254 tons. This is a reduction of 171,276 tons in water year 2008.

Conservation Efforts

Description: Reclamation's water use efficiency (WUE) program includes several grant programs (Water 2025, CALFED, and WCFSP) that fund actions to assure efficient use of existing water supplies. In addition to these grant programs, Reclamation also requires that all water contractors maintain current Water Management Plans which include Best Management Practices, all of which pertain to water use efficiency and conservation.

The Water Conservation Program is an ongoing program mandated through the Reclamation Reform Act of 1982 and the CVPIA. The status of these efforts will be updated in reports required by the MAA.

Quantification Methodology, Data Collection and QA/QC: Currently there is a lack of information regarding the baseline condition (i.e. irrecoverable flows, water runoff, water quality, etc.) of many of the project implementation areas. Without sufficient baseline data, it is challenging to quantify actual changes to water use in a project area. In addition, efforts to assess and project water use efficiency potential on farm are limited by the lack of reliable water use measurement data for agriculture.

Each grant application submitted to Reclamation must include requirements for performance and accountability; however, the recipients' expected benefits of the proposed actions have generally been qualitative in nature. In addition, projects generally take 24 months to complete, and true impacts of a project can only be accurately assessed over a minimum period of five years to account for yearly temporal differences, variable cropping patterns, etc. The nature of the grant program makes it difficult for the recipient to implement a proper monitoring program due to cost and time limitations. Until a mechanism is developed to effectively capture this information and place the information in a centralized data repository, it will be difficult to quantify the contribution the WUE program on reduction to salinity impacts to the river.

Example: Although Reclamation is unable to quantify the benefits of the various funded projects as related to salinity reduction, the following information is provided to depict the agency's water conservation efforts in the basin. Through Water 2025, CALFED, and the WCFSP, Reclamation has awarded 19 projects in the San Joaquin Valley that require performance measures. As information is collected from these projects, quantifiable benefits may be determined and reported in the future.

Mitigation Actions

In the Action Plan, Reclamation identifies two actions to mitigate salinity loads: a real time management program (RTMP) to maximize the removal of salt using assimilative capacity in the San Joaquin River, and a wetlands Best Management Practices (BMP) plan to research and potentially develop practices to reduce or better manage salinity loading from managed wetlands. Reclamation has actively supported the development of a real time monitoring and forecasting program in the River and in managed wetlands.

Real Time Management Program–Development of Stakeholder-Driven Program

Description: The RTMP is described in the Basin Plan as a stakeholder driven effort to use "real-time" water quality and flow monitoring data to support water management operations in order to maximize the use of assimilative capacity in the San Joaquin River. The Regional Board describes this assimilative capacity as up to 85 percent of the load determined by the salinity objective at Vernalis minus the actual load in the river and uses this adaptive approach as a means to encourage the maximum export of load from the basin while still meeting the stated objective.

The salinity issues in the San Joaquin River are complex and diverse, involving many interested stakeholders. The process of developing and implementing a successful program must have broad support and consensus from all parties. This effort will include engaging stakeholders in developing a plan, addressing obstacles identified by stakeholders, and designing implementable strategies for the program, including the identification and implementation of physical infrastructure to facilitate real-time management. A neutral third party coordinator is necessary to manage the group's efforts and keep the focus on developing a viable program without bias through a collaborative process.

Reclamation has contracted with a facilitation firm to support the development of this stakeholder-driven program. Currently, Reclamation is funding efforts, but anticipates future cost-sharing arrangements. To date, a work plan has been developed which includes a stakeholder survey, scoping meetings, three workshops, work elements meetings, and technical group meetings. The program schedule, meeting notes, related documents, and additional information regarding the program are available at http://www.sanjoaquinriverrtmp.com/.

Quantification Methodology: MAA-required reports will include the status and quarterly accomplishments of the following Program tasks:

- Solicit stakeholder comments and feedback on RTMP
- Form working groups to develop program components
- Engage stakeholders in related basin activities
- Conduct periodic stakeholder workshops
- Develop an implementable program

Data Collection and QA/QC: Technical memorandums and work group products will be vetted through the stakeholder process and made available to all interested parties.

Example: Actions undertaken in 2008 include:

- Executed a contract to procure the service of a consultant to facilitate stakeholder involvement in developing a RTMP.
- Directed a consultant to develop and conduct a stakeholder survey to solicit feedback on the RTMP process and garner suggestions on salinity management in the basin.
- Conducted several coordinating and planning meetings to develop and prepare for the first stakeholder workshop held on January 8, 2009.

Real Time Management Program–Technical Support

Description: A successful RTMP will require a real time monitoring network on the San Joaquin River and a model capable of reasonably accurate forecasting of assimilative capacity. The RTMP may also require the construction of new physical infrastructure to optimize the program. Reclamation is committed to participating in the process, supporting the development of data and analytical tools, and the study of the system capacity and physical infrastructure needs. The stakeholder process will direct the technical support of this program. Reclamation is already involved in the development of various tool and analytical models and will be an active participant in the various technical working groups. Reclamation has made personnel available to serve as technical resources to support the various working groups, and has retained some initial engineering support for other technical needs. Reclamation and DWR share a common interest in collection of flows and water quality data on the San Joaquin and are working collaboratively to adapt the existing monitoring networks to support the RTMP.

Quantification Methodology: MAA-required reports will include the status and quarterly accomplishments of the following Program tasks:

- Survey of existing tools/monitoring points
- Identify data/analysis gaps
- Stakeholder subgroup to scope and manage technical support efforts

Data Collection and QA/QC: Technical memorandums and work group products will be vetted through the stakeholder process and made available to all interested parties.

Example: In order to illustrate the potential use of assimilative capacity, Reclamation calculated the available daily capacity in 2008. In 2008, assimilative or dilution capacity was available for 246 days of the year in the San Joaquin River (times at which the river was less than 85 percent of the Water Quality Objective) for a total of approximately 115,000 tons of salt (when calculated on a daily basis). On the other hand, the assimilative capacity of the river was exceeded for 119 days. The concept behind the RTMP is to enable the use of this available assimilative capacity to export salt loads from the basin or to better time the release of salinity loads into the river to times when there is greater dilution capacity, which should also reduce the times where river capacity is exceeded (to the extent that exceedance is caused by discharges and not by background or allowed loads). Development of an accurate forecast model will serve as a decision making tool to help manage salinity loads in the river without violating water quality standards.

Using the same data as was used to calculate Vernalis salinity (section F, Table 12), Figure 1 and Table 4 were generated. Figure 1 illustrates the timing and magnitude of potential dilution capacity in tons for 2008, by calculating actual WY 2008 salinity loads at Vernalis and the Basin Plan load goals of meeting 85 percent of the Water Quality Objective. Table 4 illustrates assimilative capacity at Vernalis (allowed loads based on existing WQO and a margin of safety minus actual loads) in monthly tons.

Figure 1. WY 2008 Vernalis Load and Assimilative Capacity, on a Daily Scale

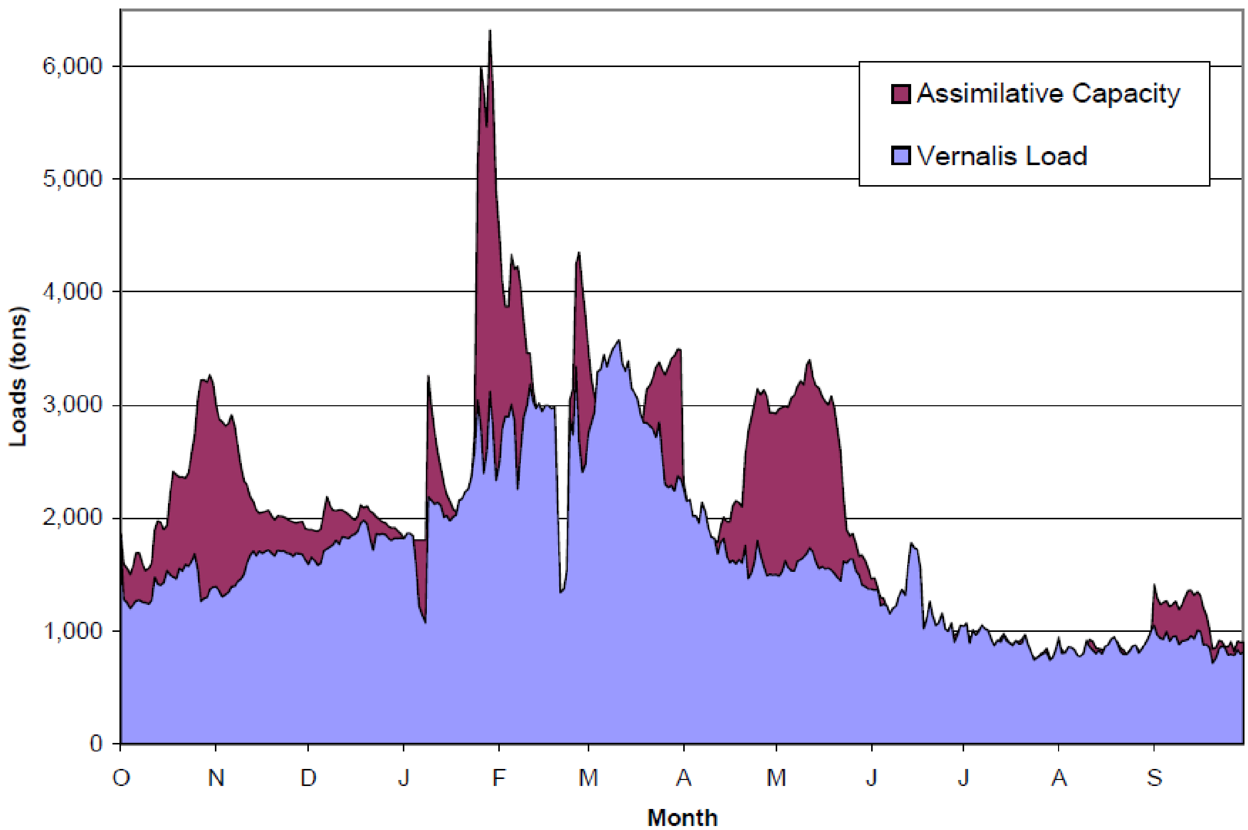


Table 4. Monthly “Real-Time” Assimilative Capacity at Vernalis in WY 2008, tons

Timeframe	Vernalis Flow, TAF	Vernalis EC, µS/cm	Vernalis actual load, tons	Vernalis max load, tons	“Real Time” Assimilative Capacity, tons
September-March Standard, 1000 µS/cm					
Oct	95	554	43,719	68,354	24,635
Nov	99	589	47,536	68,216	20,679
Dec	88	760	55,562	62,012	6,451
Jan	136	686	78,011	97,384	19,373
April to August Standard, 700 µS/cm					
Apr	141	479	55,570	73,020	17,450
May	169	367	48,292	83,440	35,149
Jun	68	669	38,422	34,177	None
Jul	55	611	28,325	27,519	None
Aug	53	600	26,846	26,641	None
September to March Standard, 1000 µS/cm					
Sep	48	687	27,530	34,084	6,554

Wetlands Best Management Practices Plan

Description: Managed wetlands compose a majority of the acreage within the Grassland Subarea. Although wetlands do not concentrate salinity to the degree that agriculture does, there is a significant volume of DMC water supply that flows through wetland complexes. The Program to Meet Standards and the Action Plan describe the development of a strategic plan for identifying, studying and implementing Best Management Practices in managed wetlands. The goal of this concept is to reduce salinity in discharges or to manage the timing of discharges while optimizing the ecological benefits of managed wetlands.

Status: Reclamation has been working with the Service, CDFG, and the Grassland Water District to develop a Strategic Wetlands BMP Plan. Reclamation also provides resources to support the development of a real-time monitoring network (over 28 stations) and other potential BMP analysis tools within federal, state, and private managed wetlands. In 2010, Reclamation will work with the Service to facilitate the sharing of information on these tools between investigators, with the goal of finalizing a strategic plan for moving forward. Wetland water and salinity balances will also likely be explored through the RTMP.

Quantification Methodology: These efforts are not at a stage where they can be quantified. Reporting will focus on the status of Plan development and on study results.

Central Valley Project Deliveries Load Calculation

Description: The CVP delivers water to both the Grassland and Northwest subareas (as described in the Basin Plan) through the DMC. The DMC starts at the pumping headworks in the Delta, the C.W. Jones (Jones) Pumping Plant at Tracy, California. Water is conveyed south to the San Luis Reservoir, where water is mixed with the SWP in O'Neill Forebay and then either pumped into San Luis Reservoir for later delivery, or conveyed further south through the DMC to the Mendota Pool. Turnouts and groundwater pump-ins occur at several locations along the DMC. "Reach 1" of the DMC includes turnouts between the Jones Pumping Plant and the San Luis Reservoir. Deliveries for Reach 1 are made through the San Luis Canal and the Cross Valley Canal, as well as directly out of the DMC. "Reach 2" of the DMC includes turnouts between the O'Neill Forebay and the Mendota Pool. "Reach 3" covers deliveries made out of the Mendota Pool. Some simplification of this system has been made for accounting purposes, as some districts take portions of their deliveries through several turnouts.

Figure 2 is a map of the DMC water quality monitoring locations. Figure 3 is a map of the agencies served by the DMC.

Quantification Methodology: The Basin Plan allocates a load to Reclamation for water delivered to the Grassland and Northwest side Subareas. This load allocation is calculated according to Table IV-8 Summary of Allocations and Credits:

$$LA_{DMC} = Q_{DMC} * 52\ mg/L * 0.0013599$$

Where:

LA_{DMC} = Load Allocation of salts, in tons

Q_{DMC} = monthly amount of water delivered to Grassland and Northwest side subareas, in acre feet 52 = "background" TDS of water in the San Joaquin River at Friant per the Basin Plan

0.0013599 = factor for converting units into tons

Figure 2 (attached as pdf)

Figure 3 (attached as pdf)

Actual DMC salt loads are calculated by the following equation:

$$L_{DMC} = Q_{DMC} * (C_{DMC}) * 0.0013599$$

Where:

L_{DMC} = Actual DMC Load, in tons

Q_{DMC} = monthly amount of water delivered to Grassland and Northwest side subareas, in acre feet

C_{DMC} = monthly average (arithmetic mean) of salinity of the water delivered to Grassland and Northwest Subareas, in mg/L TDS

0.0013599 = factor for converting units into tons

Each delivery reach's Q_{DMC} is calculated and then paired with the associated monthly average EC for that reach, so the equation essentially becomes:

$$L_{DMC} = 0.0013599 * \Sigma(Q_{DMC} * C_{DMC})_{Reach\ 1\text{-}3}$$

This equation is then broken into two calculations, one for each subarea.

Data and QA/QC: Water delivery data is assembled by the SLDMWA water master and submitted to Reclamation and SLDMWA members. Reclamation checks submitted numbers against contract schedules and measured pumping volumes at the Bill Jones Pumping Plant in Tracy and at O'Neill Forebay. CVO compiles and publishes this data on-line at: http://www.usbr.gov/mp/cvo/CVO_Rpts.html.

Data are publicly available shortly after the end of each month, and the pertinent reports are the San Joaquin and Mendota Pool (Table 24), Delta-Mendota Canal (Table 25), and San Luis and Cross Valley Canals (Table 26).

The delivered water is applied within contractors' service areas. Some service areas lie partially within the Grassland and/or Northwest subareas (defined in the Basin Plan). Since the subareas are given their own load allocations with a supply water credit, it is important to differentiate how much imported water is delivered to each subarea. Using the boundary description of subareas in the Basin Plan (Appendix 1, Item 41), Reclamation applied GIS tools to determine the proportion of acres for each service area that lies only partially within one or both subareas (less than 100 percent of the DMC supply water is used within the subarea). There are seven parties that apply less than 100 percent of their Delta water supplies within a subarea, and the percent of area that lies within each subarea are quantified in Table 5.

To compute the Q_{DMC} needed to calculate excess loads, delivered water from each reach is summarized, in some cases prorated by the subset of irrigated or wetland acreage within the defined subareas.

Table 5. CVP Districts that are Less than 100 Percent Served by DMC Control Point

Recipient	Tables	Total Acres	Grassland–Acres Served	Grassland–Percent Served	Northwest–Acres Served	Northwest–Percent Served
CDFG–China Island Unit	24, 25	3,699	3,174	86%	525	14%
Central California ID	24, 25	149,814	129,805	87%	20,007	13%
Columbia Canal Co	24	16,719	15,762	94%		0%
Del Puerto WD	25	54,673	11,656	21%	43,017	79%
USFWS–San Luis NWR	24	28,048	23,712	85%		
Banta-Carbona ID	25	16,728			1,055	6%
West Stanislaus ID	25	22,192			21,291	96%

For each reach, daily EC data is averaged over the month[9] to determine CDMC. Daily TDS measurements for the DMC Headworks and DMC Check 21, and electrical conductivity measurements for DMC Check 13 are publicly available at http://www.usbr.gov/mp/cvo/wqrpt.html. The CVO data are continuously collected and publicly available, so they are used to represent the water quality through this reach. EC and TDS are measured continuously (every 15 minutes) by Hydrolab MS5 sondes. The CVO probes are suspended in the middle of the canal. Currently the Check 21 probe is encased to prevent fouling due to debris; the probe at Check 13 is not. There is a proposal to encase the Check 13 probe in the near future. The CVO stations are maintained and calibrated every 2 months by personnel from Reclamation's Tracy Area Office. The EC probes are calibrated from a range of 0 – 2000 µS/cm according to manufacturer's recommendations. Although the probes generally demonstrate good stability, accuracy, and reproducibility between calibrations, previous data is not corrected if a calibration reveals sensor drift or other problems.

Reclamation also operates autosamplers at each site that collect daily composite samples. These data will be used to verify the CVO measurements and replace missing data if necessary. Reclamation currently publishes monthly reports of DMC water quality.

Example: 2008 load allocations and actual loads are calculated as an example. Reprints of CVO Water Delivery Report Tables 24 through 26 for 2008 are attached as Appendix B.

For the Grasslands Subarea, water delivery data is taken from all three CVO Water Delivery Report Tables. Monthly deliveries from CVO Table 24 are multiplied by Check 21 TDS to determine total salinity loads, deliveries from CVO Tables 25 and 26 are multiplied by Check 13 EC and an EC:TDS conversion factor of 0.62 to determine total salinity loads. Where appropriate, deliveries are prorated to reflect the proportion of service area within the Grasslands Subarea that receives CVP water (when less than 100 percent). Total salinity loads from the

[9] To be consistent with the Vernalis WQO calculation

DMC and Mendota Pool are then summed for the subarea. The DMC loads from the Grassland area that are above the Basin Plan Amendment load allowance are calculated by subtracting the allowance from the load. Calculations are presented in Tables 6 through 8.

For the Northwest Subarea, water delivery data is taken from CVO Tables 24 and 25. Monthly deliveries from CVO Table 24 are multiplied by Check 21 TDS to determine total salinity loads, deliveries from CVO Table 25 are multiplied by DMC Headworks TDS to determine total salinity loads. Where appropriate, deliveries are prorated to reflect the proportion of service area within the Northwest Subarea (when less than 100 percent). Total salinity loads from the DMC and Mendota Pool are then summed for the subarea. The DMC loads from the Northwest area that are above the Basin Plan Amendment load allowance are calculated by subtracting the allowance from the load. Calculations are presented in Table 9.

DMC salinity loads above load allocations are tabulated in Table 10.

Table 6. WY 2008 San Joaquin River and Mendota Pool Deliveries from CVP (Grassland Subarea)

Months	Laguna WD (via CCID), TAF	San Luis WD (via CCID), TAF	Central California ID (CCID), TAF	Columbia Canal Co, TAF	Fire-baugh Canal WD, TAF	San Luis Canal Co (SLCC), TAF	Grassland WD (via CCID & SLCC), TAF	Kester-son (USFWS) (via CCID), TAF	Los Banos WMA (CDFG) (via CCID), TAF	San Luis NWR (USFWS) (via SLCC), TAF	China Island Unit (CDFG), TAF	Salt Slough Unit (CDFG), TAF	Freitas Unit (USFWS) (via CCID), TAF	Total Deliver-ies, TAF	Average TDS at Check 21, mg/L	Monthly Salt Load, thousand tons
Multiplier	1.00	1.00	0.87	0.94	1.00	1.00	1.00	1.00	1.00	0.85	0.86	1.00	1.00	NA	NA	NA
September to March Standard, 1000 µS/cm																
Oct	0	0	23.1	4.7	1.4	4.1	12.1	0	4.3	3.7	0.7	1.4	1.9	57.4	329	25.7
Nov	0	0	1.0	0	0	0.5	5.4	0	3.3	4.3	0.4	1.2	1.1	17.3	345	8.1
Dec	0	0	1.7	0	0	0	3.2	0	3.0	3.2	0.8	1.1	1.0	13.9	375	7.1
Jan	0	0	0	0	0.4	0	4.9	0	1.8	3.2	0.6	0.8	1.1	12.7	451	7.8
Feb	0	0.08	15.2	1.5	4.0	3.9	4.3	0.7	0.9	7.9	0.7	0.6	0.3	40.8	384	21.3
Mar	0	0.02	38.8	4.7	3.9	11.4	0.5	0.2	0.3	1.5	0.1	0.2	0.2	61.7	415	34.9
April to August Standard, 700 µS/cm																
Apr	0	0	24.0	5.0	5.6	14.4	0.3	0.1	0.2	0	0.1	0.1	0.2	50.0	361	24.6
May	0	0.1	47.2	6.3	5.2	14.1	3.4	0.1	0.3	2.4	0.1	0.2	0.1	79.3	352	38.0
Jun	0	0.04	42.6	7.5	6.2	24.9	0.9	0	0.1	0	0.1	0.1	0	82.3	362	40.5
Jul	0	0.05	52.6	8.2	5.4	27.5	0.1	0	0.1	0	0.2	0.1	0	97.7	271	36.1
Aug	0	0.04	44.7	8.3	5.5	24.2	0.4	0	0.5	0	0.1	0.2	1.0	83.9	336	38.3
September to March Standard, 1000 µS/cm																
Sep	0	0	25.8	6.0	3.3	6.1	19.8	0	3.2	4.9	0.9	1.4	1.9	72.2	393	38.6

Table 7. WY 2008 Delta- Mendota Canal Deliveries from CVP (Grassland Subarea)

Months	**Del Puerto WD,TAF**	**Eagle Field WD, TAF**	**Mercy Springs WD, TAF**	**Oro Loma WD, TAF**	**Panoche WD - Ag, TAF**	**Panoche WD - M&I, TAF**	**San Luis WD - Ag, TAF**	**San Luis WD - M&I, TAF**	**Central California ID (Abv C), TAF**	**Central California ID (Blw C), TAF**	**Firebaugh Canal WD, TAF**	**Total Deliveries, TAF**	**Average EC at Check 13, µS/cm**	**Monthly Salt Load, thousand tons**
Multiplier	0.21	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.87	0.87	1.00	NA	NA	NA
September to March Standard, 1000 µS/cm														
Oct	0.4	0	0.1	0	0.1	0	0.1	0	1.5	0.1	0.5	2.9	506	1.2
Nov	0.3	0	0.1	0	0.1	0	0.1	0	0.2	0	0.5	1.2	519	0.5
Dec	0	0	0	0	0	0	0.1	0	0	0	0.2	0.4	571	0.2
Jan	0	0	0	0	0.1	0	0	0	0	0.4	0.1	0.6	673	0.3
Feb	0	0	0	0.1	0.1	0	0.2	0	0	0.8	0.2	1.6	557	0.7
Mar	1.0	0	0.1	0	1.0	0	0.7	0	1.0	7.6	0.4	11.8	557	5.5
April to August Standard, 700 µS/cm														
Apr	1.8	0	0.1	0	0.7	0	0.6	0	1.4	6.2	0.4	11.2	475	4.5
May	2.0	0	0.2	0	0.8	0	0.6	0	2.0	10.6	2.0	18.3	525	8.1
Jun	1.8	0	0.1	0	0.9	0	0.9	0	1.8	17.3	2.5	25.3	523	11.2
Jul	1.9	0	0.2	0	0.8	0	1.3	0	1.6	23.5	3.9	33.1	376	10.5
Aug	2.0	0.1	0.1	0	0.7	0	0.7	0	1.9	23.1	2.0	30.5	468	12.0
September to March Standard, 1000 µS/cm														
Sep	1.1	0	0.2	0	0.2	0	0.4	0	1.4	0.4	0.1	3.7	566	1.8

Table 7 (Continued). WY 2008 Delta-Mendota Canal Deliveries from CVP (Grassland Subarea)

Months	China Island Unit (CDFG) (76), TAF	Frietas Unit (USFWS) (76.05L), TAF	Salt Slough Unit (CDFG) (76), TAF	Los Banos WMA (CDFG) (76.05), TAF	Volta WMA (CDFG), TAF	Grassland WD (76.05L & CCID), TAF	Grassland WD (Volta Wasteway), TAF	Kesterson Unit (USFWS) (Volta Waste-way), TAF	Kesterson Unit (USFWS) (76.0), TAF	Total Deliveries, TAF	Average EC at Check 13, µS/cm	Monthly Salt Load, thousand tons
Multiplier	0.86	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	NA	NA	NA
September to March Standard, 1000 µS/cm												
Oct	0	0	0	2.5	8.0	13.0	0	1.0	0	21.7	506	9.3
Nov	0	0	0	1.5	3.0	5.4	0	0.8	0	10.7	519	4.7
Dec	0	0	0	0.4	0	1.3	0	0.7	0	2.4	571	1.2
Jan	0	0	0	0	0.2	1.1	0	0.6	0	1.8	673	1.0
Feb	0	0	0	0	0.4	6.0	0.7	0	0	7.2	557	3.4
Mar	0.4	0.8	0.5	0.5	0	1.5	0	0	0.6	4.2	557	2.0
April to August Standard, 700 µS/cm												
Apr	0.3	0.5	0.4	0.7	0.1	0.9	0.4	0	0.3	3.6	475	1.5
May	0.3	0.5	0.7	0.8	0.4	8.9	3.7	0	0.3	15.5	525	6.9
Jun	0.2	0.3	0.4	0.3	0.3	2.7	1.0	0	0.1	5.1	523	2.3
Jul	0.5	0	0.4	0.4	0	0.4	0	0	0	1.8	376	0.6
Aug	0.4	0	0.5	0.7	1.9	1.2	0.3	0	0	5.0	468	2.0
September to March Standard, 1000 µS/cm												
Sep	0	0	0	0	2.6	21.6	17.0	0.9	0	42.1	566	20.1

Table 8: WY 2008 San Luis and Cross Valley Canal Deliveries from CVP (Grassland Subarea)

Months	CDFG - O'Neill Forebay WMA, TAF	City of Dos Palos, TAF	Pacheco WD, TAF	Pacheco CCID Non-project (Hamburg), TAF	Panoche WD, TAF	San Luis WD, TAF	San Luis WD - Ag (via O'Neill Forebay), TAF	San Luis WD - M&I (via O'Neill Forebay), TAF	VA Cemetery, TAF	Total Deliveries, TAF	Average EC at Check 13, µS/cm	Monthly Salt Load, thousand tons
Multiplier	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	NA	NA	NA
September to March Standard, 1000 µS/cm												
Oct	0	0.1	0.1	0	0.9	3.3	0.1	0.1	0	4.6	506	2.0
Nov	0	0.1	0.1	0	0.5	1.7	0.1	0.1	0	2.6	519	1.2
Dec	0	0.1	0.1	0	0.4	0.1	0	0	0	0.9	571	0.4
Jan	0.1	0.1	0	0.1	0.1	0.6	0	0	0	1.1	673	0.6
Feb	0	0.1	0	0.8	1.2	3.5	0.3	0	0	5.9	557	2.8
Mar	0	0.1	0.2	1.1	3.3	5.5	0.7	0.1	0	11.0	557	5.2
April to August Standard, 700 µS/cm												
Apr	0	0.1	0	1.5	4.9	7.2	0.7	0.1	0	14.4	475	5.8
May	0	0.1	0	1.3	5.1	9.0	0.8	0.2	0	16.6	525	7.4
Jun	0.1	0.2	0.8	0.8	4.9	8.9	0.8	0.2	0	16.7	523	7.3
Jul	0.1	0.2	1.0	0	4.9	10.5	1.2	0.1	0	18.0	376	5.7
Aug	0.1	0.2	0.7	0	2.1	6.8	0.7	0.1	0	10.7	468	4.2
September to March Standard, 1000 µS/cm												
Sep	0.1	0.1	0.3	0	1.2	3.8	0.4	0.1	0	6.1	566	2.9

Table 9. WY 2008 Deliveries from CVP to Northwest Subarea

San Joaquin River and Mendota Pool Deliveries from CVP = SJR+MP
Delta- Mendota Canal Deliveries from CVP + DMC = DMC

Months	SJR+MP China Island Unit (CDFG), TAF	SJR+MP Central California ID (CCID), TAF	SJR+MP Total Deliver-ies, TAF	SJR+MP Average TDS at Check 21, mg/L	SJR+MP Monthly Salt Load, thousand tons	DMC Banta-Carbona ID, TAF	DMC Del Puerto WD, TAF	DMC Patter-son WD, TAF	DMC West Stanislaus ID, TAF	DMC Central California ID (Abv Ck13), TAF	DMC Central California ID (Blw Ck 13), TAF	DMC China Island Unit (CDFG) (76), TAF	DMC Total Deliveries, TAF	DMC Average TDS at Head-works, mg/L	DMC Monthly Salt Load, thousand tons
Multiplier	0.14	0.13	NA	NA	NA	0.06	0.79	1.00	0.96	0.13	0.13	0.14	NA	NA	NA
September to March Standard, 1000 µS/cm															
Oct	0.1	3.6	3.7	329	1.6	0	1.6	0	0	0.2	0	0	1.7	319	0.7
Nov	0.1	0.2	0.2	345	0.1	0	1.0	0.6	0	0	0	0	1.6	329	0.7
Dec	0.1	0.3	0.4	375	0.2	0	0.1	0.3	0	0	0	0	0.4	380	0.2
Jan	0.1	0	0.1	451	0.1	0	0	0	0	0	0.1	0	0	416	0
Feb	0.1	2.3	2.4	384	1.3	0	0.2	0.4	0	0	0.1	0	0.6	358	0.3
Mar	0	6.0	6.0	415	3.4	0	3.5	0	0.7	0.2	1.2	0.1	3.6	427	2.1
April to August Standard, 700 µS/cm															
Apr	0	3.7	3.7	361	1.8	0	6.7	0.2	2.8	0.2	1.0	0.1	6.9	335	3.2
May	0	7.2	7.3	352	3.5	0	7.4	0.6	1.9	0.3	1.6	0	8.0	280	3.1
Jun	0	6.5	6.5	362	3.2	0	6.7	0.9	2.8	0.3	2.7	0	7.6	340	3.5
Jul	0	8.6	8.6	271	3.2	0	7.0	1.0	3.4	0.2	3.6	0.1	8.0	240	2.6
Aug	0	6.9	6.9	336	3.1	0	7.3	1.0	3.8	0.3	3.6	0.1	8.3	315	3.6
September to March Standard, 1000 µS/cm															

Months	SJR+MP China Island Unit (CDFG), TAF	SJR+MP Central California ID (CCID), TAF	SJR+MP Total Deliver-ies, TAF	SJR+MP Average TDS at Check 21, mg/L	SJR+MP Monthly Salt Load, thousand tons	DMC Banta-Carbona ID, TAF	DMC Del Puerto WD, TAF	DMC Patter-son WD, TAF	DMC West Stanislaus ID, TAF	DMC Central California ID (Abv Ck13), TAF	DMC Central California ID (Blw Ck 13), TAF	DMC China Island Unit (CDFG) (76), TAF	DMC Total Deliveries, TAF	DMC Average TDS at Head-works, mg/L	DMC Monthly Salt Load, thousand tons
Sep	0.1	4.0	4.1	393	2.2	0	4.2	1.5	1.5	0.2	0.1	0	5.7	355	2.7

Table 10. Example Calculation of WY2008 DMC Allocations and Load

Months	Grassland Subarea San Joaquin River and Mendota Pool Deliveries from CVP, load in thousand tons	Grassland Subarea Delta-Mendota Canal Deliveries from CVP, load in thousand tons	Grassland Subarea San Luis and Cross Valley Canal Deliveries from CVP, load in thousand tons	Grassland Subarea Total Flow, TAF	Grassland Subarea Load Alloca-tion, thousand tons	Grassland Subarea Actual Load – Load Allocation, thousand tons	Northwest Subarea San Joaquin River and Mendota Pool Deliveries from CVP, load in thousand tons	Northwest Subarea Delta-Mendota Canal Deliveries from CVP, load in thousand tons	Northwest Subarea Total Flow, TAF	Northwest Subarea Load Allocation, thousand tons	Northwest Subarea Actual Load – Load Allocation, thousand tons	Total Total DMC Actual Load – Load Allocation, thousand tons
September to March Standard, 1000 µS/cm												
Oct	25.7	10.3	2.0	86	6.1	31.9	1.6	0.7	5	0.4	2.0	33.9
Nov	8.1	5.1	1.2	32	2.2	12.2	0.1	0.7	2	0.1	0.7	12.8
Dec	7.1	1.3	0.4	18	1.2	7.6	0.2	0.2	1	0.1	0.4	8.0
Jan	7.8	1.4	0.6	16	1.1	8.6	0.1	0	0	0	0.1	8.7

Months	Grassland Subarea San Joaquin River and Mendota Pool Deliveries from CVP, load in thousand tons	Grassland Subarea Delta-Mendota Canal Deliveries from CVP, load in thousand tons	Grassland Subarea San Luis and Cross Valley Canal Deliveries from CVP, load in thousand tons	Grassland Subarea Total Flow, TAF	Grassland Subarea Load Alloca-tion, thousand tons	Grassland Subarea Actual Load – Load Allocation, thousand tons	Northwest Subarea San Joaquin River and Mendota Pool Deliveries from CVP, load in thousand tons	Northwest Subarea Delta-Mendota Canal Deliveries from CVP, load in thousand tons	Northwest Subarea Total Flow, TAF	Northwest Subarea Load Allocation, thousand tons	Northwest Subarea Actual Load – Load Allocation, thousand tons	Total Total DMC Actual Load – Load Allocation, thousand tons
Feb	21.3	4.1	2.8	55	3.9	24.2	1.3	0.3	3	0.2	1.3	25.5
Mar	34.9	7.1	5.2	88	6.2	40.9	3.4	2.1	10	0.7	4.8	45.7
April to August Standard, 700 µS/cm												
Apr	0	0.1	0	1.5	4.9	7.2	0.7	0.1	0	14.4	475	5.8
May	0	0.1	0	1.3	5.1	9.0	0.8	0.2	0	16.6	525	7.4
Jun	0.1	0.2	0.8	0.8	4.9	8.9	0.8	0.2	0	16.7	523	7.3
Jul	0.1	0.2	1.0	0	4.9	10.5	1.2	0.1	0	18.0	376	5.7
Aug	0.1	0.2	0.7	0	2.1	6.8	0.7	0.1	0	10.7	468	4.2
September to March Standard, 1000 µS/cm												
Sep	38.6	21.3	2.9	123	8.7	54.2	2.2	2.7	10	0.7	4.2	58.4
WY 2008 Total												**439.0**

Future Actions

Reclamation is currently involved in several planning studies and long-term projects that would have potential benefits in improving the water quality of the San Joaquin River Basin. Although the studies are underway, the potential outcome of these studies and projects may not be known for some time. Projects include, but are not limited to, the following:

- Delta-Mendota Canal Recirculation
- New Melones Revised Plan of Operations
- Flow and Water Quality Data Collection
- San Luis Unit Drainage Feature Re-Evaluation
- South Delta Improvements Project
- Franks Tract Project (formerly the Flooded Islands Study)
- Delta Habitat Conservation and Conveyance Program
- San Joaquin River Restoration Program
- Upper San Joaquin River Basin Storage Studies

Both Reclamation and the Board have agreed to revise the MAA when any of the above actions are implemented. For example, federal legislation authorizing the San Joaquin River Restoration Settlement Act was recently enacted and resulted in interim water releases from Millerton Lake beginning in the fall 2009. It is unknown at this time what amount of that water will be conveyed to the lower San Joaquin River. Reclamation will document the methodology of any new quantification, such as dilution flows for salinity, when enough information becomes available. Reclamation will report on potential and expected salinity benefits from these projects. Otherwise, Reclamation will report on document availability.

Vernalis Water Quality

Description: The WQOs that the Basin Plan Amendment addresses are Salinity and Boron at Vernalis in the lower San Joaquin River. The boron objectives are considered met if the salinity objectives are met. The WQOs are split into two separate seasonal objectives: 1000 µS/cm EC from September 1 to March 31 and 700 µS/cm EC from April 1 to August 31.

Quantification Methodology: Because the goal of the Basin Plan is to achieve these objectives, each report will include a section with tabular and graphical representations of this outcome. Vernalis water quality will be downloaded from the CDEC water data base at http://cdec.water.ca.gov for both VER (a Reclamation monitoring station) and SJR (a new DWR monitoring station). Two years ago, Reclamation moved its Vernalis sampling station to a location within 15 feet of the new DWR monitoring station. Data will be downloaded from

CDEC as daily values, and a thirty day average will be calculated beginning with the 29 days prior to the start of the reporting period.

Data and QA/QC: Reclamation data will be used in preference to calculate mean monthly averages and a running thirty day average over the reporting period. Reclamation's water quality monitoring device is placed directly in the San Joaquin River, while DWR's sampling station withdraws water from the River into its sampling station. Reclamation maintains the Hydrolab MS5 sonde every two months according to the procedure outlined in Appendix A, calibrating from 0- 2000 according to manufacture's procedure.

Example: The running thirty-day average salinity for 2008 was calculated using this methodology and is presented in Figure 4[10]. The monthly mean EC[11] for 2008 is presented in Table 11. WY2008 was classified as critical years for the San Joaquin River.

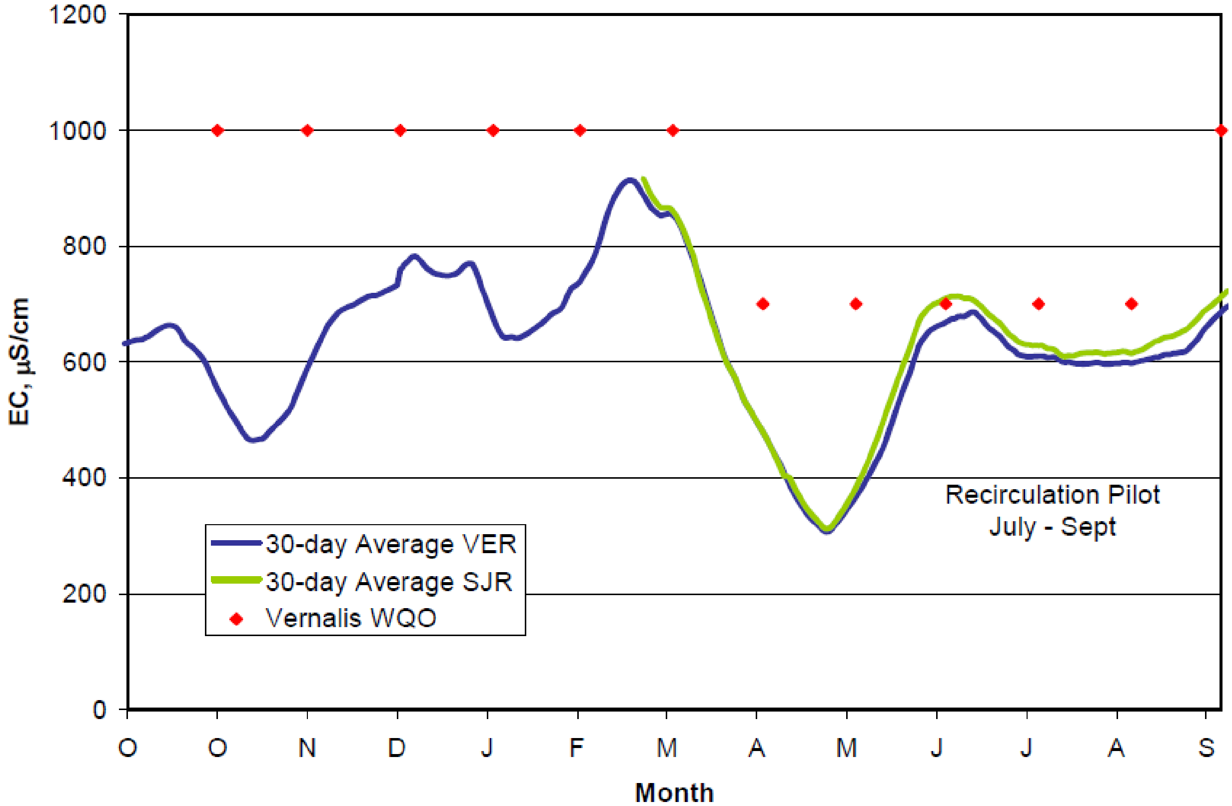
Table 11. WY2 008 Monthly mean EC at Vernalis, µS/cm

Months	**Reclamation Station**	**DWR Station**
September to March Standard, 1000 µS/cm		
Oct	554	
Nov	589	
Dec	760	
Jan	686	
Feb	750	
Mar	847	856
April to August Standard, 700 µS/cm		
Apr	479	479
May	367	383
Jun	669	710
Jul	611	630
Aug	600	617
September to March Standard, 1000 µS/cm		
Sep	687	713
Oct	600	617
Nov	763	755
Dec	870	887

[10] Footnote 2 to Table 2 of Water Rights Decision 1641 (revised) states "Determination of compliance with an objective expressed as a running average begins on the last day of the averaging period. The averaging period commences with the first day of the time period for the applicable objective. If the objective is not met on the last day of the averaging period, all days in the averaging period are considered out of compliance."

[11] Note, the monthly mean EC is mathematically closest to the last day of the running 30 day average EC.

Figure 4: 2008 Vernalis Water Quality



Reporting Requirements

In the MAA, Reclamation agreed to provide quarterly reports to the Regional Board. Reclamation will consult with the Regional Board before proposing any changes to the sample report format. Quarterly reports are due 45 days after the end of the calendar quarter:

Reporting Milestones–End of Calendar Quarter

- December 31, 2008
- March 31, 2009
- June 30, 2009
- September 30, 2009
- December 31, 2009
- March 31, 2010
- June 30, 2010

Reporting Milestones–Due Date of Quarterly Report

- February 13, 2009
- May 15, 2009
- August 14, 2009
- November 13, 2010
- February 12, 2010
- May 14, 2010
- August 13, 2010

The MAA requires Reclamation prepare a final annual report on compliance, due by July1, 2010. This report will follow the same format as used in the Compliance Plan, and will cover activities from January 2000 through September 30, 2009. The MAA expires July 1, 2010 and reporting requirements may change in the event the MAA is amended to continue. The format of the Compliance Plan is expected to continue to be used into the future, with changes as appropriate to incorporate additional activities.

Funding Reporting

In the MAA, Reclamation agreed to seek additional funding, including grant funding, to support salinity control efforts. Reclamation is operated on a three year budget cycle. Budget is requested two years in advance, and not all annual budgets are spent within a year but rather obligated to a specific contract or grant. Reclamation will report its obligated funding based on the official report provided from the Office of Management and Budget. Fiscal years run from October 1 to

September 30 (similar to the water year). In MAA-required reports, Reclamation will report on other efforts to support stakeholders in securing additional funding.

Monitoring Program

To support the actions described in this compliance Plan and to support evaluation of salinity loads, Reclamation will work with the Regional Board to develop a monitoring program. As a first step, Reclamation has identified existing monitoring data to support its evaluations of baseline, reductions, and offsets. Table 12 lists the existing monitoring sites used in the Compliance Plan.

Table 12. Monitoring Locations used in Compliance Plan

Symbol (Sensor)	Description	Parameter	Operator	Frequency	Website
Reservoir Operations Reports (Goodwin)	River Spills from Goodwin Reservoir	Flow, cfs	Reclamation	Daily	http://www.usbr.gov/mp/cvo/reports.html
Supplemental Water Contributions	Flows provided under the VAMP Agreement from Merced and Tuolumne Rivers	Flow, cfs	San Joaquin River Group	Daily	www.sjrg.org/technicalreport
Newman Wasteway Recirculation	Recirculation Flows (Newman Wasteway MP 6.88)	Deliveries, AF	SLDMWA Water Master and Reclamation CVO	Monthly (based on daily)	http://www.usbr.gov/mp/cvo/deliv.html
Monthly Water Deliveries	DMC, Cross Valley Canal, San Luis Canal, Delta-Mendota Pool, and San Joaquin River	Deliveries, AF	SLDMWA Water Master and Reclamation CVO	Monthly	http://www.usbr.gov/mp/cvo/deliv.html
VNS	San Joaquin River at Vernalis	Flow, cfs	USGS and DWR	Hourly/Daily	http://cdec.water.ca.gov/
USGS 11303500	SJR at Vernalis	Discharge, cfs	USGS	Continuous	http://waterdata.usgs.gov/nwis
OBB (100)	Stanislaus River at Orange Blossom Bridge	EC, µS/cm	DWR	Hourly/Event	http://cdec.water.ca.gov/
NWDS	Newman Wasteway MP 8.16	EC, µS/cm	Reclamation	Continuous during study	http://www.usbr.gov/mp/dmcrecirc/index.html Not yet released to public
DMC Check 13	In DMC, immediately downstream of O'Neill Forebay	EC, µS/cm	Reclamation	Continuous	http://www.usbr.gov/mp/cvo/wqrpt.html
DMC Check 21	Entrance to Mendota Pool	EC, µS/cm	Reclamation	Continuous	http://www.usbr.gov/mp/cvo/wqrpt.html
VER	San Joaquin River at Vernalis	EC, µS/cm	Reclamation	Continuous	http://cdec.water.ca.gov/
SJR	San Joaquin River at Vernalis	EC, µS/cm	DWR	Continuous	http://cdec.water.ca.gov/

Summary

Reclamation has spent considerable time examining the Basin Plan Amendment in order to understand how to calculate the allocations and offsets of Reclamation actions in a way that both complies with the Basin Plan Amendment, applicable laws, and federal authority and that maintains the environmental integrity of the Basin Plan Amendment. Reclamation has been operating to meet the salinity objective at Vernalis since 1995. Reclamation believes these operations suffice to meet the objective of the Basin Plan Amendment, and therefore is examining the dilution allocation that these operations provide.

Reclamation has conducted extensive stakeholder outreach to develop representative and acceptable accounting of DMC loads, dilution allocations, offsets, credits, and trading of loads. Sections A through C of the Compliance Plan quantified, where possible, the potential sources of dilution allocations and mitigation credits. Table 14 combines these individual calculations with the DMC load calculations and Vernalis salinity.

Table 14. Example of Calculated Loads and Offset Potential of Individual Compliance Plan Elements for WY2008, thousand tons of salt

Month	DMC Load Over Allocation	A-1: New Melones	A-2: WAP	A4: Recircu-lation	B3: WRDP (Annual Only)	Vernalis Average Salinity, µS/sm
September to March Standard, 1000 µS/cm						
Oct	33.9	-16.4				580
Nov	12.8	-3.3	-6.0			602
Dec	8.0	-3.5	-3.7			759
Jan	8.7	-5.1				681
Feb	25.5	-5.3				750
Mar	45.7	-36.7				847
April to August Standard, 700 µS/cm						
Apr	34.3	-20.0				479
May	55.8	-13.7				365
June	57.1	-13.6				669
Jul	46.4	-12.7				611
Aug	52.4	-8.8		-3.9		600
September to March Standard, 1000 µS/cm						
Sep	58.4	-7.3	0	-2.8		687
TOTAL	**439.037**	**-146.339**	**-9.672**	**-6.664**	**-171.276**	**76%**

Within the MAA is a goal for Reclamation to offset or reduce DMC excess loads by 25 percent by July 2010. For Water Year 2008, Reclamation engaged in actions that offset DMC loads by 76%. This reduction may not be typical for every year, and will very likely change when accounting of the WRDP changes in 2014 and as regulatory changes affect operation of New Melones Reservoir. However, the Vernalis water quality objective was met every month.

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Appendix A: Sonde Multiprobe (Yellow Springs Instruments)–Operation and Calibration

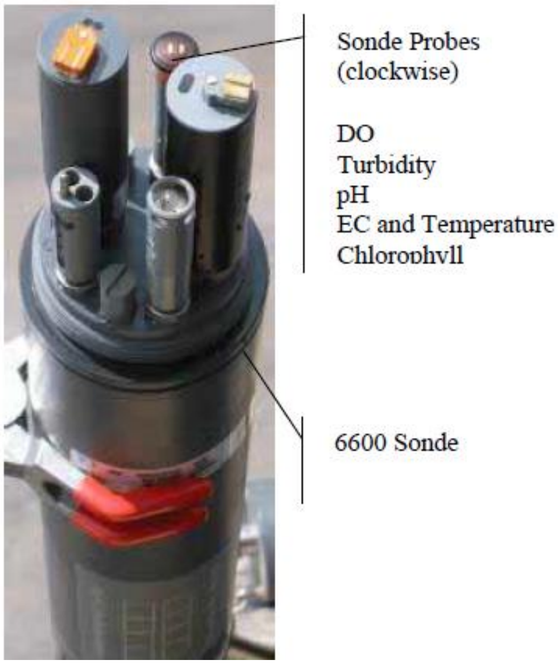
USBR, Branch of Environmental Monitoring (MP-157) SOP #_____

Summary

This SOP describes operation and calibration procedures for the Yellow Springs Instruments (YSI) 600XL and 6600 Sonde multiprobes.

Reagents

1. Electrical conductivity standard solution – 1,000 µS/cm
2. pH standard solution – 7.0 (yellow)
3. pH standard solution – 10.0 (blue)
4. Turbidity standard solution – 0.0 NTU
5. Turbidity standard solution – 123 NTU or 11.2 NTU
6. Deionized (DI) water



Equipment

1. Sonde multiprobe
2. Field cable
3. MDS 650 display/data logger
4. Four Size “C” alkaline batteries (6600 Sonde only)

Procedure-Operations

1. Before operating the instrument, calibrate it as described below.
2. If needed, attach the Sonde to the data display unit with the field cable.
3. Cover the probes with the perforated probe guard and submerge the probe end of the unit about a foot under the surface of the water to be measured. Alternately, attach the clear plastic calibration cup (cal cup) and pour environmental water into the cup until the probes are completely covered. Discard this water and repeat twice more before filling a final time.

4. To turn the on the display unit, press the green button (upper left). Use the up/down arrow key to select “Run” from the file menu. When selected, press “Enter” (←).

5. Wait for readings to stabilize: this should take less than a minute. If readings don’t settle (and you are not taking measurements directly from the source), try holding the Sonde around the cal cup – this should stabilize the temperature and EC readings.

6. Record physical measurements in the Field Log Book (SOP#____) and on the Field Sheet (SOP #____).

7. When finished, turn the unit off by pressing the green button.

8. If making measurements over an extended time period, verify the instrument calibration every 8 hours. If measuring less than 8 hours, verification is not needed. Document the instrument verification on the Instrument Calibration Sheet.

General Procedure–Calibration and Calibration Verification

1. Before sampling, verify the instrument calibration for each physical constituent to be measured. If the calibration cannot be verified, the instrument must be recalibrated for that measurement. Since some calibrations are interdependent, perform verifications and calibrations in the following order:

    a. Specific conductance (EC)

    b. pH

    c. Dissolved oxygen (DO)

    d. Turbidity

    e. Depth

    f. Oxidation/reduction potential (ORP)

2. Attempt to verify the calibration.

3. If the calibration cannot be verified, calibrate as described for each measurement (below).

4. Document the verification and/or calibration on an “Instrument Calibration Sheet” (see SOP#____).

Conductivity (EC)

1. EC calibration is easy to do, so recalibrate even if the old calibration can be verified.

2. Pre-rinse the cal cup and sensors with a small amount of the 1.0 mS/cm (1,000 µS/cm) calibration standard and discard. Repeat. If 1,000 µS/cm standard is not available, it is OK to calibrate with standard ≥1.0 mS/cm.

3. Fill the cal cup with standard ensuring that the conductivity probe is completely submerged. The hole in the side of the probe must be under the surface of the solution and not have any trapped bubbles in the side opening.

4. Scroll to “Sonde Menu” and press “Enter”

5. Scroll to “Calibrate” press “Enter”

6. Scroll to “Spec. Cond” and press “Enter”

7. Type in “1” (if using 1,000 µS/cm standard) and press “Enter”. The sonde requires the input in milli-siemens.

8. If the sonde should report “Out Of Range”, investigate the cause. Never override a calibration error message. This error message can result from: 1) low fluid level, 2) air bubbles in the probe cell, and/or 3) an incorrect entry. For example, entering 1000 (for microsiemens) instead of 1.0 (for millisiemens) will result in an Out of Range error.

9. When prompted by the display unit, press “Enter” to accept the calibration.

10. After the calibration has been accepted, check the conductivity cell constant which can be found in the Sonde’s Advanced Menu under Cal Constants. Record the value on the calibration sheet. If the cell constant is out of range (5.0 ± 0.45) the probe may need replacing.

pH

1. pH calibration is easy to do, so recalibrate even if the old calibration can be verified.

2. If necessary, attach a temperature probe to the Sonde (temperature is needed to measure pH).

3. If needed, go to the Sonde “Report Menu” and turn on the pH millivolt (mV) display. This will allow the Sonde to display the probe’s raw output as well as pH units.

4. If the in-situ pH value is unknown, use a three point calibration. If the general pH range is known, bracket the anticipated value using a two point calibration.

5. Start all calibrations (two or three point) with yellow Buffer 7 standard solution.

6. Pre-rinse the cal cup and sensors with a small amount of the calibration standard and discard. Repeat.

7. Fill the cal cup with standard. Ensure that the pH probe is completely submerged.

8. Calibrate the pH as directed by the data display unit. Record the pH mV on the Calibration Sheet at each calibration point. The acceptance level for each buffer is:

Buffer	Millivolt Reading	Tolerance
4	180	±50 mV
7	0	±50 mV
10	180	±50 mV

9. Determine the difference between the mv recorded for the 4 & 7 or the 7 & 10 calibration points. For example, if buffer 7 gave a 3 mV reading and buffer 10 gave a -177 Mv reading, the difference is 180mV. The acceptable range for the mV difference is 165 to 180. If the mV difference is outside of this range, the pH probe should be replaced.

10. Do not use a probe that has given a “Calibration Error” or “Out of Range” message.

    Recondition the probe if pH readings are slow to settle. The reconditioning procedure is in the “Sonde Care and Maintenance” section of the YSI manual.

Dissolved Oxygen (DO)

1. Attempt to verify the DO calibration (steps 2- 5, this section). If the calibration is good, don’t recalibrate.

2. Put about ½ cm of water in the cal cup and set the lid on the cup. Don’t tighten down the lid. Alternately, if the probe guard is on, wrap the guard in a moist towel. This will place the DO probe in a saturated atmosphere.

3. Go to the “Run” menu and press “Enter”

4. On the Calibration/Verification sheet, record the barometric pressure and the DO in %. If the DO reads between 95 and 105 % (at sea level), no calibration is needed.

5. If you are not at sea level, you must determine the acceptable DO range for your altitude.

6. If the calibration cannot be verified, inspect the DO probe anodes. If the anodes are not bright and shiny, remove the membrane and recondition using the 6035 reconditioning kit. If the o-ring looks loose or old, replace it as described in the YSI manual.

7. After replacing the membrane, allow the Sonde to run for 10 minutes. Check the DO Charge after about 5 minutes, it should read between 25 and 75.

8. After the 10 minute “burn-in”, go to the Advanced Menu and confirm that the RS-232 auto sleep function is enabled. If the Sonde is to be connected to an SDI-12 data logger then the SDI-12 auto sleep must be enabled as well. After turning on auto sleep, wait one minute before proceeding.

9. Start the probe in the Discrete Run mode at a 4 second rate and record the first 10 DO% numbers on paper, the numbers must start at a high number and drop with each four second sample, example: 110, 105, 102, 101.5, 101.1, 101.0, 100.8, 100.4, 100.3, 100.1. It does not matter if the numbers do not reach 100%, it is only important that they have the same high to low trend. If you have a probe that starts at a low number and steadily climbs upward then the sensor has a problem and it must not be used. Note: Initial power up can make the first two DO% samples read low, the first two samples can be disregarded.

10. A new membrane will be slightly unstable for 3 to 6 hours after replacement so wait a few hours and then try again to verify your calibration.

11. If you still can’t verify the calibration, calibrate by setting “auto sleep” ON for unattended studies and OFF for discreet sampling.

12. Fill the calibration cup as in Step 2. Let the DO probe sit idle, not in “Run” mode, in this saturated environment for at least 10 minutes before beginning the DO calibration.

13. Calibrate the Sonde in DO%.

14. Enter the local barometric pressure in mm/hg. In Unattended mode (RS-232 Auto-Sleep ON) the DO probe will be calibrated automatically once the barometric pressure is entered and the warm-up time counter counts down to zero.

15. For "Discrete" or "Sampling" modes, press the Enter Key when the DO readings are stable. Wait at least three minutes and press the enter key again to calibrate.

16. When the calibration is complete, go to the "Advanced" menu and then to "Cal Constants". Record the DO gain on the Calibration Sheet. The gain should be between -0.7 and +1.4.

Turbidity (6600 only)

Notes: The calibration of all YSI turbidity sensors must be done with either YSI distributed standards, Hach StablCal, Diluted Hach 4000 NTU formazin or standards that have been prepared according to instructions in Standard Methods (Section 2130B). Standards from other vendors are NOT approved, and their use will likely result in a bad calibration and incorrect field readings. Please refer to the turbidity calibration section of your manual for more information.

Calibrating turbidity is best done in a lab. It is better to post-calibrate an optical probe back in the lab than to attempt a field calibration, especially if you are working out of a small boat or in less than clean conditions.

Never override a calibration error message without fully understanding the cause of the problem. Calibration errors messages usually indicate that problems exist that will result in incorrect field readings.

1. Before calibrating or verifying calibration, confirm that 1) the wiper on the turbidity probe is parking approximately 180 degrees opposite of the optics, 2) the wiper reverses direction during the wipe cycle, 3) the probe output increases when a finger is placed in front of the optics, 4) all submerged parts of the sonde and wipers are clean and 5) the optics are clean and clear of fingerprints.

2. Remove the EDS wiper and replace it with a clean standard (no brush) wiper.

3. Start with the zero (0) NTU standard. Pour the 0 NTU standard into the calibration cup – pour down the side to avoid aerating the sample. Set the Sonde on top of the calibration cup, do not engage the threads. Verify that there are no air bubbles on the probe face.

4. Run the wiper at least once before accepting the first point. To accept the point, press "Enter".

5. Calibrate the second point with 123 NTU standard (for the 6136 sensor). Wipe the probe at least once, then press "Enter".

Depth

Note: To calibrate, the depth sensor module must be in air and the sensor channel must be free of dirt. If the channel needs cleaning, use a syringe to flush water through it.

1. From the Calibration menu, select Pressure-Abs or Pressure-Gage (depending if you have a vented level sensor).

2. Input 0.00 or some known offset in feet. Press Enter and monitor the stabilization of the depth readings with time.

3. When no significant change occurs for approximately 30 seconds, press Enter to confirm calibration. This zeros the sensor with regard to current barometric pressure. Then press Enter again to return to the Calibration menu.

4. Go to the “Advanced” menu and then to “Cal Constants” and record the pressure offset on the Calibration Sheet.

Calibration Chart

Temperature Celsius	Zobell Solution Value, mV
-5	270.0
0	263.5
5	257.0
10	250.5
15	244.0
20	237.5
25	231.0
30	224.5
35	218.0
40	211.5
45	205.0
50	198.5

Employee Safety

Handle standards with care; do not ingest.

Pollution Prevention and Waste Management

Place used batteries in recycle bin at the 112 lab. Tape battery ends before binning them.

Appendix B: 2008 CVO Water Delivery Tables 24, 25, and 26

The following are the water delivery tables from calendar year 2008. Names highlighted with * are used in the Grassland Subarea calculations. Names highlighted with ** are used in the Northwest Subarea calculations. Names highlighted with *** are used in both Subarea calculations.

Red *
Blue **
Purple ***

Table 24. San Joaquin and Mendota Pool, 2008 (Monthly Deliveries in AF)

U.S. Department of the Interior-Bureau of Reclamation
Central Valley Operations Office

Water User	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Fresno Slough WD	0	18	80	97	437	156	276	54	0	0	0	0	1118
Tranquility Public Utilities	0	0	13	0	0	27	33	29	0	0	0	0	102
James ID	28	4515	487	612	2459	5418	3747	1945	936	224	84	0	20455
Meyers (SLWD)	619	1216	1242	583	147	113	256	825	987	61	226	0	6275
Dudley & Indart (formerly C	15	159	117	176	165	220	217	225	39	63	1	0	1397
Mid-Valley WD (no contract)	0	0	0	0	0	0	0	0	0	0	0	0	0
Reclamation District #1606	0	14	51	52	118	134	73	11	0	0	0	0	453
Terra Linda Farms (Coehlo F	284	585	746	758	1066	1473	1533	1053	470	245	55	0	8268
Tranquility ID	0	2197	2631	2565	4585	6372	6372	2943	1082	365	500	0	29612
Westlands WD (Lateral 6 &7	0	0	0	0	0	84	316	84	363	0	0	0	847
Wilson, JW (no contract)	0	82	107	0	0	208	233	272	76	0	0	0	978
Laguna WD (via CCID)*	0	0	0	0	0	0	0	0	0	0	0	0	0
San Luis WD (via CCID)*	0	82	20	0	50	40	45	37	0	0	0	0	274
Total	946	8868	5494	4843	9027	14245	13101	7478	3953	958	866	0	69779

Exchange Contractors													
Central California ID (CCID)***	0	17424	44627	27615	54252	48941	64554	51418	29618	29935	1801	0	370185
Columbia Canal Co*	0	1628	4975	5278	6701	7940	8735	8799	6420	3500	46	0	54022
Firebaugh Canal WD*	426	3979	3902	5629	5221	6150	5431	5541	3259	2071	1665	916	44190
San Luis Canal Co (SLCC)*	0	3913	11387	14426	14064	24935	27450	24210	6102	2000	2750	0	131237
Total	426	26944	64891	52948	80238	87966	106170	89968	45399	37506	6262	916	599634

Water User	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Refuges													
Grasslands WD (via CCID & S*	4892	4280	500	303	3410	897	146	400	19765	9649	10173	0	54415
China Island Unit (CDFG) (v***	647	803	151	119	101	70	195	174	1046	884	1008	0	5198
Los Banos WMA (CDFG) (via C*	1759	944	341	233	272	99	144	518	3218	4590	2447	0	14565
Mendota Wildlife Area (CDFG)	556	1149	1479	1317	1776	1864	2817	1338	5259	5863	2678	693	26789
Salt Slough Unit (CDFG) (vi*	835	605	173	144	220	122	134	151	1381	1577	1208	0	6550
Freitas Unit (USFWS) (via C*	1069	1106	256	181	173	89	0	0	968	1865	1396	0	7103
Kesterson (USFWS) via CCID*	0	662	197	108	108	22	0	0	0	0	1164	0	2261
San Luis NWR (USFWS) (via S*	3708	9295	1749	0	2840	0	0	0	5822	4136	2994	0	30544
Total	13466	18844	4846	2405	8900	3163	3436	2581	37459	28564	23068	693	147425
Total Deliveries	14838	54656	75231	60196	98165	105374	122707	100027	86811	67028	30196	1609	816838

Delivery data is based on District turn-out readings and may include water in addition to water service contract deliveries.

Table 25. Delta-Mendota Canal, 2008 (Monthly Deliveries in AF)

U.S. Department of the Interior-Bureau of Reclamation
Central Valley Operations Office

Water User	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Tracy, City of	277	0	0	415	736	942	1045	1003	903	849	472	349	6991
Byron Bethany ID (formerly P	13	9	52	455	621	564	510	423	350	241	46	21	3305
West Side ID	0	0	0	402	263	255	371	43	0	0	0	0	1334
Banta Carbona ID**	0	0	0	431	222	133	727	473	0	1	0	0	1987
West Stanislaus ID**	0	41	766	2884	2028	2934	3584	3917	1610	0	0	0	17764
Patterson WD**	11	400	35	210	602	910	1000	1010	1458	567	72	0	6275
Del Puerto WD***	44	199	4484	8506	9448	8503	8893	9228	5389	2907	1030	305	58936
San Luis WD – Ag*	0	238	717	597	566	863	1273	747	359	172	30	60	5622
San Luis WD – M&I*	1	1	2	16	19	23	19	1	33	14	6	1	136
Panoche WD – Ag*	65	112	956	655	845	869	768	663	209	107	181	62	5492
Panoche WD – M&I*	2	2	2	2	2	2	2	2	2	2	2	2	24
Eagle Field WD*	31	0	0	0	1	0	13	72	1	1	0	0	119
Oro Loma WD*	0	56	0	0	10	22	17	28	0	0	0	0	133
Mercy Springs WD*	0	0	92	108	194	95	162	71	155	207	1	18	1103
Newman Wasteway Recirculation**	0	0	0	0	0	0	1065	13439	7089	0	0	0	21593
DWR Intertie @MP7.70-R	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	444	1058	7106	14681	15557	16115	19449	31120	17558	5068	1840	818	130814

Exchange Contractors													
Central California ID (Abv c***	0	32	1209	1642	2358	2121	1855	2156	1577	949	321	781	15001
Central California ID (Blw c***	407	971	8821	7146	12240	19949	27083	26621	456	183	100	0	103977
Firebaugh Canal WD*	129	248	353	405	1955	2483	3916	1992	62	0	61	6	11610
Total	536	1251	10383	9193	16553	24553	32854	30769	2095	1132	482	787	130588

Water User	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Refuges													
China Island Unit (CDFG) (76***	0	0	452	357	302	212	585	524	0	0	0	1176	3608
Los Banos WMA (CDFG) (76.05*	0	0	485	698	818	296	432	720	0	0	0	837	4286
Salt Slough Unit (CDFG) (76.*	0	0	519	432	659	366	401	453	0	0	0	915	3745
Volta WMA (CDFG) (Volta Wast	156	421	0	62	370	260	25	1911	2588	2756	1516	183	10248
Grasslands WD (76.05 & CCID)*	1051	5990	1500	910	8857	2691	438	1199	21551	12744	7617	500	65048
Grasslands WD (Volta Wastewa*	10	748	0	360	3740	980	0	283	17003	11759	1014	312	36209
Kesterson Unit (USFWS) (76.0*	0	0	591	324	324	66	0	0	0	0	0	828	2133
Kesterson Unit (USFWS) (Volt*	616	0	0	0	0	0	0	0	942	1523	0	0	3081
Frietas Unit (USFWS) (76.05*	0	0	767	542	518	267	0	0	0	0	0	886	2980
Total	1833	7159	4314	3685	15588	5138	1881	5090	42084	28782	10147	5637	131338

Table 26. San Luis and Cross Valley Canals, 2008 (Monthly Deliveries in AF)

U.S. Department of the Interior-Bureau of Reclamation
Central Valley Operations Office

Water User	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
San Luis Canal													
City of Avenal	194	191	213	202	193	169	169	171	133	252	202	173	2262
City of Coalinga	324	310	369	537	626	671	796	715	672	648	381	432	6481
City of Dos Palos*	130	107	109	123	149	172	182	174	143	115	75	36	1515
City of Huron	66	61	90	125	114	116	127	127	110	106	88	56	1186
Pacheco WD*	1	1	237	1	1	765	1003	652	318	1	22	53	3055
Pacheco CCID Non-project (Hamburg)*	96	772	1109	1494	1346	806	0	0	0	142	116	0	5881
Panoche WD	106	1224	3318	4872	5054	4883	4887	2106	1175	874	343	327	29169
San Luis WD*	586	3467	5472	7150	9017	8930	10490	6827	3812	4712	2703	28	63194
Westlands WD	5588	23834	60024	76747	97166	81129	83558	61458	35231	25309	10161	5754	565959
Mendota WMA (CDFG) (via WWD Lateral	0	0	0	28	0	1	31	1	1	0	0	0	62
Mendota WMA (CDFG) (via WWD Lateral	0	0	0	0	0	0	0	0	0	0	0	0	0
Kern National Wildlife Refuge (USFW	489	2266	0	0	276	0	0	1562	3949	3640	4857	4154	21193
Total	**7580**	**32233**	**70941**	**91279**	**113942**	**97642**	**101243**	**73793**	**45544**	**35799**	**18948**	**11013**	**699957**

O'Neill Forebay Deliveries													
O'Neill Forebay Widlife*	138	31	0	0	14	147	79	108	140	148	84	100	989
San Luis WD Ag*	38	274	675	666	834	759	1225	734	404	346	151	100	6206
San Luis M&I*	41	42	92	93	153	168	81	113	107	81	53	33	1057
VA Cemetery*	1	1	14	20	37	30	30	25	24	13	5	5	205
Total	**218**	**348**	**781**	**779**	**1038**	**1104**	**1415**	**980**	**675**	**588**	**293**	**238**	**8457**

Water User	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Cross Valley Canal (See Note 1 below)													
County of Fresno	0	0	0	0	0	0	152	272	776	0	0	0	1200
County of Tulare	0	0	0	0	0	0	123	0	1072	928	0	0	2123
Lower Tule River ID	0	0	0	0	0	0	2026	3212	1998	1083	307	96	8722
Pixley ID	0	0	0	0	0	0	2027	3212	1997	1083	307	96	8722
Kern-Tulare WD	0	0	0	0	0	0	0	3541	12459	0	0	0	16000
Rag Gulch WD	0	0	0	0	0	0	0	249	5071	0	0	0	5320
Hills-Valey ID	0	0	0	0	0	0	169	309	860	0	0	0	1338
Tri-Valley ID	0	0	0	0	0	0	58	107	292	0	0	0	457
Total	**0**	**0**	**0**	**0**	**0**	**0**	**4555**	**10902**	**24525**	**3094**	**614**	**192**	**4388**

Delivery data is based on District turn-out readings and may include water in addition to water service contract deliveries.
NOTE: Cross Valley Canal section represents deliveries on behalf of the contractors listed, not necessarily what flows went into the Cross Valley Canal.