RECLAMATION

Managing Water in the West

In compliance with the "Management Agency Agreement between the Central Valley Regional Water Quality Control Board and the United States Bureau of Reclamation" executed on December 4, 2014

2018 Annual Report

October 1, 2017 – September 30, 2018

Goodwin Dam on the Stanislaus River, California

Bureau of Reclamation
Mid-Pacific Region

2018

Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

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Abbreviations and Acronyms

Action Plan	Actions to Address the Salinity and Boron TMDL Issues for the Lower San Joaquin River November 2008
ANN	artificial neural network
Authority	San Luis & Delta-Mendota Water Authority
Basin Plan	Water Quality Control Plan for the Sacramento and San Joaquin River Basins, 5th Edition
BMP	Best Management Practices
BO	Biological Opinion
CALFED	California Bay-Delta Authority
CCID	Central California Irrigation District
CDEC	California Data Exchange Center
CDFW	California Department of Fish and Wildlife
Corps	U.S. Army Corps of Engineers
CVO	Central Valley Operations
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CV Water Board	Central Valley Regional Water Quality Control Board
CV-SALTS	Central Valley Salinity Alternatives for Long Term Sustainability Stakeholder Group
D-1641	State Water Resources Control Board Decision 1641
DF	Base Design Flow
DMC	Delta-Mendota Canal
DSS	Decision Support System
DWR	California Department of Water Resources
EC	electrical conductivity
GBP	Grassland Bypass Project
GDA	Grassland Drainage Area
GDF	Goodwin Dam Flow
GOES	Geostationary Operational Environmental Satellites
GRCD	Grassland Resource Conservation District
GWD	Grassland Water District

LBNL	Lawrence Berkeley National Laboratory
LSJR	Lower San Joaquin River
MAA	Management Agency Agreement
MID	Modesto Irrigation District
MOU	Memorandum of Understanding
NOAA	National Oceanic and Atmospheric Administration
µS/cm	micro Siemens per centimeter
mg/L	milligram(s) per liter (parts per million)
PTMS	Program to Meet Standards
Reclamation	United States Bureau of Reclamation
Regression Model	inverse gradient regression model
RFC	California-Nevada River Forecast Center
RTMP	Real Time Management Program
Service	U.S. Fish and Wildlife Service
SJR	San Joaquin River
SJRIP	San Juaquin River Improvement Program
SJTSP	San Joaquin Tributary Settlement Process
State Water Board	State Water Resources Control Board
TAF	thousand acre-feet
TDS	total dissolved solids
TID	Turlock Irrigation District
TMDL	total maximum daily load
USGS	United States Geological Survey
VAMP	Vernalis Adaptive Management Plan
WARMF	Watershed Analysis Risk Management Framework
WDR	Waste Discharge Requirement
WQO	water quality objective
WRDP	Westside Regional Drainage Plan
WSI	Water Supply Index
YSI	Yellow Springs Instrument Company

2018 Reclamation San Joaquin River Salinity TMDL MAA Summary of Activities

Purpose
The Central Valley Regional Water Quality Control Board's (CV Water Board) Control Program for Salt and Boron Discharges into the Lower San Joaquin River (LSJR), also known as the Salt and Boron Total Maximum Daily Load (TMDL) was approved and placed into effect on September 10, 2004. In response to the Salt and Boron TMDL, the United States Bureau of Reclamation (Reclamation) developed the salinity management plan titled *Actions to Address the Salinity and Boron TMDL Issues for the Lower San Joaquin River* (Action Plan) and entered into a Management Agency Agreement (MAA) with the CV Water Board on December 22, 2008. The MAA described Reclamation's actions to meet the obligations allocated to it by the Salt and Boron TMDL for the Lower San Joaquin River. In the MAA, Reclamation agreed to implement the Action Plan.

Reclamation and the CV Water Board revised the MAA on December 4, 2015. The revised MAA does not reference the Action Plan. However, Section 2.3d of the revised MAA states that "Reclamation actions will be detailed in an Annual Work Plan and submitted along with a Status of Activities to Date from the previous year."

This Report summarizes activities conducted by Reclamation in 2018 in conjunction with the related elements outlined in the revised MAA. The original Action Plan described Reclamation's past practices and procedures to mitigate and manage adverse impacts of salt and boron imported into the San Joaquin Basin via the Delta Mendota Canal (DMC) to help achieve compliance with the objectives contained in the CV Water Board's *Water Quality Control Plan for the Sacramento River and the San Joaquin River Basins – 4th Edition* (Basin Plan). Reclamation reported the activities in quarterly reports as agreed to in the 2008 MAA. As agreed to in the revised MAA (referred to as the MAA from here forward), Reclamation activities are now be reported at the end of each calendar year in the Annual Report and activities planned for the next fiscal year proposed in the Annual Work Plan.

Organization of Annual Report
The Annual Report provides a synopsis of the various activities performed by Reclamation in accordance with the MAA. Action categories include Providing Flows to the System, Salt Load Reductions, and Mitigation. For each action a brief description and list of activities are provided. The annual report includes calculations of salt loads based on DMC deliveries and calculations of assimilative capacity provided through dilution flows. The calculation methods used in this report are provisional and some elements in this report do not include estimations of benefits. The *Compliance Monitoring and Evaluation Plan,* dated May 2010 and submitted in 2010, outlines the criteria and methodology for determining DMC loads and credits.

Providing Flows to the System

In 2000, Reclamation agreed to the provisions in State Water Board's revised Decision 1641 (D-1641), which require the release of flows from New Melones Reservoir to meet the Vernalis

salinity objectives. Historically, Reclamation has provided both fishery and water quality dilution flows to the San Joaquin River from New Melones reservoir and through purchases for the Vernalis Adaptive Management Plan (VAMP) or the Central Valley Project Improvement Act (CVPIA). The San Joaquin River Agreement, which included provisions to acquire spring and fall pulse flows for the VAMP, expired on December 31, 2011. Reclamation continued to provide interim spring pulse flows for the San Joaquin River through a two-year agreement with Merced Irrigation District, which expired on December 31, 2013. During this timeframe, stakeholders within the watershed, including Reclamation, initiated the San Joaquin Tributary Settlement Process to formulate a collaborative solution to present to the State Water Board as an alternative to the State Water Board's new proposed San Joaquin River flow standard.

New Melones Reservoir Operations – Provision of Dilution Flow

Brief Description: In the Flood Control Act of October 1962, Congress reauthorized and expanded the function of the Melones Reservoir (P.L. 87-874) to a become a multipurpose Reservoir, constructed by the U.S. Army Corps of Engineers (Corps) and operated by the Secretary of the Interior as part of the Central Valley Project (CVP) -thus creating the New Melones Reservoir. The multipurpose objectives of the Reservoir now include flood control, irrigation, municipal and industrial water supply, power generation, fishery enhancement, water quality improvement, and recreation. Since June of 2009, New Melones Reservoir has been operated to meet the National Marine Fisheries Service Biological Opinion (BO) to Reclamation on the effects of the continued operation of the CVP and the California State Water Project on the various runs of Chinook salmon, Central Valley steelhead, and green sturgeon, and their designated critical habitat.

Figure 1. New Melones Reservoir

The Sacramento and San Joaquin River Basin Plan was amended in 2004 to include a Control Program for Salt and Boron Discharges into the Lower San Joaquin River. Items 12 and 13 in the Salt and Boron Water Quality Control Program include the following statements:

Item 12. Salt loads in water discharged into the 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 (WQOs) 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.

Item 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:

1) Offset salt loads discharged by this entity in excess of any allocation or; 2) trade, as described in item 10. The additional dilution flow allocation provided by dilution flows will be calculated as described in Table IV-8 (CV Water Board 2004c).

Activities

- Reclamation continues to operate its facilities to comply with State Water Board D-1641, New Melones Interim Plan of Operations, the applicable Biological Opinions and the Stanislaus River at Ripon monitoring station dissolved oxygen criteria.

Quantification Methodology: Table IV-4.4 (CV Water Board 2017) 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 tons of salt per month

Q_{dil} = dilution flow volume in thousand acre-feet (TAF) per month [above base flows]

C_{dil} = dilution flow electrical conductivity (EC) in micro-Siemens per centimeter (μS/cm)

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

Table 1 lists data and monthly calculations for the past year. Data for flow releases from Goodwin Dam, the Stanislaus River "design flows," and salinity at Orange Blossom Bridge are used to calculate the monthly dilution flow allocations. The water-year type is estimated based on the 75% probability of exceedance found in California Department of Water Resources (DWR) Water Supply Index Forecasts (http://cdec.water.ca.gov/cgi-progs/iodir/WSI) for the San Joaquin Valley. The 75% exceedance forecast for May 1, 2018 is 3.0, which classifies 2018 as a "Below Normal" year, 97% of the average.

Dilution Flow Allocation: WY2018 classified as a below-normal year.

Table 1. Goodwin Dam Monthly Dilution Flow Allocation, WY2018

	Goodwin Dam Flow (GDF) [a] TAF	Base Design Flow (DF) [b] TAF	Q_{dil} , TAF GDF-DF=Q_{dil} TAF	WQO[c], µS/cm	C_{dil} (monthly average EC at Orange Blossom Bridge) [d], µS/cm	Dilution Flow Allocation, A_{dil}, tons
January 2018	61	9	52	1,000	72	-40,017
February 2018	73	13	60	1,000	68	-46,356
March 2018	15	11	4	1,000	72	-3,078
April 2018	86	36	50	700	71	-26,082
May 2018	159	46	113	700	68	-59,207
June 2018	49	2	47	700	68	-24,629
July 2018	19	2	17	700	64	-8,971
August 2018	19	2	17	700	58	-9,048
September 2018	18	15	3	1,000	60	-2,340
October 2017	57	9	48	1,000	73	-36,915
November 2017	62	12	50	1,000	68	-38,635
December 2017	82	13	69	1,000	65	-53,491
Total						-348,774

Source: Reclamation 2018a

[a] http://www.usbr.gov/mp/cvo/reports.html / http://cdec.water.ca.gov/dynamicapp/selectQuery

[b] Reclamation 2010 Compliance Monitoring and Evaluation Plan

[c] State Water Board Decision 1641

[d] http://cdec.water.ca.gov/cgi-progs/staSearch

[e] In months where Goodwin Dam flow is less than Base Design flow the Base Design flow has been adjusted to match the Goodwin Dam flow. This action eliminates the dilution credit for that month.

Water Acquisitions

Brief Description: The CVPIA signed into law on October 30, 1992, modified priorities for managing water resources of the CVP. The CVPIA altered the management of the CVP to elevate fish and wildlife protection, restoration, and enhancement as a co-equal priority with water supply for agriculture and municipal and industrial purposes while recognizing other associated benefits such as power generation. To meet water acquisition needs under CVPIA, the U.S. Department of the Interior developed a Water Acquisition Program, a joint effort by Reclamation and the U.S. Fish and Wildlife Service (Service). The program's purpose is to acquire water supplies to meet the habitat restoration and enhancement goals of the CVPIA and to improve Interior's ability to meet regulatory water quality requirements.

Activities

- Reclamation did not acquire any additional water for water quality purposes this year.

Salt Load Reductions

Reclamation is under a court order to provide drainage to the San Luis Unit, on the west side of the Lower San Joaquin Valley. As part of this effort, Reclamation historically supported the Westside Regional Drainage Plan (WRDP) through grants and in-kind services. Salt Load Reduction Actions include the Grassland Bypass Project (GBP), implementation of the WRDP, and the following conservation programs: Water Conservation Field Services Program, WaterSMART Water and Energy Efficiency Grants (formerly Water 2025 Grants Program), and the California Bay Delta Authority (CALFED) Bay-Delta Water Use Efficiency Program.

Grassland Bypass Project

Brief Description: The GBP is a multi-agency stakeholder project currently based upon the 2009 Use Agreement[1] between Reclamation and the San Luis and Delta-Mendota Water Authority (Authority) to manage and reduce the volume of agricultural drainage water produced within the Grassland Drainage Area (GDA), and to use a 28-mile section of the San Luis Drain to convey this drainage water to Mud Slough, a tributary of the San Joaquin River. The GBP removed agricultural drainage water from most wetland water supply conveyance channels, facilitated drainage management that maintains the viability of agriculture in the GDA, and promoted continuous improvement in water quality in the San Joaquin River. The GBP is scheduled to attain zero discharge of pollutants to the San Joaquin River by the end of 2019. The progress and feasibility of attaining this goal is assessed by the Interagency Data Collection and Review Team that implements the GBP environmental monitoring program.

Activities

- The load of salts and boron discharged from the GDA to the lower San Joaquin River have been significantly reduced through the implementation of the GBP in 1996 and the development of the San Joaquin River Improvement Project (SJRIP) in 2002.

[1] U.S. Bureau of Reclamation and the San Luis and Delta-Mendota Water Authority, December 22, 2009. Agreement for Continued Use of the San Luis Drain for the Period January 1, 2010, through December 31, 2019. Agreement No. 10-WC-20-3975

- Prior to WY 1996, more than 191,000 tons of salts and 357 tons of boron were discharged annually from the GDA to the lower San Joaquin River.
- During WY 2018, approximately 13,000 tons of salts and 88 tons of boron were discharged from the GDA to the San Luis Drain.
- These significant reductions are the result of activities conducted by the Grassland Area Farmers to develop and operate the SJRIP re-use area.
- During WY2018, approximately 202,000 tons of salts and 539 tons of boron were displaced to the SJRIP. Absent the efforts of the Grassland Area Farmers, these loads would have been discharged to the Lower San Joaquin River.

Figure 2 shows the progressive reduction of salts discharged from the GDA[2] displacement to the SJRIP.

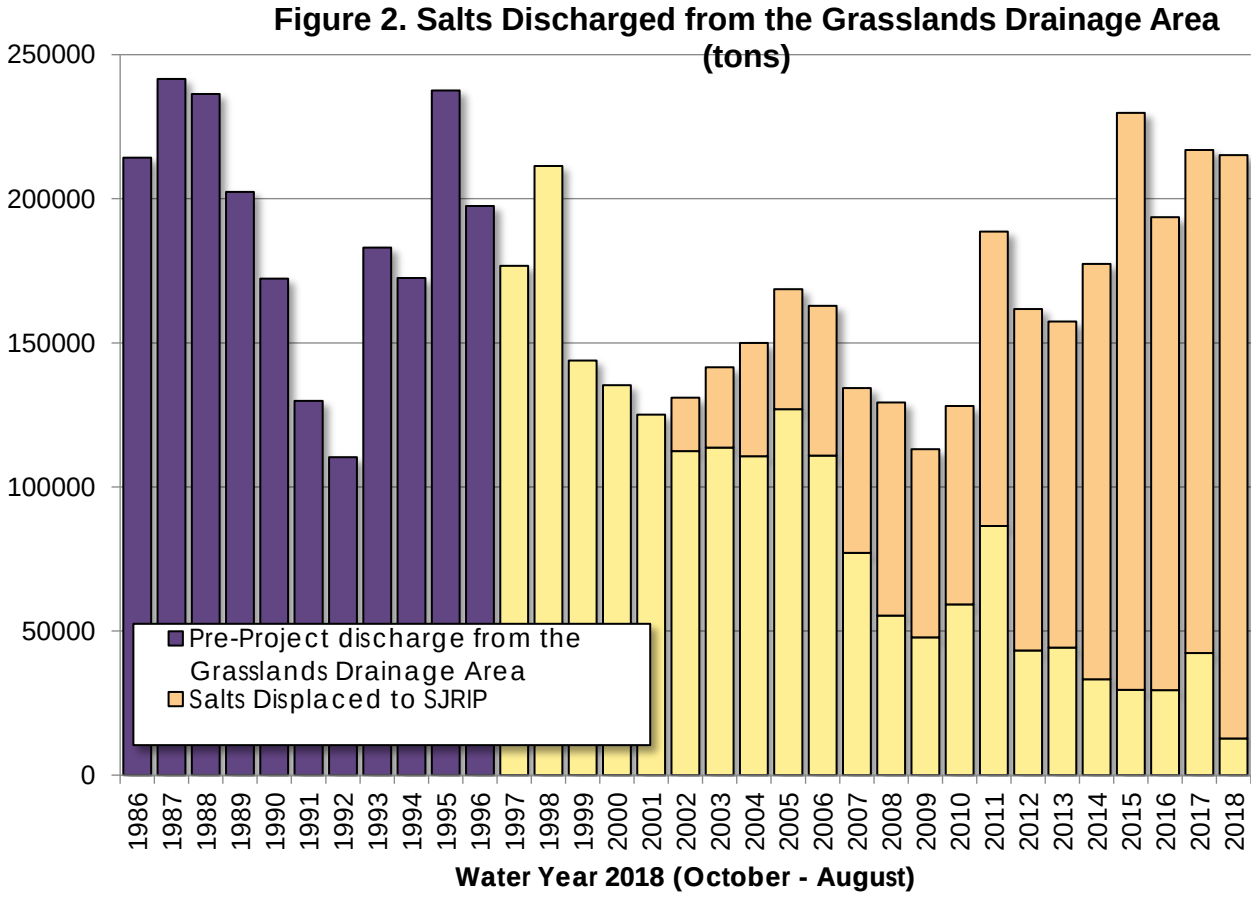

Figure 2. Salts Discharged from the Grasslands Drainage Area (tons)

[2] Data Sources: Regional Board (pre-project), Reclamation, and Summers Engineering

Figure 3 shows the progressive reduction of boron discharged from the GDA. For Water Year 2018, 88 tons of boron were discharged to the lower San Joaquin River from the GDA and approximately 539 tons were displaced to the SJRIP.

Figure 3. Boron Discharged from the Grasslands Drainage Area (tons)

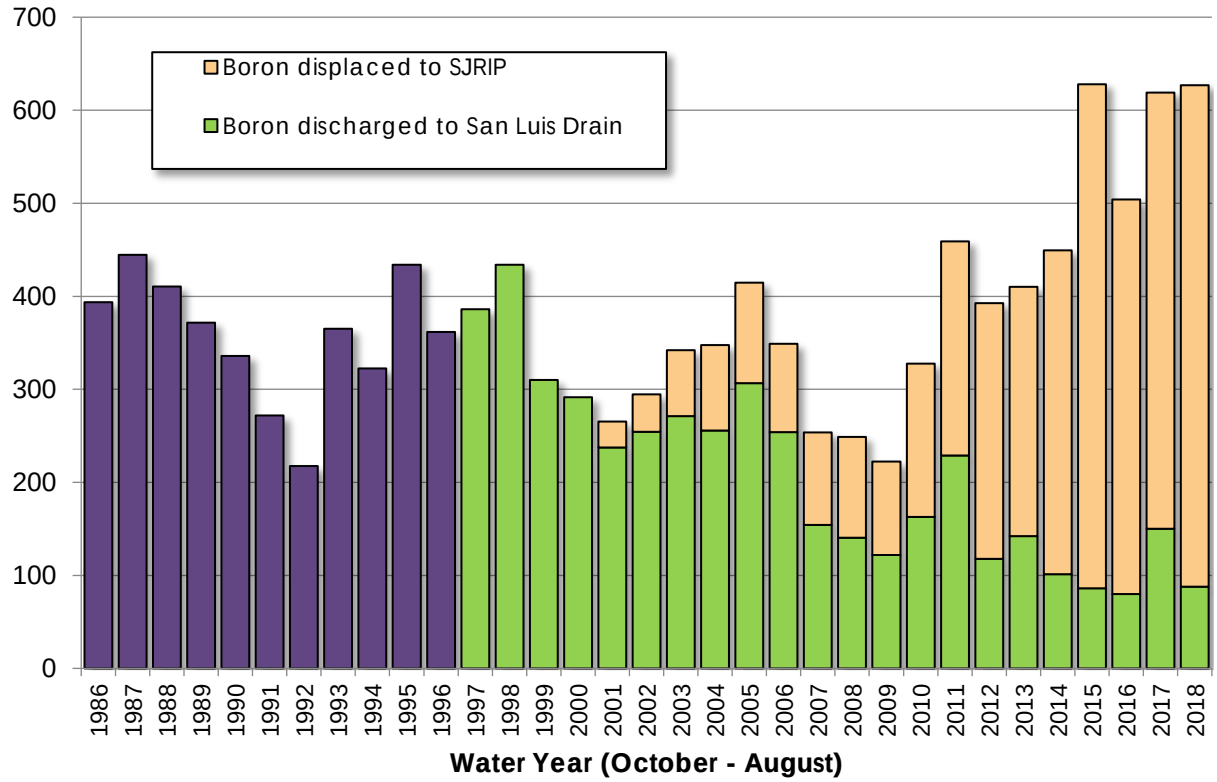

Figure 3. Boron Discharged from the Grasslands Drainage Area (tons)

- A small amount of seepage from adjacent wetlands in Grassland Water District is flowing from the San Luis Drain into Mud Slough, which is closely monitored by Reclamation.
- Runoff from winter rainstorms on the GDA has been conveyed through the San Luis Drain. Reclamation has been approached by representatives of the Grassland Area Farmers to discuss continued use of the San Luis Drain to convey stormwater after the expiration of the current Use Agreement on December 31, 2019.
- Reclamation continues to collect and analyze water samples from nine sites for selenium, boron, salts, nutrients, and molybdenum and continues to operate auto-samplers in the San Luis Drain and in the river at Crows Landing.
- All data and reports associated with the GBP are posted on the GBP website that is maintained by the San Francisco Estuary Institute: http://www.sfei.org/gbp.

Westside Regional Drainage Plan

Brief Description: The Westside Regional Drainage Plan (WRDP) is a local stakeholder program developed by integrating all consistent elements of drainage management developed by

government and local agencies and private partnerships. The original efforts of the WRDP focused on reducing selenium discharges to the San Joaquin River. Success of the original effort prompted a proposal to expand the WRDP to go beyond regulatory requirements and eliminate selenium, boron, and salt discharges to the San Joaquin River, while maintaining productivity of agricultural lands in the San Joaquin valley and enhancing water supplies for the region.

Reclamation provided $45 million in grant funding to implement the WRDP since 2002.

Activities

- In January 2018, Reclamation resumed work on San Luis Unit Drainage activities after the expiration of the partial stay relating to *Firebaugh Canal Company v. United States*, Case No. 95-15300. In preparation for returning to implementation of drainage activities, Reclamation is developing a comprehensive control schedule that will address in detail the expected project activities.
- Reclamation continues to administer the FY17 $3M grant provided to San Luis Water District for the Kaljian Drainwater Reuse Project.
- Panoche Drainage District continues to implement activates associated with the WRDP and San Joaquin River Improvement Project (SJRIP). The SJRIP allows agricultural drainwater from the Grassland Drainage Area to be reused to irrigate salt tolerant crops. Reclamation grants associated with the SJRIP are currently suspended. The suspension may affect further development of the SJRIP infrastructure but has not affected current operations.
- Reclamation continues work on the San Luis Demonstration Treatment Facility in cooperation with Panoche Drainage District.
- For WY 2018 (October 2017 thru September 2018), the District reports that it has displaced 30,300 acre-feet of agricultural drainage water, containing 202,000 tons of salts and 539 tons of boron. Absent the SJRIP, these salt and boron loads would have been discharged into the Lower San Joaquin River.

Conservation Efforts

Brief Description: The water use efficiency program includes several grant programs which fund actions to assure efficient use of existing and new water supplies. Efficiency actions can alter the pattern of water diversions and reduce the magnitude of diversions, providing additional benefits. Efficiency actions can also result in reduced discharge of pollutant-laden effluent or drainage and therefore improve water quality. 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 WaterSMART, the Reclamation/Natural Resources Conservation Service partnership and the CALFED Bay-Delta Restoration program, approximately 100 projects in the San Joaquin Valley have been awarded that required performance measures since 2006. As information is collected from these projects, quantifiable benefits may be determined in the future.

Activities

The 2018 WaterSMART Water and Energy Efficiency Program grants announced the following project within the San Joaquin basin:

Merced Irrigation District, Bear Creek Water Regulating Reservoir Reclamation Funding: $1,000,000 Total Project Cost: $4,194,849
The Merced Irrigation District will construct an off-stream regulating reservoir to better control its obligated water deliveries from Bear Creek. The project is expected to save 5,300 acre-feet of water annually by reducing over-deliveries and spills, which will allow more water to remain in storage and improve water supply reliability.

Salt Load Management

The MAA lists several actions that are intended to improve management of salt and boron loads in the San Joaquin River. Reclamation has actively supported the development of the San Joaquin River Salinity Forecasting Model which utilizes the WARMF (Watershed Analysis Risk Management Framework) model code to estimate daily River salt assimilative capacity and to provide decision support for real-time salinity management at the watershed level. The model provides a framework for analysis of flow and salinity data from tributaries to the River and for water district diversions from the River. Salt assimilative capacity forecasts require both the provision of real-time flow and salinity data and anticipated actions impacting flow and salinity in the River over a two-week forecast period. The accuracy of these forecasts is a function of the level of stakeholder involvement and the sharing of information.

During 2018, Reclamation developed and evaluated new methods of estimating the assimilative capacity of salt and boron in the San Joaquin River with the use of data-driven models. One advantage of data-driven models is that they can be easily automated. After testing numerous artificial neural network (ANN) frameworks and regression models, it was found that an inverse gradient regression model (Regression Model) stood out in terms of forecast accuracy. The basis for the Regression Model is the relationship in the River's flow and its EC such that: 1) EC decreases when stream flow increases, and vice versa; and 2) the EC's rate of change is proportional to the River's change in flow rate. A detailed description of the Regression Model will be provided to the CV Water Board during 2019, including a statistical measure of its accuracy compared to the WARMF model. Preliminary results, based on flow and EC data for the years 2004 to 2018, indicates that the Regression Model performs as well compared to the WARMF model.

RTMP – Development of Stakeholder-Driven Program

Brief Description: The Real Time Management Program (RTMP) is described in the TMDL as a stakeholder driven effort to use real-time water quality and flow monitoring data to support water salinity management decisions to maximize the use of assimilative capacity in the San Joaquin River. Reclamation has been working with San Joaquin River stakeholders and participants in the Central Valley Salinity Alternatives for Long Term Sustainability (CV-SALTS) initiative to support the development of a stakeholder-driven RTMP.

Activities

- A stakeholder meeting was held on August 7, 2018, in Los Banos (Merced County), and was attended by a large cross section of agencies and individuals from the Lower San Joaquin River watershed. Topics included stakeholder coordination, salinity forecasting, and the status of United States Geological Survey (USGS) monitoring stations that are

used in the RTMP. Participants were shown two online portals where River forecasts for EC and discharge can be found. One site is hosted by the consulting group, 34 North, and provides graphic displays of WARMF-based 14-day forecasts for EC and discharge that are updated weekly, and can be found at: https://sjrrtm.opennrm.org/. This site provides forecasts for Vernalis, Crows Landing, Patterson, Newman, and Maze Road Bridge. The other site is hosted by Reclamation and can be found at https://www.usbr.gov/mp/ptms/background.html. This site provides 14-day forecasts based on both models (Regression Model and WARMF) for Vernalis and Crows Landing. The Regression Model forecast is updated daily and the WARMF-based forecast is updated weekly.

- During 2018, two major irrigation districts on the eastside of the San Joaquin River - Turlock Irrigation District and Modesto Irrigation District (MID) became subject to load allocations in accordance with the Basin Plan's Salt and Boron Control Program. Turlock Irrigation District (TID) has been supplying continuous flow data since 2016 from its five monitoring sites that measure mostly operational spill from the District into the River. MID announced its willingness to participate in the RTMP by providing operational spill data monthly.
- The RTMP Framework document continues to be implemented thru Annual Work Plans as described in the MAA. Reclamation intends to update this document based on improvements in modeling efforts. The goal is to provide reliable forecasts to enable stakeholders to manage releases to the LSJR in a manner that optimizes the assimilative capacity of the river.
- During 2018, Reclamation coordinated with the California-Nevada River Forecast Center (RFC) at the National Oceanic and Atmospheric Administration (NOAA) to receive daily flow forecasts for Vernalis and Crows Landing. RFC provides the best available flow forecasts, which will be helpful in improving Reclamation's salinity forecasts using Regression Model.

RTMP – Technical Support

Brief Description: A successful RTMP requires telemetered networks of flow and salinity sensors along the main stem of the San Joaquin River and within watersheds draining to the San Joaquin River that allow easy access to data and data sharing, and knowledge of scheduled releases from the reservoirs that discharge to the Lower San Joaquin River watershed. Real-time quality assurance of this data is essential to avoid posting of erroneous data, and to encourage data sharing.

Activities

- Reclamation has continued to provide funding and technical support to the Grassland Water District (GWD) for the continued development of its real-time management program. GWD manages 20 real-time web-based flow and water quality monitoring stations within the Grassland Resource Conservation District. Since the discontinuance of the Yellow Springs Instrument (YSI) Company's EcoNet telemetry system, GWD is now using HydroVu Data Services available thru In-Situ Inc.
- Reclamation supported two online portals where River forecasts for EC and discharge can be found. Reclamation provided technical support to stakeholders.

Assistance to Federal Refuges and other Wetland areas

The California Department of Fish and Wildlife (CDFW) and the Grassland Resource Conservation District (GRCD) operate under Best Management Practices (BMP) to reduce the salt loads in discharges from managed wetlands into the San Joaquin River. Reclamation has provided resources to support the development of a real-time monitoring network and other potential BMPs within Federal, State, and private managed wetlands. We anticipate greater involvement from the State and Federal Refuges during 2019 through stakeholder outreach efforts.

Activities

- Reclamation continues to support the network of real-time flow and water quality monitoring stations that provide flow and EC data at major GWD inlets and outlets as well as along the water distribution network.
- Reclamation funding from 2017 thru 2019 includes $860,000[3] for the Grassland Bypass Project (including $200,000 annually to USGS to monitor five stations on the LSJR and tributary sloughs).

Participation in CV-SALTS Program

Reclamation's salinity management program includes participation in CV-SALTS. The current focus of CV-SALTS is on: 1) new nitrate regulations that will be coming in 2019 that will require management plans for the protection of groundwater; and 2) implementation of the Salt Control Program that is expected to be approved by the State Water Resources Control Board (State Water Board) in 2019. The Salt Control Program will include a Prioritization and Optimization Study that will expand on previous studies to identify projects and management practices to achieve salt sustainability in the Central Valley. The Control Program for Salt and Boron Discharges into the Lower San Joaquin River will remain in effect as an element of the overall Salt and Nitrate Management Plan for the Central Valley.

Brief Description: The CV Water Board and State Water Board initiated a comprehensive effort to address salinity problems in California's Central Valley and adopt long-term solutions that will lead to enhanced water quality and economic sustainability. The CV-SALTS stakeholder group has been a collaborative basin planning effort aimed at developing and implementing a comprehensive salinity management program. The goal of CV-SALTS is to maintain a healthy environment and a good quality of life for all Californians by protecting the state's most essential and vulnerable resource - water.

Activities

Reclamation staff participated in ten Executive Committee meetings between January and November 2018. In prior years, Reclamation also participated in the following sub-committees of the CV-SALTS program including the Technical Advisory Committee and Lower San Joaquin River Committee (LSJRC). Reclamation co-chaired the Technical Advisory Committee (through a contract with Berkeley National Laboratory). The LSJRC has not met since 2017 due to the

[3] The funding allocation is not specifically a Program To Meet Standards allocation but yields salinity benefits in the LSJR.

completion of the analysis in support of the adoption of upstream salinity objectives at Crows Landing. The LSJRC was a useful forum for interfacing with local stakeholders and discussing options for a salinity management implementation program to meet existing and newly promulgated salinity objectives. The activities of the LSJRC have been continued to some degree by the TRT and the Westside Drainage Coalition.

Central Valley Project Deliveries Load Calculation

Brief Description: The CVP delivers water to both the Grassland and Northwest subareas (as described in the Basin Plan) through the DMC, the San Luis Canal, and the San Joaquin River/Mendota Pool. Most CVP water is pumped from the Delta into the DMC through the C.W. "Bill" Jones Pumping Plant located near Tracy, California. CVP water is conveyed south to DMC Check 13 near Santa Nella, California, where water is either mixed with the State Water Project in O'Neill Forebay and then either pumped into San Luis Reservoir for later delivery through the DMC or San Luis Canal or conveyed further south to the DMC terminus at the Mendota Pool. During periods of drought, groundwater and river water are pumped into the DMC at several locations. The calculation methods used in this report are provisional and some elements in this report do not include estimations of benefits at this time. Reclamation submitted the *Compliance Monitoring and Evaluation Plan* to the CV Water Board (Reclamation 2010) which outlines the criteria and methodology for determining DMC loads and credits.

Quantification Methodology: The monthly amount of CVP water supply delivered to each district is pro-rated according to the area of each district within either the Grassland subarea, Northwest subarea, or outside of these subareas. The monthly mean salinity of CVP water is calculated from average daily measurements taken at three locations along the DMC. The salinity of CVP water delivered to each district is associated with the salinity monitoring site closest to the District's turnout along the DMC.

The Basin Plan allocates a salt load to Reclamation for water delivered to the Grassland and Northwest subareas. This background load allocation is calculated according to Table IV-8

Summary of Allocations and Credits (CV Water Board 2004c):

$$LA_{DMC} = Q_{DMC} * 52 \text{ mg/L} * 0.00136$$

Where:

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

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

52 mg/L = "background" salinity of water in the San Joaquin River released at Friant Dam (per the Basin Plan) measured as total dissolved solids (TDS)

0.00136 = factor for converting units into tons

Actual DMC salt loads are calculated by the following equation:

$L_{DMC} = Q_{DMC} * C_{DMC} * 0.00136$

Where:

L_{DMC} = Actual DMC Load, in tons

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

C_{DMC} = monthly average of salinity of the water delivered to Grassland and Northwest subareas, in mg/L TDS

0.00136 = factor for converting units into tons

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

$L_{DMC} = 0.00136 * \Sigma(Q_{DMC} * C_{DMC})_{\text{Subareas}}$

This equation is then broken into calculations for each subarea based on the source of CVP water. Table 2 lists the monthly volumes of CVP water and salts delivered to the Grassland and Northwest subareas and an estimate of the salts delivered in excess of the Monthly Load Allocation.

Table 2. Calculation of DMC Allocations and Loads

Water Year	Water Year Type	Grassland Subarea						Northwest Subarea					Total
		San Joaquin River and Mendota Pool Deliveries from CVP, load in thousand tons	Delta- Mendota Canal Deliveries from CVP, load in thousand tons	San Luis and Cross Valley Canal Deliveries from CVP, load in thousand tons	Total Flow, thousand acre-feet	Load Allocation, thousand tons	Actual Load - Load Allocation, thousand tons	San Joaquin River and Mendota Pool Deliveries from CVP, load in thousand	Delta- Mendota Canal Deliveries from CVP, load in thousand tons	Total Flow, thousand acre-feet	Load Allocation, thousand tons	Actual Load - Load Allocation, thousand tons	Total Excess Load from CVP Deliveries, thousand tons
2013	Critical	355.1	97.2	51.3	1060.1	74.9	428.6	27.1	25.6	121.4	8.6	44.1	472.7
2014	Critical	302.1	55.3	49.1	674.8	47.7	358.9	22.5	23.5	80.8	5.7	40.3	399.2
2015	Critical	285.7	56.9	46.7	611.8	43.2	346.2	22.0	32.5	84.0	5.9	48.5	394.7
2016	Dry	275.4	89.9	36.2	873.4	61.7	339.8	50.5	15.5	92.8	6.6	29.5	369.2
2017	Wet	147.5	57.8	20.1	1,032	72.9	152.4	9.3	11.0	122.7	8.7	11.6	164.0
2018	Below Normal	219.7	117.6	41.6	1112.1	78.6	300.4	16.9	18.5	114.9	8.1	27.3	327.7

Source: Reclamation 2018, http://cdec.water.ca.gov/reportapp/javareports?name=wsi

Report of Annual Work Plan Activity Performance

Reclamation has met schedule milestones for the MAA and performance of actions that assist San Joaquin River Stakeholders in managing salt loads and offsetting the DMC salt load into the San Joaquin River. New Melones Reservoir continues to be operated in accordance with D-1641 water quality requirements.

During 2018, Reclamation continued to support the development and use of the WARMF-based 14-day forecasts for EC and discharge that are updated weekly and hosted by 34 North. A promising new development is the Regression Model that provides 14-day forecasts for Vernalis and Crows Landing that are updated daily. As previously stated, preliminary results based on flow and EC data for the years 2004 to 2018, indicates that the Regression Model performs as well, if not better, than the WARMF model.

Reclamation is in compliance with the TMDL which requires that excess salt loads delivered to the LSJR via the DMC be offset by its dilution flows. As shown on Table 1, the dilution allocation, based on flows from the New Melones Reservoir, was -348.8 thousand tons of salt, while the total excess salt load during 2018 was 327.7 thousand tons of salt, as shown on Table 2. Furthermore, the Salt and Boron Control Program states, in part, that: “Participation in a Regional Water Board approved real-time management program and attainment of salinity and boron water quality objectives will constitute compliance with this control program.” It has been found that compliance with the EC WQO is also a good indicator of compliance with the boron WQO. As shown on Figure 4, Reclamation has also maintained compliance with the salinity WQO at Vernalis.

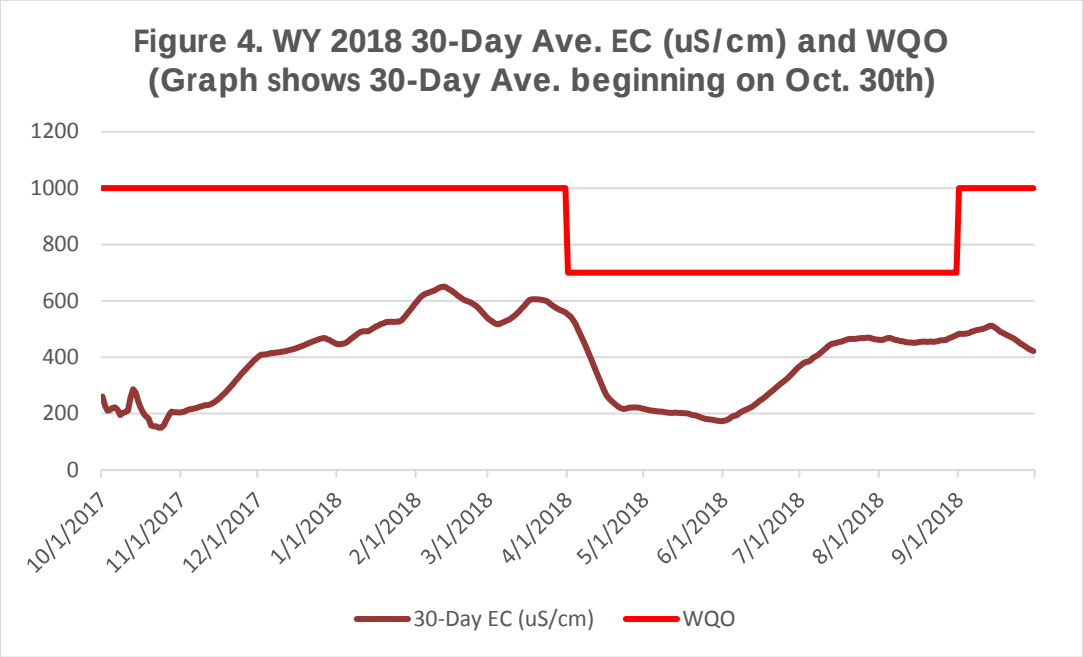

Figure 4. Water Year 2018 30-Day Average EC (uS/cm) and WQO

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