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SACRAMENTO VALLEY WATER QUALITY COALITION

Management of Chlorpyrifos and Diazinon Discharges to the Sacramento and Feather Rivers and the Sacramento-San Joaquin Delta: 2020 TMDL Compliance Monitoring Report

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Introduction

In December 2008, the Sacramento Valley Water Quality Coalition (Coalition or SVWQC) submitted a Management Plan to address specific water quality impairments within the Coalition area. A requirement of the Management Plan is to document monitoring and management activities conducted on behalf of members of the Coalition and required by the Central Valley Regional Water Quality Control Board (Regional Water Board)'s Basin Plan Amendments for the Control of Diazinon and Chlorpyrifos Runoff into the Sacramento and Feather Rivers (Resolution No. R5-2007-0034) and the Sacramento-San Joaquin Delta (Delta) (R5-2006-0061).¹ The Basin Plan Amendments set forth Total Maximum Daily Load (TMDL) requirements for dischargers and require that dischargers comply with the monitoring and management criteria defined in the *Water Quality Control Plan for the Sacramento River and San Joaquin River Basins* (Basin Plan). An Addendum² to the Coalition's approved Management Plan addresses the Coalition's planned activities to comply with the TMDL requirements specific to two organophosphate (OP) pesticides, chlorpyrifos and diazinon. Beginning in 2009, the Addendum for TMDL compliance monitoring was developed in collaboration with the Irrigated Lands Regulatory Program (ILRP) staff and was formally submitted to the Regional Water Board on April 30, 2010, as part of the *Management Plan Progress Report*. At the request of ILRP staff, the Addendum was resubmitted as a separate document on December 7, 2010.

In fulfillment of the requirements set forth in the Management Plan and an agreement with the Regional Water Board which now allows submittal of this report every two years, the Coalition is submitting this biennial TMDL Compliance Report summarizing the monitoring objectives, locations of sampling sites, and compliance results covering the period October 2018 through September 2020 (i.e., 2019 and 2020 Monitoring Years). It should be noted that the agricultural use of chlorpyrifos was essentially³ eliminated as of December 31, 2020, after which it became illegal for growers to possess or use chlorpyrifos products in California. This cancellation of the use of chlorpyrifos by agriculture should act to further reduce concentrations of the OP pesticide in receiving waters of the Sacramento Valley and Delta.

¹ On March 28, 2014, the Regional Water Board adopted Resolution R5-2014-0041, Amendment to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins for the Control of Diazinon and Chlorpyrifos Discharges. Before becoming fully effective, the Amendment must be approved by the State Water Resources Control Board (State Water Board), the Office of Administrative Law (OAL), and U.S. Environmental Protection Agency (U.S. EPA). The State Water Board approved the Basin Plan amendment on June 16, 2015 with Resolution No. 2015-0043. On March 8, 2017, the OAL provided notice of approval of this regulatory action (OAL File No. 2017-0124-04S). The U.S. EPA provided approval on August 16, 2017. http://www.waterboards.ca.gov/centralvalley/water_issues/tmdl/central_valley_projects/central_valley_pesticides/index.shtml

² *Addendum to Sacramento Valley Water Quality Coalition Management Plan: Chlorpyrifos and Diazinon TMDLs*. Sacramento Valley Water Quality Coalition, Sacramento, California. April 2010.

³ A few products that apply chlorpyrifos in granular form, representing less than one percent of agricultural use of chlorpyrifos, will be allowed to remain on the market. These products are not associated with detrimental health effects (<https://www.cdpr.ca.gov/docs/pressrls/2019/100919.htm>)

Background

The federal Clean Water Act requires each state to identify waters within its boundaries that are not currently meeting or maintaining water quality standards (33 USC 1313 (d)(1)). Water quality standards consist of the beneficial uses for which waterways are used, as well as water quality objectives set at specified levels to maintain the beneficial uses. In 1994, the Sacramento and Feather Rivers were listed as impaired by diazinon by the Regional Water Board. As a result of the 303(d) listings, the Regional Water Board adopted a TMDL in accordance with the federal Clean Water Act (33 USC 1313 (d)(1)). Loads established in a TMDL are required to implement the applicable water quality standards, considering seasonal variations and a margin of safety (*Id.*). In addition to adopting a TMDL, the Regional Water Board also prepared and adopted a Basin Plan Amendment that included new water quality objectives for diazinon, as well as an implementation plan. The Basin Plan Amendment was intended to establish an orchard runoff control program that focused on protecting the Sacramento and Feather Rivers from the impacts of diazinon.

More specifically, the Regional Water Board adopted (and the State Water Board and U.S. EPA approved) diazinon water quality objectives of 0.080 µg/L as a 1-hour average (i.e., acute objective) and 0.050 µg/L as a 4-day average (i.e., chronic objective). At the time of adoption (and subsequently), questions were raised about the validity of the objectives and the studies from which the objectives were derived. As a result of subsequent litigation, the Regional Water Board committed to reviewing the objectives by July 1, 2007, and potentially amending the objectives by July 1, 2008. The Regional Water Board adopted new amendments to revise the diazinon objectives to **0.16 µg/L**, as a 1-hour average, and **0.10 µg/L**, as a 4-day average (*Basin Plan Amendments to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins for the Control of Diazinon and Chlorpyrifos Runoff into the Sacramento and San Joaquin River Basins*). The revised Basin Plan Amendment also included acute (1-hour average) and chronic (4-day average) water quality objectives for chlorpyrifos, another OP pesticide used extensively throughout the Sacramento Valley.⁴ The previously approved Basin Plan Amendment contained requirements for an Orchard Pesticide Runoff and Diazinon Runoff Control Program. As part of the Control Program, the Regional Water Board required dischargers of diazinon to submit a management plan that “describes actions that the discharger will take to reduce diazinon discharges and meet the applicable allocations by the required compliance date.” In lieu of individual discharger plans, the Basin Plan Amendment allows a discharger group or coalition to submit management plans.

The Basin Plan Amendments (R5-2007-0034 and R5-2006-0061) require dischargers, either individually or as a coalition, to submit a management plan that describes the actions that they will take to reduce chlorpyrifos and diazinon discharges and meet the applicable allocations by the required compliance dates. The Coalition’s Management Plan (SVWQC 2009) includes a process for source identification and identification of additional management practices that may be needed to achieve additional reductions in chlorpyrifos and diazinon discharges. Quarterly meetings are held with the Regional Water Board in order to evaluate progress in meeting these

⁴ The 2007 Basin Plan Amendment also included objectives for chlorpyrifos: **0.025 µg/L** as a 1-hour average and **0.015 µg/L** as a 4-day average.

reductions, and revisions to the Management Plan will be made if sufficient progress is not being achieved.

The Coalition continues to monitor chlorpyrifos and diazinon according to the Coalition's approved monitoring schedules (i.e., annual Monitoring Plan Updates) and the SVWQC Monitoring and Reporting Program (MRP) Order⁵. The monitoring locations are representative of agricultural discharges to the Sacramento River, Feather River, and other Delta waterways. This monitoring will continue to provide information on the wide range of discharges and hydrologic conditions likely to occur in the Sacramento Valley watershed and Delta. The Coalition's Addendum to the Management Plan presents the technical rationale for selecting the representative monitoring locations for the TMDL compliance monitoring and for the schedule for chlorpyrifos and diazinon monitoring.

Monitoring to augment the routine ILRP Core and Assessment monitoring is conducted at existing Coalition monitoring sites in water bodies where at least one exceedance has occurred and that are directly tributary to the affected TMDL water bodies. Coalition efforts in these subwatersheds include, but are not limited to: (1) continued monitoring during time periods when peak pesticide application use occurs, (2) analysis of Pesticide Use Reporting (PUR) data, (3) holding subwatershed grower meetings, (4) continuing to encourage and evaluate implementation of management practices that reduce or prevent the movement of pesticides from their site of application, and (5) addressing the seven compliance components described in the Basin Plan and listed below in conjunction with other entities identified as potential sources of discharges. Additional activities addressing Basin Plan and MRP Order requirements for source identification, outreach, and management practice evaluation are described in the Coalition's Comprehensive Surface Water Quality Management Plan (CSQMP).

The Coalition's monitoring frequency and locations are evaluated and updated annually for the CSQMP, subject to approval by the Executive Officer of the Regional Water Board. These annual updates are required by the WDR. The CSQMP was most recently updated and approved by the Regional Water Board in November 2016. Beginning with the 2018 Monitoring Year (October 2017 – September 2018), the Coalition was required to schedule its pesticide monitoring according to the requirements set forth in the Regional Water Board's 2016 Pesticides Evaluation Protocol (PEP). The PEP requires the Coalition to monitor specific registered pesticides, including chlorpyrifos and diazinon, based on (1) their rate of application in a given Coalition drainage (lb 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).

On May 6, 2015, the California Department of Pesticide Regulation (CDPR) filed the final documentation to add chlorpyrifos to the list of State Restricted Use Pesticides. This rule, which became effective on July 1, 2015, affects all products containing chlorpyrifos as an active

⁵ The WDR was initially adopted in 2014 (R5-2014-0030), but was later revised to its current version in February 2020. 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).

ingredient (AI) when labeled for production of an agricultural commodity. The state-restricted⁶ status required that all chlorpyrifos products registered for production agricultural use must adhere to additional requirements for all California restricted materials. As noted above, CDPR restricted the sale of chlorpyrifos on February 6, 2020, and banned its use and possession after December 31, 2020.

MONITORING OBJECTIVES

The purpose of the TMDL monitoring is to determine whether numeric water quality objectives for chlorpyrifos and diazinon contained in the Basin Plan are continuing to be met in the Sacramento and Feather Rivers, as well as other Sacramento-San Joaquin Delta waterways. Specifically, the Basin Plan identifies the goals listed in **Table 1** (Chapter V. Surveillance and Monitoring, page V-4.00) for compliance monitoring for the TMDL. These goals are addressed in the Compliance Monitoring Report.

Table 1. Basin Plan Amendment TMDL Compliance Monitoring Goals

Compliance Monitoring Goal	Report Section Heading(s)	Page(s)
1. Determine compliance with established water quality objectives and loading capacity for chlorpyrifos and diazinon in the Sacramento and Feather Rivers and the Sacramento-San Joaquin Delta	Monitoring Results	8-13
2. Determine compliance with established waste load allocations and load allocations for chlorpyrifos and diazinon	Discussion	14-27
3. Determine the degree of implementation of management practices to reduce off-site migration of chlorpyrifos and diazinon	Outreach and Follow-Up Regarding TMDL Exceedances	28-29
4. Determine the effectiveness of management practices and strategies to reduce off-site migration of chlorpyrifos and diazinon	Outreach and Follow-Up Regarding TMDL Exceedances	28-29
5. Determine whether alternatives to chlorpyrifos and diazinon are causing surface water quality impacts	Toxicity and Additional Pesticide Results	29-30

⁶ State-restricted materials include pesticides deemed to have a higher potential to cause harm to public health, farm workers, domestic animals, honeybees, the environment, wildlife, or other crops compared to other pesticides. Additional information is available at: <http://www.cdpr.ca.gov/docs/enforce/permitting.htm>

Compliance Monitoring Goal	Report Section Heading(s)	Page(s)
6. Determine whether the discharge causes or contributes to a toxicity impairment due to additive or synergistic effects of multiple pollutants	Compliance with Load Allocations in the TMDL Receiving Water Bodies; Toxicity and Additional Pesticide Results	19-27; 29-30
7. Demonstrate that management practices are achieving the lowest pesticide levels technically and economically achievable	Summary	31

SAMPLING SITES

A map of the Coalition’s compliance monitoring sites for chlorpyrifos and diazinon is presented in **Figure 1**. Locations within the Coalition area for monitoring of chlorpyrifos and diazinon to satisfy the TMDL requirements are presented in **Table 2**. Compliance with TMDL objectives and loading capacity concentrations is assessed at the 14 sites identified as compliance monitoring sites. These specific sites were selected because they are within the TMDL watersheds, are tributary to the TMDL water bodies, and have minimal non-agricultural influences. The schedule of monitoring for OP pesticides at these compliance sites is documented in the Coalition’s annual Monitoring Plan Updates. The seasonal timing of the Coalition’s ILRP pesticide monitoring at individual sites is based on pesticide use patterns in each drainage, as characterized in the Coalition’s approved 2009 Monitoring and Reporting Program Plan (MRPP). These schedules were retained for any TMDL monitoring in the 2017 Monitoring Year, but were revised during the 2018 Monitoring Year, following the new requirement for the Coalition to develop its Monitoring Plan Update using the Regional Water Board’s Pesticides Evaluation Protocol.

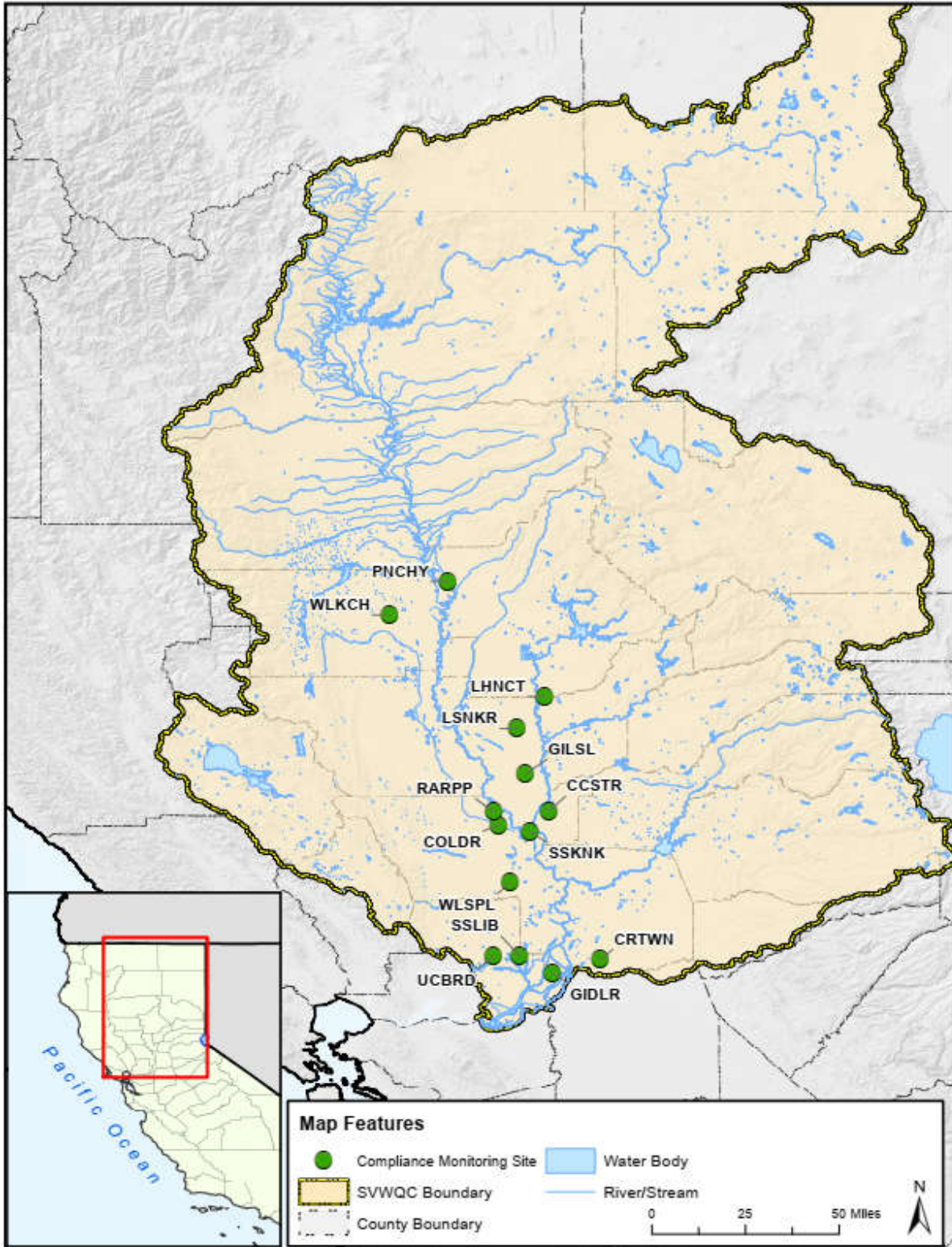


Figure 1. Coalition Compliance Monitoring Sites for Chlorpyrifos and Diazinon Runoff Management Plan

Table 2. Compliance Monitoring Sites for Chlorpyrifos and Diazinon Runoff Management Plan

Subwatershed	Location	Site ID	Lat.	Long.	Delta, Sacramento, or Feather River Basin Subarea
Butte Yuba Sutter	Gilsizer Slough at George Washington Road	GILSL	39.0090	-121.6716	Lower Feather River, Sac. River
Butte-Yuba-Sutter	Lower Honcut Creek at Hwy 70	LHNCT	39.30915	-121.59542	Feather River
Butte-Yuba-Sutter	Lower Snake River at Nuestro Road	LSNKR	39.18531	-121.70358	Feather River
Butte-Yuba-Sutter	Pine Creek at Highway 32	PNCHY	39.75338	-121.97124	Sac. River
Butte-Yuba-Sutter	Sacramento Slough Bridge near Karnak	SSKNK	38.7850	-121.6533	Sac. River, Northern Delta
Colusa-Glenn	Colusa Basin Drain above Knight's Landing	COLDR	38.8121	-121.7741	Sac. River
Colusa-Glenn	Rough and Ready Pumping Plant (RD 108)	RARPP	38.86209	-121.7927	Sac. River, NW Delta
Colusa-Glenn	Walker Creek near 99W and CR33	WLKCH	39.62423	-122.19652	Sac. River
PNSSNS	Coon Creek at Striplin Road	CCSTR	38.8661	-121.5803	Sac. River
Sacramento-Amador	Cosumnes River at Twin Cities Road	CRTWN	38.29098	-121.38044	Eastern Delta
Sacramento-Amador	Grand Island Drain near Leary Road	GIDLR	38.2399	-121.5649	Northern Delta
Solano	Shag Slough at Liberty Island Bridge	SSLIB	38.30677	-121.69337	NW Delta
Solano	Ulatis Creek at Brown Road	UCBRD	38.3070	-121.7940	NW Delta
Yolo	Willow Slough Bypass at Pole Line	WLSPL	38.59015	-121.73058	NW Delta

Monitoring Results

All TMDL monitoring data through September 2020 have been previously submitted to the Regional Water Board as required by the ILRP. A complete set of relevant monitoring data for Coalition compliance sites collected from January 2009 through September 2020 is also provided in **Appendix A**.

DATA INTERPRETATION

Assessment of Data Quality Objectives

The data quality objectives for the TMDL monitoring effort are described in the Coalition's Quality Assurance Project Plan (QAPP) for the ILRP. All quality assurance (QA) samples for TMDL compliance monitoring are integrated into the Coalition's ILRP monitoring program. As required by the ILRP, the results of these QA samples have been submitted to the Regional Water Board on a quarterly basis along with targeted environmental monitoring results.

Representativeness of the data collected was assured by selection of appropriate sampling and analytical methods. There was no deviation from the standard operating procedures specified in the QAPP, and the data are considered adequately representative for the purpose of the compliance monitoring program. Analytical precision is assessed by analyzing laboratory-prepared matrix spike duplicates, and sampling precision is evaluated by analyzing field-collected sample replicates. Analytical accuracy is assessed by routine calibration and analysis of a laboratory-prepared matrix and by addition of surrogate organic compounds to sample matrices. Based on the results of field and laboratory QA analyses, precision and accuracy tests met program data quality objectives and were adequate for the purposes of the monitoring compliance program.

Completeness is defined as the percent of planned data that were successfully collected and analyzed. All of the samples planned for October 2018 through September 2020 were successfully collected and analyzed (i.e., 59 of the 59 scheduled water column samples). Based on the total number of planned and analyzed samples, overall completeness for planned chlorpyrifos and diazinon analyses from January 2009 through September 2020 is 99% (**Table 3**).

Table 3. TMDL Compliance Sampling Completeness Summary

Compliance Site	JAN 2009 – SEP 2018		OCT 2018 – SEP 2020			JAN 2009 – SEP 2020	
	Planned	Collected	Planned	Collected	Note	Planned	Collected
Colusa Basin Drain above Knight's Landing	50	51	5	5	(2)	60	61
Coon Creek at Striplin Road	25	25	---	---	(2)	25	25
Cosumnes River at Twin Cities Road	28	17	3	3	(2)	31	20
Gilsizer Slough at George Washington Road	44	46	9	9	(2)	44	46
Grand Island Drain near Leary Road	45	48	5	5	(2)	45	48
Lower Honcut Creek at Hwy 70	39	40	3	3	(2)	42	43
Lower Snake River at Nuestro Road	38	40	6	6	(2)	44	46
Pine Creek ⁽¹⁾	46	45	13	13	(2)	66	65
Rough and Ready Pumping Plant (RD 108)	36	37	---	---	(2)	36	37
Sacramento Slough bridge near Karnak	35	36	1	1	(2)	37	38
Shag Slough at Liberty Island Bridge	41	41	2	2	(2)	44	44
Ulatis Creek at Brown Road	67	68	8	8	(2)	76	77
Walker Creek near 99W and CR33	37	30	4	4	(2)	42	35
Willow Slough Bypass at Pole Line	50	52	---	---	(2)	50	52
Totals	581	576	59	59		642	637
Percent Completeness		99%		100%			99%

Notes:

1. Beginning with Event 96 (February 2014), the Pine Creek monitoring site was moved from Nord-Gianella Road (PNCGR) to Highway 32 (PNCHY).
2. Monitoring at this site during Water Year 2019 (October 1, 2018-September 30, 2019), an assessment monitoring year, and Water Year 2020 (October 1, 2019-September 30, 2020), a non-assessment monitoring year, is indirectly addressed by the Delta RMP. Refer to the approval letter for reduced individual monitoring as a result of the Coalition's participation in the Delta Regional Monitoring Program (DRMP), provided as **Appendix B**.

Comparison with TMDL Objectives and Discussion of Exceedances

A summary of the number of analyses of water quality samples collected from January 2009 through September 2020 for TMDL compliance monitoring is presented in **Table 4** and **Table 5** for chlorpyrifos and diazinon, respectively. The number of results that exceeded water quality objectives at a given monitoring site is also indicated in each table.

Table 4. Summary of 2009-2020 TMDL Monitoring Results for Chlorpyrifos

Compliance Site	JAN 2009 – SEP 2018		OCT 2018 – SEP 2020		JAN 2009 – SEP 2020	
	Total >WQO	Total Samples	Total >WQO	# of Samples	Total >WQO	Total Samples
Colusa Basin Drain above Knight's Landing		51		5		56
Coon Creek at Striplin Road	1	25			1	25
Cosumnes River at Twin Cities Road		16		3		19
Gilsizer Slough at George Washington Road	5	46		9	5	55
Grand Island Drain near Leary Road	2	48		3	2	51
Lower Honcut Creek at Hwy 70		40		3		43
Lower Snake River at Nuestro Road		40		4		44
Pine Creek ⁽¹⁾	8	45		13	8	58
Rough and Ready Pumping Plant (RD 108)		37				37
Sacramento Slough bridge near Karnak		36		1		37
Shag Slough at Liberty Island Bridge	1	41		2	1	43
Ulatis Creek at Brown Road	5	71		5	5	76
Walker Creek near 99W and CR33	1	30		4	1	34
Willow Slough Bypass at Pole Line	2	52			2	52
Totals	25	578		52	25	630

Notes:

1. Beginning with Event 96 (February 2014), the Pine Creek monitoring site was moved from Nord-Gianella Road (PNCGR) to Highway 32 (PNCHY).
2. Five exceedances at Pine Creek occurred in isolated ponded water with no flow. A flow measurement could not be collected for one event for which an exceedance was observed. A review of these data indicates that three "exceedances" reflect degradation of the original elevated concentration and not additional discharges of chlorpyrifos.

Table 5. Summary of 2009-2020 TMDL Monitoring Results for Diazinon

Compliance Site	JAN 2009 – SEP 2018		OCT 2018 – SEP 2020		JAN 2009 – SEP 2020	
	>WQO	# of Samples	>WQO	# of Samples	Total >WQO	Total Samples
Colusa Basin Drain above Knight's Landing		51		5		56
Coon Creek at Striplin Road		25				25
Cosumnes River at Twin Cities Road		17				17
Gilsizer Slough at George Washington Road	3	46	1	9	4	55
Grand Island Drain near Leary Road	3	45		4	3	49
Lower Honcut Creek at Hwy 70		38				38
Lower Snake River at Nuestro Road		39		2		41
Pine Creek ⁽¹⁾		39		7		46
Rough and Ready Pumping Plant (RD 108)		37				37
Sacramento Slough bridge near Karnak		35		1		36
Shag Slough at Liberty Island Bridge		41		1		42
Ulatis Creek at Brown Road		72		4		76
Walker Creek near 99W and CR33		30		1		31
Willow Slough Bypass at Pole Line		52				52
Totals	6	567	1	34	7	601

Notes:

1. Beginning with Event 96 (February 2014), the Pine Creek monitoring site was moved from Nord-Gianella Road (PNCGR) to Highway 32 (PNCHY).

Compliance with Concentration-Based and Load-Based TMDL Objectives

Concentrations of chlorpyrifos and diazinon were compared to the Basin Plan objectives for the Sacramento and Feather Rivers and Delta. All detected concentrations are presented in **Table 6**.

Chlorpyrifos

Between October 2018 through September 2020, chlorpyrifos was not detected in any of the 52 samples (0% detection rate) collected at the eleven (11) compliance monitoring locations that were monitored during this time period. No samples exceeded the Basin Plan 4-day chronic objective (0.015 µg/L) nor the 1-hour acute objective (0.025 µg/L) for chlorpyrifos.

Diazinon

Between October 2018 through September 2020, diazinon was detected in only one (1) of the 34 samples (2.9% detection rate) collected at nine (9) compliance monitoring locations that were monitored during this period. The concentration measured in this one sample exceeded both the Basin Plan 4-day chronic objective (0.10 µg/L) and the 1-hour acute objective (0.16 µg/L) for diazinon.

Gilsizer Slough at George Washington Road (Event 167)

Diazinon was detected in one environmental sample collected at the Gilsizer Slough site on January 17, 2020. The concentration of 1.7 µg/L measured in the sample exceeded the Basin Plan’s 1-hour acute water quality objective of 0.16 µg/L and hence, also exceeded the 4-day chronic objective of 0.1 µg/L. There were 11 reported applications of diazinon in the month prior to the observed exceedance, with one application occurring within a week of the monitoring event. Diazinon was applied to approximately 427 acres of peaches in the Gilsizer Slough drainage during that time. All of the applications were made on the ground. During the event, the field crews noted that water was present in the slough, but there was no measurable flow. There had been about 0.43 inches of precipitation during the week preceding the event, with about 0.34 inches of rain falling in the 48 hours before the sample was collected. Toxicity tests were not performed during this event.

Load Estimates

Instantaneous loads were also calculated for all compliance sites. Loads were calculated as:

$$Load = Q \times C \times UCF$$

Where, *Load* is the instantaneous load expressed in g/day,

Q = instantaneous discharge in cubic feet per second (cfs)

C = sample chlorpyrifos or diazinon concentration in µg/L, and

UCF = a unit conversion factor of 2.45 (g*second*L/ µg*day*cubic feet)⁷.

Loads for all detected concentrations are provided in **Table 6**.

Table 6. Load Estimates for Detected Chlorpyrifos and Diazinon, October 2018 – September 2020

Site ID	Water Body	Sample Date	Discharge, CFS	Concentrations, µg/L		Instantaneous Loads, g/day		Notes
				Chlorpyrifos	Diazinon	Chlorpyrifos	Diazinon	
GILSL	Gilsizer Slough	1/17/2020	0.775	ND	1.7	ND	3.228	(1)

Notes: Exceedances of TMDL concentration objectives are bolded in the table (where they occur).

NR = Not Recorded

ND = Not Detected.

1. Concentration exceeded WQO.

The Basin Plan TMDL amendments also implement measures designed to address the additive toxicity of chlorpyrifos and diazinon. Compliance with the TMDL Load Allocations for non-point sources was determined using the methodology outlined in the Basin Plan Amendments for

⁷ Unit conversion factor: [1 g/ 1,000,000 µg]*[86,400 seconds/day]*[28.32 liter/cubic foot]

the Control of Diazinon and Chlorpyrifos Runoff (Resolutions R5-2007-0034 and R5-2006-0061). This methodology takes into account the additive effects of chlorpyrifos and diazinon.

Compliance was calculated using the following equation:

$$S = \frac{C_D}{WQO_D} + \frac{C_C}{WQO_C} \leq 1.0$$

Where the loading concentration may not exceed the *Sum(S)* of one (1.0):

C_D = diazinon concentration in $\mu\text{g/L}$; analytical results reported as “non-detected” concentrations are considered to be zero

C_C = chlorpyrifos concentration in $\mu\text{g/L}$; analytical results reported as “non-detected” concentrations are considered to be zero

WQO_D = 1-hour (0.10 $\mu\text{g/L}$) or 4-day average (0.16 $\mu\text{g/L}$) diazinon water quality objective in $\mu\text{g/L}$

WQO_C = 1-hour or 4-day average chlorpyrifos water quality objective in $\mu\text{g/L}$

The sample collected on January 17, 2020, exceeded the individual TMDL concentration objectives (Basin Plan objectives), exceeded the 4-day TMDL Load Allocation, and exceeded the 1-hour TMDL Load Allocation, based on combined (i.e., additive) toxic units (TUc or TUa) (Table 7).

Table 7. Compliance with Load Capacity Objectives for Detected Chlorpyrifos and Diazinon, October 2018 – September 2020

Site ID	Water Body	Sample Date	Discharge, CFS	Concentrations, $\mu\text{g/L}$		Load Allocation Compliance ⁽⁴⁾		Notes
				Chlorpyrifos	Diazinon	1-Hour (TUa)	4-Day Average (TUc)	
GILSL	Gilsizer Slough	1/17/2020	0.775	ND	1.7	10.63	17.00	(1,2,3)

Notes: Exceedances of TMDL concentration objectives are bolded in the table (where they occur). ND = Not Detected

1. Concentration exceeded WQO.

2. Concentrations exceeded 4-day average-based Load Allocation.

3. Compliance is assessed based on the sum of chlorpyrifos and diazinon, TUa and TUc; exceedances are indicated for values greater than 1.0 (values bolded, where they occur).

Discussion

The California Department of Pesticide Regulation (CDPR) has documented the decline in use of insecticide organophosphate chemicals, including chlorpyrifos and diazinon, for nearly every year since 1995. PUR data from the four most recent years available, 2015 through 2018, show continued reductions in statewide use of both pesticides (see

Table 8). The significant decrease in the use of chlorpyrifos over the 4-year period was likely caused by the pesticide being designated as a state-restricted material on July 1, 2015. This decreasing trend in chlorpyrifos use is expected to continue and reach zero by January 2021 due to the use prohibition of the OP pesticide by agriculture that went into effect on December 31, 2020. In the six Coalition subwatersheds within the TMDL compliance region (Butte-Yuba-Sutter; Glenn-Colusa; Placer-Nevada-South Sutter-North Sacramento (PNSSNS); Sacramento-Amador; Solano; Yolo), a substantial (135.5%) decrease in the application of chlorpyrifos also occurred between 2015 and 2018. A slightly more modest (45.7%) decrease in diazinon use was observed among the six subwatersheds over the same period.

When comparing the annual application of chlorpyrifos in the six subwatersheds from 2003 through 2018, no steady increasing or decreasing trend is observed. As illustrated in **Figure 2**, agriculture's use of chlorpyrifos has shown upswings and downturns in use over the years until the noticeable decrease observed beginning in 2016. In contrast, diazinon use in the region showed a steady decrease from 2003 to 2011, before stabilizing in 2012 (see **Figure 3**). With the exception of a sharp increase in 2017, diazinon has shown a steady decrease since 2016.

Table 8. Chlorpyrifos and Diazinon Use in California and the Six Coalition Subwatersheds: 2015 – 2016

Year	Area	Pesticide	Lbs. Applied	% Annual Change	% Four-Year Change
2015	Statewide	Chlorpyrifos	1,105,207	NA	-84.6
2016			897,938	-18.8	
2017			943,361	5.1	
2018			598,519	-36.6	
2015	Six Coalition Subwatersheds	Chlorpyrifos	125,584	NA	-135.5
2016			89,518	-28.7	
2017			78,602	-12.2	
2018			53,331	-32.2	
2015	Statewide	Diazinon	52,663	NA	-57.3
2016			48,819	-7.3	
2017			72,466	48.4	
2018			33,486	-53.8	
2015	Six Coalition Subwatersheds	Diazinon	28,813	NA	-45.7
2016			27,215	-5.5	
2017			52,403	92.6	
2018			19,779	-62.3	

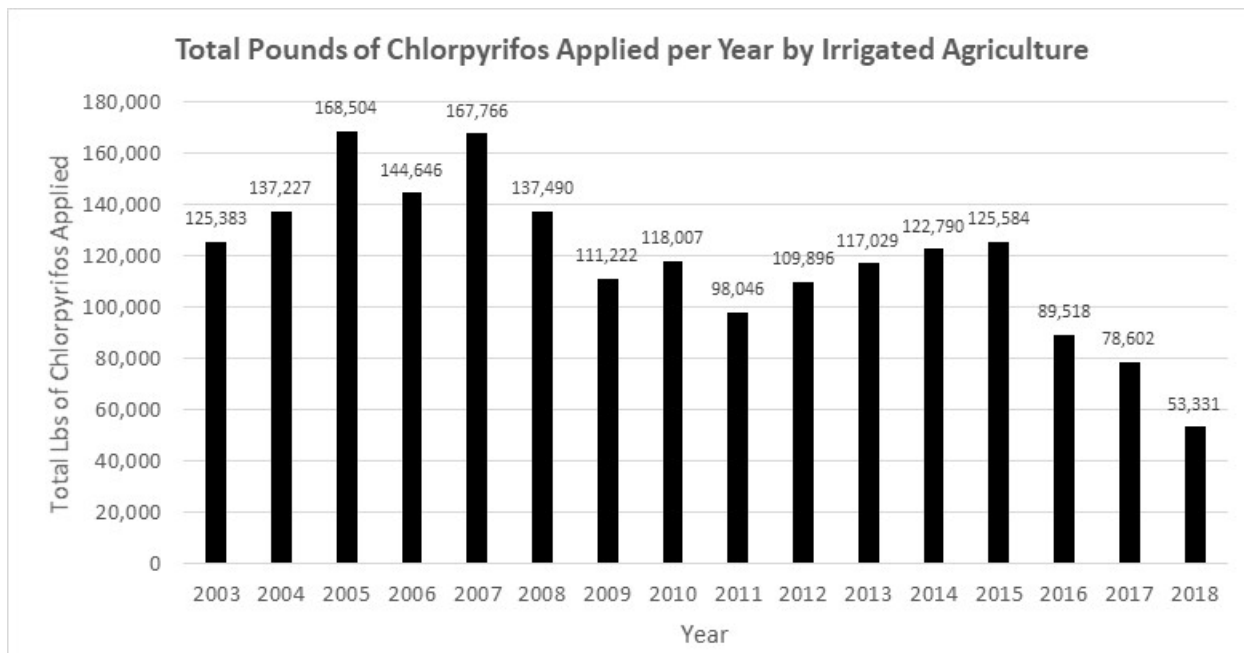


Figure 2. Trends in Agricultural Use of Chlorpyrifos

The data plotted above are for the six Coalition subwatersheds in the TMDL compliance region (Butte-Yuba-Sutter; Colusa-Glenn; Placer-Nevada-South Sutter-North Sacramento; Sacramento-Amador; Solano; Yolo) and were taken from the California Department of Pesticide Regulation PUR Database.

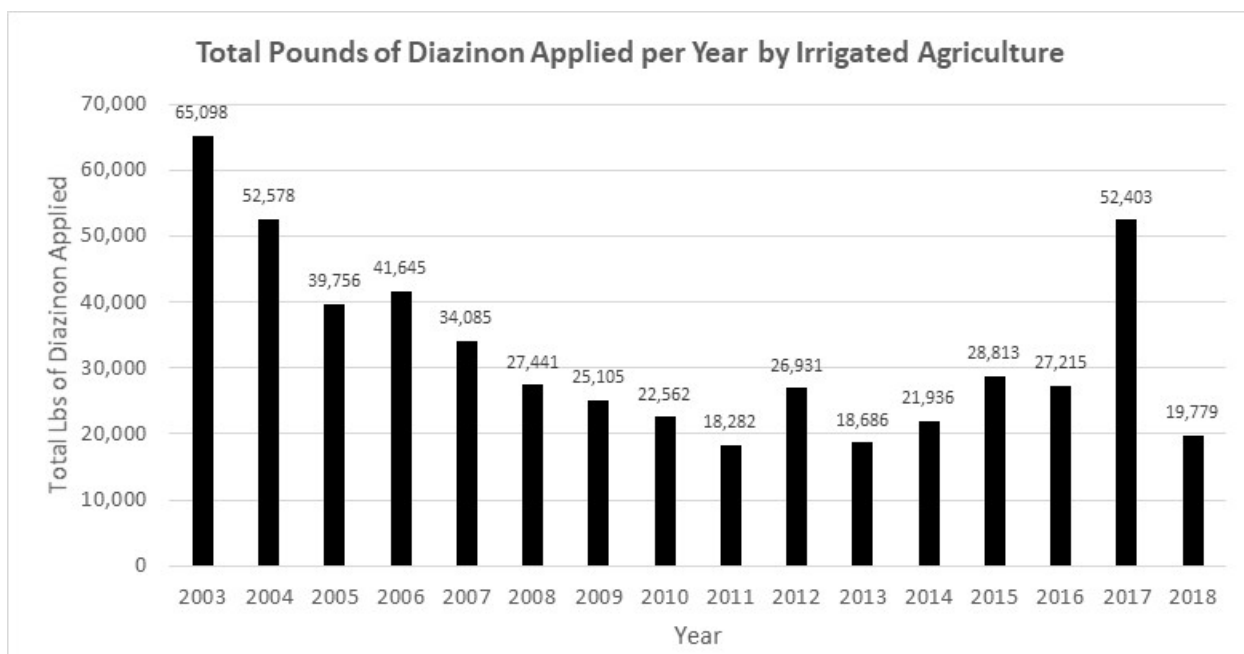


Figure 3. Trends in Agricultural Use of Diazinon

The data plotted above are for the six Coalition subwatersheds in the TMDL compliance region (Butte-Yuba-Sutter; Colusa-Glenn; Placer-Nevada-South Sutter-North Sacramento; Sacramento-Amador; Solano; Yolo) and were taken from the California Department of Pesticide Regulation PUR Database.

From the beginning of the Coalition’s monitoring efforts (January 2005) through September 2020, there have been 821 samples collected and analyzed for chlorpyrifos and 789 samples collected and analyzed for diazinon under the ILRP at the 14 compliance sites. Results for Coalition monitoring at TMDL compliance sites are summarized in **Table 9**.

Table 9. Summary of Chlorpyrifos and Diazinon Exceedances in Coalition Monitoring at TMDL Compliance Sites, 2005-2018

Data for the six Coalition subwatersheds in the TMDL compliance region (Butte-Yuba-Sutter, Colusa-Glenn, Placer-Nevada-South Sutter-North Sacramento, Sacramento-Amador, Solano; Yolo)

Constituent	Exceedances	Non-Exceedances	Total Samples
Chlorpyrifos	35	786	821
Diazinon	10	779	789
Total	45	1,565	1,610

There has been a total of 45 combined exceedances of chlorpyrifos and diazinon (approximately 3% of all samples) observed in Coalition monitoring at the TMDL compliance sites from January 2005 through September 2020. Of the 45 total exceedances, 35 have been for chlorpyrifos (~4% of total samples analyzed for chlorpyrifos) and ten have been for diazinon (~1% of total samples analyzed for diazinon). These exceedances have been observed at nine of the 14 compliance sites, with seven sites having more than one exceedance. At six of the compliance sites (Colusa Basin Drain, Cosumnes River, Lower Honcut Creek, Lower Snake River, Rough and Read Pumping Plant, Sacramento Slough), there have been no exceedances observed in Coalition monitoring since January 2009. With respect to the 110 samples collected and analyzed from October 2018 through September 2020 for TMDL compliance monitoring, there was only one exceedance at the Gilsizer Slough site. The rates of exceedance have been significantly decreasing since the 2016 Monitoring Year (**Figure 4**).

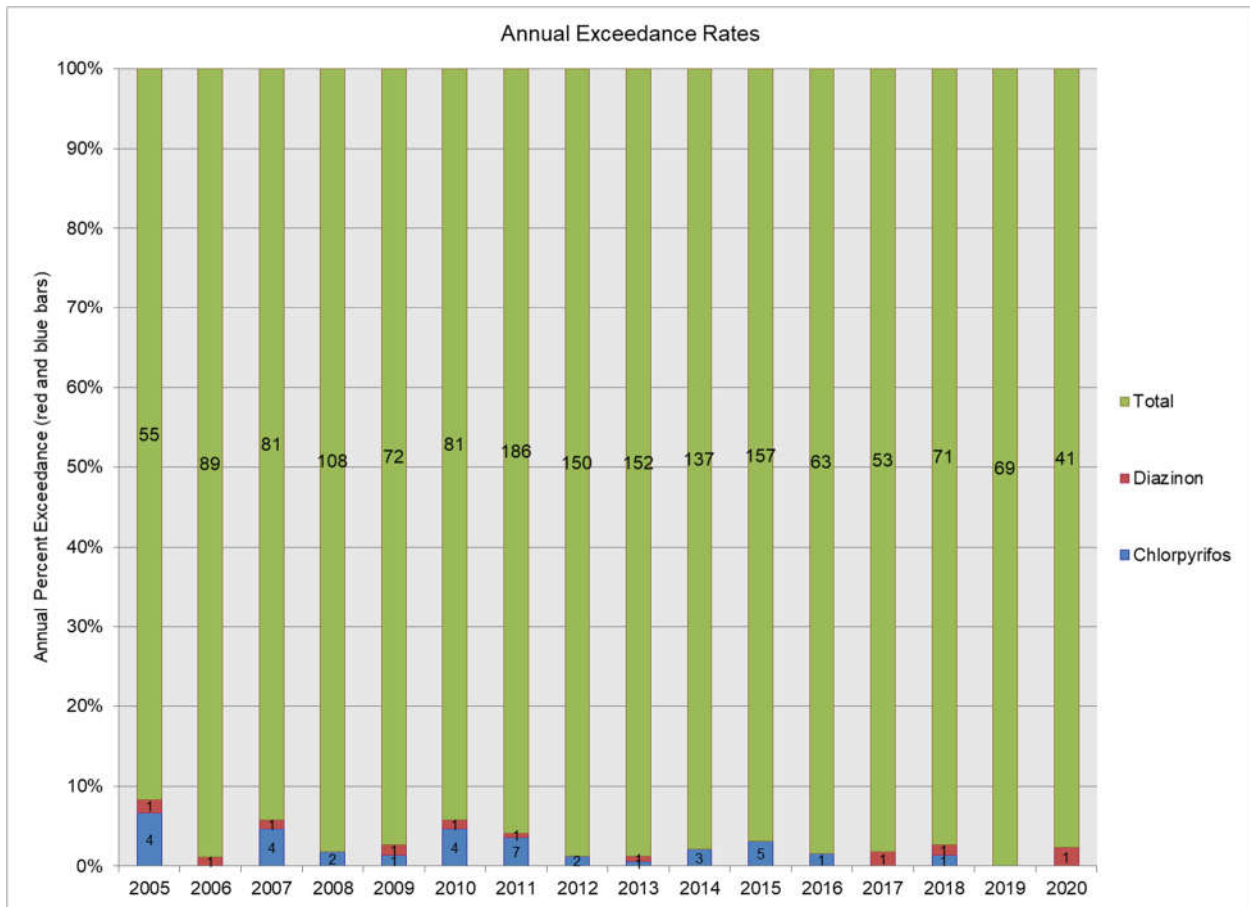


Figure 4: Annual Exceedance Rates at TMDL Compliance Sites, 2005-2020.

Annual exceedance rates are calculated as the sum of exceedances for each pesticide divided by the total number of samples of both pesticides analyzed for the year. Numeric labels indicate actual number of samples in compliance or in exceedance for each pesticide.

COMPLIANCE WITH LOAD ALLOCATIONS IN THE TMDL RECEIVING WATER BODIES

In separate TMDL monitoring conducted by the Coalition from 2006 to 2008, there were two diazinon exceedances observed at one of the compliance sites (Colusa Basin Drain) in 2008,⁸ and no exceedances observed in 2006 and 2007. Chlorpyrifos was not detected in any TMDL samples collected from the five TMDL monitoring locations sampled from 2006 to 2008 (Sacramento River at Colusa, Colusa Basin Drain, Sacramento Slough, Feather River above Yuba City, and Feather River near Verona). Although two diazinon exceedances were observed in 2008, the majority of the 95 samples collected from 2006 through 2008 and all 21 concentrations estimated at the Sacramento River at Verona monitoring location were in compliance with the TMDL objectives. The overall monitoring results for the Sacramento and Feather River diazinon TMDL indicate that the combination of outreach and education, the increased awareness and the resulting changes in diazinon use patterns and management practices, and the modifications to pesticide labeling have been successful in reducing instream ambient chlorpyrifos and diazinon concentrations and loads below the historically observed levels that resulted in listing the Sacramento River and Feather River as impaired for chlorpyrifos and diazinon. The relatively low rate of exceedances observed in the current TMDL compliance monitoring of the tributaries to these water bodies further indicates that the TMDL objectives will continue to be met.

The TMDL compliance monitoring conducted from 2006-2008 in the named TMDL water bodies indicated that conditions have improved and that these water bodies are generally in compliance with the TMDL. After 2008, continued compliance with the TMDL in the named TMDL water bodies has been assessed indirectly through analysis of monitoring conducted primarily in tributary water bodies (see **Table 2**). The TMDL compliance monitoring from 2009 through 2020 was conducted at Coalition monitoring sites that were selected to be representative of the larger drainage areas that contribute flows and pollutant loads to the receiving water bodies specifically identified for compliance in the TMDL.

Data from the compliance sites monitored from 2009 through September 2020 can be used in a number of ways to evaluate whether compliance in named TMDL water bodies is continuing and/or improving. The three following scenarios were evaluated for TMDL receiving waters for all cases where 2018 – 2020 compliance monitoring site concentrations exceeded or equaled the 1.0 TUc (4-day average) concentration-based Load Allocation (see **Table 7**).

Scenario 1: No Upstream Receiving Water Loads

The first level of evaluation is to determine whether the loads observed in the individual monitored water bodies were sufficient to *directly cause* exceedances in the named TMDL receiving water bodies. This was accomplished by simple mass load calculations based on the measured loads at the compliance sites and a conservative estimate of the receiving water

⁸ Diazinon Runoff Management Plan for Orchard Growers in the Sacramento Valley: 2008 Annual Report. Sacramento Valley Water Quality Coalition. June 2008.

discharge volume. The receiving water discharges were based on measured flows in Delta tributaries and tidal fluxes for the Delta (Liberty Island) reported by the Department of Water Resources California Data Exchange Center (CDEC)⁹. The relationship between all monitoring sites and receiving water flow sites is illustrated in **Figure 5**.

This initial evaluation assumes no chlorpyrifos or diazinon loads (TUc = 0) in the upstream receiving water. This analysis estimated that the dilution of loads from the monitored TMDL compliance sites with exceedances observed between October 2018 through September 2020 would result in TMDL receiving waters showing a chronic toxic unit concentration of 0.00394 TUc for the January event at GILSL (**Table 11**, Scenario 1).

⁹ CDEC Historical Data Selector available at: <http://cdec.water.ca.gov/selectQuery.html>

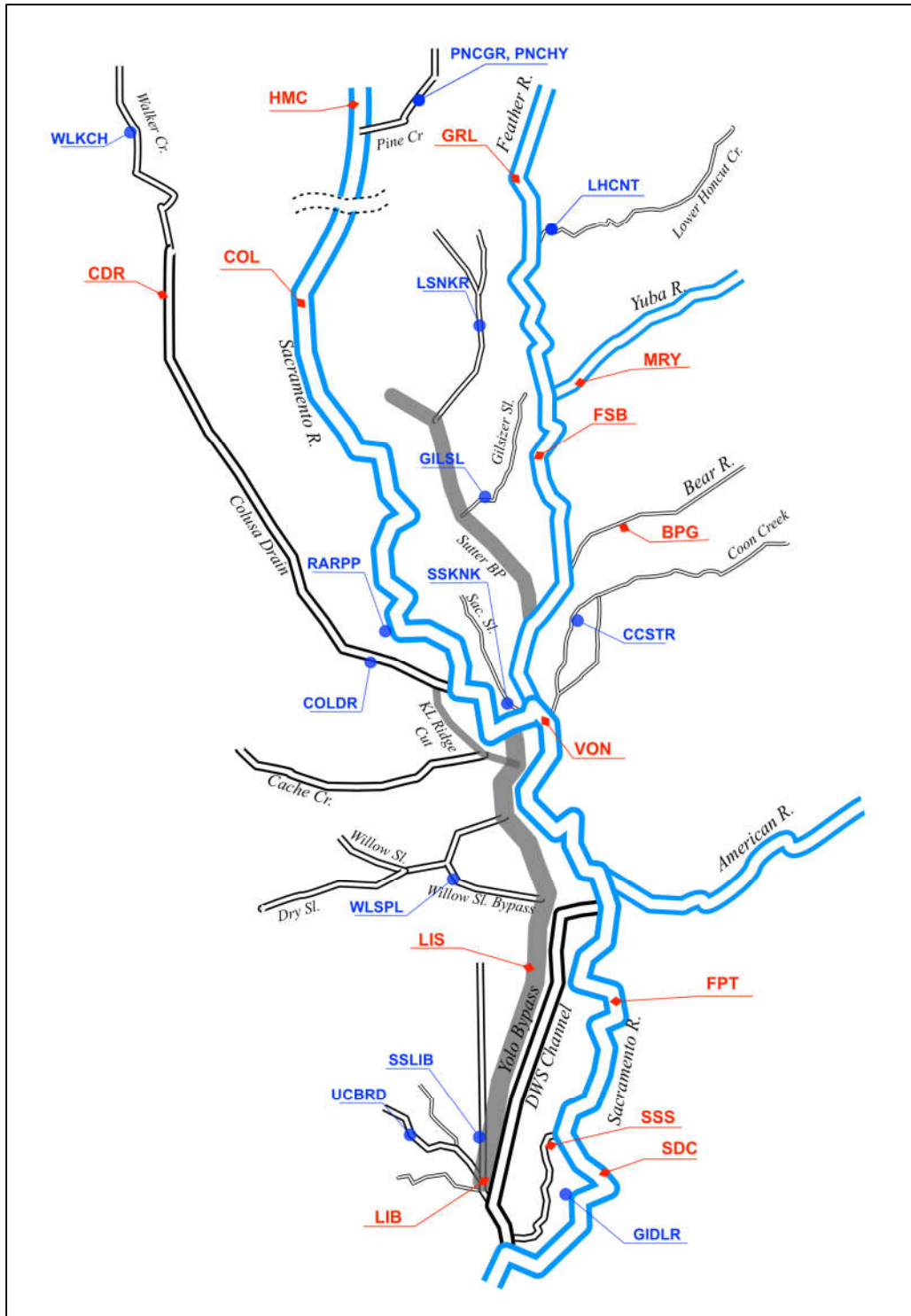


Figure 5. Compliance and Flow Monitoring Sites used for Analysis of Receiving Water Impacts.
 (Key for sites on following page)

Feature	KEY	Description
Monitoring Sites	WLKCH	Walker Creek near 99W and CR33
	PNCGR	Pine Creek at Nord Gianella Road (retired)
	PNCHY	Pine Creek at Highway 32
	LHCNT	Lower Honcut Creek at Hwy 70
	LSNKR	Lower Snake River at Nuestro Road
	GILSL	Gilsizer Slough at George Washington Road
	CCSTR	Coon Creek at Striplin Road
	RARPP	Rough and Ready Pumping Plant (RD 108)
	SSKNK	Sacramento Slough Bridge near Karnak
	COLDR	Colusa Basin Drain above Knight's Landing
	WLSPL	Willow Slough Bypass at Pole Line
	SSLIB	Shag Slough at Liberty Island Bridge
	UCBRD	Ulatis Creek at Brown Road
	GIDLR	Grand Island Drain near Leary Road
CRTWN	Cosumnes River at Twin Cities Road (off-scale, not included in figure)	
Flow Sites	HMC	Sacramento River at Hamilton City
	COL	Sacramento River at Colusa
	VON	Sacramento River at Verona
	FPT	Sacramento River at Freeport
	SDC	Sacramento River at the Delta Cross-Channel
	CDR	Colusa Drain at Highway 20
	LIS	Yolo Bypass at Lisbon
	LIB	Liberty Island at South Center End
	SSS	Steamboat Slough between Sutter Slough and Sacramento River
	GRL	Feather River at Gridley
	MRY	Yuba River at Marysville
	FSB	Feather River above Star Bend
	BPG	Bear River at Pleasant Grove

Scenario 2: Upstream Receiving Water Loads Equivalent to Additional Represented Loads Extrapolated from Compliance Sites

This evaluation uses the same methods as Scenario 1 above but assumes that the loads in the *upstream* receiving waters are equal to the additional loads from the irrigated acreage represented by the compliance site where an exceedance was observed. The additional loads from the represented irrigated acres were extrapolated from the compliance site loads using the following extrapolation factor:

$$\left(\frac{\text{Represented Irrigated Acres}}{\text{Compliance Drainage Irrigated Acres}} \right) \times \text{Compliance Site Frequency of Exceedance}$$

Where the ratio of irrigated acres accounts for that additional represented acreage, and the frequency of exceedance (for 2009 through the current reporting year) accounts for the probability of individual represented drainages exceeding the concentration-based Load Allocation.

This analysis estimates that the dilution of loads from the monitored TMDL compliance sites and represented irrigated acres would result in TMDL receiving waters showing a chronic toxic unit concentration of 0.00779 TUc for the January 2020 event at GILSL (Table 11, Scenario 2).

Scenario 3: Reasonable “Worst Case”, Upstream Receiving Water Loads Approaching Load Allocation

This evaluation also uses the same methods as Scenarios 1 and 2 but assumes that the cumulative loads in the *upstream* receiving waters are 90% of the TMDL concentration-based Load Allocation (i.e., 0.9 TUc). This scenario represents a reasonable “worst case” scenario for receiving water conditions coinciding with exceedances at the compliance sites. The addition of the observed load from the compliance site would not cause the receiving water to exceed the chronic toxic unit concentration-based TMDL Load Allocation of 1 TUc for the January 2020 event at GILSL under this scenario.

Summary of Evaluation of Compliance with Load Allocations

Continued compliance in the TMDL-named water bodies with the TMDL concentration-based Load Allocations can also be inferred from several lines of evidence:

- Past compliance in TMDL water bodies has been demonstrated through direct monitoring of the named TMDL water bodies.
- Use of diazinon and chlorpyrifos in the Sacramento Valley watersheds that drain to these TMDL water bodies continues to decrease.
- There is a decreasing trend in the frequency of exceedances for chlorpyrifos and diazinon at the currently monitored TMDL compliance monitoring sites.
- In 2010, the Feather River was removed from the 303(d) list for impairment due to diazinon.
- Loads represented by exceedances observed at individual Coalition TMDL compliance monitoring sites are not sufficient to directly cause an exceedance in the

named TMDL water bodies under reasonably expected receiving water conditions (**Table 11**, Scenario 1).

- Loads and exceedance rates extrapolated from representative compliance sites to larger represented regions are also extremely unlikely to cause exceedances in the named TMDL water bodies (**Table 11**, Scenario 2).
- Loads represented by exceedances observed at individual Coalition TMDL compliance monitoring sites are not sufficient to directly cause an exceedance in the named TMDL water bodies under reasonably worst-case upstream receiving water conditions (**Table 11**, Scenario 3).

Additional qualitative evidence supporting continued compliance is represented by the ongoing outreach and education efforts to warn of and/or address chlorpyrifos and diazinon exceedances throughout the Coalition area, when such occur. Outreach specific to the exceedance observed between October 2018 through September 2020 is discussed below (Outreach and Follow-Up Regarding TMDL Exceedances). As these efforts continue, it is reasonable to assume that management of pesticide applications and runoff will continue to improve and that exceedances in contributing tributaries and named TMDL receiving waters will continue to decrease in frequency and magnitude.

Historically, changes that were implemented in Yolo County to classify chlorpyrifos and diazinon as restricted materials have also proven successful in further increasing compliance. Coalition monitoring conducted at Yolo County sites since the 2007 implementation of these additional label and use restrictions have resulted in only five additional exceedances in a total of 136 samples at the compliance site sampled in the Yolo subwatershed (Willow Slough). There has never been a diazinon exceedance observed in Willow Slough and there hasn't been a chlorpyrifos exceedance observed at this site since August 2010.

Beginning on July 1, 2015, chlorpyrifos began to be regulated statewide as a restricted material, with similar restrictions to those implemented years earlier in Yolo County. The new state-restricted material status required that all chlorpyrifos products registered for production agricultural use must adhere to three additional requirements for all California restricted materials:

- Applications must be made or supervised by a certified applicator.
- Purchase, possession, or use requires the property operator to obtain a permit from the County Agricultural Commissioner.
- Businesses require a recommendation from a California Department of Pesticide Regulation (CDPR) licensed pest control adviser.

The Coalition submitted formal requests to the Executive Officer of the Regional Water Board for completion of chlorpyrifos management plans in two drainages (Walker Creek and Lower Snake River) in 2013 on the basis that these drainages were meeting and continue to meet water quality objectives. The Walker Creek management plan was approved as complete in January 2014, and the Lower Snake River management plan was approved as complete in March 2015. Additionally, a request for completion of the management plan at Gilsizer Slough for diazinon

and Willow Slough for chlorpyrifos were submitted in December 2015. Both were approved for completion in July 2016. The most recent Management Plans for OP pesticides to be deemed complete by the Regional Water Board are those for chlorpyrifos in Ulatis Creek, which received approval on April 2, 2019, and for chlorpyrifos in Pine Creek, which was approved for completion on August 28, 2020. A summary of the Coalition’s active Management Plans for chlorpyrifos and diazinon during the period covered by this report is included in **Table 10**.

Table 10. Active Management Plans for Chlorpyrifos and Diazinon during October 2018 through September 2020

Subwatershed	Waterbody	Analyte	Management Plan Status
Butte-Yuba-Sutter	Gilsizer Slough	Chlorpyrifos	Management Plan approved December 16, 2016
	Gilsizer Slough	Diazinon	Management Plan approved November 6, 2020.
	<i>Pine Creek</i>	<i>Chlorpyrifos</i>	<i>Request for Completion approved August 28, 2020.</i>
Solano	<i>Ulatis Creek</i>	<i>Chlorpyrifos</i>	<i>Request for Completion approved April 2, 2019.</i>

Note: A Management Plan is triggered when a monitoring result exceeds water quality objectives twice within a 3-year period. To complete the Management Plan, no exceedances may be observed during a 3-year period and growers/applicators must be provided outreach and education specific to management practices known to avoid or limit future agricultural discharges of the subject pesticide to surface waters.

Management Plans that were approved for completion between October 2018 and September 2020 are italicized.

Table 11. Estimated TMDL Receiving Water Body Loads from Compliance Sites and Represented Areas

Compliance Site Water Body	Sample Date	4-Day Average TUC for Compliance Site	TMDL Receiving Water	Receiving Water Discharge Estimate, cfs ⁽¹⁾	Basis for Receiving Water Discharge Estimate	Compliance Site Drainage Irrigated Acres	Represented Total Irrigated Acres	Frequency of Exceedance for Compliance Monitoring Site (2009-2020)	Load Extrapolation Factor ⁽²⁾	Represented Additional Load ⁽³⁾ , TUC	TMDL Receiving Water Estimation Scenarios ⁽⁴⁾		
											1. Estimated TMDL RW Chronic Toxic Unit Concentration when Upstream Load is 0, TUC	2. Estimated downstream TMDL RW Chronic Toxic Unit Concentration including Additional Represented Load, TUC	3. Estimated downstream TMDL RW Load when Upstream Chronic Toxic Unit Concentration Assumed to be 0.9, TUC
Gilsizer Slough at George Washington Road	1/17/2020	17.0	Feather River (via Sutter Bypass)	3,341	Feather River above Star Bend + Bear River	22,655	179,576	7.3%	0.504	8.564	0.00394	0.00651	0.90373

- Notes:
- (1) Receiving Water Discharge Estimate = measured or estimated instantaneous discharge for the receiving water
 - (2) Load Extrapolation Factor = (Represented area irrigated acres + Compliance site irrigated acres) X compliance site exceedance percentage
 - (3) Represented Additional Load = Monitoring site load X Load Extrapolation Factor
 - (4) Estimates of TUC concentration in the TMDL Receiving Water Body, calculated using standard mass balance methods, for comparison to TUC Load Allocation of 1.0 TU.
 - Scenario 1 assumes a chronic toxic unit concentration of 0 TUC in the upstream TMDL Receiving Water Body. The resulting RW TU concentration is thus based on dilution of Compliance site load only.
 - Scenario 2 assumes a chronic toxic unit load in the upstream TMDL Receiving Water Body is based on the represented additional load extrapolated from the compliance site. This scenario represents the most realistic RW chronic toxic unit concentration estimate.
 - Scenario 3 assumes (very conservatively) a chronic toxic unit concentration of 0.9 TUC in the upstream TMDL Receiving Water Body. This scenario represents a "worst-case" RW chronic toxic unit concentration estimate.

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OUTREACH AND FOLLOW-UP REGARDING TMDL EXCEEDANCES

Follow-up actions and source evaluations for exceedances in the TMDL water bodies and tributaries have been reported in past Annual Monitoring Reports and Management Plan Progress Reports and will be reported in future versions of these reports. Typically, the first step taken is to analyze the pesticide application data from the California Department of Pesticide Regulation (CDPR) Pesticide Use Reporting (PUR) database. All users that were considered to have the potential to contribute to the observed chlorpyrifos or diazinon exceedance are contacted directly to inform them of the exceedances and appropriate management practices to reduce the risk of future exceedances.

Descriptions of all outreach and education activities conducted by the Coalition's subwatersheds during October 2018 through September 2020 are provided in Appendix F (*SVWQC Outreach Materials*) of the Coalition's 2019 and 2020 Annual Monitoring Reports (AMR). Outreach activities specific to the diazinon exceedance that occurred during the time period covered by this report are provided below.

Butte-Yuba-Sutter Water Quality Coalition (Gilsizer Slough)

Targeted outreach was conducted by the Butte-Yuba-Sutter Water Quality Coalition in response to the diazinon exceedance observed on January 17, 2020 and as ongoing active management for chlorpyrifos and diazinon exceedances observed since 2015 at the Gilsizer Slough site. The targeted outreach and general outreach efforts are summarized below in **Table 12**.

Table 12. Outreach Activities Conducted by the Butte-Yuba-Sutter Water Quality Coalition

Date	Location	Attendance	Type of Outreach	Description
Targeted Outreach for the Diazinon Exceedance on January 17, 2020 and for Ongoing Active Management for Chlorpyrifos and Diazinon Exceedances				
9/1/2021	Mailing	150	Letter	Focused Outreach Surveys
9/15/2020	YouTube (https://www.youtube.com/watch?v=wCJdedr-HuU)	Not Applicable	Online Video	Focused Outreach Survey Guidance and Information
General Outreach Efforts				
11/19/2019	Butte County Fairgrounds	51	Meeting	NMP Self-Certification Training, BYS Member Requirements, Update on Events
12/1/2019	Email	1800	Email	Reporting Information and Deadlines
1/21/2020	Butte County Fairgrounds	60	Meeting	Member Obligations, Current Exceedances, Management Plans, FES, NMP, Upcoming Events
1/28/2020	Butte County Fairgrounds	23	Meeting	NMP Self-Certification Training, BYS Member Requirements, Update on Events
3/23/2020	Email	1800	Email	Reporting Information and Deadlines and COVID-19 Notice

TOXICITY AND ADDITIONAL PESTICIDE RESULTS

The results of pesticide monitoring from October 2018 through September 2020 are reported in the Coalition's 2019 and 2020 AMRs. There were 2,117 individual pesticide results analyzed in 243 water column samples collected from 18 different sites, including those classified as Representative or Special Study sites. Analyses were conducted for organophosphates, carbamates, organochlorines, benzophenyls, pyrethroids, and a variety of herbicides. Greater than 91.9% of all pesticide results were below detection during the two years covered by this report.

Determine Whether the Discharge Causes or Contributes to a Toxicity Impairment Due to Additive or Synergistic Effects of Multiple Pollutants (TMDL Monitoring Goal 6)

Pesticides that have modes of action that are potentially additive to chlorpyrifos and/or diazinon include carbaryl, malathion, methomyl, naled, and dichlorvos (cholinesterase inhibitors). These pesticides are typically detected much less frequently than chlorpyrifos or diazinon. However, none of these pesticides were detected during the January 2020 monitoring event at the Gilsizer Slough site (GILSL) when diazinon was detected in a sample .

Reviewing the results of the past five monitoring years indicates that toxicity due to additive or synergistic effects with chlorpyrifos or diazinon is extremely rare. There were 330 individual toxicity results analyzed in water column and sediment samples collected from 15 different sites during the 2019 and 2020 Coalition Monitoring Years. Toxicity analyses were conducted for *Selenastrum capricornutum*, *Ceriodaphnia dubia*, and *Hyaella azteca*. Toxicity to *Ceriodaphnia* was tested 139 times during these two monitoring years and there was never any observed toxicity. The last time that Coalition monitoring observed *Ceriodaphnia* toxicity that was determined to be caused solely by chlorpyrifos, based on measured concentration, was during the 2015 Monitoring Year. With respect to the last eight years of Coalition monitoring, we can reasonably and definitively conclude that 520 out of 521 samples collected since 2013 did not have additive or synergistic *Ceriodaphnia* toxicity associated with chlorpyrifos or diazinon (99.8%) and only one sample (0.2%) had toxicity that *may potentially* have been attributable to additive or synergistic effects with chlorpyrifos and diazinon.

Determine Whether Alternatives to Diazinon and Chlorpyrifos are Causing Surface Water Quality Impacts (TMDL Monitoring Goal 5)

Based on our evaluation of the relative risks of current use pesticides, most potential alternatives to chlorpyrifos and diazinon have a much lower risk of causing adverse impacts to surface waters and have not been prioritized for monitoring. One exception to this finding is the category of pyrethroid pesticides, which have been identified as having significant potential to cause toxicity in sediments. The potential current impacts of pyrethroid pesticides are being assessed by the Coalition through toxicity and chemical monitoring of sediment and water column samples, initially driven by the requirement for the Coalition to implement the Regional Water Board's 2016 Pesticides Evaluation Protocol and more recently by the approved Central Valley

Pyrethroid Pesticides Total Maximum Daily Load and Basin Plan Amendment¹⁰. Prior to the recent pyrethroid pesticides monitoring effort, the Coalition observed several cases of pyrethroid-caused sediment toxicity and addressed these cases through Management Plans and other targeted outreach mechanisms. However, our longer-term monitoring indicates that sediment toxicity is not a widespread or common problem in the Coalition's subwatersheds. Out of 319 sediment toxicity sample events, there have been only 19 cases (6.0%) of significant toxicity with *Hyalella azteca* survival less than 80% compared to laboratory controls.

¹⁰ Pyrethroid pesticides considered in the 2017 Central Valley Pyrethroid Pesticides Total Maximum Daily Load and Basin Plan Amendment (Amendment) include the following: Bifenthrin, Cyfluthrin, Cypermethrin, Esfenvalerate, Lambda-Cyhalothrin, and Permethrin (The Amendment was adopted by the Central Valley Water Board on June 8, 2017, approved by the State Water Resources Control Board on July 10, 2018, and approved by the Office of Administrative Law on February 19, 2019.)

Summary

Based on the results of the Coalition’s routine and TMDL monitoring, compliance with the TMDL water quality objectives and load allocations is achieved in the overwhelming percentage of samples. These results demonstrate that outreach and education, the resulting changes in use patterns and changes in management practices, and modifications to pesticide labeling have been successful in reducing in-stream ambient concentrations of chlorpyrifos and diazinon to the degree required by the TMDL. The relatively low rate of exceedances since the beginning of the ILRP suggests that many of the changes were successfully implemented prior to or soon after 2005. Although exceedances are still occasionally observed, the overall trend from 2005 through September 2020 has been a decrease in the rate of annual exceedances (**Figure 4**). Exceedances observed in the TMDL tributaries monitored for compliance during the 2019 and 2020 Monitoring Years were determined unlikely to cause exceedances of the TMDL Load Allocations in the named TMDL receiving water bodies under any reasonably probable scenario (**Table 11**).

Continuing efforts to further reduce exceedances are being implemented through the Coalition’s Management Plans for sites that have triggered Management Plan requirements for these two pesticides. Additionally, the Coalition aggressively investigates all exceedances and conducts follow-up contact with growers reporting applications that have the potential to cause specific observed exceedances. These combined efforts, along with the implementation of the state-restricted material status for chlorpyrifos in July 2015 and the prohibition of use in December 2020, are expected to result in a continuation of the observed decreasing trend in the number of exceedances for these pesticides.

Demonstrating that management practices are achieving the lowest “technically and economically achievable” pesticide concentrations is fundamentally addressed through the TMDL compliance monitoring (Goal 7). The high level of compliance discussed extensively within this Compliance Report is empirical evidence that this goal is being achieved on a broad geographic scale through the practices employed in the Coalition’s subwatersheds. Further evidence is provided by the progress toward completion of the Coalition’s Management Plans for chlorpyrifos and diazinon. Furthermore, achieving the level of compliance required for completion of the Management Plans is direct evidence that the combination of practices employed are effective at reducing and eliminating discharges of chlorpyrifos and diazinon. Seven Management Plans have already been approved for completion: Lower Coon Creek in the Placer-Nevada-South Sutter-North Sacramento Subwatershed (chlorpyrifos), Walker Creek in the Colusa-Glenn Subwatershed (chlorpyrifos), Willow Slough in the Yolo Subwatershed (chlorpyrifos), Gilsizer Slough in Butte-Yuba-Sutter Subwatershed (diazinon), Lower Snake River in the Butte-Yuba-Sutter Subwatershed (chlorpyrifos), Pine Creek in the Butte-Yuba-Sutter Subwatershed (chlorpyrifos) and Ulatis Creek in the Solano Subwatershed (chlorpyrifos).

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Appendix A

Sacramento Valley Water Quality Coalition Chlorpyrifos and Diazinon TMDL Monitoring Results, January 2009 – September 2020

Please see attached Microsoft Excel spreadsheet file.

Appendix B

Delta Regional Monitoring Program Participation Approval Letter for Reduced Individual Monitoring (February 26, 2016)