

POTENTIAL RESOURCE ISSUE:

~~Comply~~ Water quality compliance with Central Valley Regional Water Quality Control Board (CVRWQCB) Basin Plan objectives and water quality standards.

PROJECT NEXUS:

Project structures and, operations and, maintenance activities, and Project betterments could affect water quality.

POTENTIAL LICENSE CONDITION(S):

- Instream flow releases.
- Best management practices (BMPs).
- Spill Prevention Control Countermeasure (SPCC) Plan.

STUDY OBJECTIVE(S):

Characterize physical, chemical, and bacterial water quality conditions in the bypass reaches and the peaking reach, comparison reaches, and Project reservoirs and diversion pools and compare to Basin Plan objectives and water quality standards.

EXTENT OF STUDY AREA:

The study area will include bypass reaches and, the peaking reach, and Project reservoirs, and diversion pools (Tables AQ11-1 and AQ11-2, Figures AQ11-1 and AQ11-2).

STUDY APPROACH:

Water Quality Sampling Field Program

The following describes the water quality sampling field program which includes the collection of (1) *in-situ* water quality measurements; (2) general water quality samples; (3) contingency water quality samples; (4) fecal coliform samples; (5) fish tissue samples; and (6) benthic macroinvertebrate samples.

In-situ Field Measurements

- Collect *in-situ* water quality measurements at sampling locations listed in Table AQ11-1 (i.e., bypass reaches, the peaking reach, Project reservoirs, and diversion pools) using a YSI® meter. Samples will be collected once during the spring runoff (April or May), and once during the summer low flow or base flow period (August or September). Pre and post sampling calibration of *in-situ* instrumentation will be conducted following the manufacturer's instructions.

- Monitor *in-situ* water quality parameters at bypass reaches and the peaking reach, including dissolved oxygen (DO), pH, specific conductance, and water temperature. *In-situ* parameters will be measured ~~from the shoreline in moving water or from within a representative location of the stream channel, with the sampling personnel standing downstream of the measurement location.~~
- Monitor *in-situ* water quality parameters at all Project reservoirs and diversion pools including DO, pH, specific conductance, water temperature, and Secchi depth. Reservoir profile analysis will be conducted at sampling locations in French Meadows Reservoir, Hell Hole Reservoir, and Ralston Afterbay. Collect reservoir profile *in-situ* measurements of water temperature and DO at 1-meter (m) depth intervals to determine if thermal stratification is present. If a thermocline is present, the water quality parameters will be measured below the thermocline at 2-m intervals to the bottom of the reservoir.
- Compare the results of *in-situ* monitoring and laboratory analytical analysis to determine if the measured and reported levels ~~comply with regulatory standards and criteria with~~ meet the water quality objectives identified in the Basin Plan.

General Water Quality Sampling

- Collect general water quality samples at sampling locations listed in Table AQ11-1 and depicted on Figure AQ11-1. Samples will be collected once during the spring runoff and once during the summer low flow or base flow period.
- Collect water quality samples in bypass reaches and the peaking reach ~~from the shoreline in moving water or from within the~~ a representative portion of the stream channel, using methods consistent with the EPA 1669 sampling protocol ~~personnel standing downstream of the sample collection location~~ Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria. Water quality samples collected from streams will be analyzed for the parameters listed in Table AQ11-3, which include general parameters, dissolved metals and fecal coliform ~~*E. coli*~~.
- Collect water quality samples from Project reservoirs and diversion pools at the surface and immediately below the thermocline, if encountered. If the Project reservoir or diversion pool 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 from reservoirs will be analyzed for the parameters listed in Table AQ11-3, which include general parameters, hydrocarbons, dissolved metals (identify biologically available metals), and fecal coliform ~~*E. coli*~~. 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.
- Water quality samples will be decanted into laboratory-supplied sample containers. The sample containers will be labeled with the date and time that the sample is collected, sampling site or identification label. The sample container will be preserved (as appropriate), stored and delivered to a State-certified water quality laboratory for analyses in accordance with maximum holding periods. A chain-of-custody record will be maintained with the samples at all times. The sampling site location will be recorded using a Global Positioning System (GPS) unit and the coordinates will be recorded in a field log book.

Contingency Sampling

- Conduct contingency sampling where water quality sampling results obtained from the general water quality sampling program indicate that a potentially adverse water quality condition may exist. The contingency sampling will be conducted to further evaluate the cause or source of the adverse water quality condition. Samples collected from the contingency sample sites will be analyzed only for the specific parameter detected by the general water quality sampling program.
- Consult with the Aquatic Technical Working Group (TWG) if results from the general water quality sampling program indicate a potentially adverse water quality condition. If appropriate, develop an additional sampling program to further investigate the cause or source of the potentially adverse water quality condition.

Fecal Coliform Sampling

- Conduct total and fecal coliform sampling to determine if Project waters meet Basin Plan objectives for contact recreational activities. Samples will be collected at near-shore locations adjacent to recreation facilities at Project reservoirs and along bypass reaches where substantial contact recreation occurs. Fecal coliform sampling locations are listed in Table AQ11-2 and depicted on Figure AQ11-2. In accordance with the fecal coliform sampling protocols, samples will be collected no less than five times within a thirty-day period ~~that between July 4th and Labor Day~~ and will include ~~a either~~ holiday weekend ~~(either Independence Day or~~. If early summer weather indicates that the July 4th weekend will be a large recreational weekend, sampling will include the July 4th preference to Labor Day).

Laboratory Analysis and Reporting

- Provide water quality samples collected during the field program to a State-certified laboratory approved by the State Water Resources Control Board (SWRCB) for chemical analysis. The laboratory will report each chemical parameter analyzed with the laboratory method detection limit, and reporting limit, practical quantification limit, ~~and the J-value as appropriate~~. The laboratory will attempt to attain reporting detection limits that are at or below the applicable regulatory criteria. The parameters to be analyzed by the analytical laboratory are provided in Table AQ11-3.

Fish Tissue Analysis

- Conduct a screening level study of methyl mercury concentrations in sport fish muscle tissue.
- Collect a total of three native (nonhatchery) sport fish of edible size, if present, from Middle Fork Interbay and Ralston Afterbay and submit to an analytical laboratory for muscle tissue analysis. Larger fish with greater potential for bioaccumulation will targeted. Record the species, fork length, and weight of each fish. Place fish in sealed containers and place immediately on ice for delivery to the analytical laboratory.
- The analytical laboratory will analyze muscle tissue from each fish for concentrations of methyl mercury in accordance with the General Protocol for Sport Fish Sampling and Analysis developed by the California Environmental Protection Agency (Cal EPA 2005).
- If methyl mercury in fish tissue exceeds the OEHHA guidelines of 0.08 ppm (Cal EPA 2005) during the initial sampling, the Aquatic TWG will be consulted concerning the need for additional sampling.

- [Fish tissue sampling may be expanded in the event water quality sampling identifies locations that are of potential concern due to the presence of levels of Mercury that exceed the United States Environmental Protection Agency \(USEPA\) California Toxic Rule \(CTR\) criteria as described in 40 CFR §131.](#)

Benthic Macroinvertebrate Sampling

- Implement California Stream Bioassessment Procedures to quantify benthic macroinvertebrate (BMI) species compositions, abundance, and distribution at locations where potentially adverse water quality issues may exist or are identified by the water quality sampling program (See Macroinvertebrate Technical Study Plan). Develop sampling to address potential water quality issues in consultation with the Aquatic TWG.

SCHEDULE:

To be developed in early 2007.

REFERENCES:

California Environmental Protection Agency (Cal EPA). 2005. General Protocol for Sport Fish Sampling and Analysis. Pesticide and Environmental Toxicology Branch, Office of Environmental Health Hazard Assessment, California Environmental Protection Agency. December 2005.

[Central Valley Regional Water Quality Control Board \(CVRWQCB\). 1998. Basin Plan. Fourth Edition, The Sacramento River Basin and the San Joaquin River Basin. September 1998.](#)

Table AQ11-1. Water Quality Monitoring and Sampling Locations.

Study Reach	Water Quality Sampling Sites	Water Quality Monitoring and Sampling Locations
Duncan Creek		
Duncan Creek upstream of Diversion	DC-1	Duncan Creek above diversion
Duncan Creek from Diversion to confluence with Middle Fork American River	DC-2 DC-3	Duncan Creek below diversion Duncan Creek above Middle Fork American River confluence
Middle Fork American River		
Middle Fork American River upstream of French Meadows Reservoir	MFAR-1	Middle Fork American River above French Meadows Reservoir
French Meadows Reservoir	FM-1, FM-2, and FM-3	Three locations in French Meadows Reservoir
Middle Fork American River from French Meadows to confluence with Duncan Creek	MFAR-2 MFAR-3	Middle Fork American River below French Meadows Dam Middle Fork American River above Duncan Creek confluence
Middle Fork American River from confluence with Duncan Creek to Middle Fork Interbay	MFAR-4 MFAR-5	Middle Fork American River below Duncan Creek confluence Middle Fork American River above Interbay Reservoir
Middle Fork Interbay	IR-1	In Interbay Reservoir
Middle Fork American River from Middle Fork Interbay to Ralston Afterbay	MFAR-6 MFAR-7	Middle Fork American River below Middle Fork Interbay Middle Fork American River above Ralston Afterbay
Ralston Afterbay Downstream		
Ralston Afterbay	RA-1	In Ralston Afterbay
Middle Fork American River from Ralston Afterbay to confluence with Canyon Creek	MFAR-8 ¹ MFAR-9 ¹	Middle Fork American River below dam Middle Fork American River below Oxbow Powerhouse tailrace
Middle Fork American River from confluence of Canyon Creek to confluence with North Fork American River	MFAR-10 ¹ MFAR-11 ¹	Middle Fork American River below Canyon Creek Middle Fork American River above North Fork American River
North Fork American River from confluence with Middle Fork American River to Folsom Reservoir	NFAR-1 ¹	North Fork American River below Middle Fork American River

Table AQ11-1. Water Quality Monitoring and Sampling Locations (continued).

Study Reach	Water Quality Sampling Sites	Water Quality Monitoring and Sampling Locations
Rubicon River		
Rubicon River upstream of Hell Hole Reservoir	RR-1	Rubicon River above Reservoir
Hell Hole Reservoir	HH-1, HH-2, and HH-3	Three locations in Hell Hole Reservoir
Rubicon River from Hell Hole Reservoir to confluence with South Fork Rubicon River	RR-2 RR-3 SFRR-1	Rubicon River below dam Rubicon River above South Fork Rubicon River confluence South Fork Rubicon River above Rubicon River confluence
Rubicon River from confluence with South Fork Rubicon River to Ralston Afterbay	RR-4 RR-5 RR-6 RR-7	Rubicon River below South Fork Rubicon River confluence Rubicon River above Long Canyon Creek confluence Rubicon River below Long Canyon Creek confluence Rubicon River above Ralston Afterbay
Long Canyon Creek		
North Fork Long Canyon Creek upstream of Diversion	NFLCC-1	North Fork Long Canyon Creek above diversion
North Fork Long Canyon Creek from Diversion to confluence with Long Canyon Creek	NFLCC-2 NFLCC-3	North Fork Long Canyon Creek below diversion North Fork Long Canyon Creek above Long Canyon Creek confluence
South Fork Long Canyon Creek upstream of Diversion	SFLCC-1 SFLCC-2	South Fork Long Canyon Creek above diversion South Fork Long Canyon Creek below diversion
South Fork Long Canyon Creek from Diversion to confluence with Long Canyon Creek	SFLCC-3	South Fork Long Canyon Creek above Long Canyon Creek confluence
Long Canyon Creek from North and South Fork Long Canyon creeks confluence to confluence with Rubicon River	LCC-1 LCC-2	Long Canyon Creek below North Fork and South Fork Long Canyon creeks confluence Long Canyon Creek above Rubicon River confluence

¹If pending operations are occurring during sampling periods, water quality samples will be collected during high and low flow events.

Table AQ11-2. Fecal Coliform Sampling Locations Using SWRCB Protocols.

Sample Identification Label	Sample Location
FC-1	Middle Fork American River below Ahart Campground
FC-2	Middle Fork American River below Gates Group Campground
FC-3	Middle Fork American River below Coyote and Lewis Campground
FC-4	French Meadows Reservoir at McGuire Picnic Area
FC-5	French Meadows Reservoir at McGuire Boat Ramp
FC-6	French Meadows Reservoir at French Meadows Campground
FC-7	French Meadows Reservoir at French Meadows Boat Ramp
FC-8	French Meadows Reservoir at Poppy Campground
FC-9	Hell Hole Reservoir at Hell Hole Campground
FC-10	Hell Hole Reservoir at Hell Hole Boat Ramp
FC-11	South Fork Long Canyon Creek above Big Meadows Campground
FC-12	South Fork Long Canyon Creek below Big Meadows Campground
FC-13	South Fork Long Canyon Creek above Middle Meadows Campground
FC-14	South Fork Long Canyon Creek below Middle Meadows Campground
FC-15	Ralston Afterbay at Ralston Picnic Area
FC-16	Middle Fork American River below Oxbow Powerhouse

Table AQ11-3. Parameters for Water Quality Monitoring and Laboratory Analysis.

Parameter	Analysis Method	Sample Holding Times	Sample Locations to be Analyzed
Water Quality Monitoring Parameter			
In-Situ Measurements			
Dissolved Oxygen (DO)	Water Quality Meter	Not Applicable	All
Secchi Depth	Secchi Disk	Not Applicable	Reservoir
pH PH	Water Quality Meter	Not Applicable	All
Water Temperature	Water Quality Meter	Not Applicable	All
Specific Conductance	Water Quality Meter	Not Applicable	All
Laboratory Analysis Parameter			
General Parameters			
Calcium	EPA – 7440 200.7	180 days	All
Chloride	EPA – 300.0	28 days	All
Hardness	EPA 130.2	180 days	All
Magnesium	EPA – 7450 200.7	180 days	All
Nitrate/Nitrite	EPA – 353.2	48 hours	All
Ammonia as N	EPA – 350.1	28 days	All
Total Kjeldahl Nitrogen	EPA – 351.2	28 days	All
Total Phosphorus	EPA 365.2	28 days	All
Ortho-phosphate	EPA – 365.1	48 hours	All
Potassium	EPA – 7460 200.7	180 days	All
Sodium	EPA – 7770 200.7	180 days	All
Sulfate	EPA – 300.0	180 days	All
Total Dissolved Solids	EPA – 160.1	7 days	All
Total Suspended Solids	EPA – 160.2	7 days	All
Turbidity	EPA – 180.1		All
TOC	EPA – 415.1	28 days	All
Total Alkalinity	EPA – 310.1	14 days	All
Metals - TotalsDissolved			
Arsenic	SM-3114 EPA – 1638	180 days 48 hours	All
Cadmium	EPA 200.8 and 245.7 – 1638	180 days 48 hours	All
Copper	EPA – 6040 1638	180 days 48 hours	All
Iron	EPA – 6040 1638	180 days 48 hours	All
Lead	EPA – 7424 1638	180 days 48 hours	All

Table AQ11-3. Parameters for Water Quality Monitoring and Laboratory Analysis (continued).

Parameter	Analysis Method	Sample Holding Times	Sample Locations to be Analyzed
Laboratory Analysis Parameter (continued)			
Manganese	EPA – 6040 1638	180 days 48 hours	All
Mercury	EPA – 1631 1631e	180 days 48 hours	All
<u>Nickel</u>	<u>EPA – 1638</u>	<u>48 hours</u>	
<u>Chromium</u>	<u>EPA – 1638</u>	<u>48 hours</u>	
Hydrocarbons			
Methyl-tertiary Butyl Ether (MtBE)	EPA – 8260	14 days	Reservoir
Total Petroleum Hydrocarbons	EPA – 8020	14 days	Reservoir
Oil and Grease	EPA 1664	48 hours	Reservoir
Bacteria			
<u>Total Coliform</u> / E. coli	9221/9222D as available – <u>SM9222B</u>	24 hours	All
Fecal Coliform	<u>EPA – SM922B</u>	24 hours	(1)

(1) At fecal coliform sampling locations listed in Table 3.

Placeholder for Figure AQ11-1

Water Quality Monitoring Locations

Non-Internet Public Information

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Placeholder for Figure AQ11-2
Fecal Coliform Sampling and Monitoring Locations
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