

**Municipal Water Quality Investigations Program
Work Plan
January - December 2021**

DRAFT WORK PLAN

State of California
Natural Resources Agency
DEPARTMENT OF WATER RESOURCES

Municipal Water Quality Investigations Program Work Plan January – December 2021

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List of Acronyms and Terms

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
EMP	DES Environmental Monitoring Program
FDOM	Fluorescence of Dissolved Organic Matter
FY	Fiscal Year
IC	Ion Chromatography
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
SOP	Standard Operating Procedure
SPC	Specific Project Committee
SWP	State Water Project
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 monitors and evaluates water quality in the Sacramento-San Joaquin Delta (Delta) to produce a comprehensive information base for State Water Contractors and other interested parties. MWQI generated data, incorporated with non-program data, are disseminated via daily and weekly reports at the Real-Time Data and Forecasting–Comprehensive Program (RTDF-CP) web site located at: <http://rtdf.info/>

DWR staff also represent MWQI interests when interacting with external organizations such as the State Water Resources Control Board (SWRCB), the Central Valley Regional Water Quality Control Board (CVRWQCB), the CVRWQCB's Nutrient Stakeholder and Technical Advisory Group (STAG) and the Delta Regional Monitoring Program (RMP).

Finally, MWQI staff support database infrastructure management, and the administration of essential program management activities mandated by DWR, including the development of quality assurance to ensure data are of a known and documented quality and efforts to ensure workplace health and safety.

2.2 MWQI Program – Program Partners

The MWQI Program has program partners who work in the Division of Operations and Maintenance's Environmental Assessment Branch (EAB) and the Operations Control

Office (OCO). The MWQI Program and its program partners use resource agreements to manage workloads, staff resources, and budgets across DWR Divisions. Each resource agreement (RA) is prepared, reviewed, approved, and kept on-file by the program managers involved in the agreement. Typically, the duration of a RA is one year, and agreements are renewed when workloads change. For this work plan cycle, MWQI Program has in place resource agreements that have been approved through fiscal year 2021-2022 (July 1, 2021 through June 30, 2022) for the following Program Partners:

O&M - Environmental Assessment Branch
OCO - Regulatory Compliance & Reporting

2.3 MWQI Program Core Elements

MWQI Program core elements will receive priority, though staff time may occasionally shift away from the work described in this work plan. Examples include work on the Delta Smelt cage study, biological monitoring, and D-1641 compliance monitoring. If it becomes apparent that core elements will be affected, adjustments will be made to keep the program moving forward.

Core elements of the MWQI Program include:

1. Water quality monitoring (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, safety and policy training, specific meetings and conferences).

3. PROGRAM FUNDING NEEDS

3.1 MWQI Funding Agreement and MWQI Specific Project Agreement

The MWQI Funding Agreement, signed by DWR, SWC, and MWQI SPC, provides the funding authority for the MWQI Program costs. MWQI Program costs include salaries and benefits of DWR staff, operating expenses and equipment, and DWR overhead expenses. These MWQI Program costs are funded through the annual statement of charges of the SWP Contractors participating in the MWQI Program. The MWQI Funding Agreement is in effect from January 1, 2020 to December 31, 2022, 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 are held in the MWQI SPC Account. 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 CY 2021 MWQI Program contract budget total is \$3.1 million, with \$2,434,620 assigned to the DWR MWQI Program, and the remaining portion for the MWQI SPC fund.

The estimated budget expenses for the 2021 work plan are shown in Table 1 and is followed by an explanation of MWQI Program expenditures in Table 2.

3.2 The 2020-21 California State Budget Crisis and MWQI Program budget cuts

In early 2020, the COVID global pandemic resulted in severe budget issues for the State of California. In July 2020, the State implemented a 2-day per month furlough program for all staff working under the MWQI workplan. The furlough will result in financial savings to the MWQI fund but will result in reduced production hours for program staff. In the 2020 workplan, staff had 1778 production hours per year. For the 2021 workplan, that number will drop to 1586 production hours. This may result in extended timelines for projects, reductions in scope for projects, and possible cancellation or postponement of activities that won't fit into the available staff time. This reduction also applies to DWR project partners staff. Resource Agreements are in place and provide 1 PY of OCO staff time and 0.6 PY for Division of O&M EAB. Given furlough reductions, available staff time for OCO will be 1586 hours, and 952 hours for O&M EAB.

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Table 1. January – December 2021 Program Element Costs for MWQI Program

Workplan Element	Program Element	2021 IO#	Labor Hours	Labor Cost	Contracts	OE&E	Total Cost
5	Water Quality Assessment						
5.1	Routine Monitoring Program	VWQASSMENT13	720	\$100,800		\$20,000	\$120,800
5.2	Short-term Monitoring	VWQASSMENT13	720	\$100,800		\$20,000	\$120,800
6	RTDF-Comprehensive Program						
6.1	RTM Stations	VRTMONITOR13	1502	\$210,280	\$61,000	\$267,606	\$538,886
6.2	RTM Office Tasks	VGIANNELLI13	918	\$128,520			\$128,520
6.3	RTM Distribution and Reporting	VRTDDISRPT13	768	\$107,520			\$107,520
6.4	RTDF Modeling	VRTOCOMODL13	1586	\$285,480			\$285,480
7	Special Studies						
7.1	FDOM Project	VFDOMPOCS013	37	\$5,180			\$5,180
7.2	North Valley Regional Recycled Water Program	VMWQSPCSTD19	56	\$7,840			\$7,840
7.3	Data Display and Review	VMWQSPCSTD19	60	\$8,400			\$8,400
7.4	Chlorophyll Study	VMWQSPCSTD19	24	\$3,360		\$27,000	\$30,360
7.5	Support of Nutrient Concerns	VMWQSPCSTD19	0	\$0			\$0
7.6	Endothall Monitoring Activities	VMWQSPCSTD19	87	\$12,180			\$12,180
7.7	QAPP Development and Update	VMWQSPCSTD19	150	\$21,000			\$21,000
8	Overhead Activities						
8.1	Administration Work	VDWRRQDDPC13	1980	\$277,200		\$48,000	\$325,200
8.2	Field Unit Office Work	VFUOFCWORK13	448	\$62,720		\$15,000	\$77,720
9	Other Required Program Costs						
9.1	MEO Insurance, Fuel, & Maintenance	n/a				\$5,000	\$5,000
9.2	In-Kind Services	VINKINDSER19	96	\$13,440			\$13,440
10	Non-MWQI Funded Activities	n/a	144	--	--	--	--
	Total		9,296	\$1,344,720	\$61,000	\$402,606	\$1,808,326

* 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 1.6 PY's for program partners in OCO and O&M. Hourly labor rates are estimated at: MWQI Program Staff - \$140; OCO Staff - \$180/hour; EAB Staff- \$130

3.3 Explanation of Program Element Costs for Work Plan Projects

Table 2 provides further detail on the planned 2021 OE&E and Contract expenses that are generally covered in Table 1.

Table 2. January – December 2021 MWQI Program Contract and Operating Expenses & Equipment (OE&E) Costs

Program element:		Description	Justification	Cost
5.1	WQ Assessment	Routine Monitoring Program - calibration equipment & consumables	required for sample collection and to meet QA guidelines	\$40,000
6.1	RTDF	MWQI Real Time Stations - equipment & filter replacement	consumables	\$70,000
6.1	RTDF	YSI replacement probes	consumables	\$50,000
6.1	RTDF	YSI new EXO sondes	end of life replacement, plus a few additional to meet new QA guidelines	\$50,001
6.1	RTDF	2 New Sievers M5310 TOC instruments	end of life replacement	\$60,000
6.1	RTDF	Thermo-Fisher service contract for 3 Dionex IC analyzers	Annual maintenance and repair	\$36,000
6.1	RTDF	MWQI Real Time Stations - Computer and Chromeleon Software upgrade	End of life replacement	\$37,605
6.1	RTDF	GE/Sievers - service contract for 4 organic carbon analyzers	Annual maintenance and repair	\$25,000
7.4	Special Studies	Chlorophyll Study- Contract Lab Analysis Costs	Study requires contract lab analysis for comparison to Turner and YSI algal sensors	\$27,000
8.1	MWQI Administration	meetings, conferences, training for MWQI staff	Conferences and training fees and per diem	\$40,000
8.1	MWQI Administration	4 new computers	Replaces old computers	\$8,000
8.2	Field Unit Office Duties	Facility Maintenance	Annual maintenance and repair	\$15,000
9.1	Mobile Equipment Office	Vehicle maintenance, fuel, and insurance		\$5,000
TOTAL Contract & OEE COSTS:				\$463,606

4 WORKLOAD ASSESSMENT

The workload assessment is a vital tool in managing staff workloads, project status, and impacts to the MWQI budget. A workload assessment is useful to determine if staff have enough work to be fully engaged, but not overallocated. This assessment covers 8 full-time staff in the MWQI Program, OCO and O&M. Due to the 2021 furloughs, this assessment assumes that full time staff have 1586 hours of production time available during the year (1778 if no furlough). The methodology to build the workload assessment in Table 3 has been refined this year to break staff time allocation down by month. This results in more resolution as to when during the year staff are over-allocated or have available time. This level of detail helps with planning but is too detailed for presentation in this document. Therefore, the data has been annualized, by staff, by project in Table 3.

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Table 3. Workload Assessment for CY2021

Work Plan Element	IO#	MWQP					Non-MWQP			Total Hours	Total PYs @1778 hrs
		Arin Conner	Travis Brown	Jeremy DelCid	Steven San Julian	Mark Bettencourt	O&M EAB- Chris Gray	OCO – Various Staff			
5.0 Discrete Monitoring											
5.1 Routine Monitoring Activities	VWQASSMENT13	240	240	240	0	0	0	0		720	0.4
5.1 Short-term Monitoring Activities	VWQASSMENT13	240	240	240	0	0	0	0		720	0.4
6.0 Real Time Data Forecasting											
6.1 RTM Stations	VRTMONITOR13	384	384	384	0	0	350	0		1502	0.8
6.2 RTM Office Tasks	VGIANNELLI13	192	192	192	0	240	102	0		918	0.5
6.3 RTM Distribution and Reporting	VRTDDISRPT13	48	48	48	0	576	48	0		768	0.4
6.4 RTDF Modeling	VRTOCOMODL13	0	0	0	0	0	0	1586		1586	0.9
7.0 Special Studies											
7.1 Fluorescence of Dissolved Organic Matter (FDOM)	VFDOMPOCS013	0	0	37	0	0	0	0		37	0.02
7.2 North Valley Regional Recycled Water Program	VMWQSPCSTD19	36	10	10	0	0	0	0		56	0.03
7.3 Data Display and Review	VMWQSPCSTD19	20	20	20	0	0	0	0		60	0.03
7.4 Chlorophyll Study	VMWQSPCSTD19	0	0	24	0	0	0	0		24	0.01
7.5 Support of Nutrient Concerns	VMWQSPCSTD19	0	0	0	0	0	0	0		0	0.00
7.6 Endothall Monitoring Activities	VMWQSPCSTD19	24	24	24	0	15	0	0		87	0.05
7.7 QAPP Development and Update	VMWQSPCSTD19	30	30	30	0	30	30	0		150	0.08
8.0 Overhead Activities											
8.1 Administration Work-- Training/meetings	VDWRRQDDPC13	120	120	120	1500	120	0	0		1980	1.1
8.2 Field Unit Office Work	VFUOFCWORK13	96	96	96	64	96	0	0		448	0.3
9.0 In Kind Services	VINKINDSER19	32	32	32	0	0	0	0		96	0.1
10.0 Non-MWQI funded Activities	n/a	48	48	48	0	0	0	0		144	0.1
Totals		1510	1484	1545	1564	1077	530	1586		9296	5.2

5 WATER QUALITY ASSESSMENT

Water quality assessment has been a key feature of the MWQI Program since its inception in 1990. MWQI's monitoring data are used by many groups, including DWR, 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 O&M EAB, and OCO, monitoring data are used to further develop an "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 2021. Section 6 focuses on continuous, remote real-time monitoring.

See Table 4 for the list of 2021 monitoring locations, with associated analytes, and Figure 2 for the discrete and real-time sampling sites map.

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Table 4. MWQI Program’s 2021 Discrete Sampling Stations

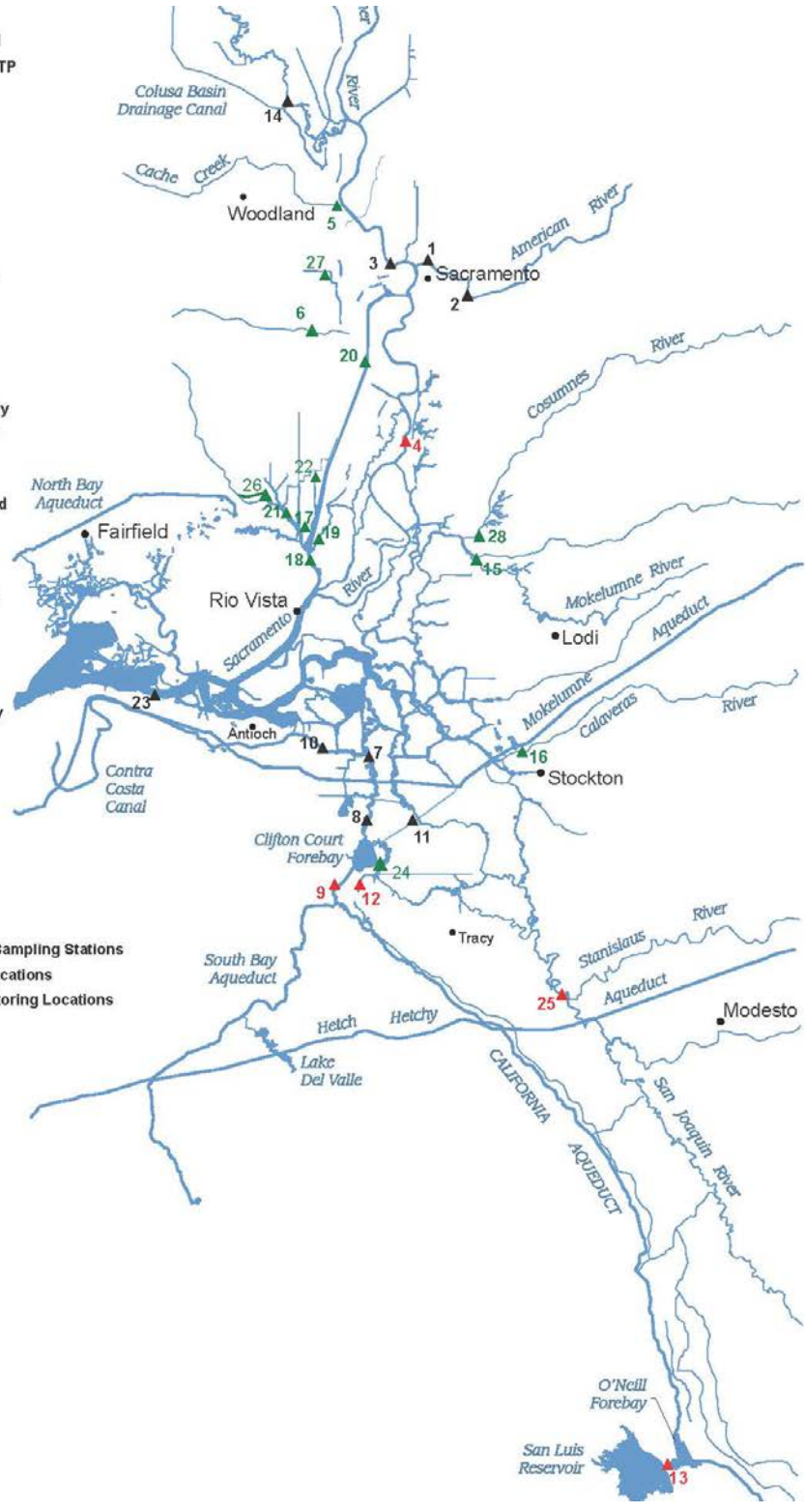
#	Stations Name	WDL Stations (ID)	Analytes Collected (W=Weekly, M= Monthly, Q=Quarterly, F=Flow Based, S=Seasonal)													Study			
			Std Minerals	Std Nutrients	TOC	DOC	Anions	Chlorophyll	Metals	PTOX Cyanobacteria	Total Suspended Solids	Purgeable Organics	Tate & Odor	Radiological	Pesticides		Herbicides		
1	Natomas East Main Drainage Canal	A0V83671280	F	F	F	F	F	F											Routine
2	American River at E.A. Fairbairn WTP Intake	A0714010	M	M	M	M	M	M											Routine
3	Sacramento River at West Sacramento WTP Intake	A0210451	M	M	M	M	M	M											Routine
4	Sacramento River at Hood	B9D82211312	M	M	M	M	M	M	M										Routine, RTDF
5	Cache Creek at Yolo Bypass	A30001	F	F	F	F	F	F											DBIM
6	Putah Creek @ Mace Blvd	B9D83141418	F	F	F	F	F	F											DBIM
7	Old River @ Rancho Del Rio (D28A) (EMP collecting)	B9D75821344	M	M	M	M	M	M											Routine
8	Old River at Station 9	B9D75351342	M	M	M	M	M	M											Routine
9	Banks Pumping Plant at Headworks (MWQI, O&M Collecting)	KA000331	M	M	M	M	M	M	M	S	M	M	W	Q	Q	Q			Routine, RTDF
10	Rock Slough at CCWD Fish Screen (NCRO collecting)	B9C75861385	M	M	M	M	M	M											Routine
11	Middle River @ Union Point	B9D75351292	M	M	M	M	M	M											Routine
12	Jones Pumping Plant at DMC	B9C74781351		M	M	M	M	M											RTDF
13	Gianelli Pumping/Generating Plant	ON003050		M	M	M	M	M											RTDF
14	Colusa Ag Drain nr. Sacramento River	A0294500	M	M	M	M	M	M			M								Routine
15	Mokelumne River upstream of Benson's Ferry	B2D81531267	M	M	M	M	M	M			M								DBIM
16	Calaveras River @ UOP Foot-bridge	B9D75891188	F	F	F	F	F	F			F								DBIM
17	Southern tip of Liberty Island	B9D81461410	M	M	M	M	M	M			M								Cache Complex
18	Cache Slough nr Ryer Island	B9D81281401	M	M	M	M	M	M			M								Cache Complex
19	Miner Slough below Prospect	B9D81410400	M	M	M	M	M	M			M								Cache Complex
20	Lisbon Weir (Yolo Bypass East Toe Drain) (AES Collecting)	B9D82851352	S	S	S	S	S	S			S								Cache Complex
21	Upper Cache Slough	B9S81841416	M	M	M	M	M	M			M								Cache Complex
22	Liberty Cut at Stair-step	B9D81971401	M	M	M	M	M	M			M								Cache Complex, DBIM
23	Sacramento River @ Chipps Island- D10 (EMP collecting)	B9D80281551	M	M	M	M	M	M			M								Routine, DBIM
24	Old River at Clifton Court (EMP collecting)	B9D74981334	M	M	M	M	M	M			M								EMP
25	San Joaquin River near Vernalis	B9D74051159	M	M	M	M	M	M	M		M								Routine, RTDF, DBIM, EMP
26	Cache Slough at Hastings Cut	B9S81761444	M	M	M	M	M	M			M								Cache Complex
27	Willow Creek at County Road 102	A82000	F	F	F	F	F	F			F								DBIM
28	Cosumnes River ab Benson Ferry	B1D81541262	F	F	F	F	F	F			F								DBIM

Physical Parameters collected at all sites: Temperature, pH, Turbidity, Dissolved Oxygen, and Specific Conductance

Figure 2. MWQI Discrete and RTDF Monitoring Locations, CY 2021

1. Natomas East Main Drainage Canal
2. American River at E.A. Fairbairn WTP
3. West Sacramento WTP Intake
4. Sacramento River at Hood
5. Cache Creek nr. Yolo Bypass
6. Putah Creek at Mace Blvd
7. Old River at Rancho Del Rio
8. Old River at Station 9
9. Banks Pumping Plant
10. Rock Slough at CCWD Fish Screen
11. Middle River at Union Point
12. Jones Pumping Plant
13. Gianelli Pumping Plant
14. Colusa Basin Ag Drain
15. Mokelumne River ab Benson's Ferry
16. Calaveras River at UOP Footbridge
17. South tip of Liberty Island
18. Cache Slough nr. Ryer Island
19. Miner Slough below Prospect Island
20. Lisbon Weir
21. Upper Cache Slough
22. Liberty Cut at Stairstep
23. Sacramento River at Chipps Island
24. Old River at Clifton Court
25. San Joaquin River nr. Vernalis
26. Cache Creek at Hastings Cut
27. Willow Slough at Co. Road 102
28. Cosumnes River ab Benson's Ferry

- ▲ RTDF and Discrete Sampling Stations
- ▲ Routine, Discrete Locations
- ▲ Special Study, Monitoring Locations



5.1 Routine Monitoring Program

Sampling at long-term, routine monitoring locations remains unchanged from the 2020 work plan. Monitoring continues at a monthly interval. For RTDF station quality control (Section 6), discrete samples are collected once per month at the Banks Pumping Plant, Jones Pumping Plant, Gianelli Pumping Plant, Hood, and Vernalis stations. These river and canal samples are collected to examine instrument performance and are also used as discrete data representative of the sample location. Discrete sample data are available through DWR's Water Data Library (WDL).

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

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. In 2021, MWQI will continue monitoring 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 above Benson's Ferry (monthly)
- San Joaquin River near Vernalis (monthly)
- Sacramento River near Mallard Island (monthly)
- Liberty Cut in Yolo Bypass (monthly)
- Cosumnes River above Benson's Ferry (sampled only when flow threshold met)
- Calaveras at UOP (sampled only when flow threshold met)

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, there are new questions worth exploring. In Stage 2 monitoring, which began in January 2019, we adjusted 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. Phase 2 Cache Slough monitoring will end on December 31, 2021. See Figure 2 for map of locations and Table 4 for the constituent list.

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 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

These three 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.

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 MWQI Program Real Time Stations

The RTDF-CP operates five remote real-time monitoring stations; four located in the Delta and one south of the Delta (Table 5). 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 5 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.

Table 5. 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) (Phosphate analyzer install for testing purposes. See 7.3)	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), YSI EXO Sonde (EC, Temp, DO, pH, FDOM, Algal Fluorescence) and Turner C3 Fluorometer (Algal Fluorescence)	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), and YSI EXO Sonde (EC, Temp, DO, pH, FDOM, Algal Fluorescence)	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), and YSI EXO Sonde (EC, Temp, DO, pH, FDOM, Algal Fluorescence)	Pump and Generation discharge

6.2 Real Time Station Office Activities

To track time and expenditures related to the office activities required to operate the real time stations, a separate IO is used to track this part of the program.

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.
8. Updating stations manuals, standard operating procedures, and quality assurance project plans

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: <http://rtdf.info/>

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.

RTDF Data Dissemination and Reporting

In this workplan the scope of activities being billed to this element has been expanded to better track all station lead responsibilities that directly relate to the creation and reporting of information to the RTDF committee. Aside from this, 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 6.

Table 6. Information Management and Data Dissemination Deliverables and Timelines

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

6.4 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 will continue to focus on Historical representations (fingerprints) and Short-Term Delta and Aqueduct Forecasts. These efforts are scheduled to continue through this work plan cycle.

OCO Modeling

OCO staff, the model operators, will continue to produce short-term aqueduct forecasts, short term Delta forecasts and monthly historical fingerprints. Paul Hutton presented a proposal for adding alkalinity to the short-term forecast suite of constituents to the contractors and OCO on November 18, 2020. Paul will work with OCO on the technical details of how to best model alkalinity and to evaluate the accuracy of the model. Discussion on how best to move this project forward will kick off in January 2021.

7. SPECIAL STUDIES

Studies that fall outside the scope of WQ Assessment and RTDF are outlined below and will be worked on this year by existing staff.

7.1 Fluorescence of Dissolved Organic Matter (FDOM) Project

Principal Investigator – Jeremy Del Cid

Project Partner –Justin Pascual/Steven San Julian

The goal of the study is to use FDOM as a proxy for organic carbon measurements. For current work, FDOM sensors have been installed at different locations to 1) determine how the FDOM responds to different water sources, 2) to determine how YSI FDOM probes compare to the *Turner* probe used in the 2020 FDOM Final Report, and 3) to build a regression equation between the FDOM and discrete data, which will be compared to the continuous organic carbon data. In 2020, staff worked with the DWR Environmental Monitoring Program on the installation of FDOM sensors at Hood and Vernalis. YSI FDOM probes had already been installed at Banks, Jones and Gianelli Stations. FDOM data from all five stations will be made available on CDEC. Due to delays in getting river site FDOMs installed, the data collection phase of the study is being extended through 2021. Final report is planned to be complete by June 2022.

7.2 North Valley Regional Recycled Water Program

Principal Investigator – Leslie Palencia

Project Partner – Arin Conner

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 wastewater 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 started discharging into the DMC in March 2020. 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. In 2021, one additional monitoring events will be scheduled.

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 phosphate analyzer at the Sacramento River, Hood Station. The analyzer uses a standard colorimetric method to determine phosphate levels. The analyzer has been installed but has not been

evaluated. Testing the analyzer at Hood is a logistical decision due to Hood's proximity to our main office. If the phosphate unit proves capable; calibrations, check standards and grab sample comparisons with Bryte lab will be done to verify that the analyzer is providing valid data. If validated, the instrument will be moved to the San Joaquin River at Vernalis station to collect data that will help determine if agricultural inputs upstream of the station affect phytoplankton blooms in the southern Delta.

7.4 Data Display and Review

Principal Investigator – Shaun Philippart
Project Partner – Steven San Julian

This project consists of two annual tasks, short-term modeling comparison and the generation of graphs that follow the Sanitary Survey format, and a comparison between continuous data collected by O&M and MWQI at two RTDF stations--Jones and Banks.

The objective of short-term modeling comparison is to determine how well the modeling data performs at predicting three water quality variables--specific conductance, bromide, and total organic carbon--during different seasons and water years. Data will be analyzed from the following three stations on an annual basis: Banks, Check 13, and Check 41. The results from the retrospective analysis and an investigation of any anomalies of the 2019 modeling and lab data will be presented to the contractors by no later than June 1, 2021.

The second task is that MWQI staff will produce real-time and discrete data graphs for the RTDF stations (Banks, Jones, Gianelli, Vernalis, and Hood) that follow the Sanitary Survey format for the following constituents: specific conductance, total organic carbon, bromide, turbidity, total phosphorus, and total nitrogen. The objective of this task is to ensure the MWQI program reviews the data it collects on an annual basis and to produce graphs that can be used in the Sanitary Survey. The graphs for each station will be presented to the contractors by no later than June 1, 2021.

MWQI and O&M both monitor water quality at the Jones and Banks stations. Now that MWQI staff have installed YSI EXO2 sondes at these locations, there is redundancy in the collection of the following parameters: water temperature, pH, dissolved oxygen, specific conductance, and turbidity. MWQI staff will analyze the datasets between the two groups to determine how data collected between the groups, which use different instruments, compares. The objective of this study is to make a recommendation by October 1, 2021 on how monitoring should continue at these sites (e.g., MWQI takes monitoring responsibilities or reduces the number of constituents recorded by the YSI instrument).

7.5 Chlorophyll Study

Principal Investigator – Steve San Julian

Project Partner – Atlasi Daneshavar

The primary objectives of this study: 1) compare chlorophyll *a* data collected by two different instruments, *Turner Designs* and YSI, at Banks; and 2) study correlation between phycocyanin-specific fluorescence measured by *Turner Designs* probe and cyanobacterial biomass at Banks and Pacheco Pumping Plant. Although the data collection phase of this was originally intended to go for one algal season, the decision was made to extend data collection through late 2021. MWQI plans to continue paying for contract lab analysis costs during the extension. Current projection is \$27,000 for lab costs.

7.6 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 2019 and 2020. Applications in the SWP have been effective in treating aquatic vegetation, but endothall degradation is complex and affected by environmental conditions, such as water temperature of aquatic vegetation biomass. If endothall does not breakdown or is not completely absorbed by plant material, it can adversely affect human health; the drinking water MCL for Endothall is 0.1 mg/L.

Monitoring is planned to assess chemical degradation in the treatment forebays and adjacent waterways. O&M will likely treat again in 2021. If treatment occurs, MWQI plans to support O&M monitoring efforts by supplying field staff, autosamplers, and other resources, as needed.

7.7 Development of Project QAPPs

Project Investigators—Mark Bettencourt & Steven San Julian

Effective June 30, 2021, all monitoring projects that require sample submission to Bryte Laboratory are required to have a QAPP document in place. MWQI does not have QAPP documents that meet the current QAPP requirements and therefore, MWQI projects will need to be created or updated in order for sampling to continue. In 2021, MWQI will have 5 projects active for which QAPPs will be required. Those are:

1. Discrete Routine Monitoring
2. Cache Slough Monitoring
3. Delta Boundary Input Monitoring
4. RTDF Carbon Monitoring
5. RTDF Anion Monitoring

Mark Bettencourt will work with Steven San Julian and MWQI Field Section staff to divvy out writing responsibilities for these 5 documents. Labor requirement for these 5 documents is estimated at 30 hours per document at this time, for a total of 150 hours.

7.8 Monitoring at High Slack Tide – Feasibility Study

Principal Investigator – Steve San Julian

Project Partner – Scott Waller

MWQI will work with DWR Environmental Monitoring Program (EMP) staff to determine the feasibility of monitoring at high slack tide for all the constituents that are currently being collected. The EMP has been monitoring during high slack tide at all of their sites since 1975. Collecting data at high slack tide will allow for data analysis across a broader range of sites in the Delta. The rationale for collecting data at a specific phase of the tidal cycle (e.g., high slack) is to reduce variability in the data that results from sampling at random times during the tidal cycle, when there is either ebb or flood water movement. This task was part of the 2020 workplan, but due to COVID was delayed. The intent is to revisit this task sometime in 2021 and come up with a recommendation on how future monitoring should be conducted by the MWQI program.

8. Administrative Work

8.1 General Required Program Costs

The majority of time billed to this IO covers most of the line-level program management costs for the MWQI program (Steven San Julian's time). This includes supervisory level duties, meetings, schedule development, coordination with various program partners, oversight and assistance on MWQI programs and projects, etc. For staff, the Administrative Work IO is used for time and fees associated with meetings, conferences, trainings and various other Department level events. MWQI staff are also 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. If these activities are directly related to specific projects that have an IO, those IOs will be billed, but the default billing for these instances will fall to the Administrative Work IO.

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

8.2 Field Unit Office Work

MWQI program staff work mainly out of the Bryte Field Facility, located in West Sacramento. There are costs associated with the maintenance, upkeep, and restoration of the MWQI part of the facility for which MWQI is responsible. Since MWQI is required to provide a charge number for such costs, it makes sense for those charges to be separated out from the normal *Administration Costs* associated with Section 8.1.

The MWQI program is responsible to bear the cost associated with unallocated labor; and so, activities deemed unrelated to other projects will be billed to 8.2. This means that some of the time billed to this IO is time that could be available to work on other MWQI projects or on non-MWQI funded projects (Section 10). Any such expenditures will be addressed in RTDF meetings prior to allocation.

9. Other Required Program Costs

In this workplan, *Other Required Program Costs* is split into two parts. The first part being all charges billed to overhead. There are many categories of charges that fall under overhead, but the largest are charges associated with mobile equipment. DWR's Mobile Equipment Office (MEO) provides insurance, fuel, and vehicle maintenance and repair for MWQI vehicles and vessels. This part is unchanged from the 2020 workplan. The second part of *Other Required Program Costs* covers work that MWQI does for non-MWQI projects--but that are still billed to the MWQI fund. These activities are also referred to as *in-kind services*. Our involvement in these projects is cleared in advance with the MWQI SPC. Time billed for these in-kind services will be bill to IO#VINKINDSER19. In CY2021, MWQI will continue to provide in-kind services for a Delta Regional Monitoring Program project looking at Contaminants of Emerging Concern (CECs) in the Sacramento and San Joaquin River lower watersheds. MWQIs involvement in this project is limited to sample collection at selected river sites, field run preparations, communication with RMP staff, during quarterly sampling events in 2020 and 2021.

10. Non-MWQI Funded Activities

At times, MWQI program staff will work on other Department activities which are unrelated to the MWQI program and will therefore not be billed to the MWQI budget. The list of projects that might fall under this section are too numerous to mention, but some examples are bio-monitoring for construction activities or conducting field work for the Environmental Monitoring Program (EMP). It is not possible to precisely track these hours as they are billed to many charge numbers, but MWQI staff time billed to these activities is generally less than 200 total hours per year.