

**Municipal Water Quality Investigations Program  
Work Plan  
January - December 2019**

**FINAL WORK PLAN**

State of California  
Natural Resources Agency  
DEPARTMENT OF WATER RESOURCES

Municipal Water Quality Investigations Program, January – December 2019 Work Plan

	MWQI Work Plan Version Control	Edit made:
1.	Final Work Plan (original- v1), dated November 15 <sup>th</sup> , 2018	Original document
2.	Final Work Plan (v2), dated January 11, 2019	Adjusted Endothall Monitoring (5.2.3) language and made adjustments to the project labor requirements.
3.	Final Work Plan (v3), dated February 13, 2019	Adjusted language in North Valley Regional Recycled Water Program (7.2) to clarify that CVRWQCB gave the permit approval, not the SWC. Also, refined sampling locations map (Fig 2) and table (Table 5) to reflect new information.
4.		
5.		



# **Municipal Water Quality Investigations Program Work Plan January – December 2019**

Updated: February 13, 2019

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# Municipal Water Quality Investigations Program, January – December 2019 Work Plan

## List of Acronyms and Terms

BDO	Department of Water Resources Bay Delta Office
CCWD	Contra Costa Water District
CDEC	California Data Exchange Center
CVP	Central Valley Project
CY	Calendar Year
DES	Division of Environmental Services
DMC	Delta-Mendota Canal
DO	Dissolved Oxygen
DOC	Dissolved Organic Carbon
DSM2	Delta Simulation Model 2
DWR	California Department of Water Resources
EC	Specific Electric Conductivity
EPA	U.S. Environmental Protection Agency
EMP	DES Environmental Monitoring Program
FDOM	Fluorescence of Dissolved Organic Matter
FY	Fiscal Year
IC	Ion Chromatography
IEP	Interagency Ecological Program
IO	Internal Order number
MEO	Mobile Equipment Office
MWQI	Municipal Water Quality Investigations
MWQI SPC	Municipal Water Quality Investigations Specific Projects Committee
Na	Sodium
NEMDC	Natomas East Main Drainage Canal
O&M	DWR Division of Operations and Maintenance
O&M EAB	Division of Operations and Maintenance Environmental Assessment Branch
OC	Organic Carbon
OCO	Operation Controls Office (DWR O&M)
OE&E	Operating Expenses and Equipment
P/G	Pumping/Generation
PY	Position Year
QA/QC	Quality Assurance/Quality Control
QC	Quality Control
RA	Resource Agreement
RTDF	Real-time Data and Forecasting Program
RTDF-CP	Real-time Data and Forecasting – Comprehensive Program
RTM	Real Time Monitoring
SBA	South Bay Aqueduct
SCWA	Solano County Water Agency
SOP	Standard Operating Procedure
SPC	Specific Project Committee
SWP	State Water Project
SWPC	State Water Project Contractors
TBD	To Be Determined
TOC	Total Organic Carbon
WDL	California Water Data Library

## ***1. MISSION STATEMENT***

The mission of the Municipal Water Quality Investigations (MWQI) Program is to:

1. Support the effective and efficient use of the State Water Project (SWP) as a source water supply for municipal purposes through monitoring, forecasting, and reporting of Sacramento San Joaquin Delta and the SWP water quality;
2. Provide early warning of changing conditions in source water quality used for municipal purposes;
3. Provide data and knowledge-based support for operational decision-making on the SWP; and
4. Provide scientific support to the Department of Water Resources (DWR), the State Water Contractors (SWC) MWQI Specific Project Committee (MWQI SPC), participating SWP Contractors, and other governmental entities.

## ***2. INTRODUCTION***

### **2.1 MWQI Program Background**

The MWQI Program continues to study and monitor water quality in the Sacramento-San Joaquin Delta (Delta). MWQI generated data are incorporated with other data to produce a comprehensive information base that provides State Water Contractors and other interested parties with details related to source water conditions as water makes its way to their facilities. The information is disseminated via daily and weekly reports, and the Real-Time Data and Forecasting – Comprehensive Program (RTDF-CP) web site located at:

<https://water.ca.gov/Programs/Environmental-Services/Water-Quality-Monitoring-And-Assessment>

MWQI managers, supervisors, and staff participate in various activities external to the Program. Examples include, involvement with regulatory activities that occur in the Delta through the SWRCB, and/or the Central Valley Regional Water Quality Control Board (CVRWQCB), participation in the CVRWQCB's Nutrient Stakeholder and Technical Advisory Group (STAG) which is determining whether nutrient objectives are needed for the Delta, and assisting with pathogen and nutrient monitoring under the Delta Regional Monitoring Program (RMP). MWQI staff also assist with the Delta smelt related turbidity transect study, Oroville Dam response, and may help support new Fish Restoration Program monitoring stations as they come online.

Finally, MWQI staff support database infrastructure management, the administration of essential program management activities mandated by DWR's policies and procedures including implementing quality control measures, and efforts to ensure the health and safety of workplace staff.

## **2.2 MWQI Program – Program Partners**

The MWQI Program has several Program Partners who work in other DWR Divisions (see the organization chart below) including O&M's Environmental Assessment Branch (EAB), the Operations Control Office (OCO), the Bay-Delta Office (BDO), and Quality Assurance Quality Control (QA/QC) Support Services. The MWQI Program and its Program Partners use Resources Agreements to manage workloads, staff resources, and budgets across DWR Divisions. Each Resources Agreement (RA) is prepared, reviewed, approved, and kept on-file by program managers involved in the agreement. Typically, the duration of a RA is one to three years and agreements are renewed when workloads change. For this work plan cycle, MWQI Program has in place 3-year resource agreements for the following Program Partners:

O&M - Environmental Assessment Branch  
OCO - Regulatory Compliance & Reporting  
BDO - Delta Modeling Section

## **2.3 MWQI Program Core Elements**

Although MWQI Program core elements will receive priority, staff time may occasionally shift away from work described in this work plan. Examples include work on drought activities, CA WaterFix, EcoRestore, or Oroville spillway and fire recovery efforts. If it becomes apparent that core elements will be affected, adjustments will be made to keep the program moving forward.

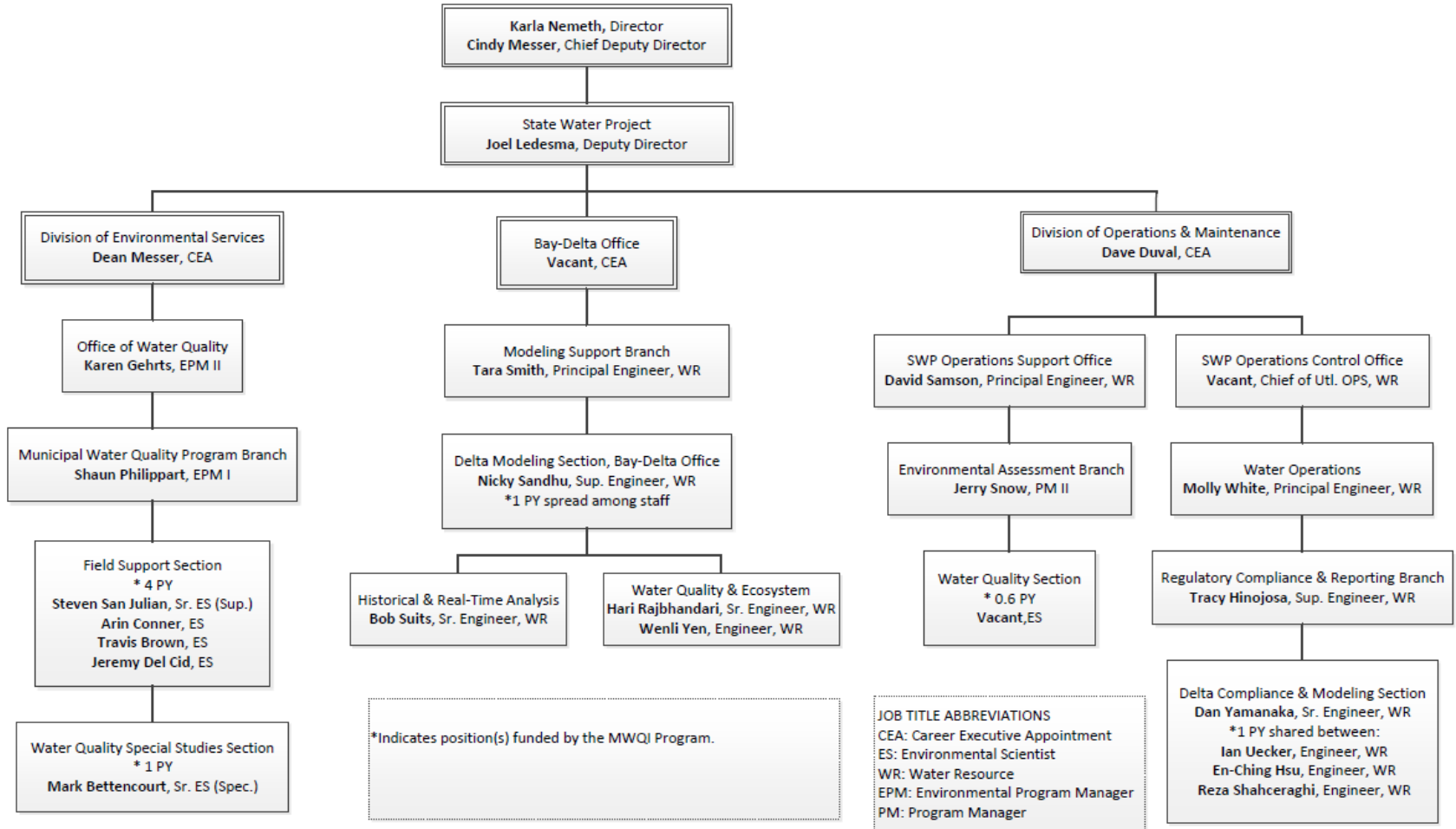
Core elements are listed in priority of importance to the MWQI SPC:

1. Water quality monitoring (both real-time and discrete) at existing stations and sites.
2. Modeling duties associated with producing short term water quality forecasts and performing historical updates of existing models.
3. Production and dissemination of daily and weekly RTDF reports
4. Data management activities pertaining to database infrastructure enhancement and improvement of long-term RTDF data storage and retrieval.
5. Program management activities listed in the MWQI funding agreement and those mandated by DWR health and safety. This includes RTDF Steering Committee meetings, budget updates, Bulletin 132 updates, and support to department emergency, drought, and O&M programs.
6. Other required Program activities mandated by DWR or essential to the MWQI Program (i.e. purchasing, contracts, budgeting, 2019 DWR Environmental Scientist Workshop, safety and policy training, specific meetings and conferences).



## 2.4 DWR MWQI Program Organization Chart

Figure 1. DWR org chart showing positions funded by MWQI Program funds.



### ***3. PROGRAM FUNDING NEEDS***

#### **3.1 MWQI Agreement and MWQI Specific Project Agreement**

The Municipal Water Quality Investigations Agreement (MWQI Agreement) between the Department of Water Resources, the State Water Contractors (SWC), and the MWQI Committee of the State Water Contractors provide the funding authority for DWR's MWQI Program costs. DWR's MWQI Program costs include salaries, benefits and overhead of DWR staff working for the MWQI Program, and equipment, supplies and operating expenses associated with the Program. These DWR MWQI Program costs are funded through the annual statement of charges of those SWP Contractors who participate in the MWQI Program. The current MWQI Funding Agreement is in effect from January 1, 2017 to December 31, 2019 which covers the timeframe of this calendar year (CY) based annual work plan.

The State Water Contractors MWQI Program Specific Project Agreement (MWQI Specific Project Agreement) establishes an independent, supplemental funding authority to support the objectives of the MWQI Program. SWP Contractors who are signatories to the MWQI Specific Project Agreement collectively form the MWQI Specific Project Committee (MWQI SPC) which carries out the work. Funds collected from the participating contractors form the MWQI SPC Account. In addition, the Contra Costa Water District which is not a SWP Contractor and not a signatory to the MWQI Specific Project Agreement provides some funding to help with MWQI Program expenses. The MWQI SPC Fund is generally used to pay for MWQI Program related costs that are not administered by DWR. These costs include hiring and retaining consultants, special studies or investigations, administrative and related costs, and if emergency or urgent needs warrant, the purchase of equipment or supplies for the MWQI Program or facilities. The current MWQI Specific Project Agreement is in effect from January 1, 2017 through December 31, 2019.

The CY 2019 MWQI Program budget total is \$3.1 million with \$2,620,443 (\$2,424,315 of which is allocated in the 2019 workplan – see Table 1) assigned to the DWR MWQI Program, and the remaining portion for the MWQI SPC fund. The MWQI SPC will continue to budget on a FY basis.

The estimated budget expenses for this work plan CY are shown in Table 1.

This work plan covers January to December 2019. The 12-month budget is presented in Table 1 below and is followed by an explanation of MWQI Program expenditures in Table 2. Partner staffing in this budget reflects 1 Position Year (1 PY = 1778 hours/year = 221 working days) each for the BDO and OCO, and 0.6 PY for the Division of O&M EAB.

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**Table 1. January – December 2019 Program Element Costs for MWQI Program**

Workplan Element	Program Element	2019 IO#	Labor Hours	Labor Cost	Contracts	OE&E	Total Cost
5	Water Quality Assessment						
5.1	Routine Monitoring Program	VWQASSMENT13	1937	\$236,555		\$40,000	\$276,555
5.2	Short-term Monitoring (included with 5.1)	VWQASSMENT13					
5.2.1	Delta Boundary Inputs Monitoring	VWQASSMENT13	190	\$32,500			\$32,500
5.2.2	Cache Complex, Stage 2 Monitoring	VWQASSMENT13	200	\$34,000			\$34,000
5.2.3	Endothall Monitoring	VWQASSMENT13	60	\$6,900		\$30,000	\$36,900
6	RTDF-Comprehensive Program						
6.1	6.1.1 MWQI Real Time Stations	VRTMONITOR13	2755	\$330,185	\$44,000	\$200,000	\$574,185
	6.1.2 Gianelli WQ Station	VGIANNELLI13	1017	\$116,955	\$14,000	\$20,000	\$150,955
6.2	6.2.1 Bay Delta Office Modeling	VRTBDOMODL13	1628	\$276,760			\$276,760
	6.2.2 Operations Control Office Modeling	VRTOCOMODL13	1438	\$244,460			\$244,460
	6.2.3 Improve Aqueduct Pump-In Dynamics	VPUMPINDYN15	220	\$37,400			\$37,400
	6.2.4 Compare WQ Forecasts to Actual Conditions	VCOMPAREWQ15	120	\$26,400			\$26,400
6.3	RTDF-CP Information Management and Data Dissemination	VRTDDISRPT13	800	\$125,000			\$125,000
7	Special Studies						
7.1	FDOM Project	VFDOMPOCS013	100	\$11,500			\$11,500
7.2	NVR Recycled Water Program	VFDOMPOCS013	40	\$4,600			\$4,600
7.3	Support for Nutrient Concerns	VFDOMPOCS013	160	\$21,600			\$21,600
7.4	Pesticide and Herbicide Use in the Delta	VFDOMPOCS013	40	\$4,600			\$4,600
8	Other MWQI Funded Program Activities						
8.1	Administration Work	VDWRRQDDPC13	2628	\$383,900		\$48,000	\$431,900
9	Other Required Program Costs						
9.1	MEO Insurance & Fuel & Maintenance					\$5,000	\$5,000
9.2	MEO New Boat and New Truck					\$130,000	\$130,000
	<b>Total</b>		<b>13,333</b>	<b>\$1,893,315</b>	<b>\$58,000</b>	<b>\$473,000</b>	<b>\$2,424,315</b>

\* DWR assessments are equally charged to programs to cover costs of Departmental overhead expenses. For example, administration, legal, and executive offices.

\*\*The MWQI Program includes 5 PY for staff and 2.6 PY's for program partners in OCO, BDO, and O&M. Labor rates are estimated at: ES - \$115/hour, Sr ES Spec - \$135/hour, Sr ES Sup - \$175/hour, WR Engineer - \$170/hour

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**3.2 Explanation of Program Element Costs for Work Plan Projects**

**Table 2. January – December 2019 MWQI Program Contract and Operating Expenses & Equipment (OE&E) Costs**

Program element:		OEE for the WP	Justification	CY 2019 Cost
5.1	WQ Assessment	Routine Monitoring Program		\$40,000
5.2	WQ Assessment	Endothall monitoring - contract lab costs		\$30,000
6.1.1	RTDF	MWQI Real Time Stations - equipment & filter replacement		\$50,000
6.1.1	RTDF	YSI EXO2 Sondes with chlorophyll and FDOM probes	See Section 6.4	\$150,000
6.1.1	RTDF	All Cal Services - portable toilet at Hood real time station		\$2,000
6.1.1	RTDF	Thermo-Fisher service contract for 3 Dionex IC analyzers (Banks, Vernalis, Jones)		\$23,000
6.1.1	RTDF	GE/Sievers - service contract for 4 organic carbon analyzers (Hood, Banks, Jones, Vernalis)		\$19,000
6.1.2	Gianelli WQ Station	Thermo-Fisher service contract for 1 Dionex IC analyzers (Gianelli)		\$9,000
6.1.2	Gianelli WQ Station	GE/Sievers - service contract for 1 organic carbon analyzers (Gianelli)		\$5,000
6.1.2	Gianelli WQ Station	Equipment repairs and replacement, filters, reagents, etc.		\$20,000
8.1	MWQI Administration	Facility Maintenance, meetings, conferences, training for MWQI staff		\$40,000
8.1	MWQI Administration	4 new computers		\$8,000
9.1	Mobile Equipment Office	Replacement Truck, new	See Section 9	\$40,000
9.1	Mobile Equipment Office	Replacement Boat, new	See Section 9	\$90,000
9.1	Mobile Equipment Office	Vehicle maintenance, fuel, and insurance		\$5,000
		<b>TOTAL Contract &amp; OEE COSTS:</b>		<b>\$531,000</b>

#### ***4 WORKLOAD ASSESSMENT***

For this work plan cycle, January 1 through December 31, 2019, MWQI Program management conducted a workload assessment to determine whether staff had enough work to occupy 100% of their time. This assessment is based on 8 staff members which includes MWQI Program staff and our MWQI Program funded partner staff in OCO, BDO, and O&M. The assessment assumes that staff have 1778 hours of production time during the year. The assessment does not use the total hours in a year (2080) because total hours includes vacation, holidays, sick, etc. where staff do not produce work. The workload assessment has proved to be a vital tool in managing staff workloads, shifts in workloads, and impacts to the MWQI budget. Table 3 lists the current workload assessment.

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**Table 3. Workload Assessment**

Draft MWQP Branch Staff Labor Plan CY2019 MWQI Work Plan		Routine Monitoring Program (VWQASSMENT13)		Delta Boundary Impacts Study (VWQASSMENT13)		Cache Slough Complex, Stage 2 (VWQASSMENT13)		Endothall Monitoring (VWQASSMENT13)		MWQI Real Time Stations (VRTMONITOR13)		Gianelli WQ Station (VGIANNELLI13)		BDO - Bay Delta Office Modeling (VRTBDOMODL13)		OCO - Operations Control Office Modeling (VRTOCOMODL13)		Improve Aqueduct Pump-In Dynamics (VPUMPINDY15)		Compare WQ Forecasts to Actual Conditions (VCOMPAREWQ15)		RTDF Data Dissemination and Reporting (VRTDDISRP13)		Fluorescence of Dissolved Organic Matter (FDOM) (VFDOMPOCS013)		North Valley Regional Recycled Water Program		Support for Nutrient Concerns		Pesticide and Herbicide Use in the Delta		Administration work/training/RTDF/Modeling meetings (VDWRRQDDPC13)		Staff Hours Committed (1778 work hours/year = 221 days 2080 hours /year includes vacation, holidays, sick, etc.)		
		5.1	5.2	5.2.1	5.2.2	5.2.3	6.1.1	6.1.2	6.2.1	6.2.2	6.2.3	6.2.4	6.3.1	7.1	7.2	7.3	7.4	8.1	Total																	
Work Plan Element		combined																																		
MWQI Field Section		combined																																		
	Arin Conner	539		0	0	20	709	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1718
	Travis Brown	544		0	0	20	714	0	0	0	0	0	0	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1718	
	Jeremy Del Cid	534		0	0	20	664	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	1718	
	Steven San Julian	210		40	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1778	
RTDF-CP & Data Dissemination																																				
	Mark Bettencourt	60		0	0	0	668	0	0	0	0	790	0	0	160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1778	
Non-MWQP Staff																																				
	Vacant	50		0	0	0	0	1017	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1067	
	OCO - Hsu/Shahcheraghi	0		0	0	0	0	0	0	1438	220	120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1778	
	BDO - Yin/Rajbhandari	0		150	0	0	0	0	0	1628	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1778	
Total Hours		1937		190	200	60	2755	1017	1628	1438	220	120	800	100	40	160	40	2628	13333																	
PYs		1.09		0.11	0.11	0.03	1.55	0.57	0.92	0.81	0.12	0.07	0.45	0.06	0.02	0.09	0.02	1.48	7.50																	

## **5 WATER QUALITY ASSESSMENT**

Water quality assessment has been a key feature of the MWQI Program since its inception in 1983. MWQI's monitoring data are used by many groups including DWR and other agencies, the MWQI SPC, non-governmental organizations, and by the public. MWQI monitoring data are used in drinking water supply studies, to identify long-term trends in drinking water quality, and to help DWR and other agencies research and mitigate drinking water issues in Delta waters and the SWP. Additionally, in collaboration with the BDO, O&M EAB, and OCO, monitoring data are used to further develop the "early warning" system that provides *advance notice* to Delta water users of possible drinking water quality problems. Monitoring data are collected by two different monitoring strategies; 1) discrete grab samples, and 2) continuous real-time monitoring via remotely located instrumentation. This section focuses on discrete or 'grab sample' monitoring for January-December 2019. Section 6.1 focuses on continuous, remote real-time monitoring.

The discrete monitoring program underwent major revisions for 2019. The twelve stations that are part of MWQI's long-term, routine monitoring program (Section 5.1) continue, but the short-term monitoring projects have changed. Table 4 lists all sites that have been discontinued, changed, or added this year. Completed in December 2018 were the Cache Slough Complex Pre-Restoration Monitoring Project and the Delta Simulation Model 2 (DSM2) Nutrient Monitoring Project, which both began in 2013. Two new, but related, projects have been added in their place. These new projects are described in section 5.2.

See Table 5 for the full list of 2019 monitoring locations with associated analytes, and see Figure 2 for the discrete and real-time sampling sites map. Table 6 lists the routine and special project discrete grab sample deliverables and timelines.

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**Table 4. Discontinued, Changing, and New Sampling Sites for 2019.**

<b>Discontinued:</b>		
Station Name	Project	Reason
Mokelumne River at Benson Ferry	DSM2 Nutrient	There are safety concerns about site access. The site is also too close to the mouth of the Cosumnes River which can negatively affect representativeness. A replacement site has been added to address these concerns.
Sacramento River at Westin Boat Dock	DSM2 Nutrient	Upstream sites—Sac River at West Sac Intake, NEMDC, and American River—can be used to calculate conditions at Westin which makes sampling this site unnecessary.
Wildlands	Cache Slough Complex	Study goals met. We will continue monitoring Liberty Cut which is representative of Wildlands.
Shag Slough @ Liberty Is bridge	DSM2 Nutrient and Cache Slough Complex	Study goals met. We will continue monitoring Liberty Cut which is representative of Shag Slough.
Miner Slough at Highway 84 bridge	Cache Slough Complex	Study goals met. We will continue monitoring Miner Slough below Prospect Island which is representative of Miner at Highway 84.
Sacramento Deepwater Ship Channel	Cache Slough Complex	Study goals met. We will continue monitoring Cache Slough at Ryer Island which is representative of Sacramento Deepwater Shipping Channel.
<b>Changing:</b>		
Sacramento River at Mallard Island	Routine and DBIM	We will no longer collect at the Mallard Station, but the EMP will collect this sample mid-channel on their monthly water quality boat run. This change is part of the DES monitoring efficiency project.
Old River at Bacon Island	Routine	We will no longer collect at Bacon Island, but the EMP will collect a sample mid-channel on their monthly water quality boat run. This change is part of the DES monitoring efficiency project.
San Joaquin River nr Vernalis	Routine and DBIM	We will continue sampling at this location but will also be collecting the Vernalis sample for the EMP program as part of the DES monitoring efficiency project.
<b>New Sites:</b>		
Old River at Clifton Court	EMP Compliance Monitoring	We are taking over this site from DWR's Environmental Monitoring Program as part of the DES monitoring efficiency project.
Mokelumne River at New Hope Road	DBIM	This site is replacing Benson's Ferry site. It is upstream of that location which should remove the seasonal influence of the Cosumnes River on the quality of the sample.
Cosumnes River at Twin Cities Road	DBIM	During the dry season, the Cosumnes River operates as a slough as there are limited to no flows contributed to the Delta. This new site will be monitored only when Cosumnes River is contributing sufficient flow downstream.
Cache Creek at Yolo Bypass	Cache Slough Complex	Cache Creek inputs to the Yolo Bypass will be monitored during storm events that result in sufficient flows.
Putah Creek at Mace Blvd.	Cache Slough Complex	Putah Creek inputs to the Yolo Bypass will be monitored during storm events that result in sufficient flows.
Ulatis Creek at Cache Slough	Cache Slough Complex	Ulatis Creek inputs to the Cache Slough will be monitored during storm events that result in sufficient flows.
Willow Slough at County Road 102	Cache Slough Complex	Willow Slough inputs to the Yolo Bypass will be monitored during storm events that result in sufficient flows.



Municipal Water Quality Investigations Program, January – December 2019 Work Plan

**Table 5. MWQI Program’s Discrete and Grab Sampling Stations**

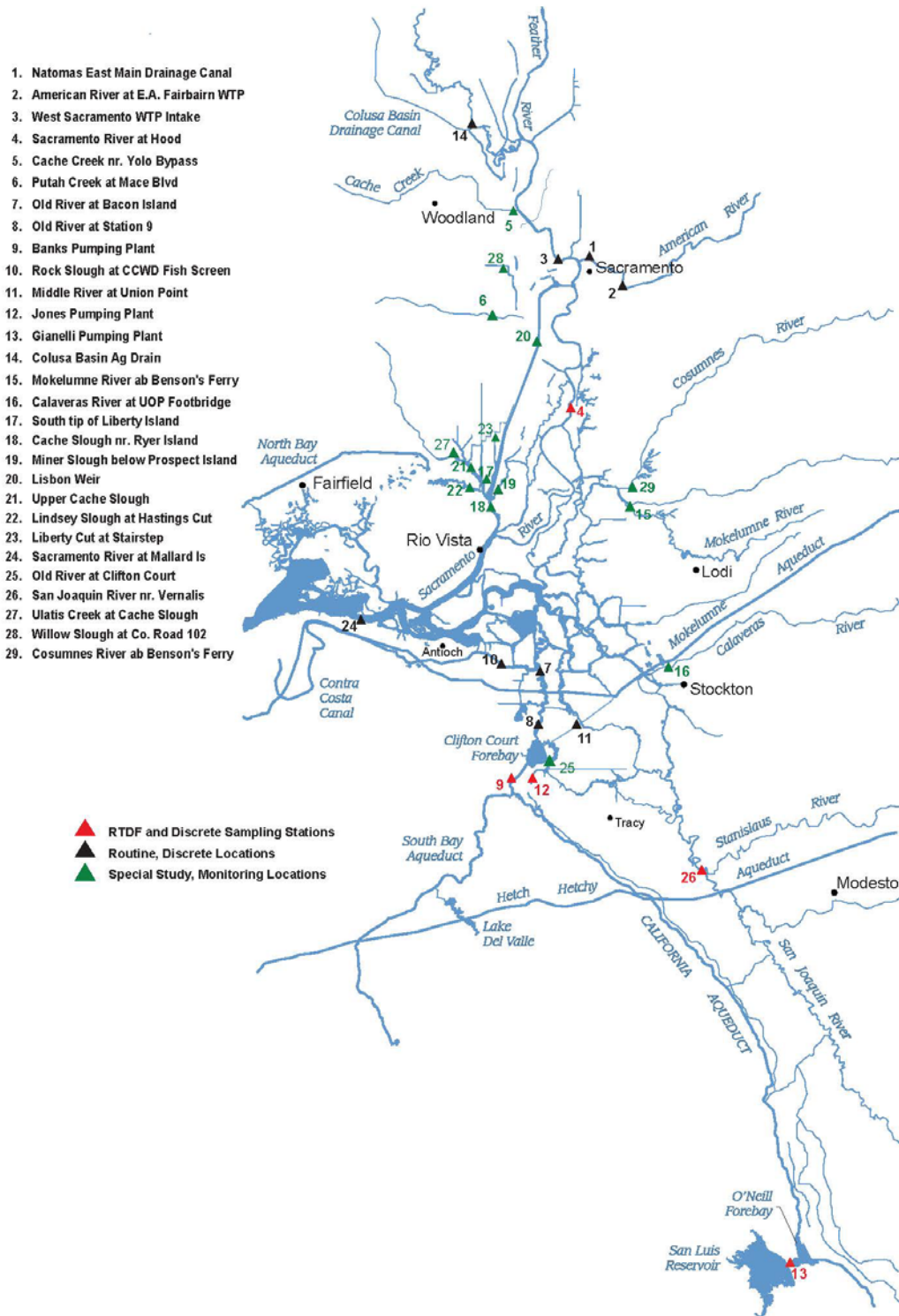
#	Stations	WDL Stations (ID)	Analytes Collected	Frequency	Study
1	Natomas East Main Drainage Canal	NATOMAS EMDC at EL CAMINO RD (A0V83671280)	Std. Mineral, nutrients, TOC, DOC, bromide, chlorophyll, metals	Monthly	Routine
2	American River at E.A. Fairbairn WTP Intake	American River at W.T.P. (A0714010)	Std. Mineral, nutrients, TOC, DOC, bromide, chlorophyll	Monthly	Routine
3	Sacramento River at West Sacramento WTP Intake	Sacramento River at W. Sac Intake Structure (A0210451)	Std. Mineral, nutrients, TOC, DOC, bromide, chlorophyll	Monthly	Routine
4	Sacramento River at Hood	Sacramento R A Hood (B9D82211312)	Std. Mineral, nutrients, TOC, DOC, bromide, chlorophyll	Monthly	Routine, RTDF
5	Cache Creek at Yolo Bypass	TBD	Std. Mineral, nutrients, TOC, DOC, bromide, chlorophyll	Flow Based, Monthly	DBIM
6	Putah Creek at Mace Blvd	Putah C SF A Liberty Is Rd (A0910500)	Std. Mineral, nutrients, TOC, DOC, bromide, chlorophyll	Flow Based, Monthly	DBIM
7	Old River at Bacon Island (D28A)	Old River @ Rancho Del Rio B9D75821344	Std. Mineral, nutrients, TOC, DOC, bromide, chlorophyll (EMP collecting)	Monthly	Routine
8	Old River at Station 9	Old R. nr. Bryon (St 9) (NEAR HWY 4) (B9D75351342)	Std. Mineral, nutrients, TOC, DOC, bromide, chlorophyll	Monthly	Routine
9	Banks Pumping Plant at Headworks	Delta P.P. Headworks at H.O. Banks PP (KA000331)	Anions, TOC, DOC (MWQI); Std. Mineral, turbidity, UVA, TOC, DOC, bromide, total phosphorous, total suspended solids, phytoplankton, purgeable organics, taste and odor (MIB & geosim), asbestos, and radiological, pesticides and herbicides (O&M collecting)	Monthly; Monthly or quarterly	Routine, RTDF
10	Rock Slough at CCWD Fish Screen	Contra Cost Canal at Rock Slough Fish Screen (B9C75861385)	Std. Mineral, nutrients, TOC, DOC, bromide, chlorophyll	Monthly	Routine
11	Middle River @ Union Point	Middle River A Union Point (B9D75351292)	Std. Mineral, nutrients, TOC, DOC, bromide, chlorophyll	Monthly	Routine
12	Jones Pumping Plant at DMC	Delta Mendota Canal intake at Jones PP (B9C74781351)	Anions, TOC, DOC	Monthly	RTDF
13	Gianelli Pumping/Generating Plant	Gianelli WQ Station nr. Pumping Plant (ON003050)	Anions, TOC, DOC	Monthly	RTDF
14	Colusa Ag Drain nr. Sacramento River	Ag Drain on Colusa Basin Main Drain (A0294500)	Std. Mineral, nutrients, TOC, DOC, bromide, suspended solids, chlorophyll	Monthly	Routine

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#	Stations	WDL Stations (ID)	Analytes Collected	Frequency	Study
15	Mokelumne River @ New Hope Road	MOKELUMNE R A NEW HOPE-GALT RD (B9D81421251)	Std. Mineral, nutrients, TOC, DOC, bromide, suspended solids, chlorophyll	Monthly	DBIM
16	Calaveras River @ UOP Footbridge	Calaveras R @ UOP (B9D75851208)	Std. Mineral, nutrients, TOC, DOC, bromide, suspended solids, chlorophyll	Flow Based, Monthly	DBIM
17	Southern tip of Liberty Island	S. Liberty Is. (B9D81461410)	Std. Mineral and nutrients, TOC, DOC, suspended solids, chlorophyll	Monthly	Cache Complex
18	Cache Slough nr Ryer Island	Cache Sl nr. Ryer Is (B9D81281401)	Std. Mineral and nutrients, TOC, DOC, suspended solids, chlorophyll	Monthly	Cache Complex
19	Miner Slough below Prospect	Miner Sl below P (B9D81410400)	Std. Mineral and nutrients, TOC, DOC, suspended solids, chlorophyll,	Monthly	Cache Complex
20	Lisbon Weir (Yolo Bypass East Toe Drain)	YOLOBYLISBON (B9D82851352)	Std. Mineral and nutrients, TOC, DOC, suspended solids, chlorophyll (AES collected)	Monthly	Cache Complex
21	Upper Cache Slough	Upper Cache Sl (B9S81841416)	Std. Mineral and nutrients, TOC, DOC, suspended solids, chlorophyll	Monthly	Cache Complex
22	Lindsey Slough at Hastings Island Bridge	Lindsey Sl. at Bridge (B9D81481421)	Std. Mineral and nutrients, TOC, DOC, suspended solids, chlorophyll,	Flow Based, Monthly	Cache Complex
23	Liberty Cut at Stair-step	LibertyCut at StairStep (B9D82011400)	Std. Mineral and nutrients, TOC, DOC, suspended solids, chlorophyll,	Monthly	Cache Complex, DBIM
24	Sacramento River @ Chipps Island- D10 (Replaces Mallard Island-D10A)	Sacramento River at Chipps Island- D10 B9D80281551	Std. Mineral, nutrients, TOC, DOC, bromide, chlorophyll (EMP collecting)	Monthly	Routine, DBIM
25	Old River at Clifton Court	West Canal at Clifton Court FB Intake (B9D74971331)	Std. Mineral, nutrients, TOC, DOC, bromide, chlorophyll	Monthly	EMP
26	San Joaquin River near Vernalis	San Joaquin R. nr. Vernalis (B0702000)	Std. Mineral, nutrients, TOC, DOC, bromide, chlorophyll	Monthly	Routine, RTDF, DBIM, EMP
27	Ulatis Creek at Cache Slough	Cache Slough @ Vallejo P.P (B9D81781448 or TBD)	Std. Mineral, nutrients, TOC, DOC, bromide, chlorophyll	Flow Based, Monthly	Cache Complex
28	Willow Slough at County Road 102	(TBD)	Std. Mineral, nutrients, TOC, DOC, bromide, chlorophyll	Flow Based, Monthly	DBIM

- 1 Mallard Island is a monthly routine monitoring location, but for the DSM2 Nutrient study samples are collected every two weeks.
- Physical Parameters collected at all sites: Temperature, pH, Turbidity, Dissolved Oxygen, and Specific Conductance
- Standard Mineral analysis includes: Ca, Mg, Na, K, B, Alkalinity, Chloride, Bromide, Nitrate, Sulfate, Dissolved Solids, Specific Conductance, Standard Nutrient analysis includes: Nitrate + Nitrite, Ammonia, Organic Nitrogen and Ammonia, Total Phosphorus (unfiltered), and Orthophosphate
-

**Figure 2. MWQI Discrete and RTDF Monitoring Locations, CY 2019**



## **5.1 Routine Monitoring Program**

Collection at long-term, routine monitoring locations remains unchanged from the previous work plan. The only difference being that two of the sites, Sacramento River at Mallard Island and Old River at Bacon Island, will be collected by the Environmental Monitoring Program (EMP) instead of MWQI, as part of the DES Monitoring Efficiency Project. For RTDF station quality control (Sec. 6), discrete samples are collected once per month at the Banks Pumping Plant, Jones Pumping Plant, Gianelli Pumping Plant, and Hood and Vernalis river stations. These river and canal samples are collected to examine instrument performance but can also be used as discrete data representative of the sample location. Discrete sample data are available through DWR's Water Data Library (WDL). Deliverables and timelines associated with discrete sample collection are shown in Table 6.

## **5.2 Short-term Monitoring**

Aside from MWQI's routine monitoring, other samples are collected for short-term monitoring projects. These projects are described below.

### **5.2.1 Delta Boundary Inputs Monitoring**

*Principle Investigator – Steven San Julian*

*Project Partners – Hari Rajbhandari & Leslie Palencia*

The Delta Simulation Model 2 (DSM2) nutrient monitoring study ended in December 2018, but continued and refined monitoring at some locations is justified to fill data gaps. Therefore, MWQI will monitor some sites on a monthly time step, and other sites seasonally based on the stream's calculated flow contribution. The data will be useful for MWQI and contractor analysis and also be available for further DSM2 model development. Sites monitored for this study will be:

- Sacramento River at Hood (monthly)
- Mokelumne River at New Hope Road (monthly)
- San Joaquin River near Vernalis (monthly)
- Sacramento River near Mallard Island (monthly)
- Liberty Cut in Yolo Bypass (monthly)
- Cosumnes River at Twin Cities Rd? (sampled only when flow threshold met)
- Calaveras at UOP (sampled only when flow threshold met)

The need for this continued monitoring will be re-assessed each year at the time of new workplan development. The Delta Boundary Inputs Monitoring project deliverables and timelines for the memorandum report are shown in Table 6.

### **5.2.2 Cache Slough Complex, Stage 2 Monitoring**

*Principle Investigator – Steven San Julian*

*Project Partners – Justin Pascual and Leslie Palencia*

In December 2018, Cache Slough Complex baseline monitoring ended after about 5 years of twice monthly sampling. The original study goals were: 1) to describe water

quality conditions in the Complex prior to restoration occurring, and 2) determine if an existing tidally restored site (Wildlands) increased concentrations of constituents of concern in the Complex. Although, these questions have been answered, other questions have grown out of this study. In Stage 2 monitoring, we will be adjusting monitoring to meet the new study goals. The new goals are 1) determine where/what occurs in the west side stream watersheds that results in seasonal spikes in concentrations of key constituents, and 2) to continue to grow the database of data in the Cache Slough Complex over the next year, albeit on a smaller scale than conducted previously. See Figure 2 for map of locations and Table 5 for the constituent list.

Aside from Stage 2 Cache Slough monitoring, there are discussion about producing a report on the 2013-2018 Cache Slough data findings. At the time of workplan development, no decision has been made on if a report will be written, what the report will entail, or by who. This will be decided over the next few months and will be addressed in RTDF meetings.

The Cache Slough Complex Study deliverables and timelines are shown in Table 6.

### **5.2.3 Endothall Monitoring**

*Project Partners – Steven San Julian (MWQI) & Leslie Palencia (SWC)*

MWQI collaborated with O&M and the MWQI SPC to monitor Endothall at Clifton Court Forebay and O'Neil Forebay in 2018. Applications in the SWP have been effective in treating aquatic vegetation, but Endothall degradation is complex and affected by environmental conditions. If Endothall does not breakdown, it may adversely affect human health. The drinking water MCL for Endothall is set at 0.1 mg/L.

Therefore, monitoring is planned to assess chemical degradation in the treatment forebays and adjacent waterways. O&M has tentative plans to treat again in 2019. If treatment occurs, MWQI plans to support O&M monitoring efforts by supplying field staff, autosamplers, and other resources, as needed.

**Table 6. Routine and Special Project Discrete Sample Deliverables and Timelines**

Deliverables	Participants	Start Date	Estimated Completion Date
Records of monthly and bi-weekly monitoring data.	MWQI	N/A	Currently available upon request
Records of periodic calibration of field monitoring equipment	MWQI	N/A	Currently available upon request
Records demonstrating consistent and timely application of QA/QC procedures	MWQI	N/A	Currently available upon request
Timely analysis and posting of results to the WDL	MWQI	N/A	Monthly, available on-line
Delta Boundary Inputs Monitoring	MWQI	January 2019	Reassess Dec 2019
Cache Slough Complex, Stage 2 Monitoring	MWQI	January 2019	Reassess Dec 2019
Cache Slough Complex, Stage 1 Report	TBD	TBD	TBD
Conduct Endothall Treatment monitoring	O&M EAB, MWQI	TBD	TBD

## **6 REAL-TIME DATA AND FORECASTING COMPREHENSIVE PROGRAM**

The RTDF-CP focuses on providing real-time water quality data and related information gathered from multiple sources. This enables water managers to make operational decisions based on observed and forecasted changes in water quality. The RTDF-CP includes a network of real-time water quality monitoring stations that provide current water quality conditions, and a modeling component that provides both historical and predictive water quality characterizations. Monitoring performed by the RTDF-CP encompasses the Delta, watersheds of the Delta, the SWP, and portions of the federal Central Valley Project (CVP). In addition, funded positions within the MWQI Program are also found within DWR’s BDO, OCO, and O&M Environmental Assessment Branch.

### **The RTDF-CP Consists of Three Principle Activities:**

1. Remote instrumentation that provides real-time water quality data
2. Modeling that provides historical water quality fingerprints and water quality forecasting
3. Information management and data dissemination

Real-time monitoring, forecasting and data dissemination activities are guided by the RTDF Steering Committee, a group of technical experts composed of MWQI Program staff, CCWD staff and participating MWQI SPC agencies.

## **6.1 Real-Time Monitoring**

The real-time monitoring section of the RTDF-CP produces water quality data that supports the development of water quality forecasting tools, provides current and advanced notice of water quality conditions, provides information for water quality and water supply planning studies, and can be used by drinking water treatment plant operators to make informed operational decisions.

This program element is comprised of:

1. Instrumentation installed at key remote locations in and around the Delta.
2. Field operations that provide timely repair and maintenance of all station equipment.
3. Timely dissemination of real-time data.
4. Standard Operating Procedure documentation and instrument QA/QC documentation.
5. Implementation and documentation of data QA/QC.

### **6.1.1 MWQI Program Real Time Stations**

The RTDF-CP continues to operate five remote real-time monitoring stations; four located in the Delta and one south of the Delta (Table 7). The Delta stations include Hood, located on the Sacramento River near the town of Hood, Banks Pumping Plant, located at the head of the SWP, Jones Pumping Plant, located at the head of the Delta-Mendota Canal (part of the CVP) and Vernalis, located on the San Joaquin River near the town of Vernalis. The southern station, at Gianelli Pumping Plant, is located within O&M's San Luis Field Division on O'Neill Forebay below San Luis Reservoir. Table 8 summarizes the tasks associated with these real-time monitoring stations.

Table 7 summarizes station locations, MWQI Program and non-MWQI Program water quality parameters, and the automated analyzers used by the MWQI Program RTM element. Figure 2 shows the location of the RTM stations.

Field office labor associated with real-time monitoring (RTM) includes:

1. Ordering RTM supplies, phone consultation with instrument manufacturers
2. Creation of RTM Quality Control (QC) sampling runs
3. Creation of instrument-specific chemical standards, solutions and reagents
4. Repairs to station peripheral components
5. Maintenance of equipment used on RTM field runs
6. Analysis of all RTM data
7. Remote operation of instruments.

**Table 7. MWQI Program Real-Time station locations, parameters, and equipment**

MWQI Program Station/CDEC Station	MWQI Program Parameters & Instruments	Non-MWQI Program Parameters
Sacramento River at Hood (CDEC = SRH)	TOC, DOC (Suez, Sievers 900)	Water: chlorophyll, EC, DO, pH, temperature and turbidity. Atmospheric: solar radiation, temperature, wind speed and direction.
San Joaquin River near Vernalis (CDEC = SJR)	TOC, DOC (Suez, Sievers 5310) bromide, chloride, nitrate, sulfate, (Thermo-Fisher Dionex ICS-2100)	Water: chlorophyll, DO, EC, pH, river flow and stage, temperature and turbidity. Atmospheric: solar radiation, temperature, wind speed and direction
Banks Pumping Plant - Delta Headworks (CDEC = HRO)	TOC, DOC (Suez, Sievers 5310), bromide, chloride, nitrate, sulfate, (Thermo-Fisher Dionex ICS-2100)	Water: EC, fluorescence, pH, pump discharge, temperature, turbidity Atmospheric: temperature, wind speed and direction.
Jones Pumping Plan (CDEC = TRP)	TOC, DOC, (Suez, Sievers 5310), bromide, chloride, nitrate, sulfate, (Thermo-Fisher Dionex ICS-2100)	Water: EC, pump discharge, temperature.
Gianelli P/G Plant (CDEC = ONG)	TOC, DOC (Suez, Sievers 5310), EC, temp, turbidity, DO, pH (YSI 6600) bromide, chloride, nitrate, sulfate (Thermo-Fisher Dionex ICS-2100)	Pump and Generation discharge

**6.1.2 Gianelli WQ Station**

To track time and expenditures related to the Gianelli water quality station, a separate IO was created (VGIANNELLI13). Most of the funding for this station goes toward the salary of an Environmental Scientist position held within the O&M EAB (Environmental Assessment Branch). Responsibilities for this position are similar to those at the MWQI stations.

**Table 8. Real-Time Monitoring Tasks**

Deliverable	Participants	Estimated Start Date	Estimated Completion Date
Continue operation of automated stations at Hood, Banks, Jones, Vernalis, and Gianelli	MWQI Program, O&M Water Quality	Ongoing	Ongoing
A) Update SOPs: documenting maintenance, operation and QA/QC of all in-situ equipment.	MWQI Program, O&M Water Quality	N/A	A) Ongoing
B) Continue to work towards standardizing, streamlining, and consolidating DWR's in-situ equipment, data quality control, and data dissemination.	MWQI Program, O&M Water Quality, North Central Regional Office, and IEP	N/A	B) Ongoing
Evaluate the need and planning for other installations per the RTDF-CP (together with RTDF Steering Committee).	RTDF SC	Jul 2008	Ongoing



## **6.2 RTDF-CP Water Quality Forecasting**

The modeling/forecasting component of the RTDF-CP continues to update and improve existing models to further develop their capabilities. The objective of this effort is to better incorporate modeling insight with water quality monitoring to maximize the use of modeling results by water quality managers.

The modeling effort continues to focus on Historical representations (fingerprints), Short-Term Aqueduct Forecasts and Seasonal Forecasts. These efforts are scheduled to continue through this work plan cycle.

### **6.2.1. BDO Modeling**

BDO staff, the model mechanics, periodically work on MWQP/RTDF model issues and special projects as needed. They will continue to be involved when model issues arise, and the models require adjustment. (This includes potential work to incorporate aqueduct turn-in water into the seasonal and short-term aqueduct models. The goal being to see how model output is affected by this water.) New projects may also be added to this task, with further discussion between MWQP staff and the MWQI SPC. The MWQI SPC will work with BDO staff to discuss the feasibility of a new project on Delta Salinity Constituents Relationships, which is a continuation of work previously conducted by the MWQI SPC on developing constituent relationships between salinity, and chloride, and bromide. Other areas where assistance from BDO may be needed are technical input into a MWQI SPC project on Improving Seasonal Forecasts (Project 6.2.4) and possibly developing a volumetric fingerprint for the Aqueduct model (Project 6.2.3).

### **6.2.2. OCO Modeling**

OCO staff, the model operators, continue to produce seasonal forecasts, short-term aqueduct forecasts and monthly historical fingerprints. Working with the BDO modelers, if need be, they continue to update and work on improving model reliability. (Since OCO staff run the models, they will also be involved with turn-in water model dynamics and work to incorporate this data.) OCO will provide a justification for alternative method for forecasting DOC (short-term) and will complete additional calibration with more DOC data.

### **6.2.3. Improve Aqueduct Pump-in Dynamics in the MWQI Program Water Quality Forecasts**

*Principal Investigator – OCO Staff Member (TBD) and MWQI Program Staff (TBD)*  
*Project Partner – Tony Liudzius*

Although the original intention of this project was to incorporate pump-ins into the short-term and seasonal forecasts, it is desired to allocate additional effort into running the Aqueduct model with historical pump-ins first. In 2018, OCO provided Aqueduct model results at checks 25, 29, 41 and 66 with and without pump-ins for bromide and EC using 2014 historical data. For this 2019 workplan, it is desired that OCO continue running

the Aqueduct model with additional historic data (ie 2012 to 2018) and additional constituents like nitrate, chromium and arsenic.

The project will also include developing a protocol so that pump-in data is transferred on a regular basis to OCO, such that OCO will continuously update the historical aqueduct simulation to include pump-ins (updated monthly, analogous to the historical Delta simulation).

#### Short-Term Forecasts

Interested SWP contractors and MWQI Program staff will investigate whether scheduled near-term aqueduct pump-in (defined here as less than 2 months) data is available and whether obtaining this information on an ongoing basis is feasible. If this information is available, the effort will include establishing procedures for acquiring the information and determining if any support tools are needed to help automate and process the data. The goal would be to include accurate, up-to-date pump-in information in the MWQI Program short-term water quality forecasts.

#### Seasonal Forecasts

This task is the same as described above except that the desired pump-in information will be for the current year (or slightly longer) in order to conform to the timeframe used in the seasonal water quality forecasts.

#### **6.2.4. Comparison of Water Quality Forecasts to Actual Conditions**

The original intention of this project was to improve the accuracy of the long-term forecasts, as the forecasts do not match well with actual conditions, particularly the earlier forecasts. The MWQI SPC has decided to retain a consultant to investigate sources of uncertainty in order to possibly improve seasonal forecast results. Technical support may be needed from both BDO and OCO.

### **6.3 RTDF-CP Information Management and Data Dissemination**

This program element includes data dissemination and information management tasks associated with the synthesis of real-time data and related information that is derived from the RTDF-CP and a variety of federal and state water quality monitoring programs. The element produces, gathers, organizes and disseminates this information via the WDL (<http://wdl.water.ca.gov/>), the California Data Exchange Center (CDEC) (<http://cdec.water.ca.gov/>) and the RTDF-CP web page:

<https://water.ca.gov/Programs/Environmental-Services/Water-Quality-Monitoring-And-Assessment>

In addition, daily and weekly summary emails containing a subset of information including real time data, Delta commentary, weather updates and hydrological conditions are sent to interested parties. (This information is also posted on the RTDF-CP web site.) Information provided on the RTDF-CP web page gives users a single location to search for related water quality information.

### **6.3.1. RTDF Data Dissemination and Reporting**

Information management and data dissemination tasks performed by MWQI and the Technical Consultant, TetraTech include:

1. Continued refinement of the WDL data set
2. Continued refinement of the MWQI Program database
3. Continued development and enhancement of online tools for editing, evaluating, and interpreting MWQI Program water quality data (QA/QC and data visualization).
4. Improve means to distribute daily and weekly water quality reports via the internet
5. Improve database functionality

Tasks for the data dissemination portion of the RTDF program are shown below in Table 9.

### **6.4 Addition of YSI EXO Sondes to Real-Time Water Quality Stations**

To further enhance the capabilities of the real-time monitoring program, the RTDF section will be installing YSI EXO sondes at the Banks, Jones, and Gianelli water quality monitoring stations. FDOM sensors will be provided to another section (the DWR Environmental Monitoring Program Section) to monitor this consistent at the other two stations, Sacramento River at Hood and San Joaquin River at Vernalis. The YSI EXO sondes instruments will measure algal concentrations. Algal blooms can cause problems for drinking water contractors, so monitoring will give treatment facilities an early warning when algal concentrations begin to increase. Besides FDOM, the sondes will also provide turbidity and any other constituent of interest that the probes are capable of monitoring, such as pH, dissolved oxygen, and specific conductance. The cost of the five YSI XO2s that were purchased is \$100,000, the remaining \$50,000 in OE&E will be held in reserve for probes or other equipment purchases that are deemed necessary.

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**Table 9. Information Management and Data Dissemination Deliverables and Timelines**

Task	Participants	Start Date	Ongoing
<p>Improve/Upgrade database infrastructure</p> <p>A) Continue to implement updates and patches as appropriate.</p> <p>B) Continued enhancement of manual and automated QA/QC processes</p> <p>C) Continue to develop the station journal database and applications.</p> <p>D) Continue to develop desktop data management tools, enhance plotting capabilities, link time series and QA/QC.</p> <p>E) Continue to document and maintain infrastructure.</p> <p>F) Add new sensors to the database as needed</p>	MWQI Program	<p>A) Began Jan 2009</p> <p>B) Began Jan 2009</p> <p>C) Began Jan 2010</p> <p>D) Began Jan 2010</p> <p>E) Began Jul 2009</p> <p>F) Began Jan 2010</p>	<p>A) Ongoing</p> <p>B) Ongoing</p> <p>C) Ongoing</p> <p>D) Ongoing</p> <p>E) Ongoing</p> <p>F) Ongoing</p>
<p>Improve Field Data Communications</p> <p>A) Continue to develop, test and enhance intranet/ internet components.</p> <p>B) Develop and implement as feasible procedures, practices and standards for supporting the reliability of field data systems.</p>	MWQI Program	<p>A) Began Jan 2011</p> <p>B) Began Jul 2011</p>	<p>A) Ongoing</p> <p>B) Ongoing</p>
<p>Development and enhancement of RTDF data dissemination products</p> <p>A) As needed, add new stations &amp; sensors to the website or daily summary table.</p> <p>B) As needed, enhance the website presentation.</p> <p>C) Enhance procedures for emailing the daily summary report.</p>	MWQI Program	<p>A) N/A</p> <p>B) N/A</p> <p>C) N/A</p>	<p>A) Ongoing as needed</p> <p>B) Ongoing as needed</p> <p>C) Ongoing as needed</p>

## **7. SPECIAL STUDIES**

Although the special studies group has disbanded, the studies outlined below will be worked on this year by existing staff. Aside from the new, the FDOM study is being carried forward to the 2019 workplan.

### **7.1 Fluorescence of Dissolved Organic Matter (FDOM) Project**

*Principal Investigator – Jeremy Del Cid*

*Project Partner – Alex Rabidou/Justin Pascual/Steven San Julian*

The purpose of this project is to investigate the use of FDOM as a proxy for organic carbon measurements. Literature reviews have shown significant relationships between FDOM and DOC and it may be possible to use FDOM as a proxy for DOC measurements. For this project, a fluorometer (Turner Designs Cyclops 7) was installed on the SWP at the Banks Pumping Plant (Banks).

In Early 2016, the two FDOM studies were reorganized into a single study. Phase 1 of the FDOM study, was renamed the FDOM Interim Report, and Phase 2 was renamed the FDOM Final Report. The FDOM Interim Report covered data collected between July 2013 and July 2014 and was completed July 2016. This report investigated the relationships between FDOM and DOC, and FDOM and UVA254.

The FDOM Final Report, expands on the relationships investigated in the interim report and encompasses the full set of data collected between July 2013 and September 2015. The final report will expand on the correlation between FDOM and DOC by including unfiltered and 100 micron filtered water along with the 0.45 filtered samples collected during the initial study phase. Final report completion date is March 2019 to allow the study lead time to edit and finalize the draft report.

### **7.2 North Valley Regional Recycled Water Program**

*Principal Investigator – Travis Brown*

*Project Partner – Steven San Julian*

The Central Valley Regional Water Quality Control Board adopted a discharge permit in February 2016 that permits the cities of Modesto and Turlock to discharge up to 59,000 acre-feet of recycled tertiary treated waste-water into the Central Valley Project Delta Mendota Canal (DMC). The recycled water will be transferred to the Del Puerto Water District and to the Central Valley Project Improvement Act. The city of Modesto began discharging recycled water into the DMC in December 2017, while the city of Turlock will not start discharging into the DMC until late 2019. A monitoring study was implemented by the city of Turlock in December 2016 to assess if there are water quality effects as the result of the addition of recycled water into the DMC.

With the addition of the City of Modesto and the City of Turlock treated wastewater effluent being discharged directly into the Delta Mendota Canal, there is concern about the possibility of increased nutrient loading and resultant algal blooms downstream. The City of Turlock has reached an agreement with the SWC to monitor for

ammonia, nitrate, TKN, dissolved ortho P, total P, temp, EC, pH and DO at upstream and downstream locations of the discharge. They will also monitor for algal biomass, chlorophyll-a, pheophytin-a and algal toxins at McCabe and upstream of the discharge. For this project, DWR staff should evaluate the City of Turlock's data as well as data already collected by DWR at McCabe, Check 13, Gianelli and Pacheco. Questions to be answered are:

- Did concentrations of ammonia, nitrate, TKN, dissolved ortho P, total P, temp, EC, pH and DO change at the downstream location once Turlock began discharging in 2019? What are the baseline concentrations at the downstream location prior to start of Turlock discharge?
- Are the upstream and downstream locations statistically different for ammonia, nitrate, TKN, dissolved ortho P, total P, temp, EC, pH and DO, prior to Turlock discharge?
- Are the upstream and downstream locations statistically different for ammonia, nitrate, TKN, dissolved ortho P, total P, temp, EC, pH and DO, once Turlock discharge commenced?
- Have concentrations of algal biomass, chlorophyll-a, pheophytin-a and algal toxins changed at McCabe, Check 13, Gianelli and Pacheco once Turlock began discharging in 2019? What are the baseline concentrations at these locations prior to Turlock discharge?

A spreadsheet with the constituent graphs and a short summary of any notable data and trends will be provided to the contractors bi-annually.

### **7.3 Support for Nutrient Concerns**

*Principal Investigator – Mark Bettencourt*

*Project Partner – Shaun Philippart*

MWQI staff will investigate the feasibility of installing a real-time ammonia analyzer at the Sacramento River at Hood Station. This is an important location because Sacramento Regional Sanitation's (Regional San) WWTP outflow is just upstream of Hood and is a major contributor of ammonia into the Sacramento River. Regional San has been mandated to switch to tertiary treatment by 2021, which will greatly reduce the amount of ammonia entering the system. MWQI would like to establish a baseline ammonia level before the treatment process is switched to monitor any changes that may occur to North Delta water quality. MWQI staff will also investigate the feasibility of monitoring for phosphate at the San Joaquin River at Vernalis station due to the possibility that agricultural inputs upstream of the station may affect phytoplankton blooms in the southern Delta. MWQI staff will also look into equipment needed to monitor phosphorus using the Dionex at Banks.

### **7.4 Pesticide and Herbicide Use in the Delta**

*Principal Investigator – Arin Conner*

*Project Partner – Steven San Julian*

The increased use of chemicals to control floating and submerged vegetation in Delta waterways is of concern to downstream water contractors. This study will collect and

summarize historical pesticide and herbicide usage in Delta waterways from the Dept. of Boating and Waterways. Any chemical use trends based on location and or timing should be noted. Questions for the study could be:

- What locations had the highest annual usage of pesticides or herbicides (lbs. or gallons)?
- For locations with higher chemical usage, are the chemicals applied in certain months or seasons?
- Has aquatic vegetation been increasing in recent years?

Data may be best displayed graphically. This data will serve to confirm the increased use of pesticides and herbicides, as well as increased vegetative growth. The information will be presented to the contractors on annual basis to discern trends in pesticide and herbicide use.

## ***8. ADMINISTRATION WORK***

In general, time and budget expense that fall under the Administrative Work IO include repair and maintenance costs to office facilities; meetings, conferences and training attended by staff; and all non-project specific office duties that are billable to the MWQI program. First level program management costs (majority of Steve San Julian's time) are also billed here.

MWQI staff are occasionally requested to support other DWR activities. For example, staff may be asked to provide technical assistance, review and revise plans, or provide support that improves workplace safety practices. Such assistance may directly or indirectly benefit the MWQI Program stakeholders and the MWQI SPC, and therefore will be charged to the MWQI budget.

MWQI Program staff will continue to inform the RTDF Steering Committee and MWQI SPC about work related to these tasks. MWQI will achieve this through updates during the RTDF meetings, by providing details in this and future work plans, and through monthly expenditure reports.

## ***9. OTHER REQUIRED PROGRAM COSTS***

Other Required Program Costs are items not directly billed to MWQI program IOs. This includes Mobile Equipment Office charges and other costs that the MWQI program would be responsible to bear in the absence of other work.

Charges that MWQI is responsible to bear are unallocated labor hours and budget. The labor and money associated with this are available for work on other MWQI projects, non-MWQI funded projects (Section 10, below), and for the purchase of other equipment and supplies as required by the program. Any such expenditures will be addressed in RTDF meetings prior to allocation.

DWR's Mobile Equipment Office (MEO) provides insurance and fuel to support the vehicles used by the Field Support Section staff for their routine water quality assessment efforts. The MEO office staff will continue to support the MWQI Program by providing customer support through cost effective fleet management and maintenance of mobile equipment owned by DWR.

In addition to fuel & insurance, this cost allocation allows for the recommended annual services on each vehicle at 6K and 12K, for miscellaneous incidental costs (such as towing, flat repair, etc.), and includes an amount for catastrophic repairs that the older vehicles may require.

MEO expenditures are not assigned to any specific program element but are tracked and reported as MEO, line item 9.1, in the column entitled "Operating Equipment and Expenses" in Table 1, and on the monthly expenditure reports. These monthly expenditure report will be provided as handouts prior to the RTDF Steering Committee meetings.

In 2019, the MWQI Field Section plans to purchase a new, replacement truck, and a new replacement boat. MWQI's current truck has reached the end of its useful life (according to DGS guidelines) and therefore needs to be exchanged for a new, replacement truck. The current MWQI boat also meets the DGS guidelines for replacement, but the main justification for boat replacement is the need for a larger boat for MWQI's monitoring activities. The boat we currently possess is very small (~15 feet) and does not provide the space, or proper conditions for MWQI's monitoring activities. The new boat will be sized appropriately for our branch's work and to improve the safety of staff operating the field.

The process for such replacement can be lengthy but these funding was set aside in the 2018 CY with the hopes that the truck and boat would be replaced during that year. Although these items have "ordered" in the MEO system, in is not clear if the money will come out of our budget during 2018 or 2019. The RTDF Committee will be informed when information regarding this purchase is known. Estimated expenditure for these items are \$40,000 for a new truck, and \$90,000 for a new boat.

## ***10. NON-MWQI FUNDED PROGRAM***

Since DWR is a matrix management organization, staff may be requested to assist with supporting various DWR activities by providing technical support, data analysis, timely document and plan reviews, and may occasionally attend meetings. Some of these support activities are not funded by the MWQI Program budget. For example, the MWQI Program staff who assist with the turbidity transects will charge their work time to the respective program's budget, and not to MWQI funds.

The amount of work time that staff spend on non-MWQI funded activities is still limited, but has increased over the past few years and can impact MWQI workload. MWQI



## Municipal Water Quality Investigations Program, January – December 2019 Work Plan

Program staff members serve as DWR's technical drinking water quality experts. Work done on non-MWQI projects is beneficial to DWR and is indirectly beneficial to the MWQI stakeholders.