Placer County Water Agency
Middle Fork American River Project
(FERC Project No. 2079)

WATER QUALITY MONITORING PLAN

Placer County Water Agency
P.O. Box 6570
Auburn, CA 95604

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TABLE OF CONTENTS

Page

List of Tables

List of Maps

List of Acronyms

CDFG	California Department of Fish and Game
Commission	Federal Energy Regulatory Commission
CTR	California Toxics Rule
DO	dissolved oxygen
EPA	Environmental Protection Agency
FERC	Federal Energy Regulatory Commission
FRMP	Flow and Reservoir Monitoring Plan
GPS	Global Positioning System
MCLs	maximum contaminant levels
MFP	Middle Fork American River Project
NTR	National Toxics Rule
PCWA	Placer County Water Agency
pH	potential of hydrogen
Project	Middle Fork American River Project
QA	quality assurance
QC	quality control
SD	Supporting Document
SMP	Sediment Management Plan
State Water Board	State Water Resources Control Board
TSMP	Transportation System Management Plan
TSR	Technical Study Report
USDA-FS	United States Department of Agriculture-Forest Service
VIPMP	Vegetation and Integrated Pest Management Plan
WQMP	Water Quality Monitoring Plan
WQPP	Water Quality Protection Plan
WTMP	Water Temperature Monitoring Plan

1.0 INTRODUCTION

This Water Quality Monitoring Plan (WQMP) was developed for the Placer County Water Agency's (PCWA) Middle Fork American River Project (MFP or Project) located on the west slope of the Sierra Nevada range primarily in Placer County, California.

The goal of the WQMP is to periodically characterize water quality in the bypass and peaking reaches and reservoirs associated with the MFP over the term of the new license. This information will be compared to the Central Valley Regional Water Quality Control Board (CVRWQCB 2007) Basin Plan objectives and water quality objectives in the California Toxics Rule (CTR) "Water Quality Standards: Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California" (Federal Register, 65 FR 31682, EPA 2000) and the National Toxics Rule (NTR) "Water Quality Standards: Establishment of Numeric Criteria for Priority Toxic Pollutants" (Federal Register, 57 FR 60848, EPA 1992) or their equivalents. This information will also be presented with historic water quality data collected during 2005, 2006, and 2007 for the MFP relicensing (2005 Water Temperature Study Report [PCWA 2006]; 2006 Water Temperature Study Report [PCWA 2007]; AQ 11 – Water Quality Technical Study Report – 2007 [AQ 11 – TSR]; Supporting Document [SD] B [PCWA 2011a]).

In addition to water quality monitoring identified in this plan, other water quality monitoring will occur as part of activities related to the Sediment Management Plan (SMP) (PCWA 2011b; SD A), Transportation System Management Plan (TSMP) (PCWA 2011c; SD A), and Vegetation and Integrated Pest Management Plan (VIPMP) (PCWA 2011d; SD A). Specific water quality monitoring results associated with other monitoring plans (e.g., SMP, TSMP, and VIPMP) will be presented in their reports.

It is also anticipated that additional water quality monitoring may be required as part of Project construction activities such as new diversion construction (Section 3.0, Appendix A), special road projects (TSMP) and non-routine recreation facilities modifications (Recreation Plan) (PCWA 2011e; SD A). If additional site-specific construction measures are necessary, then those measures will be developed in consultation with resource agencies and implemented as part of the project. In addition, other appropriate permits necessary for Project construction activities, special roads projects, and non-routine recreation facility activities (e.g., California Department of Fish and Game [CDFG] Streambed Alteration Agreement, U.S. Army Corps of Engineers Section 404 Permit, RWQCB 401 Certification, United States Department of Agriculture-Forest Service [USDA-FS] Road Use Permit, USDA-FS Special Use Authorization, etc.) will be obtained, as applicable. PCWA expects that the preparation of project-specific Water Quality Protection Plans (WQPP) will be a condition of the SWRCB 401 Certification for these activities; PCWA will develop a WQPP prior to commencement of any construction activities.

2.0 WQMP ORGANIZATON

The WQMP is organized into the following sections:

Section 3.0 WQMP Objective: This section defines the purpose of the WQMP.

Section 4.0 Monitoring Approach: This section describes the locations, schedule, and sampling and analytical methods for monitoring water quality in bypass and peaking reaches and reservoirs associated with the MFP.

Section 5.0 Reporting and Consultation: This section outlines reporting that will be required over the term of the new license and describes agency consultation that would be conducted following completion of each monitoring period.

Section 6.0 Literature Cited: This section provides a list of documents or other resources that are referenced in the WQMP.

3.0 WQMP OBJECTIVE

The objective of the WQMP is to monitor physical, chemical, and bacterial water quality conditions in the bypass reaches, the peaking reach, and Project reservoirs.

4.0 MONITORING APPROACH

This section describes the approach for water quality monitoring, including monitoring locations and schedule, sampling methods, and analysis methods.

4.1 MONITORING LOCATIONS AND SCHEDULE

General physical, chemical, and bacterial water quality conditions will be monitored at eight locations in the bypass and peaking reaches and four locations in the Project reservoirs (WQMP Map 1). Coliform sampling will be conducted at 14 additional locations adjacent to recreation facilities at Project reservoirs and along bypass reaches where substantial contact recreation (swimming, fishing, rafting, etc.) occurs (WQMP Map 2). The types of monitoring to be conducted at each location are identified in WQMP Table 1. Water quality sampling was previously conducted at these locations during studies conducted in support of the relicensing of the MFP (AQ 11 –TSR [PCWA 2011a; SD B]).

Water quality monitoring will be conducted every five years for the term of the license, beginning in year 3, following license issuance. Water temperature and hydrology data will be collected in years when the WPTMP is implemented, as described in the Water Temperature Monitoring Plan (WTMP) (PCWA 2011f; SD A) and the Flow and Reservoir Monitoring Plan (FRMP) (PCWA 2011g; SD A).

4.2 MONITORING METHODS

This section describes the water quality monitoring methods in the bypass and peaking reaches and reservoirs associated with the MFP. Water quality monitoring will include the collection of: (1) *in-situ* measurements; (2) general water quality sampling; and (3) coliform sampling. Each of these is described below.

4.2.1 *In-situ* Field Measurements

In-situ water quality measurements will be collected at the sampling locations at the bypass and peaking reach monitoring locations listed in WQMP Table 1. Sampling will occur once during the fall low flow or base flow period (September or October). The *in-situ* measurements will include dissolved oxygen (DO), pH, specific conductance, and water temperature. The parameters will be measured using a portable multi-probe water quality meter (e.g., YSI® meter, Hydrolab Quantra, or similar). The units will be calibrated by an appropriate manufacturer prior to the sampling event. In addition, the DO sensor will be calibrated in the field to adjust for changes in elevations and barometric pressure at each sampling location prior to data collection. The *in-situ* measurements will be taken just below the water surface at representative locations within the stream. Monitoring timing and methods will be consistent with those described for the relicensing studies (PCWA 2006; 2007; 2011a).

The *in-situ* water quality measurements will also be collected monthly from June through October at the Project reservoirs (French Meadows Reservoir, Hell Hole Reservoir, and Ralston Afterbay) using a portable, multi-probe water quality meter (YSI® or Hydrolab Quanta). Reservoir profile *in-situ* measurements of water temperature and DO will be collected at 1-meter-depth intervals to determine if thermal stratification is present. If a thermocline is present, then the water quality parameters will be measured below the thermocline at 2-meter intervals to the bottom of the reservoir. pH will be measured at the top (just below the surface), middle (below the thermocline, if present), and bottom of the water column. A secchi depth will be used to determine the clarity of the water column.

4.2.2 General Water Quality Sampling

General water quality samples will be collected during the low flow (base flow) period in the fall (September to October) at the sampling locations listed in WQMP Table 1. The samples will be collected from a representative portion of the stream channel, using methods consistent with the Environmental Protection Agency (EPA) 1669 sampling protocol *Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria*[1] (EPA 1996a). Water quality samples collected from the monitoring sites will be analyzed from the parameters listed in WQMP Table 2, which will include general parameters, total mercury, a suite of dissolved metals, and total and fecal coliform. Monitoring timing and methods will be consistent with those described for the relicensing studies (PCWA 2006; 2007; 2011a).

Water quality samples will be collected from the Project reservoirs at the surface and immediately below the thermocline, if present. If it is not thermally stratified, then water quality samples will be collected at mid-depth of the reservoir. Water quality samples for laboratory analysis will be collected using a Teflon® Kemmerer style sampler to ensure integrity of the sample collected from depth. Water quality samples collected

[1] The monitoring protocol will only be modified through mutual agreement between PCWA, CDFG, State Water Board, and USDA-FS.

from the reservoirs will also be analyzed for the parameters listed in WQMP Table 2 and will include general parameters, hydrocarbons, total mercury, a suite of dissolved metals, and total and fecal coliform. Laboratory analysis for hydrocarbons will be conducted only on water quality samples collected from French Meadows and Hell Hole reservoirs, where motorized boating typically occurs. Monitoring timing and methods will be consistent with those described for the relicensing studies (PCWA 2006; 2007; 2011a).

The locations of the sampling sites will be recorded using a Global Positioning System (GPS) unit and the coordinates will be recorded in a field log book. An attempt will be made to sample in approximately the same locations each monitoring period.

4.2.3 Coliform Sampling

Total and fecal coliform sampling will be conducted to determine if study waters meet Basin Plan (CVRWQCB 2007) objectives for contact recreational activities. These locations are identified in WQMP Table 1 and are also shown on WQMP Map 2. Samples will be collected at near-shore locations adjacent to recreation facilities. In accordance with State Water Resources Control Board (State Water Board) protocols[2] for sampling fecal coliform, samples will be collected no less than five times within a 30-day period between July 4 and Labor Day and will include the Independence Day holiday weekend in preference to Labor Day, if possible. Monitoring timing and methods will be consistent with those described for the relicensing studies (PCWA 2006; 2007; 2011a).

The locations of the sampling sites will be recorded using a GPS unit and the coordinates will be recorded in a field log book. An attempt will be made to sample in approximately the same locations each monitoring period.

4.2.4 Laboratory Analysis and Reporting

Water quality samples will be provided to a State-certified laboratory approved by the State Water Board for chemical analysis. The laboratory will report each chemical parameter analyzed with the laboratory detection limit, reporting limit, and practical quantification limit. The laboratory will attempt to attain reporting detection limits that are at or below the applicable regulatory criteria.

4.2.5 Quality Assurance/ Quality Control (QA/QC) Procedures

Standard precautions will be followed for the collection of water quality samples. For each monitoring period, all samples will be collected by the same crew at each station, wearing ultra-trace sampling gloves. Water quality samples will be collected using the designated collection bottle supplied by a State-certified water quality laboratory. Upon collection, each sample will be immediately labeled with the date and time and logged on a chain-of-custody form and placed into a cooler filled with ice.

[2] The survey protocol will only be modified through mutual agreement between PCWA, CDFG, State Water Board, and USDA-FS.

Water quality samples will be delivered to a State-certified water quality laboratory within the appropriate holding times (WQMP Table 2). Coliform samples will be delivered to the laboratory on the same day of collection, while all other samples will be delivered between 24 to 48 hours of the sample collection time by courier. A chain-of-custody form will accompany all samples from the time of collection to delivery and submittal to the analytical laboratory.

In-stream water samples will be collected from just below the water surface in areas of steady flow. Water samples from the reservoirs and impoundments will be collected from below the water surface following the same QC procedures. Additional precautions will be followed when sampling from a motorized boat. Samples will be collected from the bow of the boat after the motor is turned off for at least five to ten minutes to avoid possible hydrocarbon contamination from the motor boat. Sampling equipment will be cleaned with a cleaning solution and distilled water prior to sample collection.

Standard QA procedures will be performed by the analytical laboratory during analyses of the water samples, including matrix and laboratory spikes and spike duplicates, matrix duplicates, and method blanks as appropriate.

4.3 ANALYSIS METHODS

The following describes the analyses methods to be used.

4.3.1 Comparison with Water Quality Objectives

The current versions of the Sacramento River Basin and San Joaquin River Basin Water Quality Control Plan (CVRWQCB, Fourth Edition revised February 2007), California Toxics Rule (CTR) "Water Quality Standards: Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California" (Federal Register, 65 FR 31682, EPA 2000) and the National Toxics Rule (NTR) "Water Quality Standards: Establishment of Numeric Criteria for Priority Toxic Pollutants" (Federal Register, 57 FR 60848, EPA 1992) or their equivalence, will be reviewed each monitoring period to identify the water quality objectives for the monitored physical, chemical, and bacterial constituents. The Basin Plan includes water quality objectives established by the State Water Board for waters in the Upper American River Watershed. The CTR and NTR, which consider background levels based on criteria that protect both human health and aquatic life, will also be reviewed. The State Water Board selects the most controlling (most stringent) of these values to determine compliance with the Clean Water Act. For parameters that do not have established objectives, the earlier studies (e.g., PCWA 2005, 2006, and 2011a) and existing literature sources will be reviewed for each parameter to identify guidelines or ranges of the different parameters that would be expected for the Project area.

Water quality objectives include both numeric and narrative objectives (WQMP Table 2). The Sacramento River Basin and San Joaquin River Basin Water Quality Control Plan (CVRWQCB, Fourth Edition revised February 2007) provides specific numeric objectives for bacteria, *in-situ* measurements, and for chemical or metal constituents.

The objectives for chemical and metal constituents are derived from various sources such as maximum contaminant levels (MCLs) that are provided in Title 22 of the California Code of Regulations or from the CTR or NTR. The results of the water quality monitoring will be compared to the most stringent water quality objectives identified WQMP Table 2.

4.3.2 *In-situ* Field Measurements

Following QA/QC, the results of the *in-situ* measurements will be summarized in tabular format and compared to the appropriate water quality objectives (WQMP Table 2). Locations where the objectives have not been met will be identified. The results will be presented with the data from previous sampling periods.

Reservoir profile *in-situ* measurements of water temperature and DO will be presented graphically. The results will be presented with the data from previous sampling periods.

4.3.3 General Water Quality Sampling

Following QA/QC, the results of the general water quality sampling measurements will be summarized in tabular format and compared to the appropriate water quality objectives (WQMP Table 2). Locations where the objectives have not been met will be identified. The results will be presented with the data from previous sampling periods.

4.3.4 Coliform Sampling

Following QA/QC, the results of the coliform sampling measurements will be summarized in tabular format and compared to the appropriate water quality objectives (WQMP Table 2). Locations where the objectives have not been met will be identified. The results will be presented with the data from previous sampling periods.

4.3.5 Electronic Database

All data will be stored electronically in Excel or other compatible program. The databases will be provided to resources agencies upon request.

5.0 REPORTING AND CONSULTATION

A Water Quality Monitoring Report summarizing the water quality monitoring data will be prepared by PCWA and distributed to the USDA-FS, State Water Board, and CDFG for review and comment within 120 days following the completion of each monitoring year. A 60-day review period will be provided to the agencies. Based on the results of the monitoring and/or comments received during the review process, PCWA and the agencies may call a meeting to discuss the results or modify the monitoring program. Within 60 days of receipt of comments, or 60 days following any meeting, comments will be addressed and the final report will be filed by PCWA with the agencies (USDA-FS, State Water Board, and CDFG) and the Federal Energy Regulatory Commission (FERC or Commission).

6.0 LITERATURE CITED

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____. 2011b. Sediment Management Plan (SMP). Available in PCWA's Application for New License – Supporting Document A.

____. 2011c. Transportation Systems Management Plan (TSMP). Available in PCWA's Application for New License – Supporting Document A.

____. 2011d. Vegetation and Integrated Pest Management Plan (VIPMP). Available in PCWA's Application for New License – Supporting Document A.

____. 2011e. Recreation Plan. Available in PCWA's Application for New License – Supporting Document A.

____. 2011f. Water Temperature Monitoring Plan. Available in PCWA's Application for New License – Supporting Document A.

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TABLES

WQMP Table 1. Water Quality Monitoring Locations.

Location Name	Site Number	GPS Coordinates[1]		Reach Type			Sampling Type		
		UTM10_ NAD 83 X	UTM10_ NAD 83 Y	Bypass Reach	Peaking Reach[2]	Reservoir	*In-situ* Sampling	General Water Quality Sampling	Fecal Coliform Weekly Sampling
Duncan Creek									
Duncan Creek below diversion	D8.4	717492	4334534	X			X	X	
Middle Fork American River									
French Meadows Reservoir									
Surface	FM-1(S)	718930	4332295			X	X	X	
Sub-surface	FM-1	718930	4332295			X	X	X	
Middle Fork American River below French Meadows Dam at gaging station	MF46.6	717789	4331977	X			X	X	
Middle Fork Interbay	IR-1	717789	4331977			X	X	X	
Middle Fork American River below Middle Fork Interbay	MF35.5	707362	4322470	X			X	X	
Ralston Afterbay									
Surface	RA-1(S)	695348	4319604			X	X	X	
Sub-surface	RA-1	695348	4319604			X	X	X	
Middle Fork American River below dam	MF24.7	694987	4319551		X		X	X	
Middle Fork American River below Oxbow Powerhouse tailrace	MF24.3	695104	4319974		X		X	X	
Rubicon River									
Hell Hole Reservoir									
Surface	HH-1(S)	724117	4326670			X	X	X	
Sub-surface	HH-1	724117	4326670			X	X	X	
Rubicon River below Hell Hole Dam at gaging station	R30.2	724209	4326071	X			X	X	
Long Canyon Creek									
North Fork Long Canyon Creek below diversion	NFLC2.9	717848	4325174	X			X	X	
South Fork Long Canyon Creek below diversion	SFLC3.1	718669	4325275	X			X	X	
Fecal Coliform									
Middle Fork American River below Ahart Campground	WQFC1	724066	4336067	X					X
Middle Fork American River below Gates Group Campground	WQFC2	723679	4335535	X					X
Middle Fork American River below Coyote and Lewis Campground	WQFC3	723578	4334312	X					X
French Meadows Reservoir near McGuire Boat Ramp	WQFC4	722565	4333376			X			X
French Meadows Reservoir near French Meadows Campground	WQFC5	722654	4332703			X			X
French Meadows Reservoir near French Meadows Boat Ramp	WQFC6	722249	4332433			X			X
French Meadows Reservoir near Poppy Campground	WQFC7	721628	4333151			X			X
Hell Hole Reservoir near Hell Hole Boat Ramp	WQFC8	723737	4326842			X			X
South Fork Long Canyon Creek below Big Meadows Campground	WQFC9	722119	4328056	X					X

WQMP Table 1. Water Quality Monitoring Locations.

Location Name		GPS Coordinates[1]		Reach Type			Sampling Type		
		UTM10_ NAD 83 X	UTM10_ NAD 83 Y	Bypass Reach	Peaking Reach[2]	Reservoir	*In-situ* Sampling	General Water Quality Sampling	Fecal Coliform Weekly Sampling
Fecal Coliform (continued)									
South Fork Long Canyon Creek below Middle Meadows Campground	WQFC10	718907	4325560	X					X
Middle Fork American River/Ralston Afterbay near Ralston Picnic Area	WQFC11	696326	4319720		X				X
Middle Fork American River below Oxbow Powerhouse (near flow compliance gage)	WQFC12	695159	4320291		X				X
Middle Fork American River below the Drivers Flat Road Camping and Rafting Take-out	WQFC13	679156	4314631		X				X
Duncan Creek below Primitive Recreation Site[2]	WQFC14	-	-			X			X

[1]GPS coordinates of sampling locations surveyed for relicensing studies (AQ 11 – TSR [PCWA 2011a; SD B]).

[2]Location was not sampled as part of the AQ 11-TSR (PCWA 2011a; SD B) study.

WQMP Table 2. Summary of Water Quality Analytical Tests, Including Laboratory Methods and Detection Limits, and Chemical Water Quality Objectives.

Analyte	Units[1]	Analysis Method[2]	Method Detection Limit (MDL)[3]	Practical Quantitation Limit (PQL)[4]	State and Federal Criteria			Sample Container	Hold Time	Preservative/ Comment
					Basin Plan[5]	CA Toxics Rule (CTR)[6]	National Toxics Rule (NTR)[7]			
In-Situ Measurements										
Oxygen, dissolved (DO)	mg/L	Water Quality Meter	Not Applicable	Not Applicable	7.0[8]	NS	NS[9]	Not Applicable	Not Applicable	None
Secchi Depth	meter	Secchi Disc	Not Applicable	Not Applicable	NS	NS	NS	Not Applicable	Not Applicable	None
pH	unitless	Water Quality Meter	Not Applicable	Not Applicable	6.5 – 8.5[10]	NS	6.5 – 9.0[11]	Not Applicable	Not Applicable	None
Water Temperature	Celsius	Water Quality Meter	Not Applicable	Not Applicable	NS	NS	NS	Not Applicable	Not Applicable	None
Specific Conductance	uS/cm at 25 °C	Water Quality Meter	Not Applicable	Not Applicable	NS	NS	NS	Not Applicable	Not Applicable	None
General Parameters										
Calcium	mg/L	EPA-200.7	Not Applicable	0.50	NS	NS	NS	1L plastic	180 days	Refrigerate
Chloride	mg/L	EPA-300.0	Not Applicable	1.0	250[12]	NS	230/860[13]	1L plastic	28 days	Refrigerate
Hardness (as $CaCO_3$)	mg/L	SM2340B	Not Applicable	1.0	NS	NS	NS	1L plastic	180 days	HNO_3, refrigerate
Magnesium	ug/L	EPA-200.7	Not Applicable	100	NS	NS	NS	1L plastic	180 days	HNO_3, refrigerate
Nitrate/Nitrite (NO_3)	mg/L	EPA-300.0	Not Applicable	0.20	1	NS	NS	1L plastic	28 days	Refrigerate
Ammonia as N	mg/L	EPA-350.3	Not Applicable	0.1	1.5[14]	NS	(15)	1L plastic	28 days	H_2SO_4,Refrigerate
Total Kjeldahl Nitrogen (TKN)	mg/L	EPA-351.2	Not Applicable	0.100	NS	NS	NS	1L plastic	28 days	H_2SO_4,Refrigerate
Total Phosphorus	mg/L	EPA-365.3	Not Applicable	0.1	NS	NS	NS	1L plastic	28 days	H_2SO_4,Refrigerate
Ortho-phosphate	mg/L	SM4500P-E	Not Applicable	0.010	NS	NS	NS	1L plastic	48 hours	Refrigerate
Potassium	mg/L	EPA-200.7	Not Applicable	2.0	NS	NS	NS	1L plastic	180 days	HNO_3, refrigerate
Sodium	mg/L	EPA-200.7	Not Applicable	0.50	NS	NS	NS	1L plastic	180 days	HNO_3, refrigerate
Sulfate (SO_4)	mg/L	EPA-300.0	Not Applicable	0.50	250[12]	NS	NS	1L plastic	28 days	Refrigerate
Total Dissolved Solids	mg/L	SM2540C	Not Applicable	10	500[12]	NS	NS	1L plastic	7 days	Refrigerate
Total Suspended Solids	mg/L	SM2540D	Not Applicable	10	NS	NS	NS	1L plastic	7 days	Refrigerate
Turbidity	NTU	EPA-180.1	Not Applicable	0.10	(16)	NS	NS	1L plastic	48 hours	Refrigerate
Organic Carbon, Total (TOC)	mg/L	SM5310B	Not Applicable	1.00	NS	NS	NS	250 mL amber glass	28 days	HCL, refrigerate
Total Alkalinity (as $CaCO_3$)	mg/L	SM2320B	Not Applicable	5.0	NS	NS	>20[17]	1L plastic	14 days	Refrigerate
Metals-Dissolved										
Arsenic	ug/L	EPA-1368	0.06	0.20	10	150/340[13]	150/340[13]	250 mL plastic	180 days	Field filtered, refrigerate
Cadmium	ug/L	EPA-1368	0.004	0.01	5	Hardness Dependent[13, 18]	Hardness Dependent[13, 18]	250 mL plastic	180 days	Field filtered, refrigerate
Copper	mg/L	EPA-1368	0.00004	0.0002	1[12]	1.3[20], Hardness Dependent[13, 18]	1.3[20], Hardness Dependent[13, 18]	250 mL plastic	180 days	Field filtered, refrigerate
Iron	mg/L	EPA-1368	0.0014	0.005	0.3[12]	NS	1[19]	250 mL plastic	180 days	Field filtered, refrigerate
Lead	ug/L	EPA-1368	0.01	0.05	15	Hardness Dependent[13, 18]	Hardness Dependent[13, 18]	250 mL plastic	180 days	Field filtered, refrigerate
Manganese	ug/L	EPA-1368	0.01	0.05	50[12]	NS	NS	250 mL plastic	180 days	Field filtered, refrigerate
Nickel	ug/L	EPA-1368	0.04	0.20	100	610[20], 4,600[21], Hardness Dependent[13, 18]	610[20], 4,600[21], Hardness Dependent[13, 18]	250 mL plastic	180 days	Field filtered, refrigerate
Chromium-Total	ug/L	EPA-1368	0.03	0.15	50	NS	NS	250 mL plastic	180 days	Field filtered, refrigerate

WQMP Table 2. Summary of Water Quality Analytical Tests, Including Laboratory Methods and Detection Limits, and Chemical Water Quality Objectives (continued).

Analyte	Units[1]	Analysis Method[2]	Method Detection Limit (MDL)[3]	Practical Quantitation Limit (PQL)[4]	State and Federal Criteria			Sample Container	Hold Time	Preservative/ Comment
					Basin Plan[5]	CA Toxics Rule (CTR)[6]	National Toxics Rule (NTR)[7]			
Metals-Total										
Mercury	ug/L	EPA-1361e	0.00015	0.0004	NS	0.05	0.77/1.4[13]	250 mL plastic	180 days	Refrigerate
Methyl mercury	mg/Kg fish	EPA-1630 mod./MSPL-102a	0.001-0.01	0.003-0.029	NS	NS	0.3[22]	Teflon sheet and ziplock bag	Not Applicable	Freeze
Hydrocarbons										
Methyl-tertiary-butyl Ether (MtBE)	ug/L	EPA-8260	Not Applicable	0.50	5[12]	NS	NS	40mL VOA	14 days	HCL, refrigerate
Total Petroleum Hydrocarbons (as gasoline and as diesel)	ug/L	EPA-8020	Not Applicable	50	NS	NS	(23)	40mL VOA	14 days	HCL, refrigerate
Oil and Grease	mg/L	EPA-1664	Not Applicable	4.8	(24)	NS	(25)	1L amber glass	48 hours	HCL, refrigerate
Bacteria										
Total Coliform (3x5, 6 hr hold)	MPN/100 mL[26]	EPA-SM9222B	Not Applicable	2	NS	NS	NS	NS	24 hours	Refrigerate
Fecal Coliform (3x5)	MPN/100 mL[26]	EPA-SM922B	Not Applicable	2-1600	200	NS	NS	100 mL plastic	24 hours	Refrigerate

[1]Units follow listed criterion standards. If standards were not available, laboratory supplied units were used. (Note: µg/L-ppb and mg/L=ppm)

[2]Analysis methods are periodically updated by the EPA. The most recent methods available were used for the water quality analysis.

[3]MDL: "the minimum concentration of a substance that can be reported with a 99% confidence that the analyte concentration is greater than zero." (40 CFR Part 136)

[4]PQL: "the lowest concentration of an analyte that can be reliably measured within specified limits of precision and accuracy during routine laboratory operating conditions." (50 FR 46906)

[5]The Basin Plan for the Sacramento and San Joaquin River Basins rely on California primary and secondary Maximum Concentration Level objectives as criteria for water quality to be used as a municipal and domestic supply for human consumption.

[6]California Toxics Rule (CTR) criteria are based primarily on USEPA standards developed under the Clean Water Act for human consumption of water and aquatic organisms with an adult risk for carcinogens estimated to be one in one million as contained in the Integrated Risk Information System (IRIS) as of October 1, 1996.

[7]The National Toxics Rule (NTR) criteria are based on USEPA standards developed under the Clean Water Act for human consumption of water and aquatic organisms with an adult risk for carcinogens estimated to be one in one million as contained in the IRIS as of Octobder 1, 1996. These criteria are to be applied to all states not complying with the Clean Water Act section 303(c)(2)(B).

[8]For water designated as COLD.

[9]The water column concentration of 9.5 mg/L for a 7-day mean is recommended to achieve the required intergravel dissolved oxygen concentrations.

[10] pH shall not be depressed below 6.5 or raised greater than 8.5. Changes in normal ambient pH should not exceed 0.5.

[11]Instantenous maximum value. This limit has a range of values between the first and second numbers shown.

[12]The criteria listed are secondary Maximum Concentration Levels for California drinking water quality objectives that do not necessarily indicate a toxic amount of contaminate. Rather these standards dictate water quality objectives designed to preserve taste, odor, or appearance of drinking water.

[13]Freshwater Aquatic Life Protection, continuous concentration (4-day average)/maximum concentration (1-hour average).

[14]Taste and odor threshold.

[15]pH, temperature and life cycle dependent.

[16]Increases in turbidity attributable to controllable water quality factors shall not exceed the following limits: where natural turbidity is between 0 and 5 NTU's, increases shall not exceed 1 NTU. Where natural turbidity is between 5 and 50 NTU's, increases shall not exceed 20%. Where natural turbidity is between 50 and 100 NTU's, increases shall not exceed 10 NTU's. Finally, where natural turbidity is greater than 100 NTU's, increases shall not exceed 10%.

[17]20 mg/L or more of $CaCO_3$ for freshwater aquatic life except where natural concentrations are less (USEPA's 1976 'Red Book'). The 'Red Book' also recommends that natural alkalinity not be reduced by more than 25%.

[18]Criterion is hardness dependent which is expressed as a function of hardness and decreases as hardness decreases. The actual criteria are calculated based on the hardness (as $CaCO_3$) of the sample water.

[19]NTR Freshwater Aquatic Life Protection, continuous concentration (4-day average).

[20]CTR and NTR human health (30-day average); Drinking Water Sources (consumption of water an aquatic organisms).

[21]CTR human health (30-day average); Other Waters (aquatic organism consumption only).

[22]This value is an Ambient Water Quality Criteria (AWQC) for methyl mercury and was published by the USEPA in a document titled Water Quality Criterion for the Protection of Human Health: Methyl mercury-Final (EPA-823-R-01-001, January 2001). This AWQC for total mercury published in 1980 and partially updated in 1997.

[23]From Compilation of Water Quality Goals – TPH-diesel: taste and odor threshold and USEPA SNARL = 100 ug/L. TPH-gasoline: taste and odor threshold and proposed USEPA SNARL = 5 mg/L.

[24] Waters shall not contain oils, greases, waxes, or other materials in concentrations that cause nuisance, result in a visible film or coating on the surface of the water or on objects in the water, or otherwise adversely affect beneficial uses.

[25] For domestic water supply: Virtually free from oil and grease, particularly from the tastes and odors that emanate from petroleum products (USEPA's 1986 'Gold Book').

[26]MPN: Most probable number of bacterial colonies per 100 mL of water.

Items in parentheses ( ) are footnotes.

NS: no standard available

MPN: Most probable number of bacterial colonies per 100 mL of water.

MAPS