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S A C R A M E N T O V A L L E Y W A T E R Q U A L I T Y C O A L I T I O N

Monitoring and Reporting Program

Annual Monitoring Report 2019:

October 2018 – September 2019

Prepared by

LARRY WALKER ASSOCIATES

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Executive Summary

SUMMARY OF MONITORING PROGRAM

The Sacramento Valley Water Quality Coalition (Coalition) has developed and implemented a Monitoring and Reporting Program (MRP) to meet the requirements of the *Waste Discharge Requirements General Order for Growers within the Sacramento River Watershed that are Members of a Third-Party Group* (*R5-2014-0030*) (WDR).[1] The scope of the MRP and the sampling and analytical methods used in 2019 Coalition Monitoring have been approved by the Central Valley Regional Water Quality Control Board (Regional Water Board).

In accordance with the WDR requirements, the Coalition is achieving these objectives by implementing a MRP that evaluates samples for the presence of statistically significant toxicity and exceedances of applicable numeric water quality objectives and Irrigated Lands Regulatory Program (ILRP) Trigger Limits. The Coalition initiates follow-up actions designed to identify constituents causing significant toxicity when toxicity is of sufficient magnitude. Exceedances of numeric objectives and ILRP Trigger Limits for chemical, physical, and microbiological parameters trigger follow-up actions designed to identify potential sources and to inform potential users of the products that contain constituents of concern. Additionally, the Coalition is evaluating the degree of implementation of current management practices in priority watersheds (i.e., those where Management Plans have been triggered) and recommending additional practices as water quality results indicate a need to do so. The Coalition is committed to the principle of adaptive management to control specific discharges of waste from agricultural lands that are having an impact on water quality. This iterative approach allows for the most effective use of limited human and fiscal resources.

The 2019 Coalition Monitoring was conducted in coordination with the Northeastern California Water Association (Pit River Subwatershed), the Placer-Nevada-South Sutter-North Sacramento Watershed Group, the Goose Lake Watershed Group, and the Upper Feather River Watershed Group. Additional monitoring in the Upper Feather River and Pit River subwatersheds was conducted in coordination with California’s Surface Water Ambient Monitoring Program (SWAMP) beginning in 2012.

The parameters monitored in 2019 by the Coalition to achieve these objectives are as specified in the current WDR and MRP (*Order No. R5-2014-0030*):

- Water column and sediment toxicity
- Physical and conventional parameters in water
- Organic carbon
- Pathogen indicator organisms in water
- Trace metals in water

[1] Prior to adoption of the WDR, the Coalition was subject to a Conditional Waiver of Waste Discharge Requirements for the Irrigated Lands Regulatory Program (ILRP) and subsequent amendments to the ILRP requirements (WQO-2004-0003, SWRCB 2004, R5-2005-0833, R5-2008-0005, R5-2009-0875).

- Pesticides in water
- Nitrogen and phosphorus compounds in water

The current WDR and MRP also requires testing for 303(d)-listed constituents identified in water bodies downstream from Coalition sites and discharged within the watershed, if irrigated agriculture has been identified as a contributing source within the Sacramento River Watershed and such monitoring has been requested by the Regional Water Board's Executive Officer.

Note that not all parameters are monitored at every site for every monitoring event. Specific individual parameters measured for 2019 Coalition Monitoring are listed in **Table 2**.

A total of 22 sampling sites were monitored by the Coalition and coordinating subwatershed monitoring programs during 2019 (**Table 3**). A map of these sites is presented in **Figure 1**.

As required by the MRP, Coalition monitoring events include storm season monitoring and irrigation season monitoring. The sites and numbers of samples scheduled for collection for 2019 Coalition Monitoring are summarized in **Table 4**.

This *2019 Annual Monitoring Report* (AMR) includes results for October 2018 through September 2019.

Sample collection and analysis has been performed by the following agencies and subcontractors.

- Pacific EcoRisk (Fairfield, California) performs toxicity analyses and conducts sampling for all sites, with the specific exceptions noted below:
    - Placer County Resource Conservation District conducted sampling for the Placer-Nevada-South Sutter-North Sacramento Subwatershed;
    - Vestra Environmental conducted sampling on behalf of the Northeastern California Water Association for the Pit River subwatershed site and conducted sampling for one event for the Goose Lake Watershed Group for the Lower Lassen Creek site; and
    - The Modoc Resource Conservation District conducted sampling for the Goose Lake Watershed Group for the Lower Lassen Creek site for two events.
- Caltest Analytical Laboratory (Napa, California) conducted all conventional, microbiological, and pyrethroid pesticide analyses.
- Agriculture & Priority Pollutant Laboratories, Inc. (APPL) (Clovis, California) conducted pesticide analyses.
- North Coast Laboratories (Arcata, CA) conducted pesticide analyses.
- PHYSIS Environmental Lab (Anaheim, CA) conducted pesticide analyses.
- Basic Laboratory (Redding) conducted conventional and microbiological analyses for samples collected in the Pit River, Upper Feather River, and Goose Lake subwatersheds.

TREND ANALYSIS

The Coalition's 2019 Monitoring Plan Update[2] was approved by Regional Water Board staff as meeting the requirements of the WDR, MPR, and Pesticides Evaluation Protocol. The WDR provides no additional guidance or criteria for making a determination that there are "deficiencies in monitoring" or that additional locations or events are needed, and none were identified as a result of the trend analysis conducted for this report.

In summary, the results of the trend analyses conducted for this AMR did not indicate a need for monitoring any additional locations, events, or parameters. The adoption of the Pesticides Evaluation Protocol has already expanded the number of parameters that the Coalition analyzes. We continue to recommend that the trend analysis evaluation be performed no more than once per assessment year, with the next evaluation occurring in the 2022 Monitoring Year. By that monitoring year, two to three years of additional assessment monitoring will have been conducted under the Pesticides Evaluation Protocol, which will increase the amount of data evaluated and the robustness of the analysis.

MANAGEMENT PRACTICES AND ACTIONS TAKEN

Response to Exceedances

To address specific water quality exceedances, the Coalition and its partners developed a Management Plan in 2009, subsequently approved by the Regional Water Board. The Coalition also previously developed a *Landowner Outreach and Management Practices Implementation Communications Process for Monitoring Results (Management Practices Process)* to address exceedances. The 2009 Management Plan was reorganized into the Comprehensive Surface Water Quality Management Plan (CSQMP) in 2015. The CSQMP was last updated in September 2016 and approved by the Central Valley Regional Water Quality Control Board (Regional Water Board) in November 2016. Implementation of the approved 2016 CSQMP is the primary mechanism for addressing exceedances observed in the Coalition's surface water monitoring.

Management Plan Status Update

The Coalition's Management Plan Progress Report (MPPR), a document that describes the status and progress toward meeting individual Management Plan element requirements for 2019, is provided to the Regional Water Board with this Annual Monitoring Report. Activities conducted in 2019 to implement the Coalition's CSQMP included addressing exceedances of objectives for registered pesticides, development of a new Management Plan, evaluation of existing Management Plan elements that could be deemed complete, and monitoring required for toxicity and pesticide Management Plans and Total Maximum Daily Loads (TMDLs).

Implementation completed specifically for registered pesticides and toxicity included review and evaluation of pesticide application data, identification of potential sources, and determination of likely agricultural sources. Prior to 2015, surveys of Coalition members operating on high

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[2] On August 1 of each year, the Coalition is required to submit to the Regional Water Board an updated monitoring plan for the upcoming monitoring year (October through September). This annual monitoring plan is called the Monitoring Plan Update, and for 2019 it was developed to follow the requirements of the 2014 WDR and MRP and the Regional Water Board's 2016 Pesticides Evaluation Protocol.

priority parcels were conducted to determine the degree of implementation of relevant management practices related to individual Management Plan elements for registered pesticides and identified causes of toxicity. Beginning in 2015, these surveys were replaced with data compiled from Coalition Member Farm Evaluations. Farm Evaluation data have been used to establish goals for additional management practice implementation needed to address exceedances of Basin Plan water quality objectives and ILRP Trigger Limits.

CONCLUSIONS AND RECOMMENDATIONS

The Coalition submits this *2019 Annual Monitoring Report* as required under the Regional Water Board's Irrigated Lands Regulatory Program. The AMR provides a detailed description of the Coalition's monitoring results as part of its ongoing efforts to characterize irrigated agricultural and wetlands related water quality in the Sacramento River Basin.

To summarize, the results from the Coalition's monitoring conducted in 2019 continue to indicate that with few exceptions, there are no major water quality problems with agricultural and managed wetlands discharges in the Sacramento River Basin.

This AMR characterizes potential water quality impacts of agricultural drainage from a broad geographic area in the Sacramento Valley from October 2018 through September 2019. To date, a total of 163 Coalition storm and irrigation season events have been completed since the beginning of Coalition monitoring in January 2005, with additional events collected by coordinating programs and for follow-up evaluations. For the period of record considered in this AMR (October 2018 through September 2019), samples were collected for ten scheduled monthly events and 2 wet weather ("storm") events.

Pesticides were infrequently detected (~10% of all pesticide results collected in 2019 were for detected concentrations), and, when detected, rarely exceeded applicable objectives. One sample for the registered pesticide malathion and twelve pyrethroid pesticide samples exceeded applicable water quality objectives or ILRP Trigger Limits during the 2019 Monitoring Year.

Many of the pesticides specifically required to be monitored in the past by the ILRP have rarely been detected in Coalition water samples, including glyphosate and paraquat. Over 98.2% of all pesticide analyses performed to date for the Coalition have been below detection. Coalition monitoring of pesticides for the ILRP for 2019 was conducted based on the 2016 Pesticides Evaluation Protocol (PEP) and active Management Plan element requirements. The Regional Water Board's PEP requires the Coalition to monitor specific registered pesticides based on (1) their rate of application in a given drainage (lbs. applied per drainage) and (2) a pesticide-specific relative risk (the ratio of the amount of chemical applied to a reference value with a specific averaging period). The Coalition also conducted monitoring of the ILRP-required trace elements (arsenic, boron, copper, and zinc) informed by the Coalition's past monitoring results, which have demonstrated that most of these metals rarely approach or exceed objectives and are not likely to cause adverse impacts to aquatic life or human health in waters receiving agricultural runoff in the Sacramento River Watershed. This strategy for monitoring trace metals was implemented in 2010 in accordance with the Coalition's 2009 MRP (*Order No. R5-2009-0875*, CVRWQCB 2009), and this same strategy is consistent with the requirements of the current WDR and MRP (*Order No. R5-2014-0030*).

The majority of exceedances of adopted numeric objectives continue to consist of specific conductivity, dissolved oxygen, pH, and *E. coli*. Agricultural runoff and irrigation return flows may contribute to exceedances of these objectives, but these parameters are primarily controlled or significantly affected by natural processes and sources that are not controllable by agricultural management practices.

The Coalition has implemented the requirements of the ILRP since 2004. The Coalition developed a Watershed Evaluation Report (WER) that set the priorities for development and implementation of the initial Monitoring and Reporting Program Plan (MRPP). The Coalition successfully developed the MRPP, Quality Assurance Project Plan (QAPP), and Management Plan as required by the ILRP, and all were approved by the Regional Water Board. Subsequent revisions requested by the Regional Water Board and the Coalition were incorporated into the Coalition's program and implemented through the Coalition's ongoing ILRP monitoring efforts. The Coalition also continues to adapt and improve elements of its monitoring program based on the knowledge gained through its monitoring efforts.

The 2019 monitoring program, as specified in the 2019 Monitoring Plan Update, was developed to be consistent with the requirements of the WDR and MRP (*Order No. R5-2014-0030*) and 2016 PEP, and was approved by the Regional Water Board for this purpose with the understanding that it would serve as an "Assessment" monitoring period for the Coalition. The Coalition has implemented the approved monitoring program in coordination with its subwatershed partners, has initiated follow-up activities required to address observed exceedances, and continued to implement the approved 2016 CSQMP and approved individual Management Plan elements. Throughout this process, the Coalition has kept an open line of communication with the Regional Water Board and has made every effort to fulfill the requirements of the ILRP in a cost-effective, scientifically defensible, and management-focused manner. This AMR is documentation of the success and continued progress of the Coalition in achieving these objectives.

Introduction

The primary purpose of this report is to document the monitoring efforts and results of the Sacramento Valley Water Quality Coalition (Coalition) Monitoring and Reporting Program (MRP). This Annual Monitoring Report (AMR) for 2019 also serves to document the Coalition's progress toward fulfilling the requirements of its *Waste Discharge Requirements General Order for Growers within the Sacramento River Watershed that are Members of a Third-Party Group* (*R5-2014-0030-R1*) (WDR).[3]

The AMR includes the following elements noted in **Table 1**, as specified in the WDR's MRP:

Table 1. MRP Annual Monitoring Report Requirements[4]

MRP Section	AMR Requirement	Report Section Headings	Page
V.C.1	Signed Transmittal Letter	NA	-
V.C.2	Title page	Title page	-
V.C.3	Table of Contents	Table of Contents	*i*
V.C.4	Executive Summary	Executive Summary	*vi*
V.C.5	Description of the Coalition Group geographical area	Description of the Watershed	4
V.C.6	Monitoring objectives and design	Monitoring Objectives	5
V.C.7	Sampling site descriptions and rainfall records for the time period covered under the AMR	Sampling Site Locations and Land Uses; Summary of Sampling Conditions	8; 27
V.C.8	Location map(s) of sampling sites, crops and land uses	Appendix E: Drainage Maps	CD
V.A.1;[1] V.C.9; V.C.11	An Excel workbook containing an export of all data records uploaded and/or entered into the CEDEN-comparable database (surface water data). The workbook shall contain, at a minimum, those items detailed in the most recent version of the third-party's approved QAPP Guidelines; Tabulated results of all analyses arranged in tabular form so that the required information is readily discernible; Electronic data submittal.	Appendix C: Tabulated Monitoring Results	CD

[3] Prior to adoption of the WDR, the Coalition was subject to a Conditional Waiver of Waste Discharge Requirements for the Irrigated Lands Regulatory Program (ILRP) and subsequent amendments to the ILRP requirements (WQO-2004-0003, SWRCB 2004, R5-2005-0833, R5-2008-0005, R5-2009-0875).

[4] Monitoring and Reporting Program (Attachment B to R5-2014-0030), Section V.C.

MRP Section	AMR Requirement	Report Section Headings	Page
V.C.10	Discussion of data relative to water quality objectives/Trigger Limits and water quality management plan milestones/Basin Plan Amendment Workplan (BPAW) updates, if applicable	Assessment of Water Quality Objectives	43
V.C.12	Sampling and analytical methods used	Sampling and Analytical Methods	16
V.A.5;[1] V.A.7.c.; V.C.13	Electronic copies of all applicable laboratory analytical reports on a CD; Chain of custody (COCs) and sample receipt documentation; Associated laboratory and field quality control samples results	Appendix B: Lab Reports and Chains of Custody	CD
V.C.14	Summary of Quality Assurance Evaluation results (as identified in the most recent version of the Coalition's QAPP for Precision, Accuracy and Completeness)	Quality Assurance	43
V.A.3-4;[1] V.C.15	Electronic copies of all field sheets; Electronic copies of photos obtained from all surface water monitoring sites, clearly labeled with the CEDEN comparable station code and date; Specification of the method(s) used to obtain estimated flow at each surface water monitoring site during each monitoring event	Appendix A: Field Log Copies	CD
V.C.16	Summary of exceedances of water quality objectives/Trigger Limits occurring during the reporting period and surface water-related pesticide use information	Assessment of Water Quality Objectives; Appendix D: Exceedance Reports	43; CD
V.C.17	Actions taken to address water quality exceedances that have occurred, including, but not limited to, revised or additional management practices implemented	Management Practices and Actions Taken; Appendix F: SVWQC Outreach Materials	71
V.C.18	Evaluation of monitoring data to identify temporal and spatial trends and patterns	Trend Analysis; Appendix G: Trend Analysis Results	65
V.C.19	Summary of Nitrogen Management Plan information submitted to the Coalition	---[2]	NA

MRP Section	AMR Requirement	Report Section Headings	Page
V.C.20	Summary of Management Practice information collected as part of Farm Evaluations	---[3]	NA
V.C.21	Summary of Mitigation Monitoring	---[4]	NA
V.C.22	Summary of education and outreach activities	Management Practices and Actions Taken; Appendix F: SVWQC Outreach Materials	71
V.C.23	Reduced Monitoring/Management Plan Verification Option Reports	Appendix H: Reduced Monitoring Reports	NA
V.C.24	Conclusions and recommendations	Conclusions and Recommendations	74

1. Quarterly Submittals of Monitoring Results (WDR Provision V.A.) are re-submitted with the AMR.
2. The 2019 Nitrogen Management Plan (NMP) Summary Report will be submitted to the ILRP by 30 November 2020.
3. A Farm Evaluation (FE) is not required to be submitted for the 2019 monitoring year.
4. This item is not applicable because no mitigation monitoring was conducted in 2019.

With the exceptions noted in **Table 1,** all report elements required by the WDR are included in this report.

Description of the Watershed

The Sacramento River Watershed drains over 27,000 square miles of land in the northern part of California's Central Valley into the Sacramento River. The upper watersheds of the Sacramento River region include the Pit River watershed above Lake Shasta and the Feather River watershed above Lake Oroville. The Sacramento Valley drainages include the Colusa, Cache Creek, and Yolo Bypass watersheds on the west side of the valley, and the Feather, Yuba, and American River watersheds on the east side of the valley. The Coalition also monitors in the Cosumnes River watershed, which is not part of the Sacramento River Watershed.

Beginning at its northern terminus near the city of Redding, the Sacramento Valley stretches approximately 180 miles to the southeast, where it merges into the Sacramento-San Joaquin River Delta south of the Sacramento metropolitan area at Rio Vista. The valley is 30 to 45 miles wide in the southern to central parts, but narrows to about 5 miles wide near Redding. Its elevation decreases from 300 feet at its northern end to near sea level in the Delta. The greater Sacramento River Watershed includes sites from 5,000 feet in elevation to near sea level.

The Sacramento River Basin is a unique mosaic of farm lands, refuges, and managed wetlands for waterfowl habitat; spawning grounds for numerous salmon species and steelhead trout; and the cities and rural communities that make up this region. This natural and working landscape between the crests of the Sierra Nevada and the Coast Range includes the following:

- More than a million acres of family farms that provide the economic engine for the region; provide a working landscape and pastoral setting; and serve as valuable habitat for waterfowl along the Pacific Flyway. The predominant crops include: rice, general grain and hay, improved pasture, corn, tomatoes, alfalfa, almonds, walnuts, prunes, safflower, and vineyards.
- Habitat for 50% of the threatened and endangered species in California, including the winter-run and spring-run salmon, steelhead, and many other fish species.
- Six National Wildlife Refuges, more than fifty state Wildlife Areas, and other privately managed wetlands that support the annual migration of waterfowl, geese, and water birds in the Pacific Flyway. These seasonal and permanent wetlands provide for 65% of the North American Waterfowl Management Plan objectives.
- The small towns and rural communities that form the backbone of the region, as well as the State Capital that serves as the center of government for the State of California.
- The forests and meadows in the numerous watersheds of the Sierra Nevada and Coast Range.

Monitoring Objectives

The Coalition's monitoring program conforms to the goals of the Nonpoint Source (NPS) Program and achieves the following objectives as a condition of the WDR's MRP:

1. Track, monitor, assess and report program activities;
2. Ensure consistent and accurate reporting of monitoring activities;
3. Target NPS Program activities at the watershed level;
4. Coordinate with public and private partners; and
5. Track implementation of management practices to improve water quality and protect existing beneficial uses.

In accordance with WDR requirements, the Coalition is achieving these objectives by implementing a MRP that evaluates water and sediment samples for the presence of statistically significant toxicity and exceedances of applicable numeric water quality objectives and ILRP Trigger Limits. The Coalition initiates follow-up actions designed to identify constituents causing significant toxicity when toxicity is of sufficient magnitude. Exceedances of numeric objectives and ILRP Trigger Limits for chemical, physical and microbiological parameters trigger follow-up actions designed to identify potential sources of these exceedances and to inform potential users of the products that contain constituents of concern. Additionally, the Coalition is evaluating the degree of implementation of current management practices in priority watersheds (i.e., those where Management Plans have been triggered) and recommending additional practices as water quality results indicate a need to do so. The Coalition is committed to the principle of adaptive management to control specific discharges of waste from agricultural lands that are having an impact on water quality. This iterative approach allows for the most effective use of limited human and fiscal resources.

The parameters monitored in 2019 by the Coalition to achieve these objectives are as specified in the current WDR and MRP (*Order No. R5-2014-0030*):

- Water column and sediment toxicity
- Physical and conventional parameters in water
- Organic carbon
- Pathogen indicator organisms in water
- Trace metals in water
- Pesticides in water
- Nitrogen and phosphorus compounds in water

The proposed frequency and schedule for water quality sample collection used to assess the presence and concentration of the above-listed parameters in Coalition receiving waters are submitted to the Regional Water Board each year on August 1 in the form of the Coalition's Monitoring Plan Update. The WDR does not explicitly state the individual constituents that require monitoring each year, but allows for the Coalition to make that determination based on guidance provided in the WDR and MRP and the amounts and time periods of pesticide applications in representative and integration site drainages using California Department of Pesticide Regulation (CDPR) pesticide use reporting (PUR) data.

Additional guidance for the monitoring of pesticides was established in November 2016 with the Regional Water Board's requirement that all Central Valley agricultural water quality coalitions begin using a protocol for prioritizing and selecting pesticides for surface water monitoring (ILRP Pesticides Evaluation Protocol or PEP). The PEP was developed by a Pesticide Evaluation Advisory Workgroup and outlines the required steps that Coalition's must use to process PUR data when developing annual monitoring plans. The PEP process requires the Coalition to monitor specific registered pesticides based on (1) their rate of application in a given drainage (lbs. applied per drainage) and (2) a pesticide-specific relative risk (the ratio of the amount of chemical applied to a reference value with a specific averaging period). As a result, not all pesticides are monitored at each site for every monitoring event, and instead Coalition pesticide monitoring reflects the frequency and intensity of pesticide use within an individual drainage.

The current WDR and MRP also require testing for 303(d)-listed constituents identified in water bodies downstream from Coalition sites and discharged within the watershed, if irrigated agriculture has been identified as a contributing source within the Sacramento River Watershed and such monitoring has been requested by the Regional Water Board's Executive Officer.

Note that not all parameters were monitored at every site for every monitoring event. Specific individual parameters measured for 2019 Coalition Monitoring are listed in **Table 2**.

Table 2. Constituents Monitored for the 2019 Monitoring Year

Analyte	Quantitation Limit[(a)]	Reporting Unit
Physical Parameters		
Flow	NA	CFS (Ft^3/Sec)
pH	0.1 [(b)]	-log[H^+]
Specific Conductivity	0.1 [(b)]	µS/cm
Dissolved Oxygen	0.1 [(b)]	mg/L
Temperature	0.1 [(b)]	˚C
Hardness, total as $CaCO_3$	10	mg/L
Turbidity	1.0	NTU
Total Suspended Solids	3.0	mg/L
Dissolved Organic Carbon	0.5	mg/L
Total Organic Carbon	0.5	mg/L
Grain size (in sediment)	1	% fraction
Pathogen Indicators		
E. coli bacteria	2	MPN/100 mL
Water Column Toxicity		
Ceriodaphnia, 96-h acute	NA	% Survival
Selenastrum, 96-h short-term chronic	NA	% of Survival
Sediment Toxicity		
Hyalella, 10-day short-term chronic	NA	% Survival
Pesticides		
Carbamates	(c)	µg/L
Fungicide	(c)	µg/L

Analyte	Quantitation Limit[(a)]	Reporting Unit
Herbicides	(c)	µg/L
Insecticides	(c)	µg/L
Organochlorine	(c)	µg/L
Organophosphorus	(c)	µg/L
Pyrethroids	(c)	µg/L
Triazines	(c)	µg/L
Trace Elements		
Arsenic	0.5	µg/L
Boron	10	µg/L
Copper	0.5	µg/L
Zinc	1	µg/L
Nutrients		
Ammonia as N	0.1	mg/L
Nitrate + Nitrite as N	0.1	mg/L
Orthophosphate as P	0.1	mg/L
Phosphorus, total	0.1	mg/L

Notes:

a. The Quantitation Limit (QL) represents the concentration of an analyte that can be routinely measured in the sampled matrix within the stated limits and confidence in both identification and quantitation.
b. Detection and reporting limits are not strictly defined. Value is required reporting precision.
c. Limits are different for individual pesticides.

Sampling Site Descriptions

To successfully implement the monitoring and reporting program requirements contained in the ILRP adopted by the Regional Water Board in June 2003, the Coalition worked directly with landowners in the 21 counties within the Sacramento River Watershed to identify and develop ten (now 13) subwatershed groups. Representatives from each subwatershed group utilized agronomic and hydrologic data generated by the Coalition in an attempt to prioritize watershed areas for initial evaluation that were used to ultimately select monitoring sites in their respective areas based upon existing infrastructure, historical monitoring data, land use patterns, historical pesticide use, and the presence of 303(d)-listed water bodies.

Coalition members selected sampling sites in watersheds based upon the following fundamental assumptions regarding management of non-point source discharges to surface water bodies: 1) Landscape scale sampling at the bottom of drainage areas allows determination of the presence of water quality problems using a variety of analytical methods, including water column and sediment toxicity testing, water chemistry analyses, and bioassessment; 2) Strategic source investigations utilizing Geographic Information Systems can be used to identify upstream parcels with attributes that may be related to the analytical results, including crops, pesticide applications, and soil type; and 3) Management practice effectiveness can best be assessed by subwatershed coalitions at the drainage and subwatershed scale to determine compliance with water quality objectives in designated water bodies. Results from farm-level management practices evaluations are used to complement Coalition efforts on the watershed scale by providing crop-specific information that supports management practice recommendations.

The Coalition uses a “representative monitoring” approach to achieve the goals of the 2014 MRP:

- Representative monitoring is conducted at sites in drainages representative of larger regions based on shared agricultural and geographic characteristics;
- Representative monitoring includes a cycle of two years of “Assessment” Monitoring for the broader suite of ILRP analytes, followed by two years of sampling needed for Management Plan implementation (referred to as “Core” Monitoring or “Non-Assessment” Monitoring); and
- Monitoring schedules and the analytes monitored are customized based on the characteristics of individual subwatersheds and Management Plans.

Monitoring sites visited in 2019 were all previously monitored and included 15 representative sites, three integration sites, and four special project sites where monitoring requirements were triggered by Management Plans.

SAMPLING SITE LOCATIONS AND LAND USES

The water and sediment sites monitored by the Coalition in 2019 are listed in **Table 3**. All sites monitored in 2019 were approved by the Regional Water Board as MRP compliance sites. An overall map of Coalition and subwatershed sites is presented in **Figure 1**. Site-specific drainage maps with land use patterns for all monitoring locations are provided in **Appendix E**.

Table 3. Monitoring Sites for 2019 Coalition Monitoring

Subwatershed	Site Name	Latitude	Longitude	Agency	Site ID & Category (Fig. 1)	
Butte Yuba Sutter	Gilsizer Slough at George Washington Road	39.009	-121.6716	SVWQC	GILSL	SP
Butte Yuba Sutter	Lower Honcut Creek at Hwy 70	39.30915	-121.59542	SVWQC	LHNCT	REP
Butte Yuba Sutter	Lower Snake River at Nuestro Rd	39.18531	-121.70358	SVWQC	LSNKR	REP
Butte Yuba Sutter	Pine Creek at Highway 32	39.75338	-121.97124	SVWQC	PNCHY	REP
Butte Yuba Sutter	Sacramento Slough bridge near Karnak	38.785	-121.6533	SVWQC	SSKNK	INT
Colusa Glenn	Colusa Basin Drain above KL	38.8121	-121.7741	SVWQC	COLDR	INT
Colusa Glenn	Freshwater Creek at Gibson Rd	39.17664	-122.18915	SVWQC	FRSHC	REP
Colusa Glenn	Rough & Ready Pumping Plant (RD 108)	38.86209	-121.7927	SVWQC	RARPP	SP
Colusa Glenn	Walker Creek near 99W and CR33	39.62423	-122.19652	SVWQC	WLKCH	REP
El Dorado	Coon Hollow Creek	38.75335	-120.72404	SVWQC	COONH	SP
Goose Lake	Lower Lassen Creek	41.89103	-120.35594	SVWQC	LOWLC	REP
Lake	McGaugh Slough at Finley Road East	39.00417	-122.86233	SVWQC	MGSLU	SP
Lake	Middle Creek upstream from Highway 20	39.17641	-122.91271	SVWQC	MDLCR	REP
Pit River	Pit River at Pittville Bridge	41.0454	-121.3317	NECWA	PRPIT	REP
PNSSNS	Coon Creek at Brewer Road	38.93399	-121.45184	PNSSNS	CCBRW	REP
Sacramento Amador	Cosumnes River at Twin Cities Rd	38.29098	-121.38044	SVWQC	CRTWN	REP
Sacramento Amador	Grand Island Drain near Leary Road	38.2399	-121.5649	SVWQC	GIDLR	REP
Shasta Tehama	Anderson Creek at Ash Creek Road	40.418	-122.2136	SVWQC	ACACR	REP
Solano	Shag Slough at Liberty Island Bridge	38.30677	-121.69337	SVWQC	SSLIB	INT
Solano	Ulatis Creek at Brown Road	38.307	-121.794	SVWQC	UCBRD	REP
Upper Feather River	Middle Fork Feather River above Grizzly Creek	39.816	-120.426	UFRW	MFFGR	REP
Yolo	Willow Slough Bypass at Pole Line	38.59015	-121.73058	SVWQC	WLSPL	REP

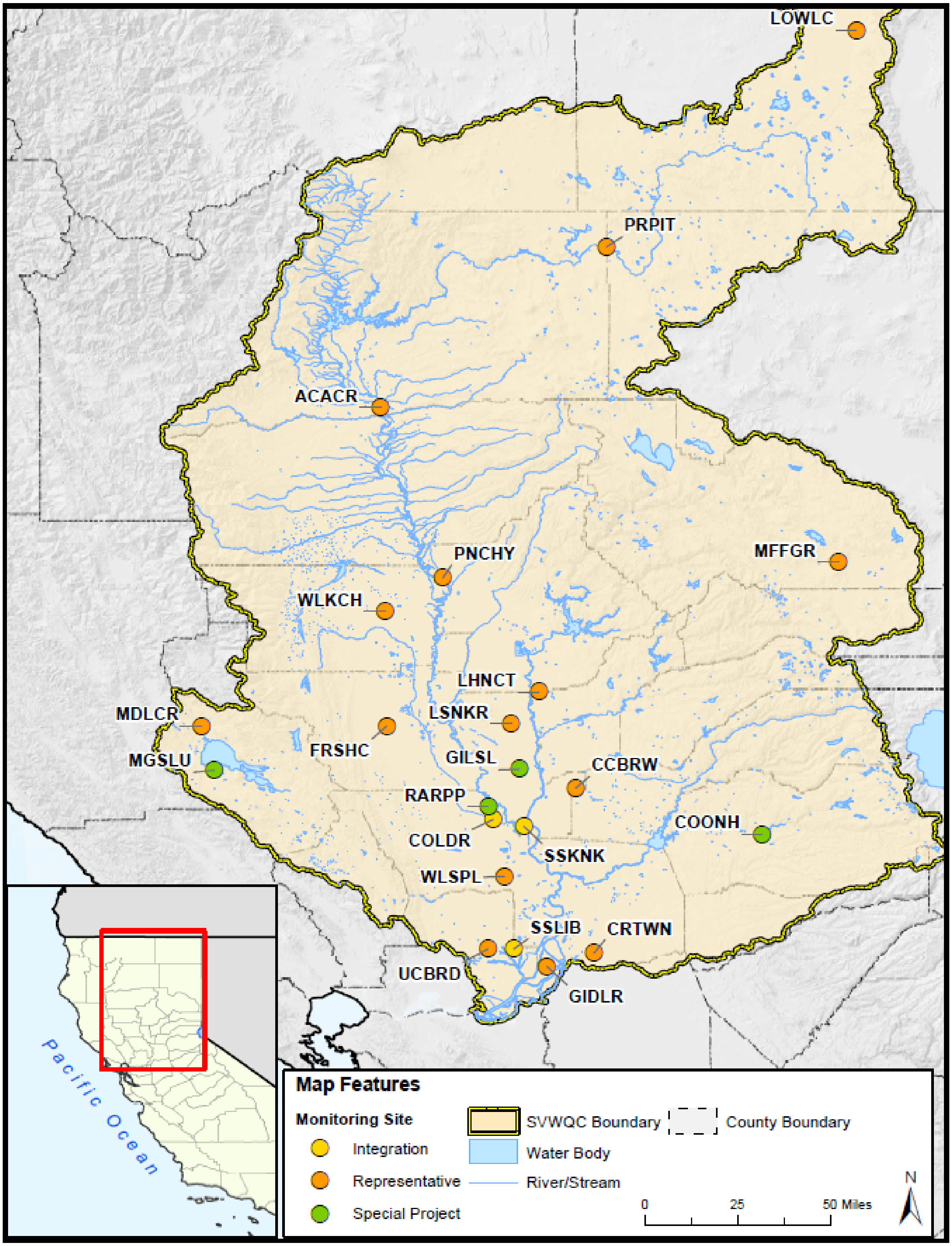

Figure 1. 2019 Coalition Monitoring Sites

SITE DESCRIPTIONS

Butte-Yuba-Sutter Subwatershed

Gilsizer Slough at George Washington Road (GILSL)

Gilsizer Slough is an unlined storm drainage outfall canal that runs from the Gilsizer County Drainage District's north pump station approximately 15 miles to the Sutter Bypass, draining 6,005 total acres. The monitoring location is located roughly 1.5 miles from its confluence with the Sutter Bypass and is a natural drainage channel that historically drained Yuba City and the area south of town. Principal crops grown in this area include prunes, walnuts, peaches, and almonds. This special project site is also a Management Plan site for this subwatershed.

Lower Honcut Creek at Highway 70 (LHNCT)

Lower Honcut Creek (in the Lower Honcut Creek drainage) was selected to represent the drainages in the eastern part of the Butte-Yuba-Sutter Subwatershed. This drainage includes the dominant crops grown in the area and typically has flows allowing sampling through irrigation season. The sampling site is located approximately 3.5 miles from its confluence with the Feather River. Dominant crops in this drainage include rice, walnuts, prunes, pasture, citrus, olive, and grapes. Lower Honcut Creek receives flows from North Honcut Creek and South Honcut Creek, which extend up into the foothills and include more pasture acreage. This is a representative site for this subwatershed.

Lower Snake River at Nuestro Road (LSNKR)

The Lower Snake River is an unlined irrigation supply and runoff canal that serves approximately 25,000 total acres and includes a relatively high percentage of rice acreage. The other predominant crops include prunes, peaches, idle acreage, and operations producing flowers, nursery stock, and Christmas trees. This is a representative site for this subwatershed.

Pine Creek at Highway 32 (PNCHY)

The watershed sampled upstream from the Pine Creek monitoring site represents approximately 28,000 acres of varied farmland, riparian habitat, and farmsteads. The predominant crops in this area are walnuts, almonds, prunes, wheat, oats, barley, beans, squash, cucumbers, alfalfa, pasture, and safflower. This is a representative site for this subwatershed.

Sacramento Slough Bridge near Karnak (SSKNK)

This site aggregates water from all areas in the subwatershed between the Feather and Sacramento Rivers. The major contributing areas include the areas downstream of the Butte Slough and Wadsworth monitoring sites. These areas include Sutter Bypass and its major inputs from Gilsizer Slough, Reclamation District (RD) 1660, RD 1500, and the Lower Snake River. Monitoring at this site is coordinated with the California Rice Commission. This is an integration site for this subwatershed.

Colusa Glenn Subwatershed

Colusa Basin Drain above Knights Landing (COLDR)

This site is near the outfall gates of the Colusa Basin Drain before its confluence with the Sacramento River. This site is downstream of all of the other monitoring sites within the basin. The upstream acreage consists of almonds, tomatoes, wetlands, pasture, corn, and walnuts. Monitoring at this site is coordinated with the California Rice Commission. This is an integration site for this subwatershed.

Freshwater Creek at Gibson Road (FRSHC)

The Freshwater Creek drainage includes approximately 83,000 total acres. Irrigated acreage (excluding rice acreage) is approximately 19,000 acres. Predominant crops in the drainage are rice, tomatoes, idle acreage, squash, grain, pasture, and safflower. This is a representative site for this subwatershed.

Rough and Ready Pumping plant, RD 108 (RARPP)

The Rough & Ready Pumping Plant (owned and operated by Reclamation District 108) aggregates runoff and return flows for the Sycamore Slough drainage. The pumps lift the water into the Sacramento River. This drainage area contains large amounts of tomatoes, safflower, wheat, melons, corn, and pasture. This special project site is also a Management Plan site for this subwatershed.

Walker Creek near 99W and CR33 (WLKCH)

The Walker Creek drainage is located east of Wilson Creek in Glenn County, and the Walker Creek monitoring site is located 1.3 miles north of the Town of Willows. The Walker Creek drainage includes approximately 27,000 total irrigated acres. Predominant crops in this drainage are almonds, rice, corn, and alfalfa. This is a representative site for this subwatershed.

El Dorado Subwatershed

The El Dorado subwatershed is currently operating under the submitted and approved *Reduced Monitoring/Management Practices Verification Option*.

Coon Hollow Creek (COONH)

This site is located in the Apple Hill area of Camino, approximately 1 mile north of the intersection of North Canyon Road and Carson Road and 0.5 mile south of the confluence with South Canyon Creek. Agricultural operations within the drainage include silviculture, apples, wine grapes, cherries, and blueberries. Coon Hollow Creek is considered a low-flow perennial stream. This special project site is also a Management Plan site for this subwatershed.

Goose Lake Subwatershed

Lower Lassen Creek (LOWLC)

The land use pattern in the Lassen Creek drainage is similar to the Goose Lake Basin as a whole. Lassen Creek originates in predominately publicly owned lands that are managed primarily for dispersed recreation and livestock grazing. Lassen Creek flows out of the Warner Mountains towards Goose Lake, and land uses along this waterbody focus on dry-land alfalfa, native meadow hay production, and irrigated pasture for livestock. This is a representative site for this subwatershed.

Lake Subwatershed

The Lake subwatershed is currently operating under the submitted and approved *Reduced Monitoring/Management Practices Verification Option*.

Middle Creek Upstream from Highway 20 (MDLCR)

The Middle Creek drainage contains approximately 60,732 acres. Over 55,000 acres are listed as Native Vegetation with the U.S. Forest Service controlling the majority of the land. Irrigated agriculture constitutes of approximately 1,100 acres farmed by members participating in the Lake County Watershed Group. This includes 374 acres of walnuts, 308 acres of grapes, 186 acres of pears, 159 acres of hay/pasture, 10 acres of specialty crops/nursery crops, and about 70 acres of wild rice.

The sampling location was chosen to avoid influence from the town of Upper Lake, and captures approximately 60% of irrigated agricultural operations within this drainage. This is a representative site for this subwatershed.

McGaugh Slough at Finley Road East (MGSLU)

McGaugh Slough captures irrigated agricultural drainage from about 10,300 acres of orchard and vineyard crops in Lake County. This site characterizes the most prevalent drain for the Big Valley, which is the most intensive area for agricultural operations in Lake County. This special project site is also a Management Plan site for this subwatershed.

Napa Subwatershed

The Napa subwatershed is currently operating under the submitted and approved *Reduced Monitoring/Management Practices Verification Option*.

No water quality samples were collected by the Coalition in this subwatershed during the 2019 monitoring year.

Pit River Subwatershed

Monitoring in this subwatershed was conducted in coordination with the Northeastern California Watershed Association (NECWA) and the California's Surface Water Ambient Monitoring Program (SWAMP).

Pit River at Pittville Bridge (PRPIT)

This site captures drainage from Big Valley, Ash Creek and Horse Creek. This site captures drainage from native pasture (the primary land use), as well as alfalfa, oat hay, grain and duck marsh, ultimately incorporating approximately 9,000 acres in the Fall River Valley. This is a representative site for this subwatershed.

Placer-Nevada-South Sutter-North Sacramento Subwatershed

Monitoring in this subwatershed was conducted in coordination with the Placer-Nevada-South Sutter-North Sacramento (PNSSNS) Subwatershed.

Coon Creek at Brewer Road (CCBRW)

This site captures drainage from the Middle Coon Creek drainage areas as identified in the Placer-Northern Sacramento Drainage Prioritization Table in the Coalition's Watershed Evaluation Report (WER). This site is on Coon Creek about six miles northwest of the town of Lincoln and includes predominantly agricultural acreage. The drainage includes approximately 65,000 irrigated acres of rice, pasture, grains, and Sudan grass, with a high percentage of rice acreage. Irrigated acres (excluding rice) is approximately 13,000. This is a representative site for this subwatershed.

Sacramento/Amador Subwatershed

Cosumnes River at Twin Cities Road (CRTWN)

This site characterizes flows from the eastern portion of the subwatershed via the Cosumnes River and a handful of tributary creeks that originate in the foothills. Contributing agricultural acreage includes pasture, vineyards, corn, and grains. This site captures drainage from the two largest drainages in the subwatershed: Lower Cosumnes and Middle Cosumnes rivers, which drain approximately 55,000 irrigated acres. This is a representative site for this subwatershed.

Grand Island Drain near Leary Road (GIDLR)

Grand Island is located in the heart of the Sacramento Delta. Crops include alfalfa, corn, safflower, apples, pears, cherries, blueberries, asparagus, grapes, and pasture land. Water is pumped on to the island at several locations. The monitoring site is located just up-slough from a station that returns water to the Delta. Approximately 8,000 irrigated acres drains to the monitoring site. This is a representative site for this subwatershed.

Shasta/Tehama Subwatershed

Anderson Creek at Ash Creek Road (ACACR)

Anderson Creek was identified as the highest priority drainage in the Shasta county portion of the Shasta/Tehama subwatershed. This ranking was based on total irrigated acreage, crop types by acreage, and amount and type of pesticide use. Anderson Creek originates about three miles west of the city of Anderson and flows into the Sacramento River. Crops are predominantly pasture, followed by walnuts and alfalfa/hay, and smaller amounts of other field and orchard crops. Total irrigated land is 8,989 acres. This is a representative site for this subwatershed.

Solano Subwatershed

Shag Slough at Liberty Island Bridge (SSLIB)

Shag Slough drains a large portion of the South Yolo Bypass. Crops grown in this drainage area include corn, safflower, grain, vineyards, tomatoes, and irrigated pasture. The Liberty Island Bridge site is approximately 2.5 to 3 miles southwest of the Toe Drain in Shag Slough. Like the

Toe Drain, it is a tidally influenced site and is likely to contain a mixture of Toe Drain water along with water from other sub-drainages within the South Yolo Bypass and the Southwest Yolo Bypass. Due to the difficulty in accessing the Toe Drain for sampling, Shag Slough replaced the original Toe Drain sampling location in late 2005. This is a integration site for this subwatershed.

Ulatis Creek at Brown Road (UCBRD)

Ulatis Creek is a flood control project (FCP) that drains the majority of the central portion of Solano County. The Ulatis Creek FCP monitoring site is located on Brown Road approximately 8.5 miles south of Dixon and 1.5 miles east of State Highway 113. This site drains the Cache Slough area, as designated in the Yolo/Solano subwatershed map, and empties into Cache Slough. The major crops in this area include wheat, corn, pasture, tomatoes, alfalfa, Sudan grass, walnuts, and almonds. This is a representative site for this subwatershed.

Upper Feather River Watershed

Agriculture in this subwatershed is localized in mountain valleys that are suitable for grazing and growing alfalfa, hay, and grain crops. Monitoring in this subwatershed is focused on characterizing drainage from three valleys with considerable agricultural acreage. Monitoring in this subwatershed was conducted in coordination with the Upper Feather River Watershed Group (UFRWG) and the California's Surface Water Ambient Monitoring Program (SWAMP).

Middle Fork Feather River Above Grizzly Creek (MFFGR)

The Middle Fork Feather River above Grizzly Creek is below the last irrigated site in the Sierra Valley subwatershed and has year-round flow in most years. This site replaced Middle Fork Feather River at County Rd A-23, which lacks year-round flows (often dry by mid-July) and has numerous non-agricultural uses, including recreation and filling water trucks. This is a representative site for this subwatershed.

Yolo Subwatershed

Willow Slough Bypass at Pole Line Road (WLSPL)

The Willow Slough Bypass is a large drainage including approximately 102,000 total acres. Irrigated acreage (excluding rice acreage) is approximately 66,000 acres. Predominant crops in the drainage are grain, pasture, corn, tomatoes, rice, almonds, and walnuts. This is a representative site for this subwatershed.

Sampling and Analytical Methods

The objective of data collection for this monitoring program is to produce data that represent, as closely as possible, *in situ* conditions of agricultural discharges and water bodies in the Sacramento Valley. This objective will be achieved by using standard accepted methods to collect and analyze surface water and sediment samples. Assessing the monitoring program's ability to meet this objective will be accomplished by evaluating the resulting laboratory measurements in terms of detection limits, precision, accuracy, representativeness, comparability, and completeness, as described in the Coalition's QAPP (SVWQC 2010; amended 2017) and approved by the Regional Water Board. Additionally, the Coalition submits an electronic QAPP (eQAPP) to the Regional Water Board on a quarterly basis with its quarterly data submittal. The eQAPP alerts Regional Water Board staff to the Coalition's event-based analysis of constituents and their associated analytical methods, along with occasional changes to a laboratory's analytical recovery limits for certain parameters.

Surface water samples were collected for analysis of the constituents listed in **Table 2** as specified in the Coalition's 2019 Monitoring Plan Update. Surface water and sediment samples were collected for chemical analyses and toxicity testing. All samples were collected and analyzed using the methods specified in the QAPP and eQAPP; any deviations from these methods were explained.

SAMPLE COLLECTION METHODS

All samples were collected in a manner appropriate for the specific analytical methods used, and to ensure that water column samples were representative of the flow in the channel cross-section. Water quality samples were collected using clean techniques that minimize sample contamination. Samples were collected as either cross-sectional composite samples or mid-stream, mid-depth grab samples, depending on sampling site and event characteristics. When grab sample collection methods were used, samples were taken at approximately mid-stream and mid-depth at the location of greatest flow (where feasible). Where appropriate, water samples were collected using a standard multi-vertical depth integrating method. Abbreviated sampling methods (i.e., weighted-bottle or dip sample) may be used for collecting representative water samples.

Sediment sampling was conducted at sampling sites on an approximately 50-meter reach of the waterbody near the water sampling location. If USGS methods were applicable, sediment sub-samples were collected from five to ten wadeable depositional zones. Depositional zones include areas on the inside bend of a stream or areas downstream from obstacles such as boulders, islands, sand bars, or simply shallow waters near the shore. In low-energy, low-gradient waterbodies, composite samples may be collected from the bottom of the channel using appropriate equipment, as specified in the Coalition's QAPP.

Details of the standard operating procedures (SOPs) for collection of surface water and sediment samples are provided in the Coalition's QAPP. The sites and number of samples for 2019 Coalition monitoring are summarized in **Table 4**. The Coalition's monitoring strategy for 2019 was designed to characterize high priority drainages that are representative of a subwatershed's dominant agricultural crops and practices. This sampling approach was initially designed to comply with the requirements in *Order No. R5-2008*-0005 and with the later adopted ILRP MRP

(*Monitoring and Reporting Program Order No. R5-2009-0875*); this approach was maintained for the current WDR and MRP (*Order No. R5-2014-0030*). The elements that are key to achieving the Coalition's goals and satisfying the intent of the requirements of the *R5-2014-0030* MRP are (1) the Coalition's prioritization process for selecting representative drainages and monitoring sites, and (2) identification of monitoring parameters and schedules appropriate for these representative drainages. This approach was detailed in the Coalition's 2009 Monitoring and Reporting Program Plan, as required by *Order No. R5-2008-0005*, and the monitoring plan is updated annually in August, as required by *Order No. R5-2014-0030*.

Table 4. 2019 Coalition Monitoring Year: Planned Samples, October 2018 – September 2019

						Core Parameters									Metals				Pesticides in Water																																													Toxicity				
Subwatershed	Representative	SiteID	SITE CATEGORY: REP=Representative INT=Integrative SP=Special Project	Water Column Sample Events	Sediment Sample Events	Field Measured Group	Dissolved Organic Carbon	Total Organic Carbon	Total Suspended Solids	Turbidity	E. coli	Nutrients Group	Arsenic (total)	Boron	Copper	Hardness	Legacy OCLs	2,4-D acids & salts	Acetamiprid	Atrazine	Bifenthrin	Carbaryl	Chloropicrin	Chlorothalonil	Chlorpyrifos	Clothianidin	Cyfluthrin	Cypermethrin	Cyprodinil	Deltamethrin	Diazinon	Dichlorvos	Dimethoate	Diuron	Dodine	Esfenvalerate	Ethalfluralin	Fenpropathrin	Glyphosate	Imidacloprid	Lambda-Cyhalothrin	Linuron	Malathion	Methidathion	Methiocarb	Methomyl	Metribuzin	Oryzalin	Oxyfluorfen	Paraquat Dichloride	Pendimethalin	Permethrin	Phorate	Prometryn	Propiconazole	Pyraclostrobin	Pyridaben	Simazine	Tau-Fluvalinate	Trifluralin	Algae - *Selenastrum*	Water Flea - *Ceriodaphnia*	*Hyalella azteca*	Grain Size	TOC
ButteYubaSutter	Lower Feather River	SSKNK	INT	4	2	4	3	4	4	4	4	4			2	2		2	2		2	2	2				2	2		1						2	2		1	2	2					2	1		2	2	1	2		1		2		1		2	4	4	2	2	2
ButteYubaSutter	Lower Honcut Creek	LHNCT	REP	10	2	10	8	10	10	10	10	10			3	3		1			3		3		3		3	2	1			1		1	2	3		1		2	2								3	3	1	3				1		1			8	8	2	2	2
ButteYubaSutter	Pine Creek	PNCHY	REP	11	2	11	7	11	11	11	11	11			5	5		4	2		4	1	1		8		3	1	1					3	2	5	3		2	4	3					1				3	1	2				3				3	10	10	2	2	2
ButteYubaSutter	Wadsworth	BTTSL	SP																																																														
ButteYubaSutter	Wadsworth	LSNKR	REP	11	2	11	7	11	11	11	11	11	4		3	3		5	4		3	3	2		4		3	3	2		2			3	2	3	3		2	5	2					2			4	3	1	2			1	3	1	3		3	9	11	2	2	2
ButteYubaSutter	Wadsworth	GILSL	SP	5		5											2								4						4																																			
ButteYubaSutter	Wadsworth	WADCN	SP																																																													
ColusaGlenn	Freshwater Creek	FRSHC	REP	11	2	11	8	11	11	11	11	11			4	4			1		3	1					3	3	1				3		2	3	2	1	2	4	4					2			2	5	1	2			1	3				3	11	9	2	2	2
ColusaGlenn	Freshwater Creek	LRLNC	SP																																																													
ColusaGlenn	Freshwater Creek	SCCMR	SP																																																													
ColusaGlenn	Lower Colusa Drain	COLDR	INT	4	2	4	3	4	4	4	4	4			2	2		1	1		2	1			1		1	3	1		1		2		1	2	2	1	2	3	3		1			1	1		2	3	2	2				2				2	4	3	2	2	2
ColusaGlenn	Lower Colusa Drain	RARPP	SP														2																																																
ColusaGlenn	Willow Creek	WLKCH	REP	11	2	11	8	11	11	11	11	11			4	2		3	2	1	3	2	4		3		2	3	2		1		2	3	2	4	3	4	3	3	4		1			1			3	2	1	2	1		2	4	1			4	11	9	2	2	2
ColusaGlenn	Willow Creek	LGNCR	SP																																																												
ColusaGlenn	Willow Creek	STYHY	SP																																																														
ElDorado	Coloma El Dorado	NRTCN	REP																																																														
ElDorado	Coloma El Dorado	COONH	SP	2		2											2																																															
GooseLake	Goose Lake	LOWLC	REP	3		3		3	3	3	3	3																																																				
Lake	Upper Lake	MDLCR	REP	4		4					4	4																																																				
Lake	Upper Lake	MGSLU	REP	4		4						4																																																				
Napa	Pope Creek	PCULB	REP																																																														
Napa	Pope Creek	CCULB	SP																																																														
NECWA	Big Lake	PRPIT	REP	5		5	4	5	5	5	5	5			6	3		3			1	4	1				3						1			3					2		3	1																	4	5			
NECWA	Big Lake	FRRRB	SP	4		4																																																										
NECWA	Big Lake	PRCAN	SP	4		4																																																										
PNSSNS	Middle Coon Creek	CCBRW	REP	9	2	9	8	9	9	9	9	9			6	3		1	1		3		2	1	2		3	3		1						5	2				5								2	4	1	4								2	6	8	2	2	2
PNSSNS	Middle Coon Creek	CCSTR	SP																																																														
SacramentoAmador	Lower Cosumnes	CRTWN	REP	10	2	10	8	10	10	10	10	10			4	2		1		1	3	1		2	2	2	3	4	1				3			3		3		2	3		2		1	1				3	1	2				3	2	3	2	3	9	10	2	2	2
SacramentoAmador	Lower Cosumnes	DCGLT	SP																																																													
SacramentoAmador	Lower Cosumnes	LAGAM	SP																																																														
SacramentoAmador	Sacramento Delta	GIDLR	REP	12	2	12	8	12	12	12	12	12	6		2	2	2			2	3	1			2	1	3	2	1		3		2	4		2		2		2	2					1				3	2	1				2		2		2	9	10	2	2	2
ShastaTehama	Anderson Creek	ACACR	REP	10	2	10	8	10	10	10	10	10			6	3		4	2		4	3	3	2	3	1	3	2	1		1		1	1	2	3	2	2	3		4		2					1		3	1	2				3	2	2			9	9	2	2	2
ShastaTehama	Anderson Creek	BRCWB	SP																																																													
ShastaTehama	Anderson Creek	COYTR	SP																																																														
Solano	Cache Slough	UCBRD	REP	12	2	12	8	12	12	12	12	12			2	2		3		1			2		4						4						1		2		3	1			1	2			5	2		4				1					10	10	2	2	2
Solano	South Yolo Bypass	SSLIB	INT	4	2	4	3	4	4	4	4	4			2	2		2		1	2	1	2	2		1	2	1	1							2	2	1		2	2									2	2	2				2		1		1	4	4	2	2	2
Solano	South Yolo Bypass	ZDDIX	SP																																																													
UpperFeatherRiver	Middle Fork Feather River	MFFGR	REP	6		6		6	6	6	6	6																																																					
UpperFeatherRiver	Middle Fork Feather River	INDAB	SP																																																														
UpperFeatherRiver	Middle Fork Feather River	SPGRN	SP																																																														
Yolo	Willow Slough	WLSPL	REP	11	2	11	8	11	11	11	11	11		4	2	2		3	2	1	3	2	2			1	2	2						1		1	2			4	3		2			5	2		3	3	1	2				3	1	1		3	10	9	2	2	2
Yolo	Willow Slough	CCCPY	SP																																																													
Yolo	Willow Slough	TCHWY	SP																																																														
			Totals	##	28	167	99	144	144	144	148	152	10	4	53	40	8	33	17	7	39	22	24	7	36	6	36	31	12	2	16	1	14	16	13	41	24	15	17	33	44	1	11	1	2	18	4	1	26	41	16	32	1	1	4	32	7	14	2	28	118	119	28	28	28

Note:

(1) Sediment grain size is analyzed along with sediment toxicity. Samples for pyrethroids, chlorpyrifos, diazinon, and TOC in sediment are analyzed if sample is found to be toxic.

ANALYTICAL METHODS

Water chemistry samples were analyzed for filtered and unfiltered fractions of samples depending on analyte. Pesticide analyses were conducted only on unfiltered (whole) samples. Laboratories analyzing samples for this program have demonstrated the ability to meet the minimum performance requirements for each analytical method, including the ability to meet the project-specified quantitation limits (QL), the ability to generate acceptable precision and recovery requirements, and other analytical and quality control parameters documented in the Coalition's QAPP. Analytical methods used for chemical analyses follow accepted standard or USEPA methods or approved modifications to these methods, and all procedures for analyses are documented in the QAPP or are available for review and approval at each laboratory.

Toxicity Testing and Toxicity Identification Evaluations

Water quality samples were analyzed for toxicity to *Ceriodaphnia dubia* and *Selenastrum capricornutum* for 2019 Monitoring. Sediment samples were analyzed for toxicity to *Hyalella azteca*. Toxicity tests were conducted using standard USEPA methods for these species.

- Determination of acute toxicity to *Ceriodaphnia* was performed as described in *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, Fifth Edition* (USEPA 2002a). Toxicity tests with *Ceriodaphnia* were conducted as 96-hour static renewal tests, with renewal 48 hours after test initiation.
- Determination of toxicity to *Selenastrum* was performed using the non-EDTA procedure described in *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, Fourth Edition* (USEPA 2002b). Toxicity tests with *Selenastrum* were conducted as a 96-hour static non-renewal test.

For all initial toxicity screening tests at each site, 100% ambient water and a control were used for the acute water column tests. If 100% mortality to a test species was observed any time after the initiation of the initial screening test, then a multiple dilution test using a minimum of five sample dilutions was conducted with the initial water sample to estimate the magnitude of toxicity.

Procedures in the Coalition's QAPP state that if any measurement endpoint from any of the two aquatic toxicity tests exhibits a statistically significant reduction in survival (*Ceriodaphnia*) or cell density (*Selenastrum*) of greater than or equal to 50% compared to the control, then Toxicity Identification Evaluation (TIE) procedures will be initiated using the most sensitive species to investigate the cause of toxicity. The 50% mortality threshold is consistent with the approach recommended in guidance published by USEPA for conducting TIEs (USEPA 1996b), which recommends a minimum threshold of 50% mortality because the probability of completing a successful TIE decreases rapidly for samples with less than this level of toxicity. For samples that met these trigger criteria, Phase 1 TIEs to determine the general class of constituent (*e.g.*, metal, non-polar organics) causing toxicity or pesticide-focused TIEs are conducted. TIE methods generally adhere to the documented USEPA procedures referenced in the QAPP. TIE procedures are initiated as soon as possible after toxicity is observed to reduce the potential for loss of toxicity due to extended sample storage. Procedures for initiating and conducting TIEs are documented in the QAPP.

Detection and Quantitation Limits

The Method Detection Limit (MDL) is the minimum analyte concentration that can be measured and reported with a 99% confidence that the concentration is greater than zero. The Quantitation Limit (QL) represents the concentration of an analyte that can be routinely measured in the sampled matrix within stated limits and confidence in both identification and quantitation. For this program, QLs were established based on the verifiable levels and general measurement capabilities demonstrated by labs for each method. Note that samples required to be diluted for analysis (or corrected for percent moisture for sediment samples) may have sample-specific QLs that exceed the established QLs. This is unavoidable in some cases.

Project Quantitation Limits

Laboratories generally establish QLs that are reported with the analytical results—these may be called *reporting limits*, *detection limits*, *reporting detection limits*, or several other terms used by different laboratories. In most cases, these laboratory limits are less than or equal to the project QLs listed in **Table** 5 and **Table 6.** Wherever possible, project QLs are lower than the proposed or existing relevant numeric water quality objectives or toxicity thresholds, as required by the ILRP.

All analytical results between the MDL and QL are reported as numerical values and qualified as estimates (Detected, Not Quantified (DNQ); or sometimes, "J-flagged", which is a USEPA data qualifier indicating that the reported value is estimated).

Table 5. Laboratory Method Detection Limit (MDL) and Quantitation Limit (QL) Data Quality Objectives for Analyses of Surface Water

Method	Analyte	Fraction	Units	MDL	QL	Note
Physical and Conventional Parameters						
EPA 130.2	Hardness, total as $CaCO_3$	Unfiltered	mg/L	3	5	
EPA 180.1; SM2130B	Turbidity	Unfiltered	NTU	0.1	1.0	
SM20-2540 C	Total Dissolved Solids (TDS)	Particulate	mg/L	4	10	(a)
EPA 160.2; SM2540D	Total Suspended Solids (TSS)	Particulate	mg/L	2	3	
EPA 9060; SM5310B; SM5310C	Organic Carbon, Total (TOC)	Unfiltered	mg/L	0.1	0.5	
Pathogen Indicators						
SM 9223 B	*E. Coli* bacteria	NA	MPN/100mL	2	2	
Organophosphorus Pesticides						
EPA 625(m)	Azinphos-methyl	Unfiltered	µg/L	0.05	0.1	
EPA 625(m)	Chlorpyrifos	Unfiltered	µg/L	0.005	0.01	
EPA 625(m)	Diazinon	Unfiltered	µg/L	0.005	0.01	
EPA 625(m)	Dichlorvos	Unfiltered	µg/L	0.005	0.01	
EPA 625(m)	Dimethoate	Unfiltered	µg/L	0.005	0.01	
EPA 625(m)	Malathion	Unfiltered	µg/L	0.005	0.01	
EPA 625(m)	Methidathion	Unfiltered	µg/L	0.01	0.02	
EPA 625(m)	Naled	Unfiltered	µg/L	0.2	0.5	(a)
EPA 625(m)	Phorate	Unfiltered	µg/L	0.01	0.02	
Organochlorine Pesticides						
EPA 625(m)	4,4’-DDT (o,p’ and p,p’)	Unfiltered	µg/L	0.001	0.005	
EPA 625(m)	4,4’-DDE (o,p’ and p,p’)	Unfiltered	µg/L	0.001	0.005	
EPA 625(m)	4,4’-DDD (o,p’ and p,p’)	Unfiltered	µg/L	0.001	0.005	
EPA 625(m)	Aldrin	Unfiltered	µg/L	0.001	0.005	
EPA 625(m)	Chlordane	Unfiltered	µg/L	0.001	0.005	
EPA 8081A	Chlorothalonil	Unfiltered	µg/L	0.1	0.2	(a)
EPA 625(m)	Dacthal	Unfiltered	µg/L	0.008	0.05	
EPA 625(m)	Dicofol	Unfiltered	µg/L	0.05	0.1	
EPA 625(m)	Dieldrin	Unfiltered	µg/L	0.001	0.005	
EPA 625(m)	Endosulfan I	Unfiltered	µg/L	0.001	0.005	
EPA 625(m)	Endosulfan II	Unfiltered	µg/L	0.001	0.005	
EPA 625(m)	Endosulfan sulfate	Unfiltered	µg/L	0.001	0.005	
EPA 625(m)	Endrin	Unfiltered	µg/L	0.001	0.005	
EPA 625(m)	Endrin Aldehyde	Unfiltered	µg/L	0.001	0.005	
EPA 625(m)	Endrin Ketone	Unfiltered	µg/L	0.001	0.005	
EPA 625(m)	HCH	Unfiltered	µg/L	0.001	0.005	
EPA 625(m)	Heptachlor	Unfiltered	µg/L	0.001	0.005	
EPA 625(m)	Heptachlor epoxide	Unfiltered	µg/L	0.001	0.005	
EPA 625(m)	Methoxychlor	Unfiltered	µg/L	0.001	0.005	

Method	Analyte	Fraction	Units	MDL	QL	Note
Carbamate and Urea Pesticides						
EPA 8321	Carbaryl	Unfiltered	µg/L	0.05	0.07	
EPA 8321	Methiocarb	Unfiltered	µg/L	0.2	0.4	
EPA 8321	Methomyl	Unfiltered	µg/L	0.05	0.07	
Pyrethroid Pesticides						
GCMS-NCI	Allethrin	Unfiltered	µg/L	0.0001	0.0015	
GCMS-NCI	Bifenthrin	Unfiltered	µg/L	0.0001	0.0015	
GCMS-NCI	Cyfluthrin	Unfiltered	µg/L	0.0002	0.0015	
GCMS-NCI	Cypermethrin	Unfiltered	µg/L	0.0002	0.0015	
GCMS-NCI	Deltamethrin/Tralomethrin	Unfiltered	µg/L	0.0002	0.003	
GCMS-NCI	Esfenvalerate/Fenvalerate	Unfiltered	µg/L	0.0002	0.003	
GCMS-NCI	Fenpropathrin	Unfiltered	µg/L	0.0002	0.0015	
GCMS-NCI	Fluvalinate	Unfiltered	µg/L	0.0002	0.0015	
GCMS-NCI	Lambda-Cyhalothrin	Unfiltered	µg/L	0.0002	0.0015	
GCMS-NCI	Permethrin	Unfiltered	µg/L	0.002	0.015	
GCMS-NCI	Tetramethrin	Unfiltered	µg/L	0.0002	0.0015	
Insecticide						
EPA 625	Acetamiprid	Unfiltered	µg/L	0.01	0.02	
EPA 625	Clothianidin	Unfiltered	µg/L	0.01	0.02	
EPA 625	Imidacloprid	Unfiltered	µg/L	0.002	0.004	
EPA 625	Pyridaben	Unfiltered	µg/L	0.01	0.05	
Other Herbicides						
EPA 8081A	Dacthal	Unfiltered	µg/L	0.008	0.05	
EPA 615	2,4-Dichlorophenoxyacetic Acid	Unfiltered	µg/L	0.45	1	
EPA 8321	Diuron	Unfiltered	µg/L	0.2	0.4	
NCL ME 321	Ethalfluralin	Unfiltered	µg/L	0.0038	0.01	
NCL ME 340	Flumioxazin	Unfiltered	µg/L	0.017	0.02	
EPA 547M	Glyphosate	Unfiltered	µg/L	1.7	5	
EPA 8321	Linuron	Unfiltered	µg/L	0.2	0.4	
EPA 625	Metolachlor	Unfiltered	µg/L	0.26	0.5	(a)
EPA 8321	Oryzalin	Unfiltered	µg/L	0.2	0.4	
EPA 8081A	Oxyfluorfen	Unfiltered	µg/L	0.008	0.05	
EPA 549.2M	Paraquat	Unfiltered	µg/L	0.19	0.4	
EPA 8141AM	Pendimethalin	Unfiltered	µg/L	0.53	1	
EPA 8141A	Trifluralin	Unfiltered	µg/L	0.036	0.05	
Triazines						
EPA 8141A	Atrazine	Unfiltered	µg/L	0.1	0.5	
EPA 8141A	Hexazinone	Unfiltered	µg/L	0.1	0.5	(a)
EPA 633M	Metribuzin	Unfiltered	µg/L	0.32	1	
EPA 8141A	Prometryn	Unfiltered	µg/L	0.05	0.1	
EPA 625(m)	Simazine	Unfiltered	µg/L	0.005	0.01	

Method	Analyte	Fraction	Units	MDL	QL	Note
Fungicides						
EPA 8260BM	Chloropicrin	Unfiltered	µg/L	7.4	10	
NCL ME 340	Cyprodinil	Unfiltered	µg/L	0.0031	0.02	
EPA 625	Dodine	Unfiltered	µg/L	0.01	0.025	
EPA 630	Mancozeb (Ziram)	Unfiltered	µg/L	1	5	
NCL ME 340/ NCL ME 342	Propiconazole	Unfiltered	µg/L	0.0069	0.02	(a)
NCL ME 340/ NCL ME 342	Pyraclostrobin	Unfiltered	µg/L	0.0034	0.02	(a)
Trace Elements						
EPA 200.8	Arsenic	Filtered, Unfiltered	µg/L	0.08	0.5	
EPA 200.8	Boron	Filtered, Unfiltered	µg/L	0.04	0.1	
EPA 200.8	Copper	Filtered, Unfiltered	µg/L	0.2	0.5	
EPA 200.8	Zinc	Filtered, Unfiltered	µg/L	0.7	1	
Nutrients						
EPA 350.1; 350.2	Ammonia, Total as N	Unfiltered	mg/L	0.02	0.1	
EPA 353.2	Nitrate + Nitrite as N	Unfiltered	mg/L	0.02	0.05	
EPA 365.2; SM4500-P E	Orthophosphate, as P	Unfiltered	mg/L	0.01	0.05	
EPA 365.2; SM4500-P E	Phosphorus, Total	Unfiltered	mg/L	0.02	0.05	

Note:

a. No QL target has been established for this analyte.

Table 6. Laboratory Method Detection Limit (MDL) and Quantitation Limit (QL) Data Quality Objectives for Analyses of Sediments for the Coalition Monitoring and Reporting Program Plan

Method	Analyte	Fraction	Units	MDL	QL
Physical and Conventional Parameters					
EPA 160.3	Solids (TS)	Total	%	NA	0.1
EPA 9060	Organic Carbon, Total (TOC)	Total	mg/kg dry wt.	50	200
Pyrethroids					
EPA 8270C(m)	Allethrin	Total	ng/g dry wt.	0.1	1
EPA 8270C(m)	Bifenthrin	Total	ng/g dry wt.	0.1	1
EPA 8270C(m)	Cyfluthrin	Total	ng/g dry wt.	0.1	1
EPA 8270C(m)	Cypermethrin	Total	ng/g dry wt.	0.1	1
EPA 8270C(m)	Deltamethrin/Tralomethrin	Total	ng/g dry wt.	0.15	1
EPA 8270C(m)	Esfenvalerate/Fenvalerate	Total	ng/g dry wt.	0.15	1
EPA 8270C(m)	Fenpropathrin	Total	ng/g dry wt.	0.15	1
EPA 8270C(m)	Fluvalinate	Total	ng/g dry wt.	0.1	1
EPA 8270C(m)	Lambda-Cyhalothrin	Total	ng/g dry wt.	0.1	1
EPA 8270C(m)	Permethrin	Total	ng/g dry wt.	0.1	1
EPA 8270C(m)	Tetramethrin	Total	ng/g dry wt.	0.1	1
Organochlorine Pesticides					
EPA 8270C(m)	Chlorpyrifos	Total	ng/g dry wt.	0.1	3
EPA 8270C(m)	Diazinon	Total	ng/g dry wt.	5	40

Monitoring Results

The following sections summarize the monitoring conducted by the Coalition and its subwatershed partners in the 2019 Monitoring Year (October 2018 through September 2019).

SUMMARY OF SAMPLE EVENTS CONDUCTED

This report presents monitoring results from 12 Coalition sampling events (Events 152-163), as well as data for events conducted by coordinating subwatershed monitoring programs and other agencies between October 2018 and September 2019. Samples collected for all of these events are listed in **Table 7**.

The Coalition and subwatershed monitoring events were conducted throughout the year. Analyses included water chemistry and toxicity, with pesticides monitored during months when higher use is typical. Sediment toxicity testing and/or chemistry analyses were also conducted by the Coalition as part of the assessment. The sites and parameters for all events were monitored in accordance with the Coalition's current MRP and QAPP.

The field logs for all Coalition and subwatershed samples collected for the October 2018 through September 2019 events, as well as associated site photographs, are provided in **Appendix A**.

Completeness

The objectives for completeness are intended to apply to the monitoring program as a whole. As summarized in **Table 7**, 156 of the 168 initial water column and toxicity sample events planned by the Coalition and coordinating programs were conducted, for an overall sample event success rate of approximately 93%. Planned sample collection at one Coalition location did not occur because the monitoring site was dry or inaccessible. Planned sampling that differed from the 2019 Monitoring Plan Update is summarized below:

- DWR did not conduct all of the planned monitoring events at Middle Fork of the Feather River above Grizzly Creek (MFFGR), Pit River at Pittville Bridge (PRPIT), Fall River Bridge (FRRRB), and Pit River at Canby Road (PRCAN), due to a suspension of funding.
- Samples for one event at MFFGR were not collected, due to unsafe sampling conditions. A make-up event was performed in April.

Table 7. Sampling for the 2019 Coalition Monitoring Year

		Sample Count		152	153	154	155	156	157	158	159	160	161	162	163
Subwatershed (Agency)	**Site ID**	**Planned**	**Collected**	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**
Butte-Yuba-Sutter (SVWQC)	GILSL	5	5	-	-	-	W	W	-	-	W	-	W	W	-
	LHNCT	10	10	-	-	W	W	W	W	W,S	W	W	W	W,S	W
	LSNKR	11	11	W	W	W	W	W	W	W,S	W	W	W	W,S	-
	PNCHY	11	11	W	-	W	W	W	W	W,S	W	W	W	W,S	W
	SSKNK	4	4	-	W	-	W	-	-	-	W,S	-	-	W,S	-
Colusa Glenn (SVWQC)	COLDR	4	4	-	W	-	W	-	-	-	W,S	-	-	W,S	-
	FRSHC	11	11	-	W	W	W	W	W	W,S	W	W	W	W,S	W
	RARPP	2	2	-	-	-	W	-	-	-	-	-	-	W	-
	WLKCH	12	12	W	W	W	W	W	W	W,S	W	W	W	W,S	W
El Dorado (SVWQC)	COONH	3	3	-	-	-	W	-	-	W	-	-	-	W	-
Goose Lake	LOWLC	3	3	-	-	-	-	-	-	W	W	-	W	-	-
Lake (SVWQC)	MDLCR	4	4	-	W	-	-	W	-	W	-	-	-	W	-
	MGSLU	4	4	-	W	-	-	W	-	W	-	-	-	W	-
Pit River (NECWA)	FRRRB	0	4	-	[1]	-	-	[1]	-	-	[1]	-	-	[1]	-
	PRCAN	0	4	-	[1]	-	-	[1]	-	-	[1]	-	-	[1]	-
	PRPIT	2	2	-	[1]	-	-	W	-	-	W	-	-	-	-
PNSSNS	CCBRW	9	9	-	-	W	W	-	W	W,S	W	W	W	W,S	W
Sac/Amador (SVWQC)	CRTWN	9	10	D	W	-	-	W	W	W,S	W	W	W	W,S	W
	GIDLR	12	12	W	W	W	W	W	W	W,S	W	W	W	W,S	W
Shasta/Tehama (SVWQC)	ACACR	10	10	-	W	W	-	W	W	W,S	W	W	W	W,S	W
Solano (SVWQC)	UCBRD	12	12	W	W	W	W	W	W	W,S	W	W	W	W,S	W
	SSLIB	4	4	-	W	-	W	-	-	-	W,S	-	-	W,S	-
Yolo (SVWQC)	WLSPL	11	11	W	W	-	W	W	W	W,S	W	W	W	W,S	W
Upper Feather River (UFRW)	MFFGR	3	6	-	[1]	-	-	[1]	[2]	W	-	W	W	[1]	-
	Totals	**156**	**168**												

Notes:

NECWA = Northeastern California Watershed Association
PNSSNS = Placer-Nevada-South Sutter-North Sacramento
SVWQC = Sacramento Valley Water Quality Coalition
UFRW = Upper Feather River Watershed Group

W = Water sample collected
S = Sediment sample collected
D = Site was dry; no samples collected.
NS = Planned, but not sampled
"-" = no samples planned

[1] = Department of Water Resources monitoring suspended due to lack of funding.
[2] = Monitoring site was not safely accessible due to high flows. Event moved to April.

SUMMARY OF SAMPLING CONDITIONS

Samples were collected throughout the year for the Coalition (see **Table 2**, Sampling for the 2019 Coalition Monitoring Year). The October 1, 2018, through September 30, 2019, monitoring year was characterized by above-average precipitation during the months of November, January, March, and April, and at or below-average precipitation during all other months. The water year was classified as "Wet" for the Sacramento Valley by the California Department of Water Resources, with an estimated 138% of average total runoff (based on 1966-2015 mean).[5,6] At the end of the 2019 water year, statewide precipitation was 131% of average.[7]

The Coalition's two sample collection periods include the wet season monitoring period from November 2018 to March 2019, and the irrigation season monitoring period from April 2019 through September 2019. October 2018 is classified as belonging to the irrigation season, but is attributed to the previous year's period. The wet season monitoring period had below-average precipitation in December and above-average amounts in the remaining months. The irrigation season had above-average precipitation in March and May, average precipitation in July, and below-average precipitation in all other months.

Regional precipitation patterns for October 2018 through September 2019 are illustrated in **Figure 2-a** through **Figure 2-f**. Compared to the prior water year, more frequent precipitation events occurred throughout the year from October to June, resulting in relatively higher flows (**Figure 3-a** through **Figure 3-f**). Water samples were collected during high- and low-flow hydrologic conditions.

Based on climate data available from the Sacramento Executive Airport weather station, rainfall during the April – September 2019 irrigation season was greater than average during May, below average in April and at or below-average from June through September (**Table 8**). No precipitation occurred from June through September. Precipitation was normal in July, above normal in November, January, February, March and May, and below normal in the remaining six months. The maximum temperature exceeded 90° on 13 days in June, 19 days in July, 21 days in August, and 5 days in September.

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[5] http://cdec.water.ca.gov/cgi-progs/iodir/WSIHIST and http://cdec.water.ca.gov/cgi-progs/previous/WSI

[6] Sacramento River Region unimpaired runoff, for water year 2019, was about 24.7 million acre-feet (MAF), approximately 138% of average. During water year 2018, the observed Sacramento River Region unimpaired runoff was about 12.4 MAF, or 71% of average.

[7] California Department of Water Resources 2019 WY Precipitation Summary available at: http://cdec.water.ca.gov/reportapp/javareports?name=PRECIPSUM.201909

Table 8. Summary of Climate Data[8] at Sacramento Executive Airport, October 2018 – September 2019

Month	Departure from Normal Mean Temperature	Days with Maximum Temperature ≥ 90°F	Precipitation Total (Inches)	Departure from Normal Precipitation
October 2018	1.3	0	0.04	-0.91
November 2018	0.7	0	2.47	0.39
December 2018	2.6	0	2.37	-0.88
January 2019	3.9	0	4.22	0.58
February 2019	-3.4	0	7.45	3.98
March 2019	-0.9	0	3.76	1.01
April 2019	3.7	0	0.77	-0.38
May 2019	-2.6	0	3.17	2.49
June 2019	2.4	13	0.00	-0.21
July 2019	1.0	19	0.00	0.00
August 2019	3.3	21	0.00	-0.05
September 2019	2.9	5	0.00	-0.05

[8] Preliminary monthly climate data (temperature and precipitation) for Sacramento Executive Airport weather station available at: http://www.weather.gov/climate/index.php?wfo=sto

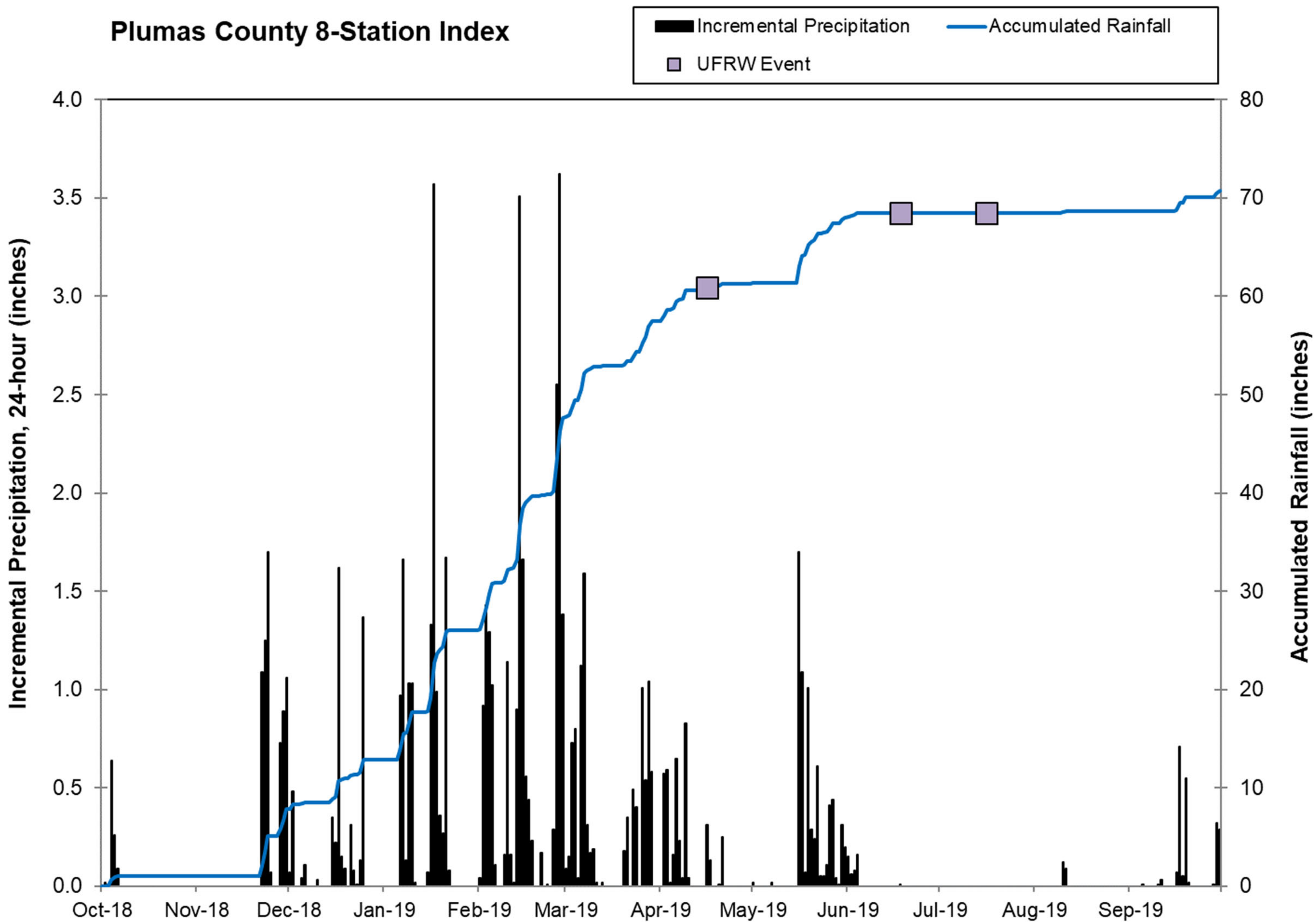

Figure 2-a. Precipitation during 2019 Coalition Monitoring: Plumas County

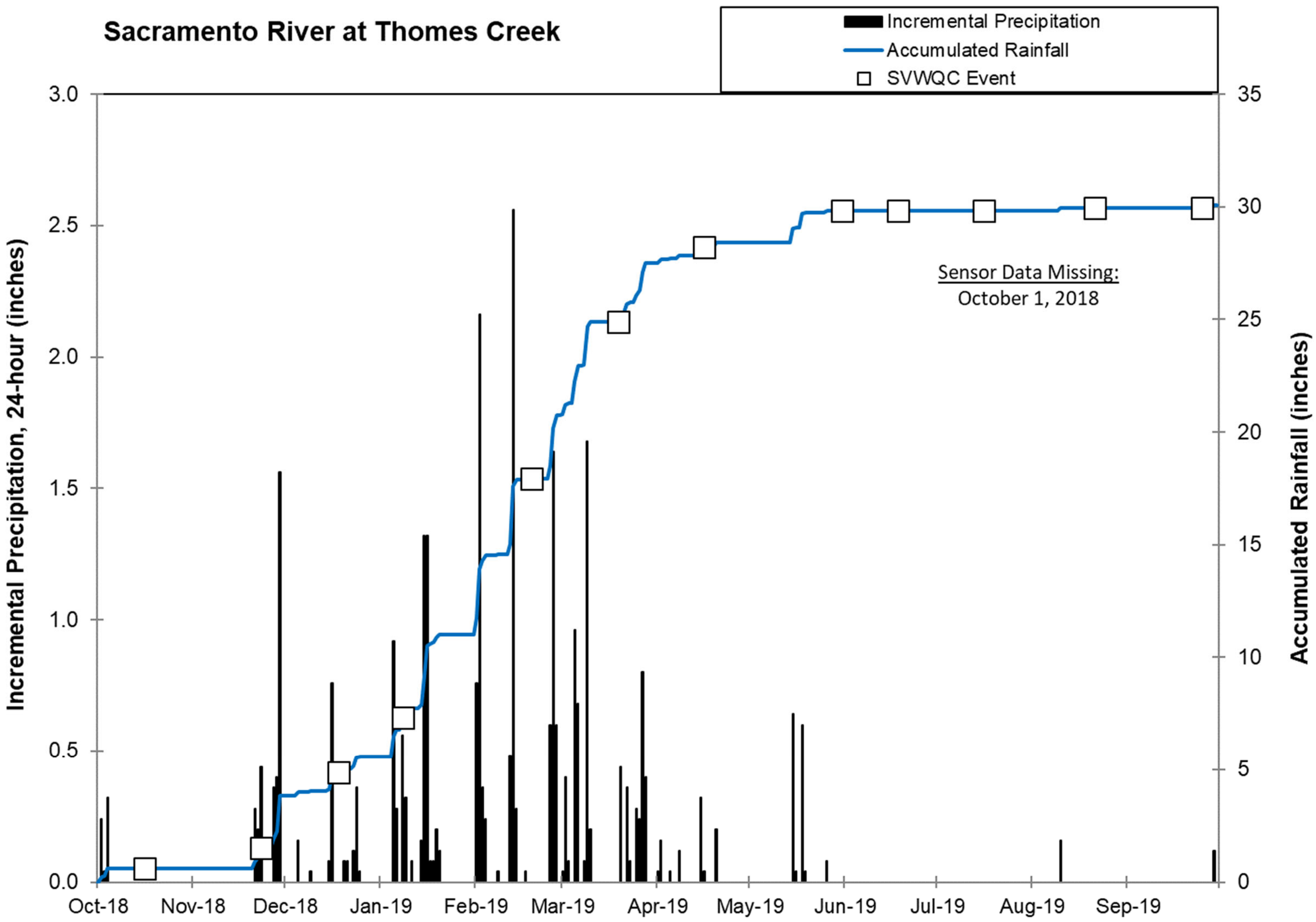

Figure 2-b. Precipitation during 2019 Coalition Monitoring: Upper Sacramento Valley

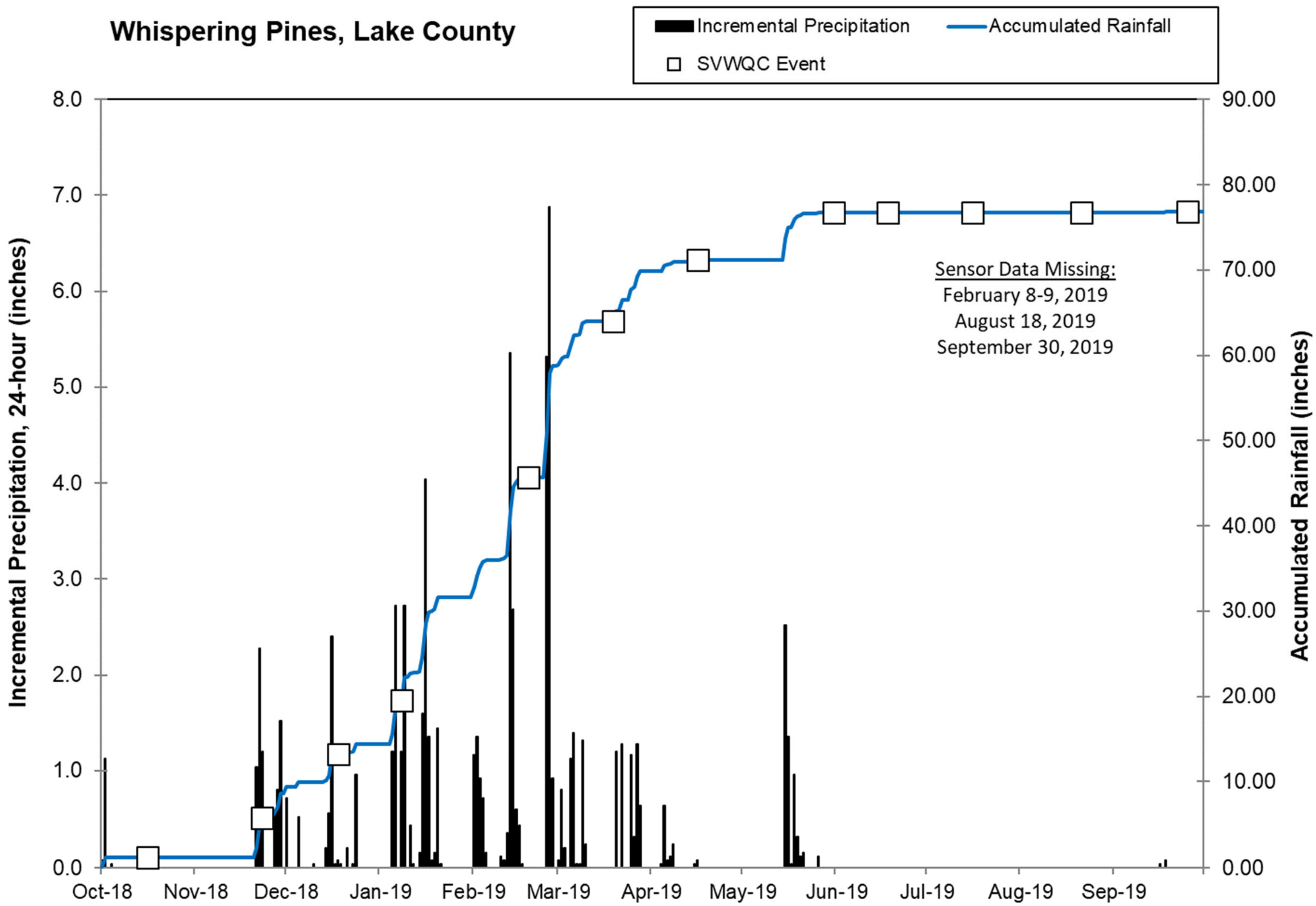

Figure 2-c. Precipitation during 2019 Coalition Monitoring: Lake County

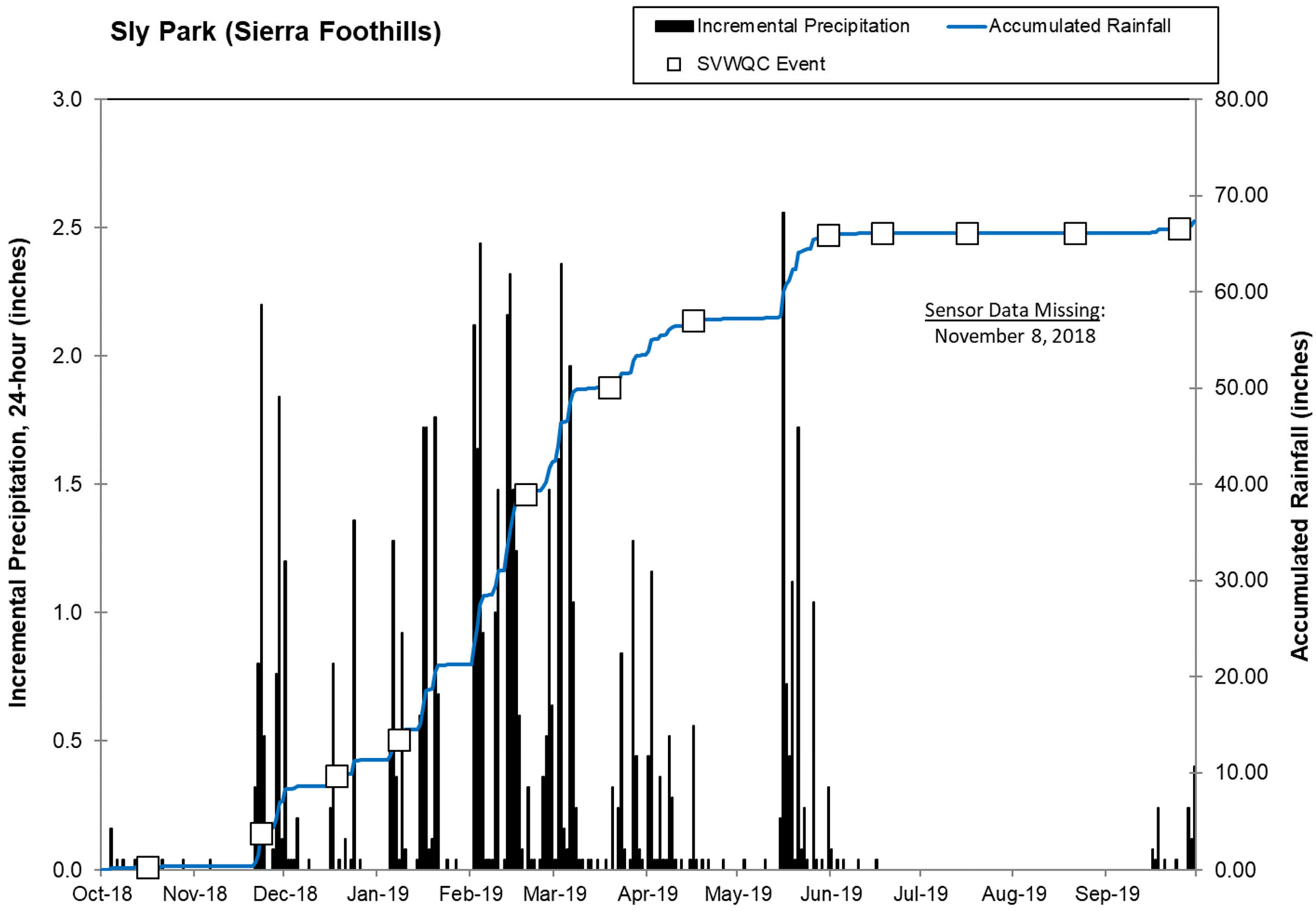

Figure 2-d. Precipitation during 2019 Coalition Monitoring: Sierra Foothills

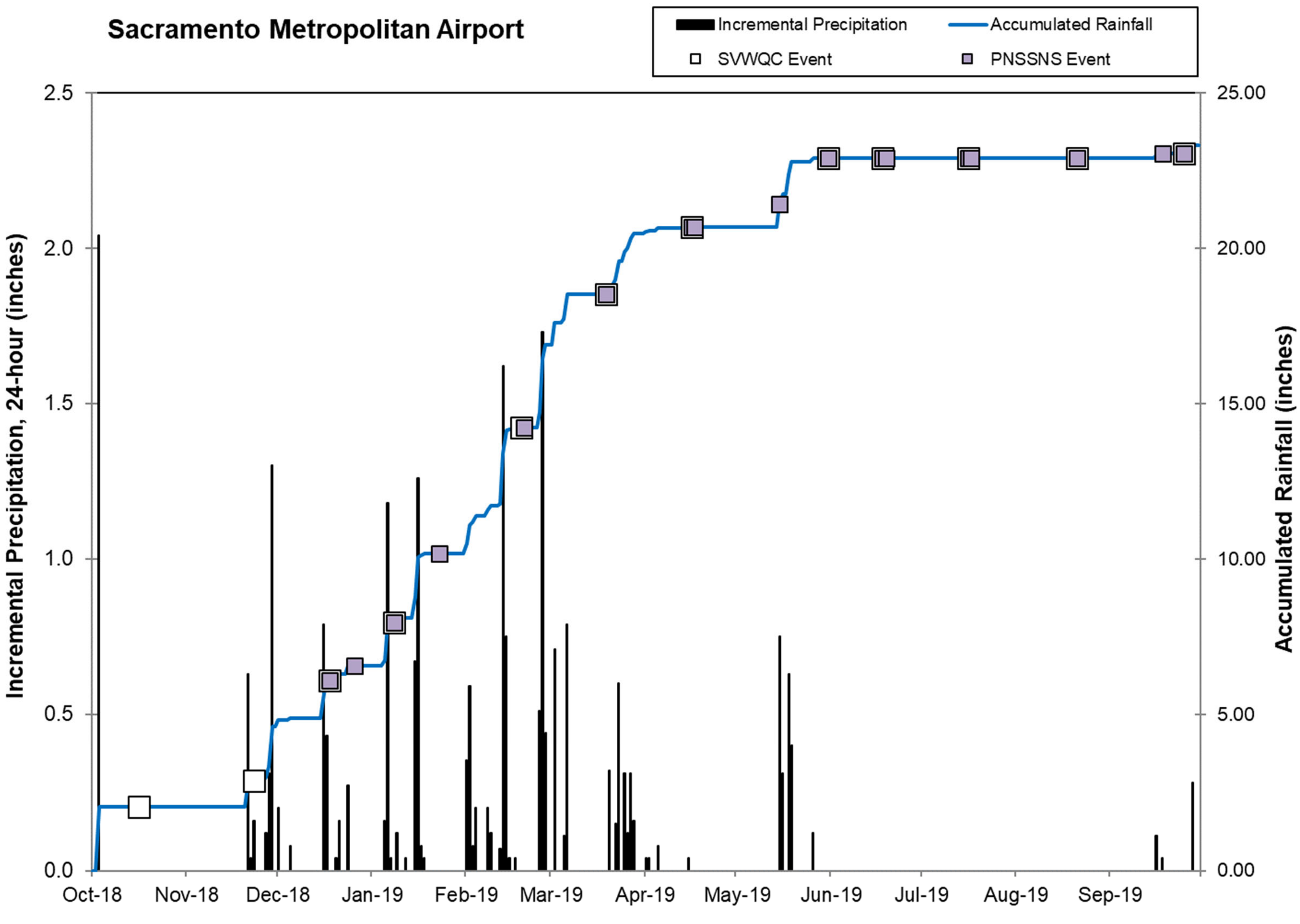

Figure 2-e. Precipitation during 2019 Coalition Monitoring: Lower Sacramento Valley

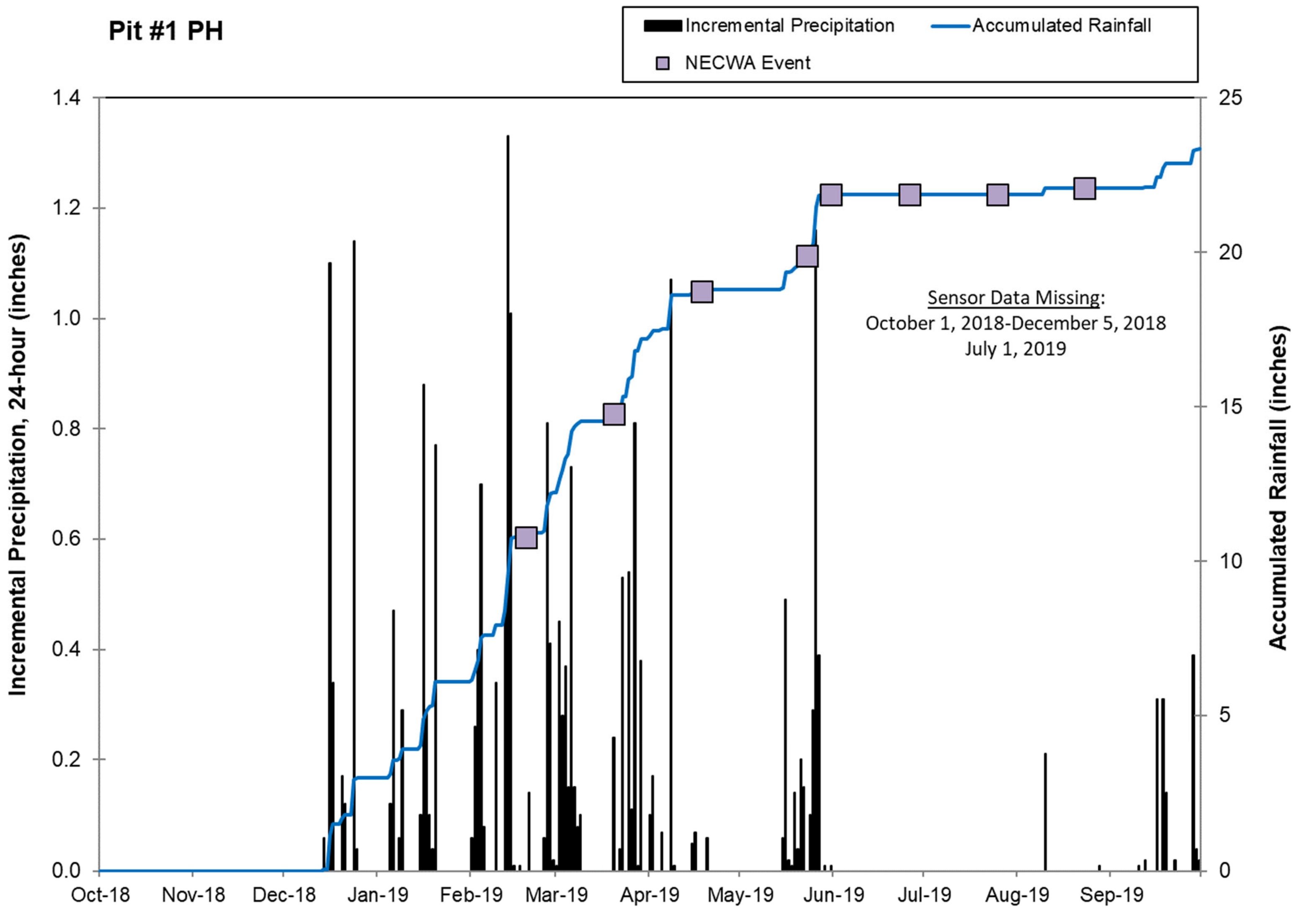

Figure 2-f. Precipitation during 2019 Coalition Monitoring: Pit River

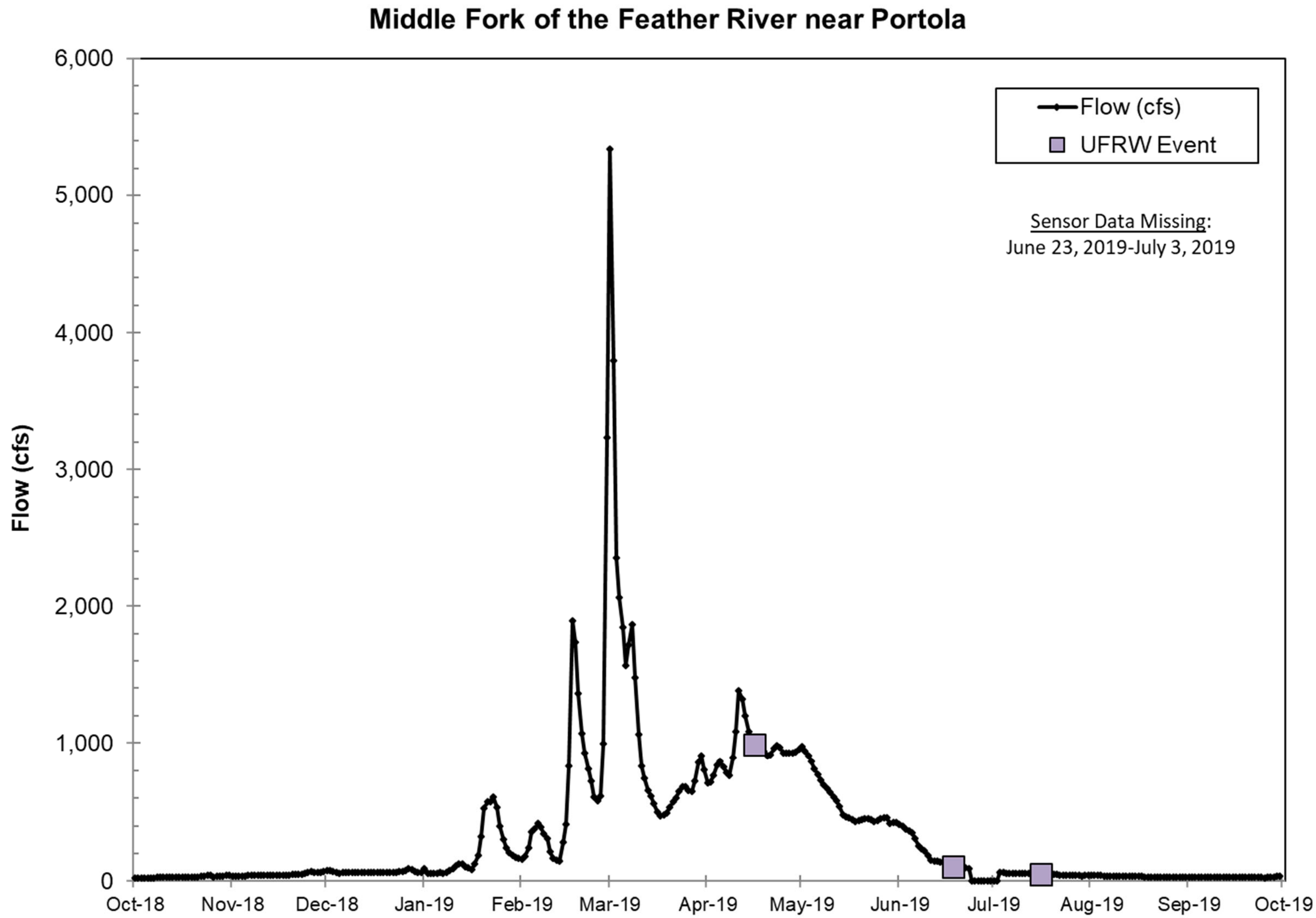

Figure 3-a. Flows during 2019 Coalition Monitoring: Plumas County

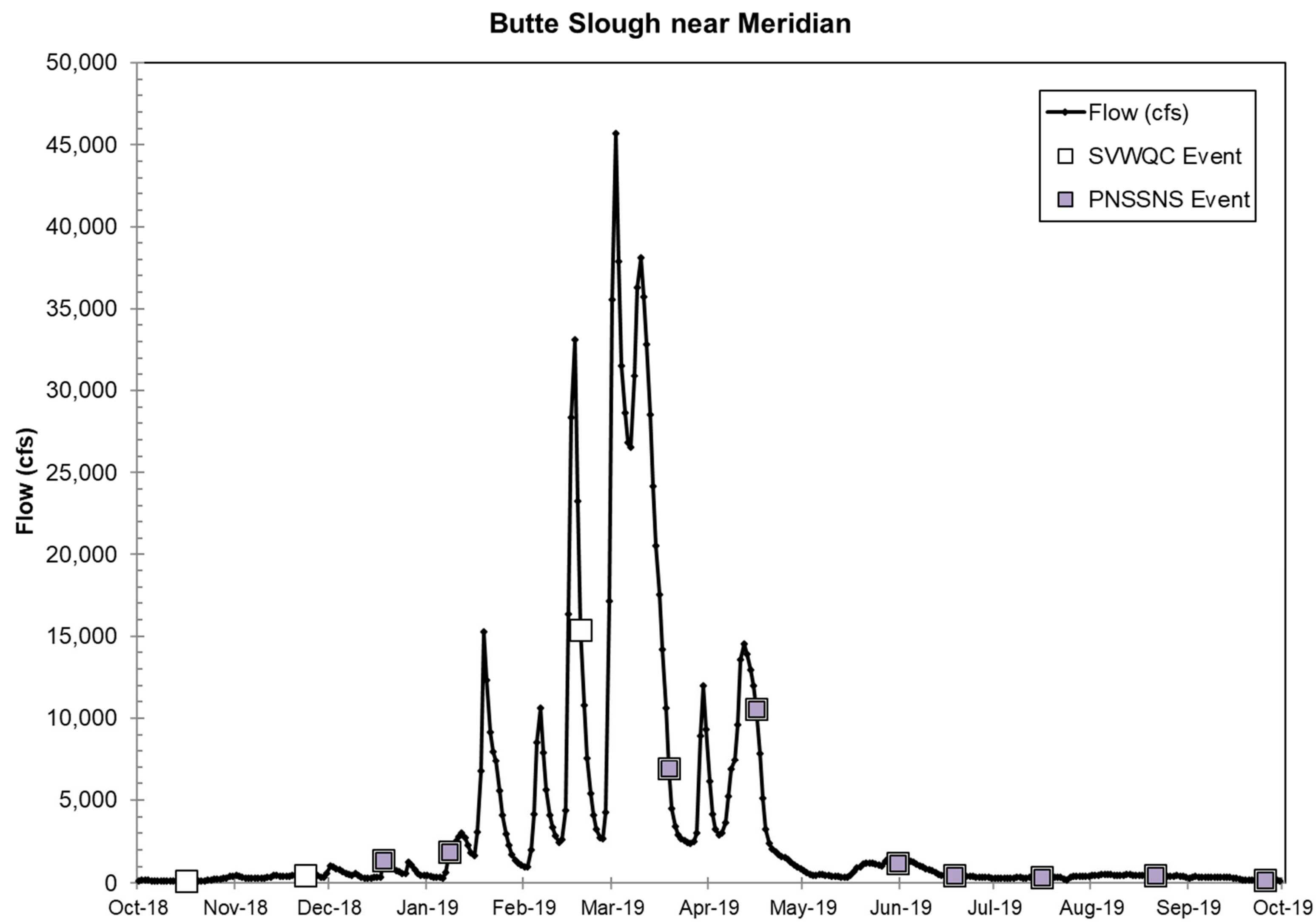

Figure 3-b. Flows during 2019 Coalition Monitoring: East Sacramento Valley

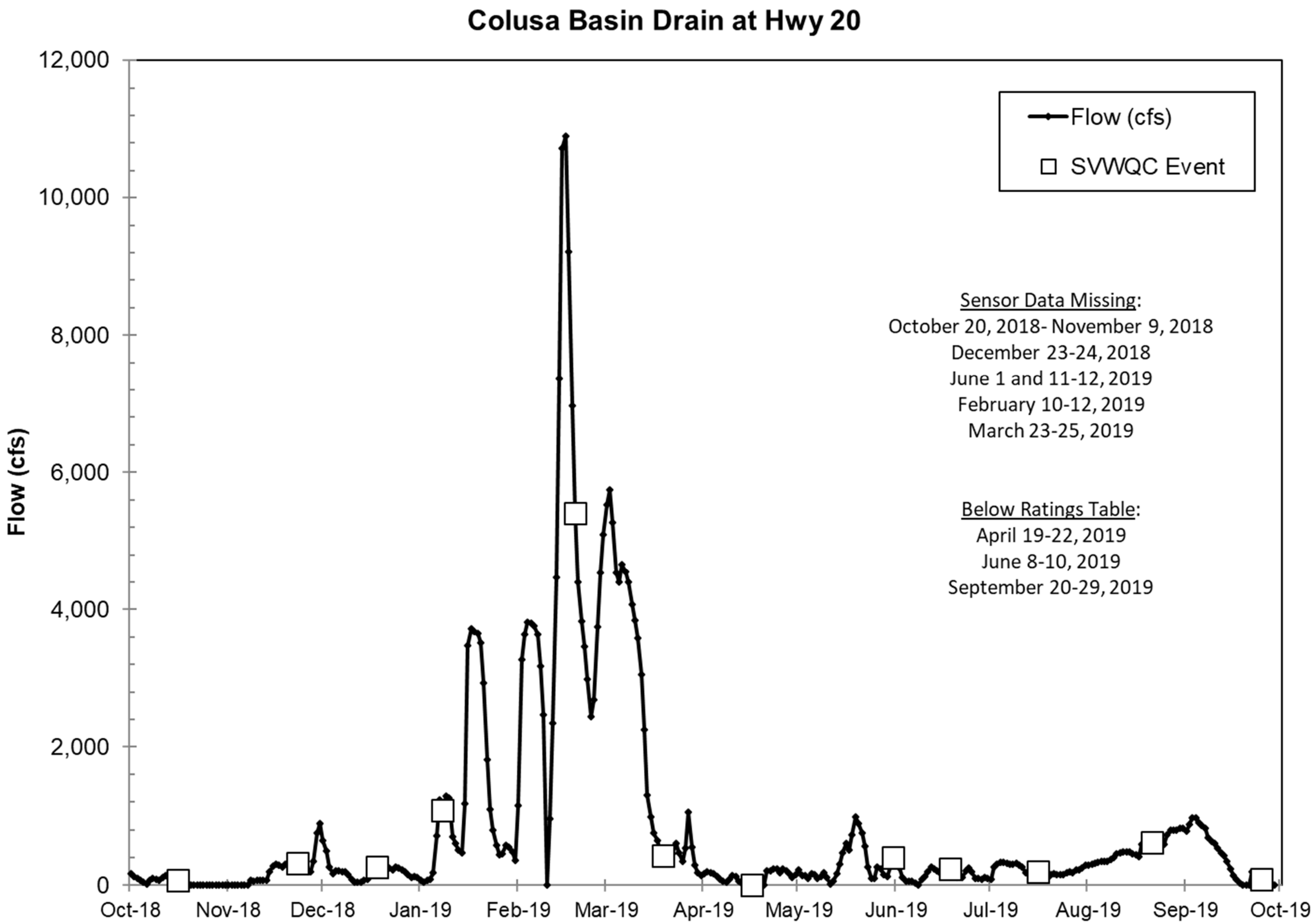

Figure 3-c. Flows during 2019 Coalition Monitoring: West Sacramento Valley

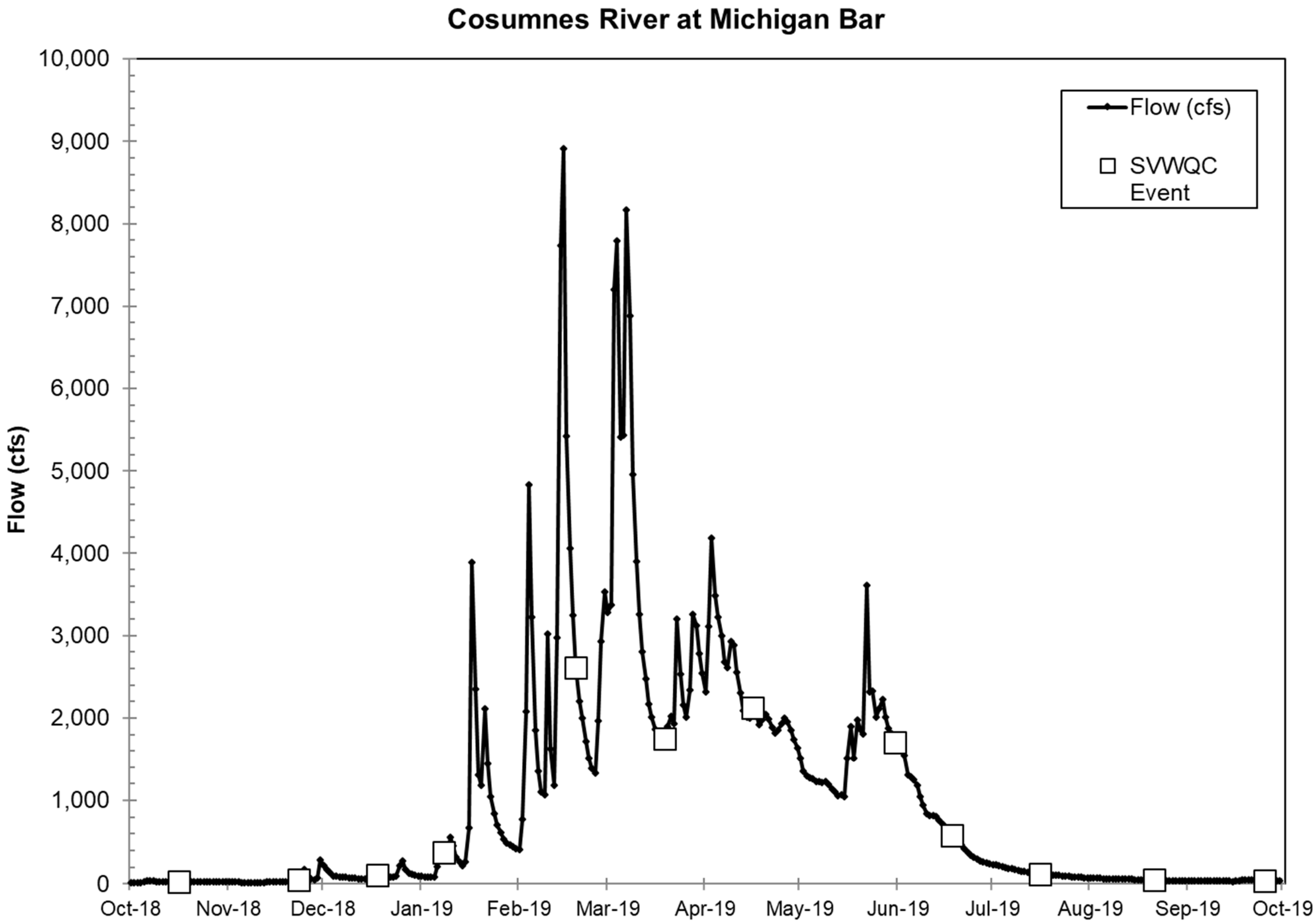

Figure 3-d. Flows during 2019 Coalition Monitoring: Lower Sacramento Valley

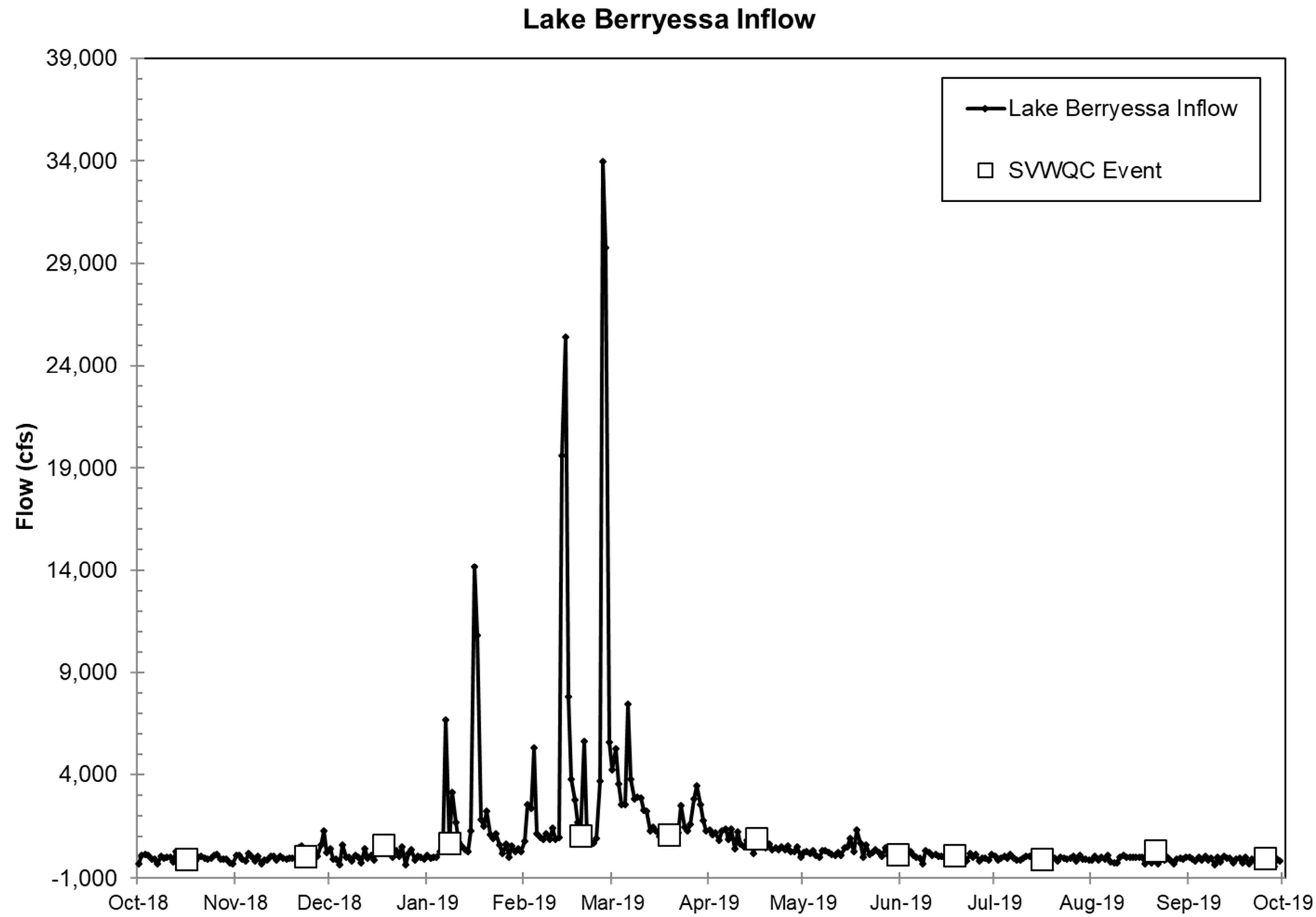

Figure 3-e. Flows during 2019 Coalition Monitoring: Lake Berryessa (Reservoir Inflow)

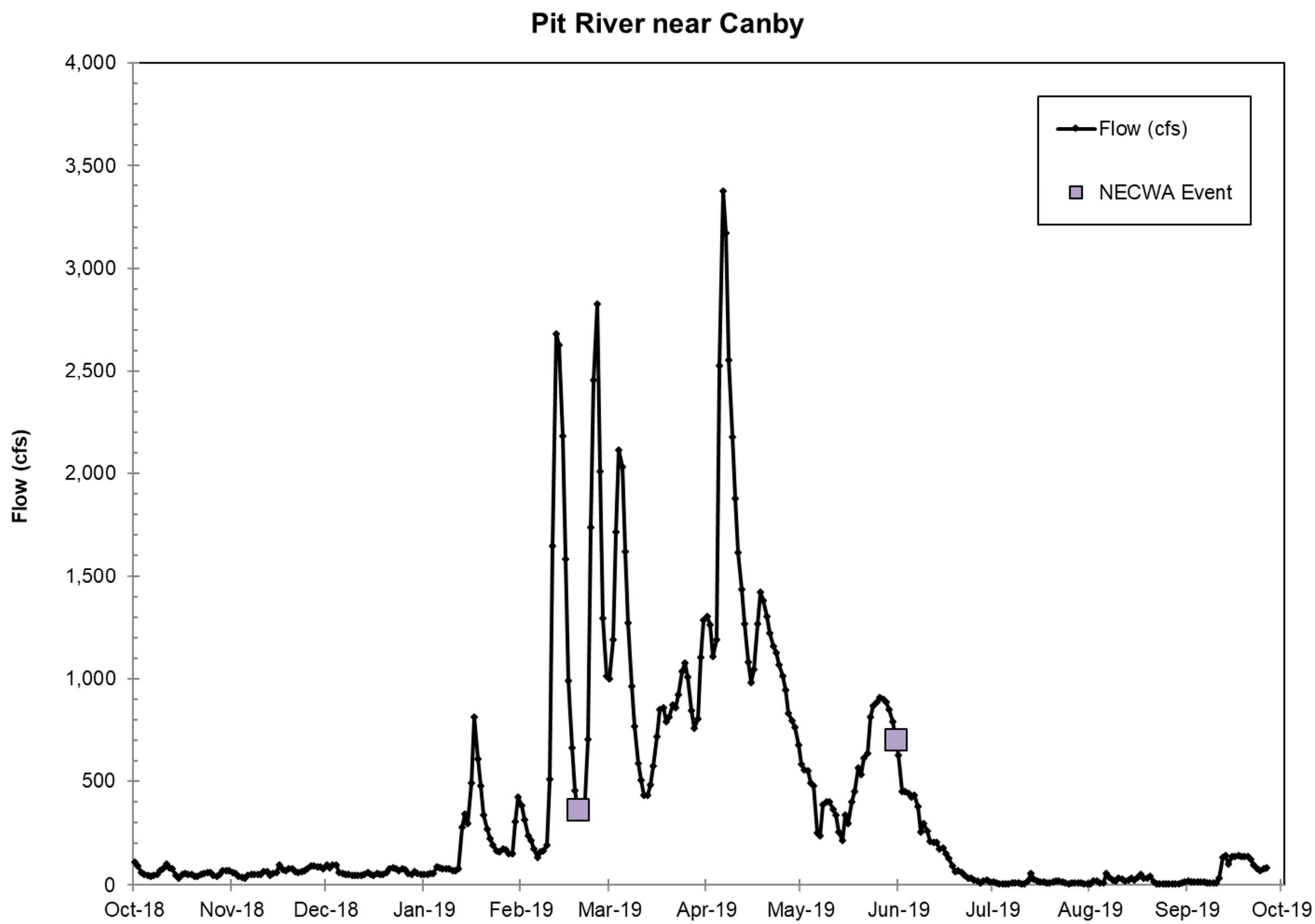

Figure 3-f. Flows during 2019 Coalition Monitoring: Pit River near Canby

SAMPLE HANDLING AND CUSTODY

All samples that were collected for the Coalition monitoring effort met the requirements for sample custody. Sample custody must be traceable from the time of sample collection until results are reported. A sample is considered under custody if:

- It is in actual possession;
- It is in view after in physical possession; and
- It is placed in a secure area (i.e., accessible by or under the scrutiny of authorized personnel only after in possession).

The chain-of-custody forms (COCs) for all samples collected by Coalition contractors for the monitoring events conducted from October 2018 through September 2019 are included with the related lab reports and are provided in **Appendix B**. All COCs for *ILRP* monitoring conducted by Coalition partners during this same period are also provided in **Appendix B** with their associated lab reports.

Sample containers are occasionally lost or broken in transit due to shipping and handling factors beyond the Coalition's control. Broken containers are relevant to program completeness if the incident prevents the Coalition from completing the required sample analyses or if they are analyzed and may potentially affect analytical quality. In general, broken bottles do not impact completeness of analyses. In most cases, sufficient remaining sample volume is available to complete the planned environmental and quality assurance analyses. If program completeness was affected, the issue of broken bottles is discussed in this report. The protocol that is followed if a broken bottle is reported is to contact the sampling crew and let them know of the issue so that they may review their packing and shipping procedures. Any known shipping and handling deficiencies are also noted. If samples lost or broken in shipping affect overall completeness for specific analyses at a specific location and the analyses are relevant to synoptically collected toxicity samples, additional sample volume is preferentially aliquoted from the sample collected for toxicity. If additional sample volume from another appropriately collected and preserved sample container is not available, the analyses are rescheduled for a future event to ensure program completeness objectives are met. Sample containers that were received broken are summarized below:

- Sample shipments for October 2018 through September 2019 monitoring were all received with no broken or damaged bottles.

In addition, sample containers occasionally arrive at the analytical laboratory at a temperature that is above the recommended maximum (6˚C) for Coalition samples. This may occur when samples do not have sufficient time to cool down to the target temperature or when extended shipping times and higher external temperatures cause sample temperatures to increase above 6˚C. This has proven to be a challenge for toxicity samples because the sample volumes are large (1-gallon containers), require additional shipping protection (bubble wrap), and take longer to cool, particularly when ambient water temperatures exceed 25˚C. However, because toxicity tests are typically conducted at ~20˚C over four days, sample temperatures slightly elevated above 6˚C on receipt are not expected to have a significant impact on the toxicity test results. However, all samples received above recommended temperatures are qualified as required (i.e., through the use of the appropriate CEDEN QA Code: *BY = Sample received at improper* *temperature*). In each case, the sampling crews are notified and the sample collection conditions and shipping procedures are reviewed to attempt to determine the cause of the elevated temperatures.

- Sample shipments for October 2018 through September 2019 monitoring were all received at temperatures below 6˚C.

QUALITY ASSURANCE RESULTS

The Data Quality Objectives (DQOs) used to evaluate the results of the Coalition monitoring efforts are detailed in the Coalition's QAPP. These DQOs are the detailed quality control specifications for precision, accuracy, representativeness, comparability, and completeness. These DQOs are used as comparison criteria during data quality review to determine if the minimum requirements have been met and the data may be used as planned.

Results of Field and Laboratory QA/QC Analyses

Quality Assurance/Quality Control (QA/QC) data are summarized in **Table 9**. All program QA/QC results are included with the lab reports in **Appendix B** of this document, and any qualifications of the data are presented with the tabulated monitoring data.

Table 9. Summary of QA/QC Results for 2019 Monitoring Year

Field Blank	Field Duplicate	Method or Lab Blank	Lab Control Spike	Lab Control Spike Duplicate	Matrix Spike	Matrix Spike Duplicate	Lab Duplicate	Surrogate Recovery
98.9%	92.3%	99.9%	98.8%	99.6%	93.4%	97.6%	96.3%	97.6%

TABULATED RESULTS OF LABORATORY ANALYSES

Copies of final laboratory reports and all reported QA/QC data for Coalition monitoring results are provided in **Appendix B**. The tabulated results for all validated and Quality Assurance-evaluated (QA) data are provided in **Appendix C**. These data were previously submitted as part of the Coalition's quarterly data submittals to ILRP.

Assessment of Water Quality Objectives

Coalition and subwatershed monitoring data were compared to ILRP Trigger Limits. Generally, these trigger limits are based on applicable narrative and numeric water quality objectives in the Central Valley Basin Plan (CVRWQCB, 2018), subsequent adopted amendments, the California Toxics Rule (USEPA 2000), and numeric interpretations of the Basin Plan narrative objectives. Observed exceedances of the ILRP Trigger Limits are the focus of this discussion.

Other relevant non-regulatory toxicity thresholds were also considered for the purpose of identifying potential causes of observed toxicity. It should be noted that these unadopted non-regulatory toxicity thresholds are not appropriate criteria for determining exceedances for the purpose of the Coalition's monitoring program and evaluating compliance with the ILRP. The additional toxicity thresholds were acquired from USEPA's Office of Pesticide Programs (OPP) Ecotoxicity database (USEPA 2019; online database updated regularly) and the International Union of Pure and Applied Chemistry Pesticide Properties Database (IUPAC PPDB; online database updated regularly).

Water quality objectives and other relevant water quality thresholds discussed in this section are summarized in **Table 10** and **Table 11**. Monitored analytes without relevant water quality objectives or *ILRP* Trigger Limits are listed in **Table 12**.

The data evaluated for exceedances as described in this document include all Coalition collected results, as well as the compiled results from the subwatershed monitoring programs presented in this report where relevant water quality objectives exist. The results of these evaluations are discussed below.

Table 10. Adopted Basin Plan and California Toxics Rule Objectives for Analytes Monitored for 2019 Coalition Monitoring

Analyte	Most Stringent Objective(1)	Units	Objective Source(2)
Ammonia, Total as N	narrative	mg/L	Basin Plan
Arsenic, total	50	µg/L	CA 1˚ MCL
Atrazine	1	µg/L	CA 1˚ MCL
Cadmium, dissolved	Hardness-dependent(3)	µg/L	CTR
Chlorpyrifos	0.015	µg/L	Basin Plan
Copper, dissolved	Hardness-dependent(3)	µg/L	CTR
DDE (o,p' and p,p')	0.00059	µg/L	CTR
Diazinon	0.10	µg/L	Basin Plan
Dissolved Oxygen	5	mg/L	Basin Plan
Glyphosate	700	µg/L	CA 1˚ MCL
Malathion	0.1(4)	µg/L	Basin Plan
Nitrate, as N	10	mg/L	CA 1˚ MCL
pH	6.5-8.5	-log[H+]	Basin Plan
Pyrethroid Pesticides[5]	1 CGU	----	Basin Plan
Simazine	4	µg/L	CA 1˚ MCL
Temperature	narrative	µg/L	Basin Plan
Toxicity, Algae (*Hyalella*) Survival	narrative	µg/L	Basin Plan
Toxicity, Algae (*Selenastrum*) Cell Density	narrative	µg/L	Basin Plan
Toxicity, Water Flea (*Ceriodaphnia*) Survival	narrative	µg/L	Basin Plan
Turbidity	narrative	µg/L	Basin Plan

Notes:

1. For analytes with more than one limit, the most limiting applicable adopted water quality objective is listed.
2. *CA 1º MCLs* are California's Maximum Contaminant Levels for treated drinking water; *CTR* = California Toxics Rule criteria.
3. Objective varies with the hardness of the water.
4. These values are Basin Plan performance goals. The Basin Plan states: "…discharge is prohibited unless the discharger is following a management practice approved by the Board." This has been interpreted as an ILRP Trigger Limit of ND (Not Detected).
5. Pyrethroid pesticides considered in the 2017 Central Valley Pyrethroid Pesticides Total Maximum Daily Load and Basin Plan Amendment (Pyrethroid Pesticide BPA) include the following: Bifenthrin, Cyfluthrin, Cypermethrin, Esfenvalerate, Lambda-Cyhalothrin, and Permethrin. The ILRP Trigger Limit for the additive concentration of these six pyrethroid pesticides was compared to Coalition water quality results beginning in April 2019.

Table 11. Unadopted Water Quality Limits Used to Interpret Narrative Water Quality Objectives for Analytes Monitored for 2019 Coalition Monitoring

Analyte	Unadopted Limit[(1)]	Units	Limit Source
Boron, total	700	µg/L	Ayers and Westcott 1988
Specific Conductivity	700	µS/cm	Ayers and Westcott 1988
Specific Conductivity	900	µS/cm	CA Recommended 2˚ MCL
E. coli [(1)]	235	MPN/100mL	Basin Plan Amendment
Total Dissolved Solids	500	mg/L	CA Recommended 2˚ MCL
Total Dissolved Solids	450	mg/L	Ayers and Westcott 1988
Azinphos methyl	0.01	µg/L	USEPA NAWQC[(2)]
Carbaryl	2.53	µg/L	USEPA NAWQC
Dichlorvos	0.085	µg/L	Cal/EPA Cancer Potency Factor
Dimethoate	1	µg/L	CDPH Notification Level[(3)]
Diuron	2	µg/L	USEPA Health Advisory
Linuron	1.4	µg/L	USEPA IRIS Reference Dose
Methidathion	0.7	µg/L	USEPA IRIS Reference Dose
Methiocarb	0.5	µg/L	USFW Acute Toxicity
Methomyl	0.52	µg/L	USEPA NAWQC
Paraquat	3.2	µg/L	USEPA IRIS Reference Dose
Phorate	0.7	µg/L	NAS Health Advisory
Trifluralin	5	µg/L	USEPA IRIS Cancer Risk Level
Zinc	1000	µg/L	CA Recommended 2˚ MCL

Note:

1. Adopted by the Regional Water Board but not approved by the State Water Resources Control Board.
2. USEPA National Ambient Water Quality Criteria.
3. Notification levels (formerly called "action levels") are published by the California Department of Public Health (CDPH) for chemicals for which there is no drinking water MCL.

Table 12. Analytes Monitored for 2019 Coalition Monitoring without Applicable Adopted or Unadopted Limits

Analytes		
% Solids	Dissolved Organic Carbon	Phosphorus as P, Total
Acetamiprid	Dodine	Prometryn
Allethrin	Ethalfluralin	Propiconazole
Chloropicrin	Fenpropathrin	Pyraclostrobin
Chlorothalonil	Hardness as CaCO3	Pyrethroid Pesticides[1]
Clothianidin	Hexazinone	Pyridaben
Cyprodinil	Imidacloprid	Tau-Fluvalinate
Deltamethrin	Orthophosphate, as P	Tetramethrin
Dichlorophenoxyacetic Acid, 2,4-	Oryzalin	Total Organic Carbon
Discharge (flow)	Oxyfluorfen	Total Suspended Solids
Dissolved Organic Carbon	Pendimethalin	

1. Pyrethroid pesticides considered in the 2017 Central Valley Pyrethroid Pesticides Total Maximum Daily Load and Basin Plan Amendment (Pyrethroid Pesticide BPA) include the following: Bifenthrin, Cyfluthrin, Cypermethrin, Esfenvalerate, Lambda-Cyhalothrin, and Permethrin. The ILRP did not require comparison to the Trigger Limit prior to April 2019.

TOXICITY AND PESTICIDE RESULTS

A summary of the toxicity and pesticide results from 2019 Coalition monitoring is provided in this section.

Toxicity Exceedances in Coalition Monitoring

There were 281individual toxicity results (including 27 field duplicates) analyzed in water column and sediment samples collected from 15 different sites during 2019 Coalition monitoring. Analyses were conducted for *Selenastrum capricornutum, Ceriodaphnia dubia,* and *Hyalella azteca*. Statistically significant toxicity to *Selenastrum capricornutum* was observed in one water column sample collected from the Willow Slough Bypass site, analyzed by Pacific EcoRisk (PER). Two sediment samples exhibited statistically significant toxicity to *Hyalella azteca*. Significant toxicity to *Hyalella azteca* was observed in samples from Ulatis Creek in April 2019 and Walker Creek in August 2019. Both of the samples exhibited toxicity that exceeded the 20% effect threshold recommended by SWAMP to evaluate toxicity in sediment[9]. Samples exhibiting statistically significant sediment and water column toxicity are summarized in **Table 13**.

Table 13. Toxicity Exceedances in 2019 Coalition Monitoring

Matrix	Site ID	Water Body	Sample Date	Analyte	% of Control
Water Column Toxicity	WLSPL	Willow Slough Bypass	1/9/2019	*Selenastrum capricornutum cell growth*	50.5
Sediment Toxicity	UCBRD	Ulatis Creek	4/18/2019	*Hyalella azteca* survival	64.6
Sediment Toxicity	WLKCH	Walker Creek	8/22/2019	*Hyalella azteca* survival	62.3

Significantly toxic results and any follow-up evaluations or testing conducted on these samples are summarized below by event.

Event 155, January 9, 2019 – Willow Slough Bypass at Pole Line, *Selenastrum capricornutum* toxicity

In a water column toxicity test conducted with *Selenastrum*, the Coalition observed reductions in cell density of 53% compared to the control used for the Willow Slough Bypass sample. In the water column sample, oxyfluorfen was detected at a concentration of 0.36 µg/L, which is above the United States EPA (2017) Aquatic Life Benchmark and Ecological Risk Assessments for Registered Pesticides of 0.29 µg/L.

Event 158, April 18, 2019 – Ulatis Creek at Brown Road, Hyalella toxicity

In a sediment toxicity test conducted with *Hyalella*, the Coalition observed survival of 64.6% compared to the control used for the Ulatis Creek sample. The toxicity observed in the sample

[9] Regional Water Board approval letter for completion of the Cosumnes River Hyalella toxicity Management Plan (January 22, 2015).

(≥20% reduction compared to the control) triggered follow-up sediment analyses for pyrethroid and organophosphate (chlorpyrifos) pesticides. Two pesticides were detected in the sample: bifenthrin (2.5 ng/g dry weight (dw)) and lambda-cyhalothrin (3.6 ng/g dw). A total of 1.164 toxic units (TU) of agricultural use pyrethroids were estimated to likely have contributed to the toxicity observed at the Ulatis Creek monitoring site, with bifenthrin and lambda-cyhalothrin concentrations contributing approximately 38% and 62%, respectively, to the estimated TU. The TU was estimated based on published LC50 values for pyrethroids and chlorpyrifos in sediment[10], normalized for organic carbon concentrations. A TU of 1 or greater suggests that the pesticide concentrations detected in the sediment sample are sufficient to cause toxicity to *Hyalella*.

Event 162, August 22, 2019 – Walker Creek near 99W and CR33, Hyalella toxicity

In a sediment toxicity test conducted with *Hyalella*, the Coalition observed survival of 62.3% compared to the control used for the Walker Creek sample. The toxicity observed in the sample (≥20% reduction compared to the control) triggered follow-up sediment analyses for pyrethroid and organophosphate (chlorpyrifos) pesticides. All pesticides analyzed in the sediment were found to be non-detect.

Pesticides Detected in Coalition Monitoring

There were 1,772 individual pesticide results (including 237 field duplicates) analyzed in 202 water column samples collected from 18 different sites, including both Representative and Management Plan or Special Study sites during 2019 Coalition monitoring. Analyses were conducted for organophosphates, carbamates, organochlorines, insecticides, fungicides, pyrethroids, triazines, pyrethroids, and a variety of herbicides. Within these monitored pesticide categories, 20 different pesticides were detected out of a total of 159 total detected results (including 20 field duplicates). Overall, greater than 91% of all pesticide results were below detection for the 2019 Monitoring Year.

It should be noted that detections of pesticides are not equivalent to exceedances (with the exceptions of carbofuran, malathion, and methyl parathion which have prohibitions of discharge in the Basin Plan).

All pesticides detected in water column samples for 2019 Coalition monitoring are listed in **Table 14**. Pesticides were compared to relevant numeric and narrative water quality objectives, and to toxicity threshold concentrations published in USEPA's *ECOTOX* Database (USEPA 2019; online database updated regularly) and International Union of Pure and Applied Chemistry Pesticide Properties Database (IUPAC PPDB; online database updated regularly). One registered pesticide, malathion (one sample) and 12 pyrethroid pesticide samples exceeded applicable water quality objectives or ILRP Trigger Limits.

A discussion of these detections and exceedances follows below.

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[10] Weston, D.P., Jackson, C.J., 2009. Use of engineered enzymes to identify organo-phosphate and pyrethroid-related toxicity in toxicity identification evaluations. *Environ Sci Technol* 43, 5514-5520.

- The insecticide acetamiprid was detected in one sample collected at Freshwater Creek. There is currently no ILRP Trigger Limit or adopted water quality objective for acetamiprid.
- The insecticide clothianidin was detected in two environmental samples and one field duplicate at Willow Slough Bypass. There is currently no ILRP Trigger Limit or adopted water quality objective for clothianidin.
- The insecticide cyprodinil was detected in three environmental samples. There is currently no ILRP Trigger Limit or adopted water quality objective for cyprodinil.
- The herbicide diuron was detected in three samples collected at three sites: Grand Island Drain, Lower Snake River, and Walker Creek. No samples exceed the USEPA Health Advisory limit of 2 µg/L.
- The herbicide 2,4-dichlorophenoxyacetic acid was detected once at Willow Slough Bypass. There is currently no ILRP Trigger Limit or adopted water quality objective for herbicide 2,4-dichlorophenoxyacetic acid.
- The herbicide ethalfluralin was detected in one sample each collected at Pine Creek, Sacramento Slough, and Shag Slough, and one field duplicate collected at Willow Slough Bypass. There is currently no ILRP Trigger Limit or adopted water quality objective for ethalfluralin.
- The insecticide fenpropathrin was detected in one sample at Grand Island Drain and one sample at Ulatis Creek. There is currently no ILRP Trigger Limit or adopted water quality objective for fenpropathrin
- The herbicide glyphosate was detected in three samples: one at Lower Snake River and two at Pine Creek. None of the samples exceeded the California Maximum Contaminant Level of 700 µg/L.
- The insecticide imidacloprid was detected in 24 samples (and four field duplicates) collected at eight sites, including three samples collected at Lower Snake River. There is currently no ILRP Trigger Limit or adopted water quality objective for imidacloprid.
- The insecticide malathion was detected with a concentration of 0.04 µg/L at Pit River. Detection of malathion is an exceedance of the Basin Plan discharge prohibition. There were six reported applications of malathion in the month prior to the exceedance. Malathion was applied to approximately 170 acres of alfalfa, 103 acres of wild rice, 100 acres of timothy grass, and 32 acres of strawberries in the Pit River drainage during that time. All of the wild rice applications were made aerially, while the other crops were applied by ground methods. Toxicity tests were not performed during this event.
- The herbicide oxyfluorfen was detected in 12 samples (and one field duplicate), including three samples each collected at Ulatis Creek and Willow Slough Bypass. There is currently no *ILRP* Trigger Limit or adopted water quality objective for oxyfluorfen.
- The fungicide propiconazole was detected in two samples: one collected at Lower Snake River and one at Walker Creek. There is currently no ILRP Trigger Limit or adopted water quality objective for propiconazole.

- The fungicide pyraclostrobin was detected in one sample at Walker Creek. There is currently no ILRP Trigger Limit or adopted water quality objective for pyraclostrobin
- The insecticide tetramethrin was detected in two samples: one collected at Grand Island Drain and one at Willow Slough Bypass. There is currently no ILRP Trigger Limit or adopted water quality objective for tetramethrin.

The Central Valley Regional Water Quality Control Board's *Amendment to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins for the Control of Pyrethroid Pesticide Discharges* in Resolution R5-2017-0057[11] (Pyrethroid Pesticide Basin Plan Amendment (BPA)) establishes measurable pyrethroid concentration goals. The pyrethroid pesticide numeric trigger is evaluated through calculation of additive acute and chronic concentration goal units (CGUs). Both calculations consider measured concentrations of six individual pyrethroid pesticides: bifenthrin, cyfluthrin, cypermethrin, esfenvalerate, lambda-cyhalothrin, and permethrin. While the additive concentration calculations for the acute and chronic analyses differ, both have ILRP Trigger Limits of 1 CGU; more specifically, 1 CGUa for the acute Trigger Limit and 1 CGUc for chronic Trigger Limit). Pyrethroid concentrations measured between the MDL and QL, and assigned a DNQ (Detected, Not Quantified) qualification by the Coalition, are not considered in the additive concentration calculations. All six of the pyrethroid pesticides that were detected in water column samples for 2019 Coalition monitoring are listed in **Table 14** and discussed below.

- Bifenthrin was detected in 49 environmental samples and six field duplicate samples at a total of 13 different monitoring sites.
- Cyfluthrin was detected in two environmental samples at two sites.
- Cypermethrin was detected in three environmental samples and one field duplicate at three monitoring sites.
- Esfenvalerate was detected in 11 environmental samples at a total of six monitoring sites.
- Lambda-cyhalothrin was detected in 24 environmental samples and four field duplicates samples at a total of 11 monitoring sites.
- Permethrin was detected in one environmental sample.

The Pyrethroid Pesticide BPA came into effect following its approval by the Office of Administrative Law (OAL) on February 19, 2019. The total maximum daily loads (TMDLs), established in the Pyrethroid Pesticide BPA, became effective as of April 22, 2019, with approval from the United States Environmental Protection Agency (USEPA). ILRP staff notified the Coalition that is must report exceedances of the acute and chronic pyrethroid pesticide numeric triggers beginning in April 2019. All exceedances observed from April 2019 through September 2019 are listed in **Table 15** and discussed below.

[11] Central Valley Regional Water Quality Control Board. *Amendment to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins for the Control of Pyrethroid Pesticide Discharges.* Resolution R5-2017-0057. Adopted on June 2017.
https://www.waterboards.ca.gov/rwqcb5/board_decisions/adopted_orders/resolutions/r5-2017-0057_res.pdf

- On May 21, 2019, the calculated chronic additive concentration (4 CGUc) of the detected pyrethroids measured in the sample collected from the Cosumnes River site exceeded the Basin Plan Chronic Trigger Limit of 1 CGU. Bifenthrin was the only pyrethroid whose concentration (2 ng/L) was detected above the reporting limit and thus, contributed to this exceedance. There were six reported applications of bifenthrin in the month prior to the exceedance. Applications were made to almond (185 acres), walnut (60 acres), and outdoor plants (6 acres). The single walnut application was an aerial application of bifenthrin-containing product that occurred less than one week before the observed exceedance. Approximately 1.3" of rain fell on May 18-19.
- The Freshwater Creek site had a total of two exceedances of the Basin Plan Trigger Limit for pyrethroid pesticides:
    - On May 21, 2019, the calculated chronic additive concentration (10 CGUc) and acute additive concentration (5 CGUa) both exceeded the Basin Plan Chronic and Acute Trigger Limits of 1 CGU. Concentrations of cypermethrin (1.5 ng/L) and lambda-cyhalothrin (13 ng/L) were detected above the reporting limit and thus, contributed to this exceedance. There were no agriculture or non-agricultural applications of cypermethrin made during the six weeks prior to the observed exceedance. Lambda-cyhalothrin was applied in April and May 2019 on six occasions to sunflower on a total of 267 acres. Additionally, there were 70 aerial applications of lambda-cyhalothrin made to rice in the six weeks prior to the observed exceedance. One application occurred six hours prior to the monitoring event and six other applications were made within 24 hours preceding the event. Approximately 0.9" of rain fell on May 15 followed by over 1" on May 18-19.
    - On July 16, 2019, the calculated chronic additive concentration (2 CGUc) of the detected pyrethroids measured in the sample collected from the Freshwater Creek at Gibson Road site exceeded the Basin Plan Chronic Trigger Limit of 1 CGU. Concentrations of bifenthrin and lambda-cyhalothrin (13 ng/L) were detected above the reporting limit and thus, contributed to this exceedance. There were 26 bifenthrin applications leading up to the July 16, 2019, exceedance. These applications were made to tomato (586 acres), almond (442 acres), cucumber (88 acres), and dried bean (20 acres). There were also nine lambda-cyhalothrin applications collectively made to sunflower (267 acres), almond (79 acres), and walnut (7 acres), and six applications made to rice (228 acres) leading up to the observed exceedance. There was no precipitation in the two weeks prior to the event.
- On May 22, 2019, the calculated chronic additive concentration (8 CGUc) of detected pyrethroids measured in the sample collected from the Coon Creek site exceeded the Basin Plan Chronic Trigger Limit of 1 GCU. Bifenthrin was the only pyrethroid whose concentration (7 ng/L) was detected above the reporting limit and thus, contributed to this exceedance. There were no reported agricultural applications of bifenthrin within the Middle Coon Creek Drainage in the month prior to the observed exceedance. Both Sutter and Placer counties reported many non-agricultural applications of bifenthrin in April and May.

- On May 22, 2019, the calculated chronic additive concentration (3 CGUc) of the detected pyrethroids measured in the sample collected from the Lower Snake River site exceeded the Basin Plan Chronic Trigger Limit of 1 CGU. Lambda-cyhalothrin was the only pyrethroid whose concentration (3.8 ng/L) was detected above the reporting limit and thus, contributed to this exceedance. There were only three reported applications of lambda-cyhalothrin leading up to the May 21, 2019 exceedance. In mid-April, lambda-cyhalothrin was applied to 28 acres of alfalfa and in May there were two small applications to onion seed (2 acres) and prune (1.5 acres). Less than a gallon of total product was applied during these three applications. Additionally, there were 46 applications to rice (2,225 acres) in May leading up to the monitoring event. A total of approximately 65 gallons of lambda-cyhalothrin-containing product was used in these applications to rice. Approximately 2" of rain fell during May 15 – 19.
- The Walker Creek site had a total of two exceedances of the Basin Plan Trigger Limit for pyrethroid pesticides:
    - On May 22, 2019, the calculated chronic additive concentration (3 CGUc) of the detected pyrethroids measured in the sample collected from the Walker Creek site exceeded the Basin Plan Chronic Trigger Limit of 1 CGU). Concentrations of bifenthrin (3.7 ng/L) and esfenvalerate (9.5 ng/L) were detected above the reporting limit and thus, contributed to this exceedance. There were four reported applications of bifenthrin in the month prior to the May 22, 2019, exceedance. All of these applications were made to pistachio, which totaled 234 acres. All of these applications were made greater than ten days prior to the monitoring event. There were no documented agricultural or non-agricultural applications of esfenvalerate in the month prior to the monitoring event. Approximately 0.9" of rain fell on May 15 followed by over 1" on May 18-19.
    - On July 17, 2019, the calculated chronic additive concentration (5 CGUc) and acute additive concentration (2 CGUa) both exceeded the Basin Plan Chronic and Acute Trigger Limits of 1 CGU. Concentrations of bifenthrin (1.5 ng/L) and lambda-cyhalothrin (10 ng/L) were detected above the reporting limit and thus, contributed to this exceedance. There were six reported applications of bifenthrin and nine applications of lambda-cyhalothrin in the month prior to the July 17, 2019, observed exceedance. The bifenthrin applications were made to almond (248 acres) and pistachio (110 acres), while lambda-cyhalothrin was applied to almond (815 acres). Additionally, there were 14 applications to rice (423 acres), with one of the applications (72 acres) occurring on the day of the observed exceedance. There was no precipitation measured in the two weeks prior to the event.
- On May 23, 2019, the calculated chronic additive concentration (8 CGUc) and acute additive concentration (3 CGUa) of detected pyrethroids in the sample collected from the Colusa Basin Drain site both exceeded the Basin Plan Chronic and Acute Basin Plan Trigger Limits of 1 CGU. Concentrations of bifenthrin (0.7 ng/L), cypermethrin (0.7 ng/L), and lambda-cyhalothrin (12 ng/L) were detected above their respective reporting limits and thus, contributed to this exceedance. There were only five bifenthrin applications leading up to the exceedance. With the exception of 75 acres of almonds

treated on May 13, 2109, all other applications were made on April 16 to parcels of 2.5-acres or less. Lambda-cyhalothrin was applied in April and May 2019 on six occasions to sunflower on a total of 267 acres. Additionally, there were 70 aerial applications of lambda-cyhalothrin made to rice in the six weeks prior to the monitoring event. One application to rice occurred in the six hours prior to the event and six other applications were made within 24 hours preceding the event. There were no agricultural or non-agricultural applications of cypermethrin in the six weeks prior to the observed exceedance. Approximately 0.9" of rain fell on May 15 followed by over 1" on May 18-19.

- The Pine Creek site had a total of three exceedances of the Basin Plan Trigger Limit for pyrethroid pesticides:
    - On July 17, 2019, the calculated chronic additive concentration (10 CGUc) and acute additive concentration (2 CGUa) of detected pyrethroids in the sample collected from the Pine Creek site both exceeded the Basin Plan Chronic and Acute Trigger Limits of 1 CGU. Concentrations of bifenthrin (2.6 ng/L) and cyfluthrin (15 ng/L) were detected above the reporting limit and thus, contributed to this exceedance. Bifenthrin applications we made to almond (949 acres) and walnut (772 acres). No cyfluthrin was reported as being applied to irrigated crops during this time period. There were non-agricultural applications of cyfluthrin for structural pest control made in both June and July 2017. There was no precipitation in the two weeks prior to the event.
    - On August 21, 2019, the calculated chronic additive concentration (3 CGUc) of the detected pyrethroids measured in the sample collected from the Pine Creek site exceeded the Basin Plan Chronic Trigger Limit of 1 CGU. Bifenthrin was the only pyrethroid whose concentration (1.6 ng/L) was detected above the reporting limit and thus, contributed to this exceedance. Bifenthrin applications we made to almond (5051 acres), pistachio (227), and tomato (212 acres). There was no precipitation in the two weeks prior to the event.
    - On September 26, 2019, the calculated chronic additive concentration (2 CGUc) of the detected pyrethroids measured in the sample collected from the Pine Creek site exceeded the Basin Plan Chronic Trigger Limit of 1 CGU. Bifenthrin was the only pyrethroid whose concentration (1.3 ng/L) was detected above the reporting limit and thus, contributed to this exceedance. Bifenthrin applications we made to almond (228 acres), pistachio (64), and walnut (1002 acres). Nine (9) aerial applications of bifenthrin were made to walnut the week prior to the exceedance. There was no precipitation in the two weeks prior to the event.
- On September 26, 2019, the calculated chronic additive concentration (2 CGUc) of the detected pyrethroids measured in the sample from collected from the Anderson Creek site exceeded the Basin Plan Chronic Trigger Limit of 1 CGU. Permethrin was the only pyrethroid whose concentration (110 ng/L) was detected above the reporting limit and thus, contributed to this exceedance. There were five reported permethrin applications to 170 acres of walnut within just over one week prior to the observed exceedance. The applications were made to parcels that were located upstream and adjacent to the

monitoring site, with four of the applications made within 48 hours of the observed exceedance. There was no precipitation in the two weeks prior to the event.

Table 14. Pesticides Detected in 2019 Coalition Monitoring

Site	Date	Analyte	Result[1] (ug/L)		Trigger Limit[2]	Basis for Limit[3]
FRSHC	7/16/2019	Acetamiprid	=	0.0622		
ACACR	9/26/2019	Bifenthrin	DNQ	0.1		
CCBRW	**5/22/2019**	**Bifenthrin**	**=**	**7**	**[5]**	
COLDR	1/8/2019	Bifenthrin	=	6.5		
COLDR	**5/23/2019**	**Bifenthrin**	**=**	**0.7**	**[5]**	
COLDR	**5/23/2019**	**Bifenthrin [4]**	**=**	**0.5**	**[5]**	
COLDR	8/22/2019	Bifenthrin	=	0.5		
CRTWN	**5/21/2019**	**Bifenthrin**	**=**	**2**	**[5]**	
CRTWN	7/16/2019	Bifenthrin	DNQ	0.1		
CRTWN	8/21/2019	Bifenthrin	DNQ	0.3		
FRSHC	1/9/2019	Bifenthrin	DNQ	0.3		
FRSHC	2/19/2019	Bifenthrin	=	0.6		
FRSHC	3/19/2019	Bifenthrin	DNQ	0.2		
FRSHC	4/18/2019	Bifenthrin	DNQ	0.3		
FRSHC	5/21/2019	Bifenthrin	DNQ	0.3		
FRSHC	**7/16/2019**	**Bifenthrin**	**=**	**1**	**[5]**	
FRSHC	8/21/2019	Bifenthrin	=	1		
FRSHC	8/21/2019	Bifenthrin [4]	=	0.5		
FRSHC	9/25/2019	Bifenthrin	DNQ	0.4		
GIDLR	3/19/2019	Bifenthrin	DNQ	0.2		
GIDLR	5/21/2019	Bifenthrin	DNQ	0.3		
GIDLR	7/16/2019	Bifenthrin	DNQ	0.3		
GIDLR	9/25/2019	Bifenthrin	DNQ	0.2		
LHNCT	12/18/2018	Bifenthrin	DNQ	0.2		
LHNCT	7/17/2019	Bifenthrin	DNQ	0.2		
LHNCT	9/26/2019	Bifenthrin	DNQ	0.2		
LSNKR	1/9/2019	Bifenthrin	=	2.1		
LSNKR	5/22/2019	Bifenthrin	DNQ	0.4		
LSNKR	7/17/2019	Bifenthrin	=	0.8		
LSNKR	8/22/2019	Bifenthrin	=	0.6		
PNCHY	1/9/2019	Bifenthrin	=	1		
PNCHY	4/17/2019	Bifenthrin	=	0.6		
PNCHY	4/17/2019	Bifenthrin [4]	DNQ	0.3		
PNCHY	5/22/2019	Bifenthrin	DNQ	0.3		
PNCHY	**7/17/2019**	**Bifenthrin**	**=**	**2.6**	**[5]**	
PNCHY	**8/21/2019**	**Bifenthrin**	**=**	**1.6**	**[5]**	

Site	Date	Analyte	Result(1) (ug/L)		Trigger Limit(2)	Basis for Limit(3)
PNCHY	**9/26/2019**	**Bifenthrin**	**=**	**1.3**	**[5]**	
PNCHY	**9/26/2019**	**Bifenthrin (4)**	**=**	**1.7**	**[5]**	
SSKNK	1/8/2019	Bifenthrin	DNQ	0.4		
SSKNK	5/23/2019	Bifenthrin	DNQ	0.2		
SSKNK	8/22/2019	Bifenthrin	=	0.7		
SSLIB	8/22/2019	Bifenthrin	DNQ	0.3		
UCBRD	10/16/2018	Bifenthrin (4)	DNQ	0.3		
UCBRD	2/19/2019	Bifenthrin	DNQ	0.2		
UCBRD	4/18/2019	Bifenthrin	=	2.5		
UCBRD	9/25/2019	Bifenthrin	DNQ	0.1		
WLKCH	3/20/2019	Bifenthrin	=	0.8		
WLKCH	4/17/2019	Bifenthrin	=	0.7		
WLKCH	**5/22/2019**	**Bifenthrin**	**=**	**3.7**	**[5]**	
WLKCH	**7/17/2019**	**Bifenthrin**	**=**	**3.4**	**[5]**	
WLKCH	8/22/2019	Bifenthrin	=	0.5		
WLKCH	9/26/2019	Bifenthrin	=	0.6		
WLSPL	6/18/2019	Bifenthrin	=	0.7		
WLSPL	6/18/2019	Bifenthrin (4)	=	0.6		
WLSPL	7/16/2019	Bifenthrin	DNQ	0.4		
WLSPL	8/22/2019	Bifenthrin	DNQ	0.4		
WLSPL	7/16/2019	Clothianidin	DNQ	0.0187		
WLSPL	7/16/2019	Clothianidin	DNQ	0.0107		
WLSPL	7/16/2019	Clothianidin (4)	=	0.037		
GIDLR	8/21/2019	Cyfluthrin	=	0.9		
PNCHY	**7/17/2019**	**Cyfluthrin**	**=**	**15**	**[5]**	
CCBRW	3/19/2019	Cypermethrin	DNQ	0.2		
COLDR	**5/23/2019**	**Cypermethrin**	**=**	**0.7**	**[5]**	
COLDR	**5/23/2019**	**Cypermethrin (4)**	**=**	**0.6**	**[5]**	
FRSHC	**5/21/2019**	**Cypermethrin**	**=**	**1.5**	**[5]**	
LSNKR	3/20/2019	Cyprodinil	DNQ	0.008		
WLKCH	2/20/2019	Cyprodinil	DNQ	0.017		
WLKCH	3/20/2019	Cyprodinil	=	0.06		
WLSPL	3/19/2019	Dichlorophenoxyacetic Acid, 2,4-	=	1.6		
GIDLR	2/19/2019	Diuron	DNQ	0.22	2	USEPA Health Advisory
LSNKR	1/9/2019	Diuron	DNQ	0.24	2	USEPA Health Advisory
WLKCH	2/20/2019	Diuron	DNQ	0.32	2	USEPA Health Advisory
COLDR	1/8/2019	Esfenvalerate/Fenvalerate	DNQ	0.7		
LHNCT	12/18/2018	Esfenvalerate/Fenvalerate	DNQ	0.2		
LHNCT	1/9/2019	Esfenvalerate/Fenvalerate	DNQ	0.4		
LHNCT	6/19/2019	Esfenvalerate/Fenvalerate	=	1.2		

Site	Date	Analyte	Result[(1)] (ug/L)		Trigger Limit[(2)]	Basis for Limit[(3)]
LSNKR	1/9/2019	Esfenvalerate/Fenvalerate	=	8		
PNCHY	1/9/2019	Esfenvalerate/Fenvalerate	DNQ	0.4		
PNCHY	5/22/2019	Esfenvalerate/Fenvalerate	DNQ	0.3		
PNCHY	7/17/2019	Esfenvalerate/Fenvalerate	DNQ	0.7		
SSKNK	1/8/2019	Esfenvalerate/Fenvalerate	DNQ	0.6		
WLKCH	5/22/2019	Esfenvalerate/Fenvalerate	=	9.5		
WLKCH	7/17/2019	Esfenvalerate/Fenvalerate	DNQ	0.3		
PNCHY	6/19/2019	Ethalfluralin	DNQ	0.0066		
SSKNK	1/8/2019	Ethalfluralin	DNQ	0.0083		
SSLIB	1/9/2019	Ethalfluralin	DNQ	0.0056		
WLSPL	4/16/2019	Ethalfluralin [(4)]	DNQ	0.0038		
GIDLR	5/21/2019	Fenpropathrin	DNQ	0.4		
UCBRD	2/19/2019	Fenpropathrin	DNQ	0.2		
UCBRD	2/19/2019	Fenpropathrin [(4)]	DNQ	0.2		
LSNKR	7/17/2019	Glyphosate	DNQ	4.1	700	1˚ MCL
PNCHY	7/17/2019	Glyphosate	=	27	700	1˚ MCL
PNCHY	7/17/2019	Glyphosate [(4)]	=	13	700	1˚ MCL
ACACR	4/17/2019	Imidacloprid	=	0.00698		
COLDR	1/8/2019	Imidacloprid	=	0.0457		
COLDR	1/8/2019	Imidacloprid [(4)]	=	0.0106		
FRSHC	1/9/2019	Imidacloprid	=	0.042		
GIDLR	11/23/2018	Imidacloprid	=	0.0141		
GIDLR	5/21/2019	Imidacloprid	DNQ	0.00377		
LHNCT	6/19/2019	Imidacloprid	=	0.0156		
LSNKR	4/17/2019	Imidacloprid	=	0.00569		
LSNKR	6/19/2019	Imidacloprid	=	0.0355		
LSNKR	6/19/2019	Imidacloprid	=	0.0294		
LSNKR	6/19/2019	Imidacloprid [(4)]	=	0.0256		
SSKNK	5/23/2019	Imidacloprid	=	0.00542		
SSKNK	5/23/2019	Imidacloprid	=	0.00581		
SSKNK	5/23/2019	Imidacloprid [(4)]	=	0.00606		
WLKCH	8/22/2019	Imidacloprid	=	0.141		
WLKCH	8/22/2019	Imidacloprid	=	0.126		
WLKCH	8/22/2019	Imidacloprid [(4)]	=	0.119		
CCBRW	5/22/2019	Lambda-Cyhalothrin	DNQ	0.2		
COLDR	1/8/2019	Lambda-Cyhalothrin	DNQ	0.3		
COLDR	**5/23/2019**	**Lambda-Cyhalothrin**	**=**	**12**	**[5]**	
COLDR	**5/23/2019**	**Lambda-Cyhalothrin [(4)]**	**=**	**8.8**	**[5]**	
FRSHC	5/21/2019	Lambda-Cyhalothrin	=	13		
FRSHC	6/18/2019	Lambda-Cyhalothrin	=	1.1		

Site	Date	Analyte	Result[(1)] (ug/L)		Trigger Limit[(2)]	Basis for Limit[(3)]
FRSHC	**7/16/2019**	**Lambda-Cyhalothrin**	**=**	**0.5**	**[5]**	
GIDLR	5/21/2019	Lambda-Cyhalothrin	DNQ	0.3		
GIDLR	8/21/2019	Lambda-Cyhalothrin	=	0.5		
LHNCT	5/22/2019	Lambda-Cyhalothrin	DNQ	0.3		
LHNCT	6/19/2019	Lambda-Cyhalothrin	DNQ	0.4		
LHNCT	7/17/2019	Lambda-Cyhalothrin	=	1.3		
LHNCT	7/17/2019	Lambda-Cyhalothrin (4)	=	1.4		
LHNCT	8/22/2019	Lambda-Cyhalothrin	DNQ	0.2		
LSNKR	1/9/2019	Lambda-Cyhalothrin	DNQ	0.3		
LSNKR	**5/22/2019**	**Lambda-Cyhalothrin**	**=**	**3.8**	**[5]**	
LSNKR	6/19/2019	Lambda-Cyhalothrin	DNQ	0.3		
LSNKR	7/17/2019	Lambda-Cyhalothrin	DNQ	0.2		
PNCHY	7/17/2019	Lambda-Cyhalothrin	DNQ	0.4		
SSKNK	1/8/2019	Lambda-Cyhalothrin	DNQ	0.3		
SSKNK	5/23/2019	Lambda-Cyhalothrin	=	1.4		
UCBRD	10/16/2018	Lambda-Cyhalothrin (4)	DNQ	0.2		
UCBRD	3/19/2019	Lambda-Cyhalothrin	=	2.7		
UCBRD	4/18/2019	Lambda-Cyhalothrin	=	3.6		
WLKCH	**5/22/2019**	**Lambda-Cyhalothrin**	**DNQ**	**0.3**	**[5]**	
WLKCH	**7/17/2019**	**Lambda-Cyhalothrin**	**=**	**10**	**[5]**	
WLSPL	6/18/2019	Lambda-Cyhalothrin	=	0.9		
WLSPL	6/18/2019	Lambda-Cyhalothrin (4)	=	0.9		
PRPIT	**5/22/2019**	**Malathion**	**DNQ**	**0.04**	**0.1**	**BPA**
COLDR	1/8/2019	Oxyfluorfen	=	0.059		
FRSHC	12/18/2018	Oxyfluorfen	DNQ	0.011		
LSNKR	1/9/2019	Oxyfluorfen	DNQ	0.029		
SSKNK	1/8/2019	Oxyfluorfen	DNQ	0.0098		
UCBRD	11/23/2018	Oxyfluorfen	DNQ	0.02		
UCBRD	1/8/2019	Oxyfluorfen	=	0.095		
UCBRD	1/8/2019	Oxyfluorfen (4)	=	0.12		
UCBRD	5/21/2019	Oxyfluorfen	DNQ	0.049		
WLKCH	12/19/2018	Oxyfluorfen	DNQ	0.043		
WLKCH	1/9/2019	Oxyfluorfen	=	0.92		
WLSPL	11/23/2018	Oxyfluorfen	=	0.16		
WLSPL	1/9/2019	Oxyfluorfen	=	0.36		
WLSPL	2/19/2019	Oxyfluorfen	=	0.082		
ACACR	**9/26/2019**	**Permethrin**	**=**	**110**	**[5]**	
LSNKR	3/20/2019	Propiconazole	=	0.03		
WLKCH	2/20/2019	Propiconazole	=	0.13		
WLKCH	6/19/2019	Propiconazole	=	0.35		

Site	Date	Analyte	Result[1] (ug/L)		Trigger Limit[2]	Basis for Limit[3]
WLKCH	3/20/2019	Pyraclostrobin	=	0.071		
GIDLR	3/19/2019	Tetramethrin	=	22		
WLSPL	8/22/2019	Tetramethrin	=	1		

BOLD = Exceedance

1. "DNQ" (Detected Not Quantified) indicates that the detected value was less than the quantitation or reporting limit (QL).
2. Water Quality Objective or Narrative Interpretation Limits for ILRP. "NA" if no ILRP limit established.
3. Water Quality Objective Basis: BP = Central Valley Basin Plan; BPA = Basin Plan Amendment; Cal/EPA = Cal/EPA Cancer Potency Factor; CDPH Notification Level = Notification levels (formerly called "action levels") are published by the California Department of Public Health (CDPH) for chemicals for which there is no drinking water MCL;
   CTR = California Toxics Rule; Narrative = unadopted limits used to interpret Basin Plan narrative objectives by the Central Valley Water Board; USEPA Health Advisory = Drinking water health advisory.
4. Sample was collected as a field duplicate.
5. This pyrethroid pesticide contributed to the exceedance of a chronic and/or acute trigger limit included in the Pyrethroid Pesticide BPA. The ILRP Trigger Limit for the additive concentration of six pyrethroid pesticides was compared to Coalition water quality results beginning in April 2019.

Table 15: Pyrethroid Pesticides Exceedances in 2019 Monitoring

Site	Date[1]	Detected Pyrethroids	Chronic Additive Concentration (CGUc)	Acute Additive Concentration (CGUa)	Chronic & Acute Trigger Limit (CGU)	Basis for Limit
CRTWN	5/21/2019	Bifenthrin	4	0	1	Basin Plan
FRSHC	5/21/2019	Cypermethrin, Lambda-Cyhalothrin	10	5	1	Basin Plan
CCBRW	5/22/2019	Bifenthrin	8	0	1	Basin Plan
LSNKR	5/22/2019	Lambda-Cyhalothrin	3	0	1	Basin Plan
WLKCH	5/22/2019	Bifenthrin, Esfenvalerate	3	0	1	Basin Plan
COLDR	5/23/2019	Bifenthrin, Cypermethrin, Lambda-Cyhalothrin	8	3	1	Basin Plan
FRSHC	7/16/2019	Bifenthrin, Lambda-Cyhalothrin	2	0	1	Basin Plan
PNCHY	7/17/2019	Bifenthrin, Cyfluthrin	10	2	1	Basin Plan
WLKCH	7/17/2019	Bifenthrin, Lambda-Cyhalothrin	5	2	1	Basin Plan
PNCHY	8/21/2019	Bifenthrin	3	0	1	Basin Plan
ACACR	9/26/2019	Permethrin	10	2	1	Basin Plan
PNCHY	9/26/2019	Bifenthrin	2	0	1	Basin Plan

1. Exceedances are assessed for the 2019 monitoring year beginning with the monitoring event in April 2019.

OTHER COALITION-MONITORED WATER QUALITY PARAMETERS

Exceedances of adopted Basin Plan objectives, CTR criteria, or ILRP Trigger Limits were observed for specific conductivity, dissolved oxygen, *E. coli*, pH, and trace metals during 2019 Coalition Monitoring (see **Table 16**).

Specific Conductivity

Specific conductivity was monitored in 153 samples from 22 Coalition sites. Specific conductivity exceeded the unadopted UN Agricultural Goal (700 µS/cm) in a total of 16 samples and also exceeded the California recommended 2˚ MCL (900 µS/cm) for drinking water in eight of the 16 samples. Exceedances were observed at five sites.

Dissolved Oxygen

During 2019 Coalition monitoring, dissolved oxygen was measured in 156 samples at 22 Coalition sites. A total of 12 samples exceeded the COLD Basin Plan limit with measured dissolved oxygen concentrations below 7.0 mg/L for waterbodies with a COLD designated beneficial use.

Dissolved oxygen exceedances are generally caused primarily by low flows, stagnant conditions, or extensive submerged aquatic vegetation in some cases. The low flows and stagnant conditions have the potential to increase diurnal variability or limit oxygen production by in-stream algae and also to trap organic particulates that contribute to in-stream oxygen consumption.

E. coli Bacteria

E. coli bacteria were analyzed in 140 environmental samples and 12 field duplicates from 18 Coalition sites. *E. coli* results exceeded the single sample maximum objective (235 MPN/100mL) in 45 samples (including three field duplicates) from 12 Coalition monitoring locations.

The Basin Plan objectives are intended to protect contact recreational uses where ingestion of water is probable (e.g., swimming). Agricultural lands commonly support a large variety (and very large numbers seasonally) of birds and other wildlife. These avian and wildlife resources are known to be significant sources of *E. coli* and other bacteria in agricultural runoff and irrigation return flows. Other potential sources of *E. coli* include, but are not limited to, cattle, horses, septic systems, treated wastewater, and urban runoff.

pH

During 2019 Coalition monitoring, pH was measured in 153 samples from 22 Coalition sites. pH exceeded the Basin Plan maximum of 8.5 standard pH units (-log[H+]) in 10 samples collected from six sites and fell below the Basin Plan minimum of 6.5 pH units (-log[H+]) in five samples from three sites.

The Basin Plan limit for pH is intended to be assessed based on "…*an appropriate averaging period that will support beneficial uses*" (CVRWQCB 2018). This parameter typically exhibits significant natural diurnal variation over 24 hours in natural waters, with daily fluctuations controlled principally by photosynthesis, rates of respiration, and buffering capacity of the water. These processes are controlled by light and nutrient availability, concentrations of organic matter, and temperature. These factors combine to cause increasing pH during daylight hours and decreasing pH at night. Diurnal variations in winter are typically smaller because less light is available and there are lower temperatures and higher flows. Irrigation return flows may influence this variation primarily by increasing or decreasing in-stream temperatures or by increasing available nutrients or organic matter.

The reason for these pH exceedances was not immediately obvious nor easily determined. In most cases, the marginal pH exceedances were likely due primarily to in-stream algal and/or vascular plant respiration, caused in part by low flows or ponded and stagnant conditions and temperatures sufficient to stimulate algal growth.

Trace Metals

Trace metals monitored during 2019 Coalition monitoring included the collection and analysis of both unfiltered metals (total arsenic, boron, copper, and zinc) and filtered metals (dissolved copper and dissolved zinc).

Total trace metals were monitored in 55 environmental samples and 14 field duplicate samples from 15 Coalition sites, and dissolved metals were monitored in 40 environmental samples and seven field duplicate samples from 15 Coalition sites.

Arsenic

Eleven total arsenic environmental samples and nine field duplicate samples were collected from two Coalition sites. Three environmental samples and three field duplicate samples from the monitoring site at Grand Island Drain exceeded the California 1˚ MCL of 10 µg/L.

There are both legacy and a few current sources of arsenic in the Sacramento River Watershed. There is very little remaining agricultural use of arsenic-based pesticide products (based on a review of DPR’s PUR data), and arsenic has only a few potentially significant sources: (1) natural background from arsenic in the soils, (2) arsenic remaining from legacy lead arsenate use in orchards, (3) arsenic used in various landscape maintenance and structural pest control applications (non-agriculture), and (4) arsenic used in wood preservatives. One possible source is the wooden bridge structure located just upstream of the Grand Island Drain sampling site, if arsenic-based preservatives were used on the wood. A final, but somewhat unlikely source is an arsenic-based additive that may still be used for chicken feed[12] and which can potentially make its way through the chicken and into agricultural fields and runoff if the poultry litter is used on the field.

Boron

Four total boron environmental samples and four field duplicate samples were collected from one Coalition site, Willow Slough Bypass at Pole Line. Four of the eight total boron samples, two environmental samples and two field duplicate samples, exceeded the ILRP Trigger Limit of 700 µg/L, based on Ayers and Westcott (1985).

Boron is a naturally-occurring mineral that is not applied by agriculture, but it is elevated in some irrigation supplies (especially those sourced in part or entirely from groundwater) and soils,

[12] http://water.usgs.gov/owq/AFO/proceedings/afo/pdf/Wershaw.pdf

and concentrations may be elevated through consumptive use of irrigation water. It is known to be naturally elevated in the groundwater and major tributaries supplying irrigation water in the Willow Slough drainage.

Table 16. Other Physical, Chemical, and Microbiological Parameters Observed to Exceed Numeric Objectives in 2019 Coalition Monitoring

Sample Date	Analyte	Unit	Result	Trigger Limit(1)	Basis for Limit(2)	Management Plan (3)
10/16/2018	Arsenic	µg/L	11	10	1˚ MCL (5)	Active
10/16/2018	Arsenic	µg/L	11	10	1˚ MCL (5)	Active
12/18/2018	Arsenic	µg/L	13	10	1˚ MCL (5)	Active
12/18/2018	Arsenic	µg/L	13	10	1˚ MCL (5)	Active
4/16/2019	Arsenic	µg/L	11	10	1˚ MCL (5)	Active
4/16/2019	Arsenic	µg/L	11	10	1˚ MCL (5)	Active
3/19/2019	Boron	µg/L	1500	700	Narrative	Active
3/19/2019	Boron	µg/L	1500	700	Narrative	Active
4/16/2019	Boron	µg/L	1600	700	Narrative	Active
4/16/2019	Boron	µg/L	1600	700	Narrative	Active
10/17/2018	Dissolved Oxygen	mg/L	5.1	7	BP [SSO COLD]	Active
7/17/2019	Dissolved Oxygen	mg/L	6.5	7	BP [SSO COLD]	Active
7/16/2019	Dissolved Oxygen	mg/L	4.5	7	BP [SSO COLD]	Active
8/21/2019	Dissolved Oxygen	mg/L	5.21	7	BP [SSO COLD]	Active
8/22/2019	Dissolved Oxygen	mg/L	5.09	7	BP [SSO COLD]	Active
8/21/2019	Dissolved Oxygen	mg/L	3.9	7	BP [SSO COLD]	Active
8/22/2019	Dissolved Oxygen	mg/L	4.11	7	BP [SSO COLD]	Active
8/22/2019	Dissolved Oxygen	mg/L	3.02	7	BP [SSO COLD]	Active
8/22/2019	Dissolved Oxygen	mg/L	5.51	7	BP [SSO COLD]	Active
9/25/2019	Dissolved Oxygen	mg/L	3.97	7	BP [SSO COLD]	Active
9/25/2019	Dissolved Oxygen	mg/L	4.7	7	BP [SSO COLD]	Active
9/26/2019	Dissolved Oxygen	mg/L	6.51	7	BP [SSO COLD]	Active
11/24/2018	E. coli	MPN/100mL	260.3	235	BP	Suspended
11/23/2018	E. coli	MPN/100mL	980.4	235	BP	Suspended
11/23/2018	E. coli	MPN/100mL	2419.6	235	BP	Suspended
11/24/2018	E. coli	MPN/100mL	920.8	235	BP	Suspended
12/18/2018	E. coli	MPN/100mL	1011.2	235	BP	Suspended
12/18/2018	E. coli	MPN/100mL	691	235	BP	Suspended
12/19/2018	E. coli	MPN/100mL	1046.2	235	BP	Suspended
12/19/2018	E. coli	MPN/100mL	1299.7	235	BP	Suspended
12/18/2018	E. coli	MPN/100mL	437.4	235	BP	Suspended
12/19/2018	E. coli	MPN/100mL	866.4	235	BP	Suspended
1/8/2019	E. coli	MPN/100mL	1299.7	235	BP	Suspended

Sample Date	Analyte	Unit	Result	Trigger Limit(1)	Basis for Limit(2)	Management Plan (3)
1/8/2019	E. coli	MPN/100mL	1986.3	235	BP	Suspended
1/9/2019	E. coli	MPN/100mL	307.6	235	BP	Suspended
1/9/2019	E. coli	MPN/100mL	866.4	235	BP	Suspended
1/9/2019	E. coli	MPN/100mL	2419.6	235	BP	Suspended
1/9/2019	E. coli	MPN/100mL	1553.1	235	BP	Suspended
1/9/2019	E. coli	MPN/100mL	727	235	BP	Suspended
1/8/2019	E. coli	MPN/100mL	2419.6	235	BP	Suspended
1/9/2019	E. coli	MPN/100mL	524.7	235	BP	Suspended
1/9/2019	E. coli	MPN/100mL	2419.6	235	BP	Suspended
2/19/2019	E. coli	MPN/100mL	517.2	235	BP	Suspended
3/20/2019	E. coli	MPN/100mL	365.4	235	BP	Suspended
4/18/2019	E. coli	MPN/100mL	285.1	235	BP	Suspended
4/16/2019	E. coli	MPN/100mL	272.3	235	BP	Suspended
5/22/2019	E. coli	MPN/100mL	579.4	235	BP	Suspended
5/22/2019	E. coli	MPN/100mL	272.3	235	BP	Suspended
5/21/2019	E. coli	MPN/100mL	686.7	235	BP	Suspended
5/22/2019	E. coli	MPN/100mL	410.6	235	BP	Suspended
5/22/2019	E. coli	MPN/100mL	547.5	235	BP	Suspended
5/22/2019	E. coli	MPN/100mL	816.4	235	BP	Suspended
5/21/2019	E. coli	MPN/100mL	387.3	235	BP	Suspended
6/19/2019	E. coli	MPN/100mL	727	235	BP	Suspended
6/18/2019	E. coli	MPN/100mL	866.4	235	BP	Suspended
6/18/2019	E. coli	MPN/100mL	2419.6	235	BP	Suspended
6/19/2019	E. coli	MPN/100mL	2419.6	235	BP	Suspended
7/17/2019	E. coli	MPN/100mL	770.1	235	BP	Suspended
7/16/2019	E. coli	MPN/100mL	344.8	235	BP	Suspended
7/31/2019	E. coli	MPN/100mL	326	235	BP	Suspended
7/17/2019	E. coli	MPN/100mL	261.3	235	BP	Suspended
8/21/2019	E. coli	MPN/100mL	1046.2	235	BP	Suspended
8/22/2019	E. coli	MPN/100mL	365.4	235	BP	Suspended
8/22/2019	E. coli	MPN/100mL	248.9	235	BP	Suspended
9/25/2019	E. coli	MPN/100mL	313	235	BP	Suspended
9/26/2019	E. coli	MPN/100mL	285.1	235	BP	Suspended
9/25/2019	E. coli	MPN/100mL	435.2	235	BP	Suspended
12/18/2018	pH	-log[H+]	6.44	6.5-8.5	BP	Active

Sample Date	Analyte	Unit	Result	Trigger Limit[1]	Basis for Limit[2]	Management Plan [3]
1/8/2019	pH	-log[H+]	6.43	6.5-8.5	BP	Active
2/19/2019	pH	-log[H+]	6.39	6.5-8.5	BP	Active
4/30/2019	pH	-log[H+]	6.15	6.5-8.5	BP	Active
4/23/2019	pH	-log[H+]	8.7	6.5-8.5	BP	Active
4/18/2019	pH	-log[H+]	8.54	6.5-8.5	BP	Active
5/22/2019	pH	-log[H+]	5.8	6.5-8.5	BP	Active
6/28/2019	pH	-log[H+]	9.17	6.5-8.5	BP	Active
7/23/2019	pH	-log[H+]	9.69	6.5-8.5	BP	Active
8/22/2019	pH	-log[H+]	8.89	6.5-8.5	BP	Active
10/16/2018	Specific Conductivity	µS/cm	992	700, 900 [4]	Narrative	Active
1/8/2019	Specific Conductivity	µS/cm	862	700, 900 [4]	Narrative	Active
2/19/2019	Specific Conductivity	µS/cm	838	700, 900 [4]	Narrative	Active
2/19/2019	Specific Conductivity	µS/cm	1508	700, 900 [4]	Narrative	Active
3/19/2019	Specific Conductivity	µS/cm	869	700, 900 [4]	Narrative	Active
3/19/2019	Specific Conductivity	µS/cm	1048	700, 900 [4]	Narrative	Active
3/19/2019	Specific Conductivity	µS/cm	829	700, 900 [4]	Narrative	Active
3/19/2019	Specific Conductivity	µS/cm	905	700, 900 [4]	Narrative	Active
4/16/2019	Specific Conductivity	µS/cm	1001	700, 900 [4]	Narrative	Active
4/18/2019	Specific Conductivity	µS/cm	713	700, 900 [4]	Narrative	Active
4/18/2019	Specific Conductivity	µS/cm	720	700, 900 [4]	Narrative	Active
4/18/2019	Specific Conductivity	µS/cm	767	700, 900 [4]	Narrative	Active
6/18/2019	Specific Conductivity	µS/cm	1186	700, 900 [4]	Narrative	Active
7/16/2019	Specific Conductivity	µS/cm	1071	700, 900 [4]	Narrative	Active
8/21/2019	Specific Conductivity	µS/cm	869	700, 900 [4]	Narrative	Active
9/25/2019	Specific Conductivity	µS/cm	941	700, 900 [4]	Narrative	Active

Notes:

1. Water Quality Objective or Narrative Interpretation Limits for ILRP.
2. Water Quality Objective Basis: BP = Central Valley Basin Plan; BPA = Basin Plan Amendment; CTR = California Toxics Rule; Narrative = unadopted limits used to interpret Basin Plan narrative objectives by the Central Valley Water Board.
3. Indicates whether sites and parameter are currently being addressed by an ongoing Management Plan, study, or TMDL.
4. Specific conductivity exceeded the unadopted United Nations Agricultural Goal (700 µS/cm), the California recommend 2º MCL (900 µS/cm) for drinking water, and/or the Site-Specific Objective 90th percentile limit (150 µS/cm).

Trend Analysis

As part of the evaluation of monitoring results, the WDR requires the Coalition to conduct trend analyses to…

"… identify potential trends[13] and patterns in surface and groundwater quality that may be associated with waste discharge from irrigated lands. As part of this evaluation, the third-party must analyze all readily available monitoring data that meet program quality assurance requirements to determine deficiencies in monitoring for discharges from irrigated agricultural lands and whether additional sampling locations or sampling events are needed or if additional constituents should be monitored. If deficiencies are identified, the third-party must propose a schedule for additional monitoring or source studies. … The third-party should incorporate pesticide use information, as needed, to assist in its data evaluation."

As part of the 2018 AMR, the Coalition conducted the trend analysis for all representative monitoring sites, as well as all pesticides that were detected with ≥5% detection[14]. From this dataset, it was determined that the sites and constituents shown in **Table 17** had potential to degrade water quality.

Table 17. Significant Trends from 2018 Trend Analysis

Category	Analyte	Site Name
Physical	Conductivity	Anderson Creek at Ash Creek Road
		Colusa Basin Drain above KL
		Pit River at Pittville
		Sacramento Slough bridge near Karnak
		Ulatis Creek at Brown Road
		Willow Slough Bypass at Pole Line
	Dissolved Oxygen	Middle Creek u/s from Highway 20
		Coon Creek at Brewer Road
	pH	Anderson Creek at Ash Creek Road
		Colusa Basin Drain above KL
		Lower Snake R. at Nuestro Rd
		Pine Creek at Highway 32
		Willow Slough Bypass at Pole Line
	Total Organic Carbon	Walker Creek near 99W and CR33
Nutrients	Ammonia, Total as N	Cosumnes River at Twin Cities Rd
		Sacramento Slough near Karnak
	Orthophosphate, as P	Ulatis Creek at Brown Road

[13] "All results (regardless of whether exceedances are observed) must be included to determine whether there are trends in degradation that may threaten applicable beneficial uses."

[14] Pesticides with lower than 5% detection rates were considered to have insufficient detected data to reliably identify trends.

Category	Analyte	Site Name
Pesticides	Simazine	Grand Island Drain
Trace Metals	Arsenic	Lower Snake River at Nuestro Road
	Boron	Willow Slough Bypass at Pole Line
Toxicity	Selenastrum growth	Anderson Creek at Ash Creek Road

Beginning in 2015, the Coalition proposed a prioritized approach that would focus on reanalyzing the higher priority trends from the most recent trend analysis. This approach was approved by the Regional Water Board for the second year of an Assessment Monitoring period and for non-Assessment years. 2019 was the second year of an Assessment period, so the trend analysis included here followed the prioritized approach. The modified trend assessment for 2019 reanalyzed the following:

- High priority pesticides with historically high detection rates
    - Chlorpyrifos
    - Diazinon
    - Diuron
- Sites with active Management Plans for *Ceriodaphnia* and *Selenastrum*
- Nutrient data for the 2018 sites that were listed in the "potential degradation subsection"

Pyrethroid pesticides were excluded from the current trend analysis due to their small dataset relative to those of other pesticides that have been monitored by the Coalition for years. Pyrethroids will be included in the Coalition's trend analysis after it completes the Pyrethroid Control Program's Baseline Monitoring during the 2021 Monitoring Year that is required under the Pyrethroid Pesticide BPA.

The methods used to analyze and evaluate the data for the trend analysis were as follows:

- Data were initially evaluated using Spearman's non-parametric test for trends (concentrations vs. sample date). A table of the initial Spearman's test results are provided in **Appendix G**.
    - Data below detection were coded as "0" for initial non-parametric Spearman's evaluation
    - Data were analyzed separately for each site for all parameters
    - The threshold for statistical significance was set at $p<0.05$
- Significant preliminary results ($p<0.05$) were screened for potential degradation impacts
    - Increasing trends in pesticides, metals, nutrients, pathogen indicators
    - Decreasing trends in toxicity survival or growth results
    - The subset of the initial Spearman's test results with potential degradation impacts are provided in **Appendix G**.
- Parameters with potential degradation trend indicators were plotted (concentration vs. date) for further evaluation (plots are provided in **Appendix G**.)

- Data below detection were plotted at the detection limit
- Data were reviewed for potential outliers
- Linear, log-linear, or robust trend lines were plotted to illustrate trends (the selected method was based on visual inspection and best professional judgment)
- Plots were evaluated for other (non-trend) patterns

A determination of the significance of a potential water quality degradation trend was based on the likelihood of a continuing trend and the likelihood of adverse impacts on beneficial uses. Evaluations of beneficial use impacts were based on a continued increasing probability of exceedances of trigger limits. These determinations are provided in **Appendix G**, and significant findings are discussed below.

Pesticide use data were evaluated during the process used to develop the 2019 Monitoring Plan Update, as required by the WDR, MRP, and PEP, and no additional evaluations of pesticide use data were conducted for this AMR. The results of the PEP analysis conducted in summer 2018 were incorporated into the 2019 Monitoring Plan Update that was approved by the Regional Water Board.

DISCUSSION OF RESULTS

The Coalition's 2019 Monitoring Plan Update was approved by Regional Water Board staff as meeting the requirements of the WDR, MRP, and PEP. The WDR provides no additional guidance or criteria for making a determination if there are "deficiencies in monitoring" or if additional locations or events need to be included in an annual monitoring schedule, and no deficiencies were identified as a result of the trend analysis conducted for this report.

Summary of initial Spearman's test results

- 63 site-parameter combinations were evaluated
- 33 results were not significant ($p \geq 0.05$)
- 17 results were not significant due to insufficient detected data
- 13 results were initially determined to have potentially significant trends ($p<0.05$)
    - 10 significant results were identified for trends with no potential negative impacts (i.e., they indicated potentially improving water quality)
    - Three initially significant results were identified as suggesting potential water quality degradation with potential negative impacts on beneficial uses and were further evaluated
- The three results (5% of the beginning number of evaluations) were evaluated as trend plots and were determined to have significant increasing or decreasing trends suggesting potential water quality degradation (**Table 18**) and were evaluated further.

Table 18. Significant Trends Further Evaluated for Potential Water Quality Degradation

Category	Analyte	Site Name
Nutrients	Ammonia, Total as N	Cosumnes River at Twin Cities Rd
		Sacramento Slough near Karnak
Pesticides	Chlorpyrifos	Gilsizer Slough

Total ammonia as nitrogen (N) exhibited a significant increasing trend in samples from Cosumnes River (**Figure 4-a**) and Sacramento Slough (**Figure 4-b**). Neither trend appears to indicate a continuing long-term trend in ammonia as N concentrations and there were no exceedances of the ILRP Trigger Limit for the nutrient[15]. Additional monitoring events or locations are not necessary.

Chlorpyrifos concentrations at Gilsizer Slough were elevated above the average for the site between 2014 and 2015 due to four exceedances of the WQO for chlorpyrifos (**Figure 4-c**), which triggered a Management Plan in 2015. An additional exceedance occurred in August 2018, but all samples analyzed in the 2019 Monitoring Year were below detection for the pesticide. Risk of degradation and need for tracking are addressed by the Management Plan and ongoing monitoring.

In summary, the results of trend analyses conducted for this AMR did not indicate a need for the monitoring of any additional locations, events, or parameters. We continue to recommend that the trend analysis evaluation be performed no more than once per Assessment Monitoring period, with the next evaluation occurring in the 2022 Monitoring Year. By that monitoring year, two to three years of additional assessment monitoring will have been conducted under the Pesticides Evaluation Protocol, which will increase the amount of data evaluated and the robustness of the analysis.

[15] Ammonia as N concentrations measured in Coalition water quality samples are compared to criteria promulgated in the 2013 USEPA final Aquatic Life Ambient Water Quality Criteria for Ammonia – Freshwater.

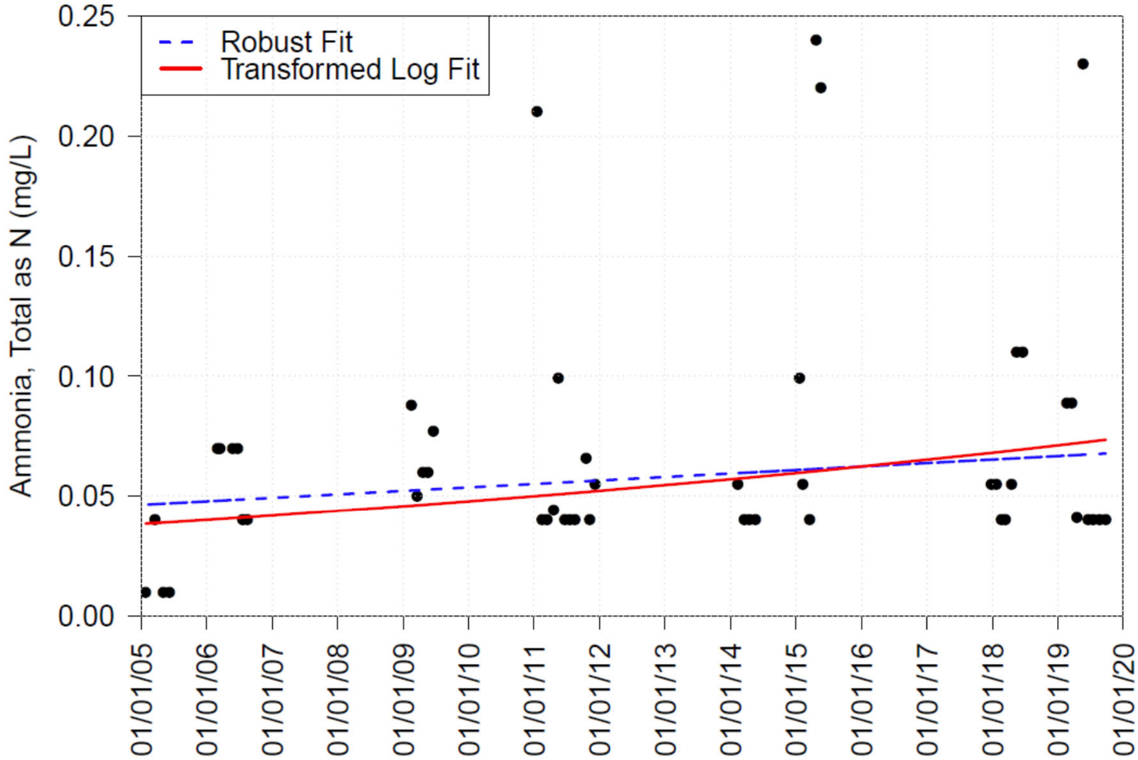

Figure 4-a. Ammonia, Total as N, Cosumnes River at Twin Cities Road

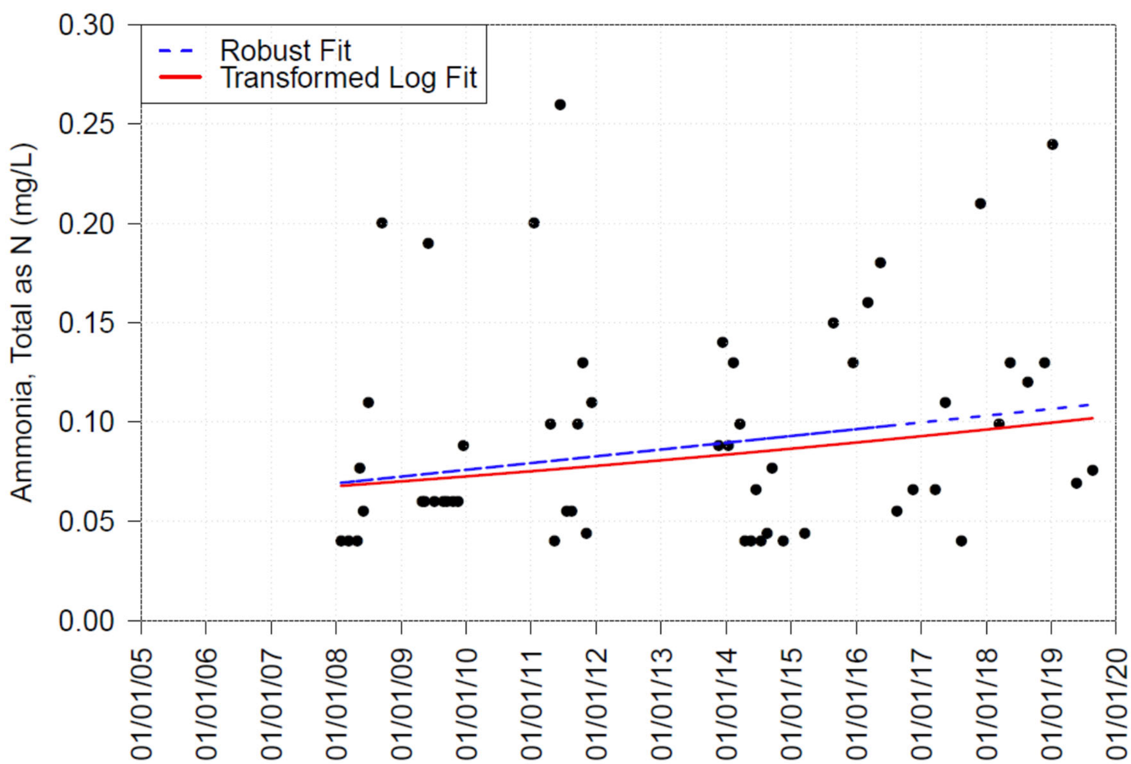

Figure 4-b. Ammonia, Total as N, Sacramento Slough Bridge near Karnak

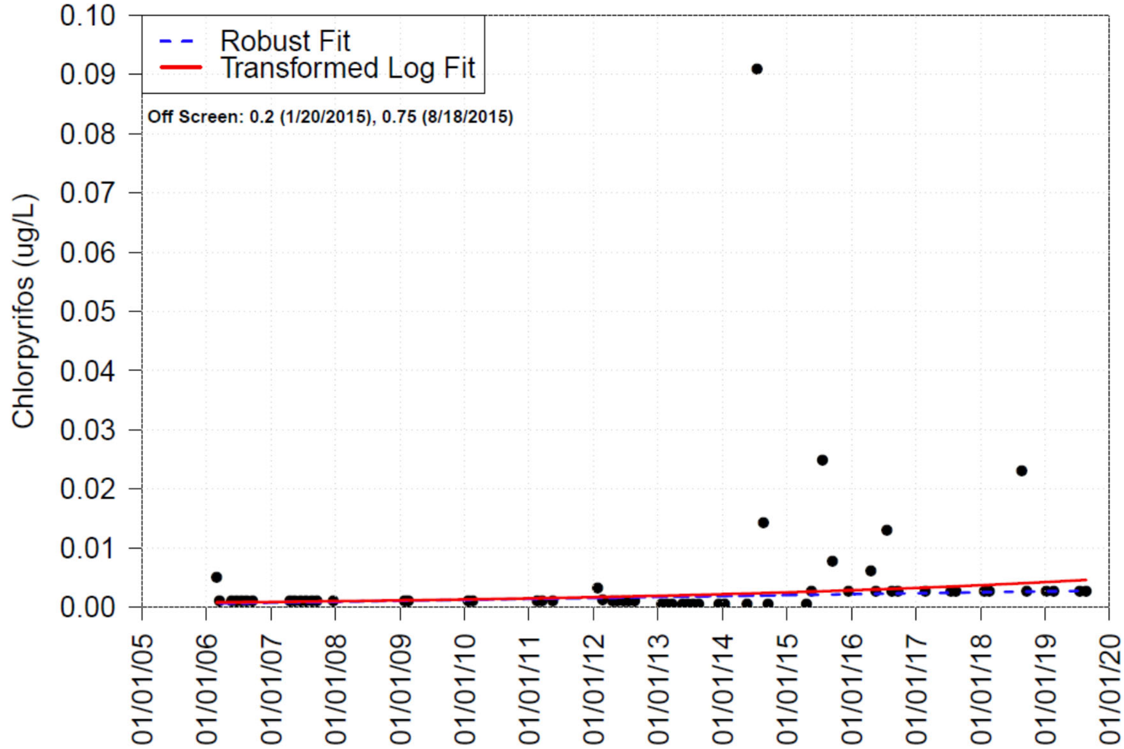

Figure 4-c. Chlorpyrifos at Gilsizer Slough

Management Practices and Actions Taken

RESPONSE TO EXCEEDANCES

To address specific water quality exceedances, the Coalition and its partners initially developed a Management Plan in 2009, subsequently approved by the Regional Water Board. The Coalition also previously developed a *Landowner Outreach and Management Practices Implementation Communications Process for Monitoring Results (Management Practices Process)* to address exceedances. The 2009 Management Plan was reorganized into the Comprehensive Surface Water Quality Management Plan (CSQMP) in 2015. The CSQMP was last updated in September 2016 and approved by the Regional Water Board in November 2016. Implementation of the CSQMP[16] is the primary mechanism for addressing exceedances observed in the Coalition's surface water monitoring.

Management Plan Status Update

The Management Plan Progress Report (MPPR), documenting the status and progress toward meeting individual Management Plan element requirements for 2019, is provided to the Regional Water Board with this AMR. Activities conducted in 2019 to implement the Coalition's CSQMP included addressing exceedances of objectives for registered pesticides, development of a new Management Plan, evaluation of existing Management Plan elements that could be deemed complete, and monitoring required for toxicity and pesticide Management Plans and TMDLs.

Implementation completed specifically for registered pesticides and toxicity included review and evaluation of pesticide application data, identification of potential sources, and determination of likely agricultural sources. Prior to 2015, surveys of Coalition members operating on high priority parcels were conducted to determine the degree of implementation of relevant management practices related to individual Management Plan elements for registered pesticides and identified causes of toxicity. Beginning in 2015, these surveys were replaced with data compiled from Coalition Member Farm Evaluations. Farm Evaluation data have been used to establish goals for additional management practice implementation needed to address exceedances of Basin Plan water quality objectives and ILRP Trigger Limits.

LANDOWNER OUTREACH EFFORTS

The Coalition and its subwatersheds, working with the Coalition for Urban/Rural Environmental Stewardship (CURES), stand committed to working with the Regional Water Board and its staff to implement the *Management Practices Process* and the Coalition's CSQMP to address water quality problems identified in the Sacramento Valley. The primary strategic approach taken by the Coalition is to notify and educate the subwatershed landowners, farm operators, and/or wetland managers about the cause(s) of toxicity and/or exceedance(s) of water quality objectives. Notifications are focused on (but not limited to) growers who operate directly adjacent to or within close proximity to a receiving water. The broader outreach program, which includes both grower meetings and notifications distributed through direct mailings, encourages the adoption

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[16] *SVWQC Comprehensive Surface Water Quality Management Plan. Prepared for the Sacramento Valley Water Quality Coalition (SVWQC) by Larry Walker Associates, Davis, California. November 2016.*

of best management practices (BMPs) and modification of the uses of specific farm and wetland inputs to prevent movement of constituents of concern into Sacramento Valley surface waters.

Targeted Outreach Efforts

The Coalition's targeted outreach approach is to focus on the growers with fields directly adjacent to or near the actual waterway of concern where statistically significant toxicity and/or exceedances of applicable numeric water quality objectives and ILRP Trigger Limits have been observed. To identify those landowners operating in high priority lands, the Coalition identifies the assessor parcels and subsequently, the owners of agricultural operations nearest the water bodies of interest. From the list of assessor parcel numbers, a subwatershed identifies its members and provides them an advisory notice along with information on how to address a specific exceedance using BMPs. This same approach was also used to conduct management practice surveys in areas targeted by individual Management Plan elements.

General Outreach Efforts

Outreach efforts conducted by the Coalition and its partners for specific subwatersheds during the monitoring period are summarized in an Excel table for each subwatershed in **Appendix F**. Available outreach materials are also included as attachments in **Appendix F**.

Summary of Farm Evaluation Data

Starting in 2014, the WDR required that the Coalition to collect and aggregate summarized information from Farm Evaluations. In 2018, the Regional Water Board revised the reporting schedule and the Coalition was not required to conduct a Farm Evaluation for the 2018 or 2019 crop years. Farm Evaluations will now be submitted on a five-year cycle beginning with the 2020 Crop Year.

Conclusions and Recommendations

The Coalition submits this 2019 Annual Monitoring Report (AMR) as required under the Regional Water Board's Irrigated Lands Regulatory Program (ILRP). The AMR provides a detailed description of the Coalition's monitoring results as part of its ongoing efforts to characterize irrigated agricultural and wetlands related water quality in the Sacramento River Basin.

To summarize, the results from the Coalition monitoring conducted in 2019 continue to indicate that with few exceptions, there are no major water quality problems with agricultural and managed wetlands discharges in the Sacramento River Basin.

This AMR characterizes potential water quality impacts of agricultural drainage from a broad geographic area in the Sacramento Valley from October 2018 through September 2019. To date, a total of 163 Coalition storm and irrigation season events have been completed since the beginning of Coalition monitoring in January 2005, with additional events collected by coordinating programs and for follow-up evaluations. For the period of record considered in this AMR (October 2018 through September 2019), samples were collected for ten scheduled monthly events and 2 wet weather ("storm") events.

Pesticides were infrequently detected (~10% of all pesticide results for 2019 were detected), and when detected, rarely exceeded applicable water quality objectives. One sample for the registered pesticide malathion and twelve pyrethroid pesticide samples exceeded applicable water quality objectives or ILRP Trigger Limits during the 2019 Monitoring Year.

Many of the pesticides specifically required to be monitored in the past by the ILRP have rarely been detected in Coalition water samples, including glyphosate and paraquat. Over 98.2% of all pesticide analyses performed to date for the Coalition have been below detection. Coalition monitoring of pesticides for the 2019 Monitoring Year was conducted based on the 2016 Pesticides Evaluation Protocol (PEP) and active Management Plan element requirements. The Regional Water Board's PEP requires the Coalition to monitor specific registered pesticides based on (1) their rate of application in a given drainage (lbs. applied per drainage) and (2) a pesticide-specific relative risk (the ratio of the amount of chemical applied to a reference value with a specific averaging period). The Coalition also conducted monitoring of the ILRP-required trace elements (arsenic, boron, copper, and zinc) informed by the Coalition's past monitoring results, which have demonstrated that most of these metals rarely approach or exceed objectives and are not likely to cause adverse impacts to aquatic life or human health in waters receiving agricultural runoff in the Sacramento River Watershed. This strategy for monitoring trace metals was implemented in 2010 in accordance with the Coalition's 2009 MRP (*Order No. R5-2009-0875*, CVRWQCB 2009), and this same strategy is consistent with the requirements of the current WDR and MRP (*Order No. R5-2014-0030*).

The majority of exceedances of adopted numeric objectives continue to consist of specific conductivity, dissolved oxygen, pH, and *E. coli*. Agricultural runoff and irrigation return flows may contribute to exceedances of these objectives, but these parameters are primarily controlled or significantly affected by natural processes and sources that are not controllable by agricultural management practices.

The Coalition has implemented the requirements of the ILRP since 2004. The Coalition developed a Watershed Evaluation Report (WER) that set the priorities for development and implementation of the initial Monitoring and Reporting Program Plan (MRPP). The Coalition successfully developed the MRPP, QAPP, and Management Plan as required by the ILRP*,* and all were approved by the Regional Water Board. Subsequent revisions requested by the Regional Water Board and the Coalition were incorporated into the Coalition's program and implemented through the Coalition's ongoing ILRP monitoring efforts. The Coalition also continues to adapt and improve elements of its monitoring program based on the knowledge gained through its monitoring efforts.

The Coalition's 2019 monitoring program, as specified in the 2019 Monitoring Plan Update, was developed to be consistent with the requirements of the WDR and MRP (*Order No. R5-2014-0030*) and 2016 PEP, and was approved by the Regional Water Board for this purpose with the understanding that it would serve as an "Assessment" monitoring period for the Coalition. The Coalition has implemented the approved monitoring program in coordination with its subwatershed partners, has initiated follow-up activities required to address observed exceedances, and continued to implement the approved 2016 CSQMP and approved individual Management Plan elements. Throughout this process, the Coalition has kept an open line of communication with the Regional Water Board and has made every effort to fulfill the requirements of the ILRP in a cost-effective, scientifically defensible, and management-focused manner. This AMR is documentation of the success and continued progress of the Coalition in achieving these objectives.

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Appendices

The following appendices are available in electronic form on the CD provided.

Appendix A: Field Log Copies

Appendix B: Lab Reports and Chains-of-Custody

Appendix C: Tabulated Monitoring Results

Appendix D: Exceedance Reports

Appendix E: Site-Specific Drainage Maps

Appendix F: SVWQC Outreach Materials

Appendix G: Trend Analysis Results

Appendix H: Reduced Monitoring Verification Reports