San Joaquin River Chlorpyrifos and Diazinon 2015 Water Year Annual Monitoring Report

Prepared by the East San Joaquin Water Quality Coalition and the Westside San Joaquin River Watershed Coalition

Submitted to the Central Valley Regional Water Quality Control Board

Reporting period:
October 1, 2014 – September 30, 2015

Report Submitted:
May 1, 2016

MICHAEL L. JOHNSON LLC
ECOSYSTEMS • CONSULTING

TABLE OF CONTENTS

Table of Contents i
List of Appendices ii
List of Tables iii
List of Figures v
List of Acronyms vi
List of Units vii
List of Terms vii
Executive Summary 1
Introduction 4
Monitoring Objectives and Design 5
Monitoring Objectives 5
Monitoring Design 7
Monitoring Frequency and Timing 7
Constituents Monitored 11
Sample Site Descriptions 12
Land Use Analysis of Subareas 16
Rainfall Records 17
Sampling and Analytical Methods 19
Monitoring Results 21
Sample Details 21
Precision, Accuracy and Completeness 23
Completeness 23
Field and Transport Completeness 23
Analytical Completeness 24
Batch Completeness 25
Hold Time Compliance 25
Summary of Precision and Accuracy 25
Comparison with TMDL Objectives 28
Objective 1: Determine compliance with established water quality objectives and the loading capacity applicable to diazinon and chlorpyrifos in the Lower San Joaquin River 28
Water Quality Objectives 28
Loading Capacity 28
Objective 2: Determine compliance with established load allocations for diazinon and chlorpyrifos. . 29
ESJWQC Load Allocation Compliance 29
Westside Coalition Load Allocation Compliance 32
Objective 3: Determine degree of implementation of management practices and strategies to reduce off-site movement of diazinon and chlorpyrifos 35

ESJWQC Implementation of Management Practices to Reduce Offsite Movement of Diazinon and Chlorpyrifos 36
Westside Coalition Implementation of Management Practices to Reduce Offsite Movement of Diazinon and Chlorpyrifos 40
Objective 4: Determine degree of effectiveness of management practices and strategies to reduce off-site movement of diazinon and chlorpyrifos 42
ESJWQC Effectiveness of Management Practices to Reduce Offsite Movement of Diazinon and Chlorpyrifos 42
Westside Coalition Effectiveness of Management Practices to Reduce Offsite Movement of Diazinon and Chlorpyrifos 44
Objective 5: Determine whether alternatives to diazinon and chlorpyrifos are causing surface water quality impacts 45
ESJWQC Assessment of Alternatives to Diazinon and Chlorpyrifos 46
Westside Coalition Assessment of Alternatives to Diazinon and Chlorpyrifos 56
Summary of Alternatives Detected 57
Objective 6: Determine whether the discharge causes or contributes to toxicity impairment due to additive or synergistic effects of multiple pollutants. 58
ESJWQC Evaluation of Toxicity Impairment Due to Additive or Synergistic Effects of Multiple Pollutants 58
Westside Coalition Evaluation of Toxicity Impairment Due to Additive or Synergistic Effects of Multiple Pollutants 59
Objective 7: Demonstrate that management practices are achieving the lowest pesticide levels technically and economically achievable 63
Conclusions and Recommendations 64
References 65

LIST OF APPENDICES

Appendix I Monitoring Results
Appendix II Field and Laboratory QA Results
Appendix III Concentration Based Load Calculations

LIST OF TABLES

Table 1. WQOs for chlorpyrifos and diazinon. 5
Table 2. Monitoring objectives and actions by the ESJWQC and Westside Coalition for the control of chlorpyrifos and diazinon runoff into the LSJR. 6
Table 3. San Joaquin River chlorpyrifos and diazinon designated Basin Plan Amendment compliance sites, subareas , and site name crosswalk for referencing appendices and electronic files. 13
Table 4. The ESJWQC and Westside Coalition upstream tributary monitoring during 2015 WY. 13
Table 5. Estimated land use acreage upstream of the San Joaquin River compliance points. 16
Table 6. Top ten commodities (in order of largest to smallest acreage) upstream of each San Joaquin River sampling site for 2015 WY. 17
Table 7. Sampling procedures. 20
Table 8. Field parameters and instruments used to collect measurements. 20
Table 9. Site specific discharge methods. 20
Table 10. Field and laboratory analytical methods. 20
Table 11. Dates of monitoring at San Joaquin River and upstream tributary sites during the 2015 WY. .. 21
Table 12. The ESJWQC and Westside Coalition field and transport completeness for chlorpyrifos and diazinon samples and field parameters. 24
Table 13. The ESJWQC and Westside Coalition analytical completeness for chlorpyrifos and diazinon samples. 24
Table 14. The ESJWQC and Westside Coalition summary of holding time evaluations for environmental, Field Blank, Field Duplicate, and Matrix Spike samples. 25
Table 15. The The ESJWQC and Westside Coalition summary of QC sample evaluations for the 2015 WY. 26
Table 16. Tally of chlorpyrifos and diazinon TMDL load capacity compliance per site before and after the compliance date of December 1, 2010. 28
Table 17. The ESJWQC tributary monitoring schedule for chlorpyrifos (C) and diazinon (D) during the 2015 WY. 30
Table 18. Chlorpyrifos and diazinon load allocation calculations for tributary sites in the ESJWQC out of compliance during the 2015 WY. 31
Table 19. Tally of ESJWQC chlorpyrifos and diazinon TMDL load allocation compliance for each subarea since inception of San Joaquin River monitoring (January 2010 through September 2015). 32
Table 20. Westside Coalition tributary monitoring schedule during the 2015 WY. 33
Table 21. Chlorpyrifos and diazinon load allocation calculations for tributary sites in the Westside Coalition out of compliance during the 2015 WY. 34
Table 22. Tally of Westside Coalition chlorpyrifos and diazinon TMDL load allocation compliance per each of the subareas. 34
Table 23. Chlorpyrifos and diazinon applications made four weeks prior in subwatersheds with exceedances in the Westside Coalition region. 35

Table 24. Current and newly implemented management practices designed to reduce offsite movement of chlorpyrifos and diazinon in the ESJWQC first through sixth priority subwatersheds listed by TMDL subarea. 39
Table 25. Management practice inventory data for subwatersheds in the Westside Coalition region. ... 41
Table 26. Count of exceedances and samples collected for high priority pesticides in first through sixth priority subwatersheds. 44
Table 27. Commodities with the most pounds of chlorpyrifos and diazinon use in the ESJWQC region from 2004 through September 2015. 47
Table 28. High concern pests for commodities using the most diazinon and/or chlorpyrifos in the ESJWQC region, with alternative pesticides recommended for those pests. 47
Table 29. The ESJWQC tributary monitoring schedule for potential alternatives to chlorpyrifos and diazinon and toxicity during the 2015 WY. 52
Table 30. Water column detections of potential alternative pesticides in ESJWQC tributaries during the 2015 WY. 53
Table 31. The ESJWQC tributary water column and sediment toxicity exceedance summary for the 2015 WY. 54
Table 32. Summary of water column phase III TIE results and conclusions. 55
Table 33. Insecticide applications within the Westside Coalition in order of highest application area. ... 56
Table 34. Westside Coalition tributary water column toxicity exceedance summary for 2015 WY. 59
Table 35. The Westside Coalition tributary sediment toxicity exceedance summary for the 2015 WY. .. 62

LIST OF FIGURES

Figure 1. Pounds of diazinon applied in the LSJR from 2004 through September 2015. 8
Figure 2. Pounds of chlorpyrifos applied in the LSJR watershed from 2004 through October 2015. 8
Figure 3. Chlorpyrifos and diazinon San Joaquin River TMDL decision tree for compliance monitoring and actions resulting from non-compliance of the San Joaquin River load capacity. 10
Figure 4. San Joaquin River tributary major and minor subareas, chlorpyrifos and diazinon TMDL compliance sites (circles), and tributary sites monitored by ESJWQC (squares) and Westside Coalition (triangles) during the 2015 WY. 15
Figure 5. Precipitation history from October 1, 2014 through December 31, 2014. 18
Figure 6. Precipitation history from January 1, 2015 through September 30, 2015. 18
Figure 7. Acreage with one or more implemented management practice per each category in the ESJWQC first through sixth priority subwatersheds. 38
Figure 8. Count of chlorpyrifos and diazinon detections from 2006 through 2015 in the Westside Coalition tributaries 45
Figure 9. Pounds of diazinon and chlorpyrifos applied in the ESJWQC region from 2004 through 2015 calendar years. 46
Figure 10. Pounds of major pesticides applied to the top seven commodities with the most chlorpyrifos and/or diazinon applications during the 2015 WY. 50

LIST OF ACRONYMS

AI	Active Ingredient
AMR	Annual Monitoring Report
CalPIP	California Pesticide Information Portal
CDEC	California Data Exchange Center
CEDEN	California Environmental Data Exchange Network
CIMIS	California Irrigation Management Information System
COC	Chain of Custody
CV RDC	Central Valley Regional Data Center
DO	Dissolved Oxygen
DWR	(California) Department of Water Resources
EPA	Environmental Protection Agency
ESJWQC	East San Joaquin Water Quality Coalition
FB	Field Blank
FD	Field Duplicate
ILRP	Irrigated Lands Regulatory Program
LCS	Laboratory Control Spike
LCSD	Laboratory Control Spike Duplicate
LSJR	Lower San Joaquin River
MDL	Minimum Detection Limit
MLJ-LLC	Michael L. Johnson, LLC
MPM	Management Plan Monitoring
MPUR	Management Plan Update Report
MRP	Monitoring and Reporting Program Order No R5-2008-0831
MRPP	Monitoring and Reporting Program Plan
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NA	Not Applicable
NONPJ	Non-project
OP	Organophosphorus compounds
PR	Percent Recovery
PUR	Pesticide Use Report
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RL	Reporting Limit
RPD	Relative Percent Difference
SAMR	Semi-Annual Monitoring Report
S	Sum loading capacity
SC	Specific Conductance
SM	Standard Methods for the Examination of Water and Wastewater
SWAMP	Surface Water Ambient Monitoring Program
TIE	Toxicity Identification Evaluation
TMDL	Total Maximum Daily Load
USDA	United States Department of Agriculture

USGS	United States Geological Survey
Westside Coalition	Westside San Joaquin River Watershed Coalition
WQO	Water Quality Objective
WY	Water Year

LIST OF UNITS

cm	centimeter
cfs	cubic feet per second
°C	degrees Celsius
L	Liter
µg	microgram
µmhos	micromhos
µS	microsiemens
mg	milligram

LIST OF TERMS

Basin Plan – Water Quality Control Plan for the Sacramento River and San Joaquin River Basins, Fourth Edition

Basin Plan Amendment – 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 Lower San Joaquin River (Final Staff Report October 2005)

Coalitions – East San Joaquin Water Quality Coalition and Westside San Joaquin River Watershed Coalition

Drainage – Water that moves horizontally across the surface or vertically into the subsurface from land

ESJWQC region – The region within the Central Valley in which the East San Joaquin Water Quality Coalition is responsible for implementing the Irrigated Lands Regulatory Program (ILRP) on behalf of its members

Not detected – The concentration of a constituent within a sample is below the minimum detection limit

Regional Board – Central Valley Regional Water Quality Control Board

Waterbody – Standing or flowing water of any size that may or may not move into a larger body of water, including lakes, reservoirs, ponds, rivers, streams, tributaries, creeks, sloughs, canals, laterals and drainage ditches

Water Year – The twelve month period from October through September, designated by the calendar year in which it ends and which includes nine of the twelve months

Watershed – The land area that drains into a stream; the watershed for a major river may encompass a number of smaller watersheds that ultimately combine at a common point. [Environmental Protection Agency (EPA) terms of environment: http://www.epa.gov/OCEPAterms/wterms.html)]

Westside Coalition region – The region within the Central Valley in which the Westside San Joaquin River Watershed Coalition is responsible for implementing the ILRP on behalf of its members

EXECUTIVE SUMMARY

The Central Valley Regional Water Quality Control Board (Regional Board) developed the Basin Plan Amendment (finalized in October 2005) to establish a Total Maximum Daily Load (TMDL) for the organophosphorus (OP) pesticides chlorpyrifos and diazinon in the lower reaches of the Lower San Joaquin River (LSJR).

The LSJR is divided into seven major subareas (LSJR upstream of Salt Slough, Grassland, East Valley Floor, Northwest side, Merced River, Tuolumne River, and the Stanislaus River) as described in the 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 LSJR (hereafter Basin Plan Amendment). As part of the Basin Plan Amendment, a surveillance and monitoring program is required. The East San Joaquin Water Quality Coalition (ESJWQC) and Westside San Joaquin River Watershed Coalition (Westside Coalition) jointly developed a monitoring strategy to comply with the chlorpyrifos and diazinon TMDL seven Monitoring Objectives:

1. Determine compliance with established water quality objectives (WQOs) and the loading capacity applicable to diazinon and chlorpyrifos in the LSJR.
2. Determine compliance with established load allocations for diazinon and chlorpyrifos.
3. Determine the degree of implementation of management practices to reduce off-site movement of diazinon and chlorpyrifos.
4. Determine the effectiveness of management practices and strategies to reduce off-site migration of diazinon and chlorpyrifos.
5. Determine whether alternatives to diazinon and chlorpyrifos are causing surface water quality impacts.
6. Determine whether the discharge causes or contributes to toxicity impairment due to additive or synergistic effects of multiple pollutants.
7. Demonstrate that management practices are achieving the lowest pesticide levels technically and economically achievable.

The monitoring design for the 2015 Water Year (WY) was the same as design utilized during 2014. During the 2015 WY, monitoring took place at the six compliance points on the LSJR to determine load compliance and monitoring in tributaries to determine load allocation. The ESJWQC monitored three of the six compliance points (San Joaquin River at Hills Ferry Road, San Joaquin River at the Maze Boulevard (Highway 132) Bridge, and San Joaquin River at the Airport Way Bridge near Vernalis) during the February storm monitoring event and from May through September. The Westside Coalition monitored the other three compliance points (San Joaquin River at Sack Dam, San Joaquin River at Highway 165 near Stevinson, and San Joaquin River at Las Palmas Avenue near Patterson) monthly. Tributary monitoring occurred monthly based on each Coalition's approved monitoring plan. The ESJWQC and Westside Coalition assess monitoring results based on the seven monitoring objectives described above and submit a report with the combined results per each Coalition on May 1 annually. The six compliance points monitored in the San Joaquin River from upstream to downstream are:

- San Joaquin river at Sack Dam,

- San Joaquin River at Highway 165 near Stevinson,
- San Joaquin River at Hills Ferry Rd,
- San Joaquin River at Las Palmas Avenue near Patterson,
- San Joaquin River at the Maze Boulevard (Hwy 132) Bridge, and
- San Joaquin River at the Airport Way Bridge near Vernalis

Water samples collected from the LSJR were analyzed for chlorpyrifos and diazinon. Habitat information and field data, including dissolved oxygen (DO), pH, specific conductance (SC), and water temperature, were collected at each site during each monitoring event. Discharge was obtained from the Department of Water Resources (DWR) gauge readings posted on the California Data Exchange Center (CDEC) Website. The ESJWQC and Westside Coalition created a decision tree to guide the Coalition's actions when a non-compliant load is detected in the LSJR.

During the 2015 WY there were no exceedances of the WQO for chlorpyrifos or diazinon at the LSJR compliance sites. However, there were eight exceedances of the chlorpyrifos WQTL in samples collected on seven different dates from ESJWQC tributaries (Bear Creek, Merced, and Tuolumne River subareas). One sediment sample collected from ESJWQC tributary sites exhibited sufficient sediment toxicity to *Hyalella azteca* for follow-up pesticide analysis. The sample contained chlorpyrifos and a number of other pyrethroid pesticides. In the Westside Coalition region, chlorpyrifos was detected in twelve water samples (over four different monitoring events), all of which exceeded the load criteria. Diazinon was not detected in any sample during 2015 WY. Eight sediment samples from the Westside Coalition exhibited sufficient sediment toxicity for follow-up pesticide analysis. All those samples contained chlorpyrifos and pyrethroids. In all of the samples exhibiting toxicity within the ESJWQC and Westside Coalition region, there was no indication of synergistic effects. Potential alternative pesticides to chlorpyrifos and/or diazinon were detected in the ESJWQC and Westside Coalition regions, but it is unknown if the pesticides were used as an alternative or as part of a rotation to manage specific pests. The management practices implemented by growers in both Coalition regions are achieving the lowest pesticide levels technically and economically feasible.

To address water quality impairments, the ESJWQC developed a management plan for waterways and constituents detected in those waterways. The Coalition focuses on constituents likely originating from agriculture including pesticides and suspended solids. The outreach and education strategy is designed to inform growers of impairments in their watershed and provide information on effective management practices. A key component of the ESJWQC's management strategy is to hold individual member meetings to discuss farm management practices and water quality impairments. The Coalition considers the significant decrease in exceedances of the WQO for chlorpyrifos since outreach began an important step in demonstrating the effectiveness of its management plan strategy. By demonstrating water quality improvements, the ESJWQC has received approval to remove 39 constituents from 17 site subwatershed management plans. Of those 38 constituents approved for management plan completion, four management plans have been reinstated due to exceedances of WQTLs during recent monitoring.

The Westside Coalition is also in the process of evaluating management practice implementation and effectiveness. To accomplish this, the Westside Coalition utilizes its two-pronged strategy guided by the tiered approach described in the Westside Coalition Management Plan. Because there is likely an

overlap in effect from practices to address a specific constituent, the Westside Coalition identified a prioritized, tiered list of actions to be taken to address impairments of the most immediate concern (highest tier constituents), and, presumably, those actions will also benefit lower prioritized (tiered) constituents. These actions are then employed under two concurrent approaches (prongs) to improve water quality within the region. The General Approach identifies and employs common, constituent-specific strategies that can be applied throughout the region. Focused Watershed Management Plans, the second prong, identify and employ a subwatershed specific approach to implement management practices and improve water quality. Together, these strategies enable the Westside Coalition to adequately assess water quality and management practice implementation in its region. Management practices assessments are reported in the Westside Coalition Semi-Annual Monitoring Reports (SAMRs).

Both Coalitions monitor chlorpyrifos, diazinon, and several other constituents as a part of tributary monitoring within their respective regions. Results from ESJWQC and Westside Coalition tributary monitoring during the reporting period (October 2014 through September 2015) are discussed as they pertain to the TMDL Monitoring Objectives 1 through 7. Additional details can be found in the ESJWQC Annual Report submitted May 1, 2016, ESJWQC Quarterly Data Submittals submitted on March 1, June 1, September 1, and December 1, and the Westside Coalition Semi-Annual Monitoring Reports (SAMRs) submitted June 15, 2015 (September 2014 through February 2015 data) and November 30, 2015 (March 2015 through August 2015 data) and to be submitted in the June 15, 2016 SAMR (September 2015 data).

INTRODUCTION

The Central Valley Regional Water Quality Control Board (Regional Board) developed the 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 LSJR (hereafter Basin Plan Amendment) to establish a Total Maximum Daily Load (TMDL) for the organophosphorus (OP) pesticides chlorpyrifos and diazinon in the lower reaches of the San Joaquin River (LSJR). This Basin Plan Amendment (finalized in October 2005) requires a surveillance and monitoring program to collect information necessary to assess compliance with seven monitoring objectives. The East San Joaquin Water Quality Coalition (ESJWQC) and Westside San Joaquin River Watershed Coalition (Westside Coalition) collect monitoring data to assess compliance with the Basin Plan Amendment which is addressed at two levels in this report: 1) assessment of water quality within the LSJR at six TMDL compliance points, and 2) assessment of water quality at tributaries within seven major subareas that drain to the LSJR. In some cases major subareas have been further subdivided into minor subareas to facilitate more effective and focused water quality monitoring and assessment (Bear Creek, Fresno-Chowchilla, Northeast Bank, North Stanislaus, Stevinson, Turlock Area, Greater Orestimba, Westside Creeks, and Vernalis North).

The LSJR and seven major subareas include agricultural drainages monitored under the Irrigated Lands Regulatory Program (ILRP) by the ESJWQC and Westside Coalition. Each Coalition conducts a monitoring program designed to assess water quality within their region. In addition, both Coalitions have developed management plans to address exceedances of the water quality objectives (WQOs) for chlorpyrifos and diazinon in specific subwatersheds. To address regulation of discharges of OP pesticides, the ESJWQC and the Westside Coalition jointly conducted monitoring at six compliance points in the LSJR during the 2015 WY. This report summarizes the monitoring results of samples collected during the reporting period (October 2014 through September 2015) and compares those results with WQOs outlined in the Basin Plan Amendment. This annual report also includes data to demonstrate how the Coalitions are complying with load allocations for the seven major subareas that drain to the LSJR.

MONITORING OBJECTIVES AND DESIGN

MONITORING OBJECTIVES

The ESJWQC and Westside Coalition developed a monitoring strategy to comply with the following seven Monitoring Objectives for the chlorpyrifos and diazinon TMDL program:

1. Determine compliance with established WQOs and the loading capacity applicable to diazinon and chlorpyrifos in the San Joaquin River.
2. Determine compliance with established load allocations for diazinon and chlorpyrifos.
3. Determine the degree of implementation of management practices to reduce off-site movement of diazinon and chlorpyrifos.
4. Determine the effectiveness of management practices and strategies to reduce off-site migration of diazinon and chlorpyrifos.
5. Determine whether alternatives to diazinon and chlorpyrifos are causing surface water quality impacts.
6. Determine whether the discharge causes or contributes to toxicity impairment due to additive or synergistic effects of multiple pollutants.
7. Demonstrate that management practices are achieving the lowest pesticide levels technically and economically achievable.

The chlorpyrifos and diazinon WQOs (Basin Plan, Fourth Edition; Page III-6.01) are used to determine compliance with the concentration based loading capacity for the LSJR and load allocations within the upstream tributaries (Table 1). Loading capacity is the maximum amount of pollution that can be present in a waterbody without violating water quality objectives. Load allocations are the allowable pollutant load among the different pollutant sources in a manner such that water quality standards are achieved. An exceedance of the loading capacity occurs if the measured concentration of either constituent in a sample collected from the LSJR exceeds their respective 4-day average (chronic) maximums WQOs listed in Table 1. An exceedance of the loading capacity occurs if the measured concentration of either constituent in a sample collected from a tributary within one of the seven subareas exceeds the WQO. The chlorpyrifos and diazinon loading capacity or load allocation can also be exceeded if the combined concentrations of chlorpyrifos and diazinon cause the sum (Equation 1) to be greater than one, even if both concentrations are below the respective WQOs.

Table 1. WQOs for chlorpyrifos and diazinon.

Pesticide	Maximum Concentration and Average Period
Chlorpyrifos	0.025 µg/L ; 1-hour average (acute) 0.015 µg/L ; 4-day average (chronic) Not to be exceeded more than once in a three year period.
Diazinon	0.16 µg/L ; 1-hour average (acute) 0.10 µg/L ; 4-day average (chronic) Not to be exceeded more than once in a three year period.

Equation 1. Formula used to calculate chlorpyrifos and diazinon loading capacity in LSJR and load allocation for waterways entering the River.

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

S = Sum loading capacity. A sum exceeding one indicates that the beneficial use might be impacted.
CD = diazinon concentration in µg/L WQOD = diazinon water quality objective; 0.1 µg/L
CC = chlorpyrifos concentration in µg/L WQOC = chlorpyrifos water quality objective; 0.015 µg/L

To assess compliance with Objective 1 (loading capacity), the ESJWQC and Westside Coalition conducted monitoring at six designated compliance sites on the LSJR during the 2015 WY. To assess compliance with Objectives 2 (load allocation) through 7, the Coalitions reviewed results from the LSJR monitoring and outreach conducted within their respective Coalition regions as a part of the ILRP. Table 2 is an overview of the ESJWQC and Westside Coalition actions and associated reporting documents utilized to assess each of the seven Monitoring Objectives. The Comparison with TMDL Objectives section of this report details each Coalition's strategy to assess compliance with each of the objectives and the outcomes of their strategies during the reporting period.

ESJWQC

1. Surface Water Quality Management Plan (SQMP)
2. ESJWQC Annual Report
3. ESJWQC Monitoring Plan Update (MPU)
4. ESJWQC Quarterly Data Submittals

Westside Coalition

1. Westside Coalition Monitoring and Reporting Program Order No R5-2008-0831 (MRP)
2. Westside Coalition Quality Assurance Project Plan (QAPP, approved January 7, 2014)
3. Westside Coalition Semi-Annual Monitoring Reports (SAMR) with management plan status updates
4. Westside Coalition Management Plan and Focused Watershed Plans

Table 2. Monitoring objectives and actions by the ESJWQC and Westside Coalition for the control of chlorpyrifos and diazinon runoff into the LSJR.

Objective Number	Coalition Actions	Location of Additional Information
1	-Monitor six compliance sites on the San Joaquin River. -Assess monitoring results to determine compliance with chlorpyrifos and diazinon WQO and loading capacity.	This report
2	-Conduct representative monitoring of the Coalition region according to Monitoring Strategy. -Assess monitoring results to determine compliance with chlorpyrifos and diazinon load allocations.	ESJWQC SQMP, MPU, Annual Report and Quarterly Submittals Westside Coalition MRP and MP
3-4	-Adhere to strategy outlined in the Management Plans. -Assess and review results of management plan strategy to determine the degree of implementation and the effectiveness of management practices implemented to reduce off-site movement of chlorpyrifos and diazinon.	ESJWQC SQMP, MPU, and Annual Report Westside Coalition MP and SAMRs
5	-Conduct representative monitoring of Coalition region according to Monitoring Strategy. -Assess monitoring results to determine whether alternatives to diazinon and	ESJWQC SQMP, MPU, Annual Report and Quarterly Submittals

Objective Number	Coalition Actions	Location of Additional Information
	chlorpyrifos are causing surface water impairments.	Westside Coalition MRP and SAMRs
6	-Conduct representative monitoring of Coalition region according to Monitoring Strategy. -Assess monitoring results to assess toxicity and determine if agricultural discharge contributes to toxicity impairment due to additive or synergistic effects of multiple pollutants.	ESJWQC SQMP, MPU, Annual Report and Quarterly Submittals Westside Coalition MRP and SAMRs
7	-Assess the information collected to meet Objectives 3 and 4 to determine if management practices are achieving the lowest pesticides levels technically and economically achievable according to Management Plans.	ESJWQC SQMP, MPU, and Annual Report Westside Coalition MP and SAMRs

MONITORING DESIGN

Monitoring is designed to characterize the concentrations of chlorpyrifos and diazinon in the LSJR. In the March 27, 2012 letter, the Regional Board determined that monitoring for the chlorpyrifos and diazinon TMDL at the six LSJR compliance points should focus on periods of peak applications of pesticides containing chlorpyrifos and diazinon, and during months when the two constituents have been detected above the WQTL in the LSJR or its tributaries.

Monitoring Frequency and Timing

The Coalitions evaluated chlorpyrifos and diazinon use over time using Pesticide Use Report (PUR) data from the California Pesticide Information Portal (CalPIP). Currently, CalPIP data are available through 2013. The Coalitions obtained PUR data through September 2015 directly from the counties in the two Coalition regions. The PUR data are considered preliminary until uploaded in CalPIP. The peak period of diazinon use has changed over time (Figure 1). Before 2008 the peak period of diazinon use was between December and February. Since 2008, January applications of diazinon have decreased substantially, and applications between March and June are more common. The amount of chlorpyrifos use has drastically decreased since 2004 (Figure 2). However, timing of use has remained relatively consistent over time.

Figure 1. Pounds of diazinon applied in the LSJR from 2004 through September 2015.
All PUR data after 2013 are considered preliminary; PUR data are incomplete through 2015.

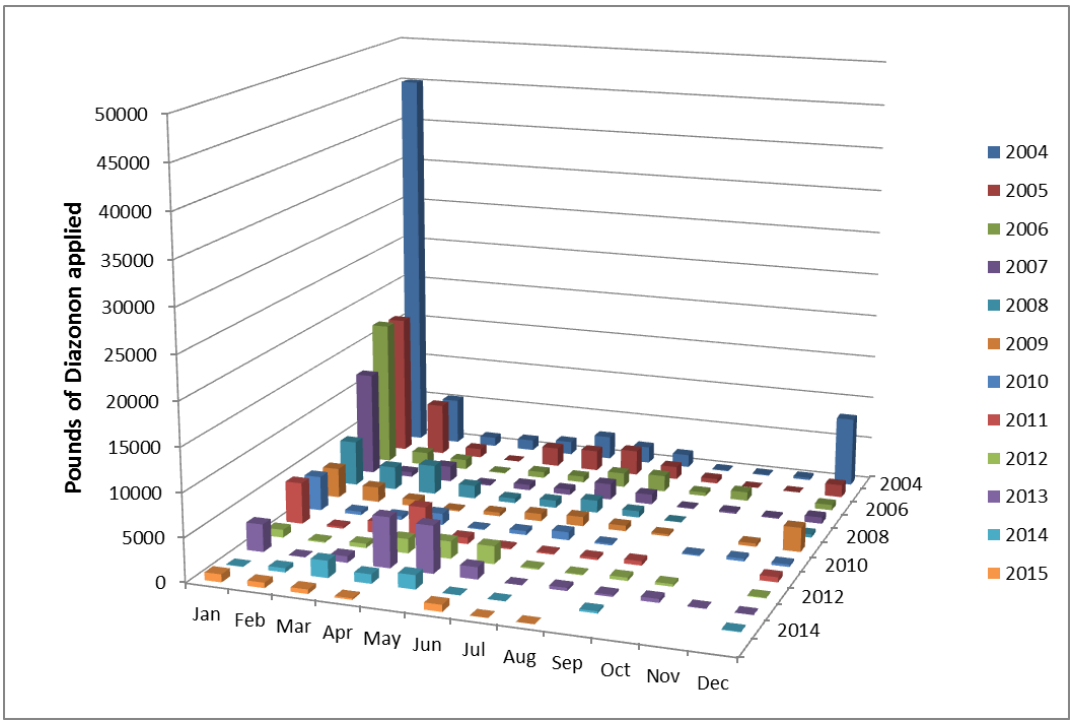
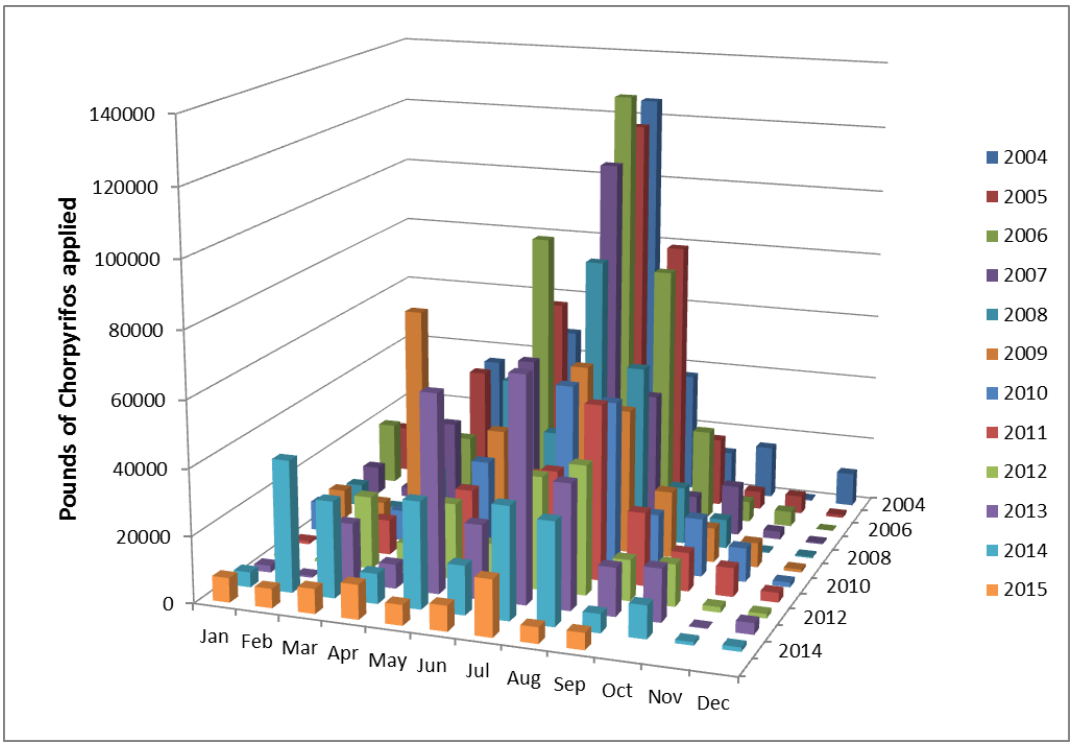


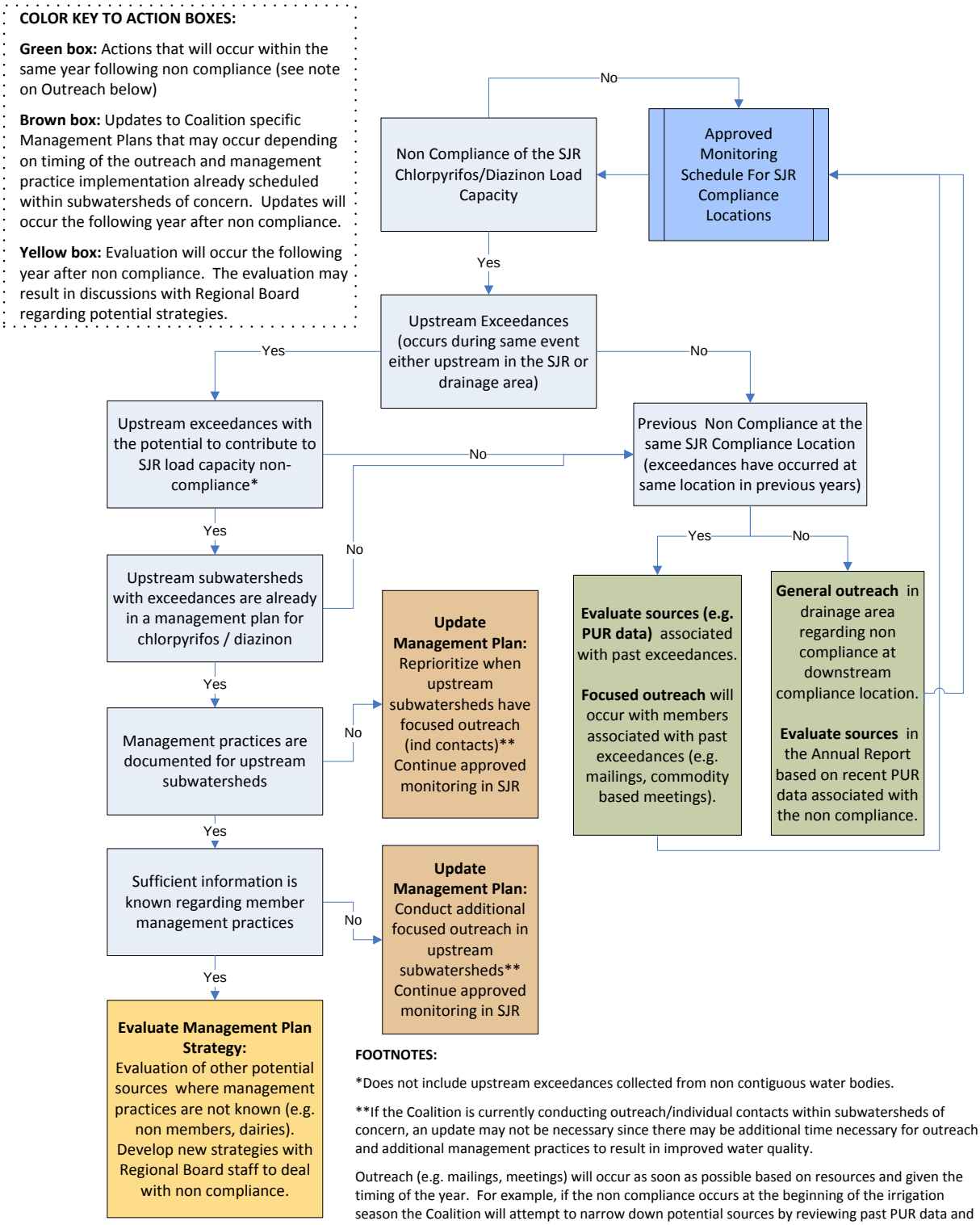
Figure 2. Pounds of chlorpyrifos applied in the LSJR watershed from 2004 through October 2015.
All PUR data after 2013 are considered preliminary; PUR data are incomplete through 2015.



The monitoring design for the 2015 WY was similar to the monitoring design utilized during the 2014 WY. During the 2015 WY, the ESJWQC monitored three of the six compliance points (San Joaquin River at Hills Ferry Road, San Joaquin River at the Maze Boulevard (Highway 132) Bridge, and San Joaquin River at the Airport Way Bridge near Vernalis) once during February storm monitoring and from May through September. The Westside Coalition monitored the other three compliance points (San Joaquin River at Sack Dam, San Joaquin River at Highway 165 near Stevinson, and San Joaquin River at Las Palmas Avenue near Patterson) on a monthly basis. The Coalitions typically schedule the TMDL compliance monitoring events with ESJWQC tributary monitoring and Westside Coalition tributary monitoring for the second Tuesday of the month; monitoring schedules are adjusted for storm events as necessary.

The Coalitions report chlorpyrifos and diazinon TMDL monitoring results from the previous WY on May 1 annually. This report includes a complete analysis and discussion of all monitoring data collected from October 2014 through September 2015. If a non-compliant load is detected in the LSJR, the Coalitions utilize the decision tree in Figure 3 to guide the Coalition's actions to address water quality impairments in a timely and efficient manner.

Figure 3. Chlorpyrifos and diazinon San Joaquin River TMDL decision tree for compliance monitoring and actions resulting from non-compliance of the San Joaquin River load capacity.



FOOTNOTES:

*Does not include upstream exceedances collected from non contiguous water bodies.

**If the Coalition is currently conducting outreach/individual contacts within subwatersheds of concern, an update may not be necessary since there may be additional time necessary for outreach and additional management practices to result in improved water quality.

Outreach (e.g. mailings, meetings) will occur as soon as possible based on resources and given the timing of the year. For example, if the non compliance occurs at the beginning of the irrigation season the Coalition will attempt to narrow down potential sources by reviewing past PUR data and inform those growers of the non compliance with the goal of improving SJR water quality during the rest of the high use period.

Constituents Monitored

Water samples collected from the six LSJR TMDL compliance monitoring sites were analyzed for chlorpyrifos and diazinon. Habitat information and field parameter measurements, including dissolved oxygen (DO), pH, specific conductivity (SC), and water temperature, were collected at each site during each monitoring event. Discharge calculations were obtained from the Department of Water Resources (DWR) and/or United Stated Geological Survey (USGS) data posted to the California Data Exchange Center (CDEC) website. Samples collected by the Westside Coalition during monthly monitoring of the LSJR compliance points were also analyzed for additional constituents for compliance with the Coalition's WDR (Waste Discharge Requirements General Order for Growers within the San Joaquin River Watershed that are Members of the Third-Party Group; Order R5-2012-0116-R2) as described in the Westside Coalition's MRP. Results from ILRP monitoring (of both additional constituents analyzed in the LSJR and tributary monitoring) are reported in the Westside Coalition's SAMRs (submitted on June 15 and November 30 annually) and the ESJWQC's Annual Report (submitted May 1 annually). The sampling procedures and analytical methods are further discussed in the Sampling and Analytical Methods section of this report.

SAMPLE SITE DESCRIPTIONS

The Basin Plan Amendment requires the Coalitions to assess compliance with WQOs and loading capacity for, at a minimum, six designated water quality compliance points on the LSJR (Table 4). The compliance points (listed from upstream to downstream) are:

- San Joaquin River at Sack Dam,
- San Joaquin River at Highway 165 near Stevinson (USGS 11260815),
- San Joaquin River at Hills Ferry Road,
- San Joaquin River at Las Palmas Avenue near Patterson (USGS 11274570),
- San Joaquin River at the Maze Boulevard (Highway 132) Bridge (USGS 11290500), and
- San Joaquin River at the Airport Way Bridge near Vernalis (USGS 11303500).

These compliance points are not named consistently in all sources used to prepare this report; hence Table 3 provides a crosswalk of the sites as they are named in other data sources.

Additionally, the Basin Plan Amendment specifies that compliance with load allocations for nonpoint source discharges into the LSJR must be determined for the following five groups of minor subareas (listed from upstream to downstream):

- Bear Creek and Fresno-Chowchilla subareas
- Stevinson and Grassland subareas,
- Turlock, Merced, and Greater Orestimba subareas,
- Tuolumne River, Northeast Bank, and Westside Creek subareas, and
- Stanislaus River, North Stanislaus, and Vernalis North subareas.

Monitoring at five of the six compliance points on the LSJR assess drainage from these subareas (Table 3). Although none of the tributary subareas drain into San Joaquin River at Sack Dam, there is the potential for indirect drainage and spray drift to occur in a small area next to the river upstream of the San Joaquin River at Sack Dam monitoring location (Figure 4). During the 2015 WY, the Coalitions collected samples from 34 tributary monitoring locations (18 in ESJWQC and 16 in Westside Coalition). The LSJR compliance sites and the associated tributaries that drain to each compliance point are listed in Table 4.

Monitoring results from ESJWQC and Westside Coalition tributary monitoring during the 2015 WY are discussed in this report as they pertain to LSJR monitoring. Details of ESJWQC 2015 WY tributary monitoring locations can be found in the ESJWQC Annual Report submitted May 1, 2016. Westside Coalition tributary monitoring locations from October 2014 through August 2015 were reported in the Westside Coalition SAMRs submitted June 15 and November 30, 2015. The Westside Coalition tributary monitoring locations and results from September 2015 will be reported in the Westside Coalition SAMR to be submitted June 15, 2016.

Table 3. San Joaquin River chlorpyrifos and diazinon designated Basin Plan Amendment compliance sites, subareas , and site name crosswalk for referencing appendices and electronic files.

Sites listed in order from upstream to downstream.

Site Name	Subareas	USGS ID No.	Appendices Site Name	Appendices Code	CEDEN Site Name	CEDEN Code	Latitude	Longitude	Coalition
San Joaquin River at Sack Dam	NA	NA	SJR @ Sack Dam	SJRSD	SJR @ Sack Dam	541MAD007	36.98361	-120.50028	Westside
San Joaquin River at Highway 165 near Stevinson	Bear Creek, Fresno-Chowchilla	11260815	SJR @ Hwy 165	SJRLA	San Joaquin River at Lander Ave	541MER522	37.29528	-120.85028	Westside
San Joaquin River at Hills Ferry Road	Stevinson, Grassland	NA	SJR @ Hills Ferry	541STC512	SJR @ Hills Ferry	541STC512	37.34250	-120.97722	ESJWQC
San Joaquin River at Las Palmas Avenue near Patterson	Turlock, Merced, Greater Orestimba	11274570	SJR @ Las Palmas Ave	SJRPP	SJR @ Patterson	541STC507	37.49778	-121.08167	ESJWQC
					San Joaquin River at PID Pumps	541XSJRPP	37.49720	-121.08280	Westside
San Joaquin River at the Maze Boulevard (Highway 132) Bridge	Tuolumne River, Northeast Bank, Westside Creek	11290500	SJR @ Maze Blvd	541STC510	San Joaquin River above Maze Boulevard	541STC510	37.64194	-121.22778	ESJWQC
San Joaquin River at the Airport Way Bridge near Vernalis	Stanislaus River, North Stanislaus, Vernalis North	11303500	SJR @ Airport Way	541SJC501	San Joaquin River at Airport Way near Vernalis	541SJC501	37.67556	-121.26417	ESJWQC

NA – Not Applicable. This station is not identified as having drainage from subareas as listed in the Basin Plan amendment. However, this report identifies some drainage possible along the river in the Fresno-Chowchilla and Grassland subareas (see Figure 4).

CEDEN – California Environmental Data Exchange Network

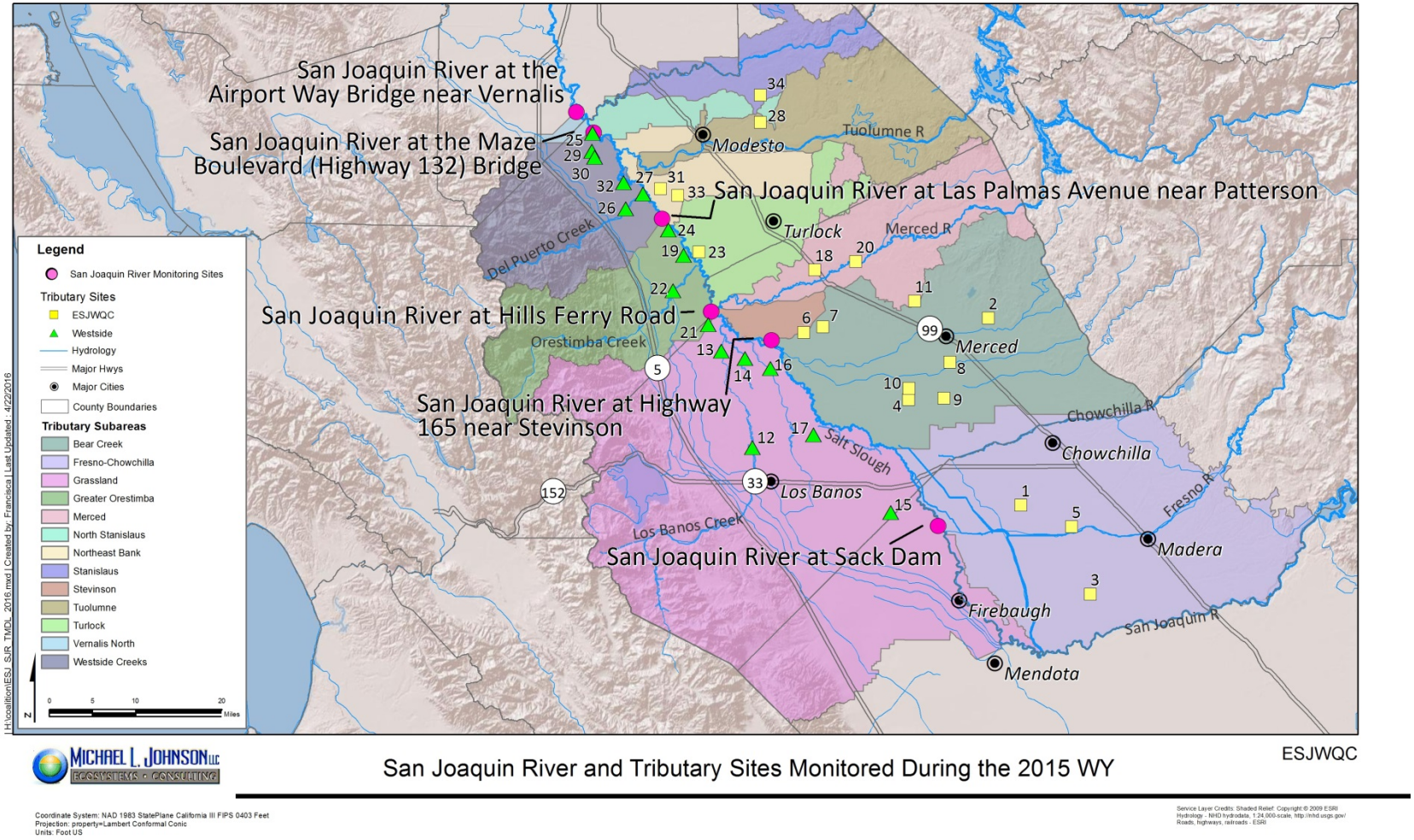
Table 4. The ESJWQC and Westside Coalition upstream tributary monitoring during 2015 WY.

Coalition	Map Key*	Site Name	Station Code	Latitude	Longitude	LSJR Downstream Monitoring Location
ESJWQC	1	Berenda Slough along Ave 18 1/2	545XBSAAE	37.01820	-120.32650	San Joaquin River at Highway 165 near Stevinson
ESJWQC	2	Black Rascal Creek @ Yosemite Rd	535BRCAYR	37.33202	-120.39435	
ESJWQC	3	Cottonwood Creek @ Rd 20	545XCCART	36.86860	-120.18180	
ESJWQC	4	Deadman Creek @ Gurr Rd	535XDCAGR	37.19514	-120.56147	
ESJWQC	5	Dry Creek @ Rd 18	545XDCARE	36.98180	-120.22056	
ESJWQC	6	Howard Lateral @ Hwy 140	535XHLAHO	37.30790	-120.78200	
ESJWQC	7	Livingston Drain @ Robin Ave	535XLDARA	37.31693	-120.74229	
ESJWQC	8	Miles Creek @ Reilly Rd	535XMCARR	37.25830	-120.47524	
ESJWQC	9	Deadman Creek @ Hwy 59	535DMCAHF	37.19755	-120.48763	
ESJWQC	10	Duck Slough @ Gurr Rd	535XDSAGR	37.21408	-120.56126	
ESJWQC	11	Canal Creek @ West Bellevue Rd	535CCAWBR	37.36090	-120.54940	San Joaquin River at Hills Ferry

Coalition	Map Key*	Site Name	Station Code	Latitude	Longitude	LSJR Downstream Monitoring Location
Westside	12	Los Banos Creek at China Camp Road	541XLBCCC	37.1145	-120.8895	Road
Westside	13	Los Banos Creek at Hwy 140	541MER554	37.2762	-120.9555	
Westside	14	Mud Slough Upstream of San Luis Drain	541XMSUSL	37.2639	-120.90611	
Westside	15	Poso Slough at Indiana Ave	541XPSAIA	37.0062	-120.5996	
Westside	16	Salt Slough at Lander Ave	541MER531	37.2479	-120.8522	
Westside	17	Salt Slough at Sand Dam	541XSSASD	37.1366	-120.7619	
ESJWQC	18	Highline Canal @ Hwy 99	535XHCHNN	37.41254	-120.75941	San Joaquin River at Las Palmas Avenue near Patterson
Westside	19	Marshall Road Drain near River Road	541XMRDRR	37.4363	-121.0362	
ESJWQC	20	Merced River @ Santa Fe	535XMRSFD	37.42705	-120.67353	
Westside	21	Newman Wasteway near Hills Ferry Road	541XNWHFR	37.3204	-120.9834	
Westside	22	Orestimba Creek at Hwy 33	541STC519	37.3772	-121.05812	
ESJWQC	23	Prairie Flower Drain @ Crows Landing Rd	535XPFDCL	37.44187	-121.00331	
Westside	24	Ramona Lake near Fig Avenue	541XROLFA	37.4788	-121.0684	
Westside	25	Blewett Drain at Highway 132	541XVH132	37.6405	-121.2296	San Joaquin River at the Maze Boulevard (Highway 132) Bridge
Westside	26	Del Puerto Creek at Hwy 33	541XDPCHW	37.5142	-121.15875	
Westside	27	Del Puerto Creek near Cox Road	541XDPCCR	37.5394	-121.1221	
ESJWQC	28	Dry Creek @ Wellsford Rd	535XDCAWR	37.66000	-120.87526	
Westside	29	Hospital Creek at River Road	541XHCARR	37.6105	-121.23078	
Westside	30	Ingram Creek at River Road	541STC040	37.6002	-121.22506	
ESJWQC	31	Lateral 2 1/2 near Keyes Rd	535LTHNKR	37.54766	-121.08509	
Westside	32	Westley Wasteway near Cox Road	541XWWNCR	37.5582	-121.1637	
ESJWQC	33	Westport Drain @ Vivian Rd	535XWDAVR	37.53682	-121.04861	
ESJWQC	34	Mootz Drain downstream of Langworth Pond	535XMDDLP	37.70539	-120.87526	San Joaquin River at the Airport Way Bridge near Vernalis

ESJWQC – East San Joaquin Water Quality Coalition
*Map Key – reference Figure 4.

Figure 4. San Joaquin River tributary major and minor subareas, chlorpyrifos and diazinon TMDL compliance sites (circles), and tributary sites monitored by ESJWQC (squares) and Westside Coalition (triangles) during the 2015 WY.
Refer to Table 4 for tributary site names.



LAND USE ANALYSIS OF SUBAREAS

The Coalitions reviewed land use acreage based on the United States Department of Agriculture (USDA) cropland data from 2015 to better characterize the upstream drainage area for each of the LSJR monitoring compliance points (Table 5 and Table 6). The entire drainage area is estimated to include a little less than three million acres. Agricultural land use in the LSJR basin includes orchards, pasture, rice, row crops, vineyards, and nursery/berries (Table 5).

Table 6 identifies the crop types with the largest acreage within the immediate upstream drainage to each monitoring site on the LSJR. Almonds, alfalfa, corn, and walnuts are among the top four commodities by acreage throughout the region based on 2015 USDA land use data. In the upstream portions of the LSJR, grapes represent the largest amount of acreage, whereas various row crops and orchards are more common downstream (Table 6). Corn, cotton, oats, tomatoes, and winter wheat are also all very common in the LSJR drainage area.

Land use maps for all ESJWQC upstream tributaries can be found in the 2016 Annual Report (Appendix VII). A discussion of land use in the Westside Coalition region is located in the November 30, 2015 SAMR (Page 13).

Table 5. Estimated land use acreage upstream of the San Joaquin River compliance points.
Stations are listed in order of upstream to downstream from left to right. Subwatershed totals reflect only the immediate upstream acreage within the subareas that drain to each LSJR site (Figure 4).

Land Use	San Joaquin River at Sack Dam	San Joaquin River at Highway 165 near Stevinson	San Joaquin River at Hills Ferry Road	San Joaquin River at Las Palmas Avenue near Patterson	San Joaquin River at the Maze Blvd. (Highway 132) Bridge	San Joaquin River at the Airport Way Bridge
Native	12,400	312,300	494,300	195,500	227,600	35,200
Orchard	24,700	205,300	26,000	94,500	87,300	33,900
Field Crops	3,300	79,800	161,500	76,300	30,000	12,000
Pasture	4,600	89,400	80,400	43,500	30,400	28,300
Developed	3,000	61,800	15,800	22,600	35,800	27,600
Vineyard	10,800	77,400	2,600	12,500	6,200	2,200
Truck/Nursery/Berry	700	28,800	59,500	12,600	12,400	3,900
Grain & Hay	3,000	56,700	13,200	4,200	5,300	1,800
Open Water	4,300	8,800	22,100	2,400	9,700	3,000
Semi-agricultural	800	15,700	5,500	12,800	7,300	4,900
Fallow/Idle Cropland	300	7,300	3,500	1,800	2,700	800
Rice	200	4,000	7,800	0	1,200	600
Estimated Subwatershed Total Acres	**68,100**	**947,300**	**892,200**	**478,700**	**455,900**	**154,200**
Estimated Cumulative Total Acres	**2,104,200**	**1,101,500**	**2,996,400**	**1,580,200**	**2,036,100**	**154,200**

Source: Acreage estimated from 2015 USDA data.

Table 6. Top ten commodities (in order of largest to smallest acreage) upstream of each San Joaquin River sampling site for 2015 WY.

Stations are listed in order of upstream to downstream from left to right. Commodities are listed in order of largest (first row) to smallest acreage (last row) per each site. Drainage reflects the immediate upstream acreage within the subareas that drains to each LSJR site (Figure 4).

San Joaquin River at Sack Dam	San Joaquin River at Highway 165 near Stevinson	San Joaquin River at Hills Ferry Road	San Joaquin River at Las Palmas Avenue near Patterson	San Joaquin River at the Maze Boulevard (Highway 132) Bridge	San Joaquin River at the Airport Way Bridge near Vernalis
Almonds	Almonds	Cotton	Almonds	Almonds	Almonds
Alfalfa	Alfalfa	Alfalfa	Corn	Corn	Corn
Misc. Deciduous	Corn	Tomatoes (Processing)	Alfalfa	Walnuts	Walnuts
Trees & Shrubs	Pistachios	Corn	Beans	Alfalfa	Alfalfa
Pistachios	Cotton	Melons, Squash and Cucumbers	Dairies	Tomatoes (Processing)	Peaches and Nectarines
Cotton	Tomatoes (Processing)	Almonds	Walnuts	Peaches and Nectarines	Dairies
Walnuts	Figs	Sugar Beets	Tomatoes (Processing)	Beans	Melons, Squash and Cucumbers
Tomatoes (Processing)	Oranges	Beans	Peaches and Nectarines	Apricots	Beans
Oranges	Dairies	Sudan	Sweet Potatoes	Dairies	Flowers, Nursery, Christmas Tree Farms
Corn	Sweet Potatoes	Walnuts	Poultry Farms	Sudan	Tomatoes (Processing)

Source: Acreage estimated from 2015 USDA data.

RAINFALL RECORDS

Daily rainfall records are provided for cities located in the ESJWQC and Westside Coalition regions: Modesto, Los Banos, Merced, and Patterson. Precipitation records were retrieved from the California Irrigation Management Information System (CIMIS). The 2015 WY included few significant storms and was therefore classified as a critically dry year. The first rainfall event with measurable precipitation did not occur until October 31, 2014, with a few periodic storms throughout the winter months interrupted by long, dry periods (Figure 5 and Figure 6).

From October 2014 through September 2015, two rainfall events produced enough runoff across the LSJR drainage area for storm sample collection. The ESJWQC collected storm samples at tributary sites on December 3, 2014 and February 10, 2015; and at the three LSJR compliance locations on February 10, 2015. Storm samples were collected in the Westside Coalition region at both tributary and TMDL compliance locations on December 4, 2014 and February 10, 2015.

Figure 5. Precipitation history from October 1, 2014 through December 31, 2014.
Rainfall data from CIMIS stations located in Modesto, Merced, Los Banos, and Patterson, CA.

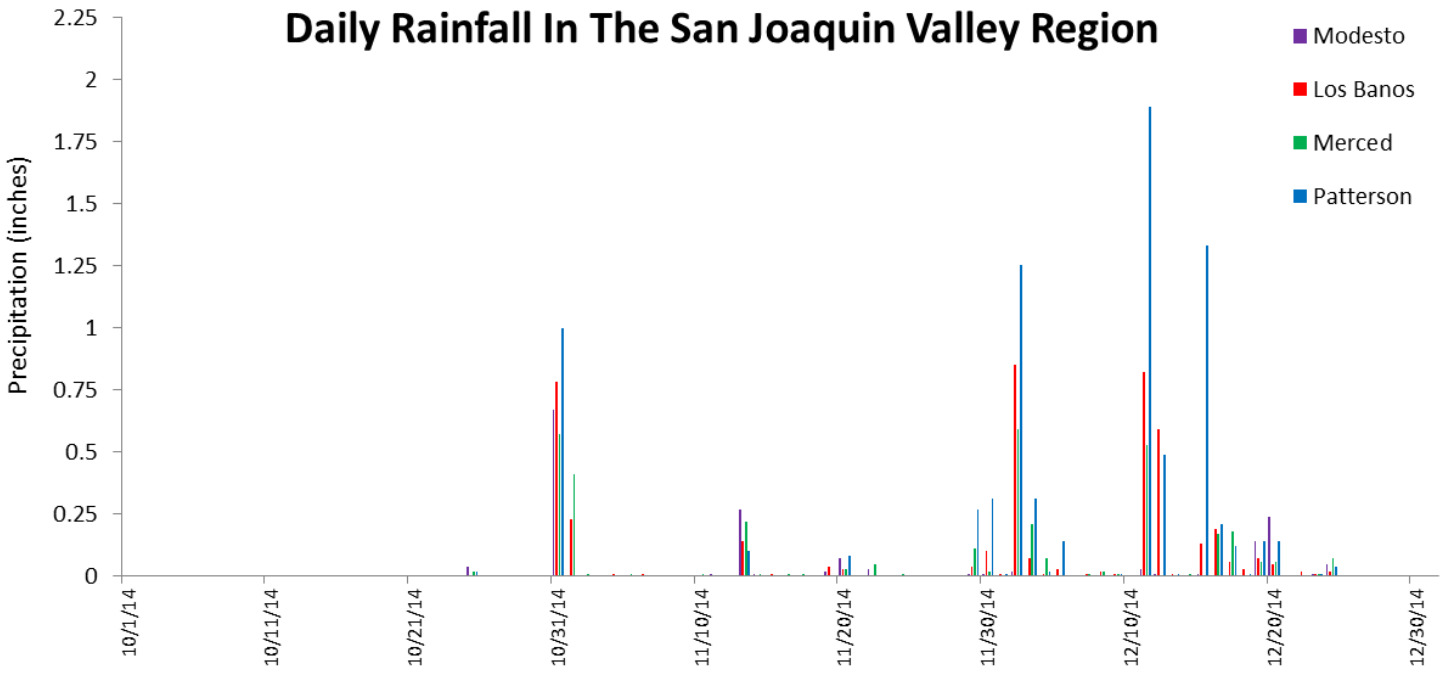
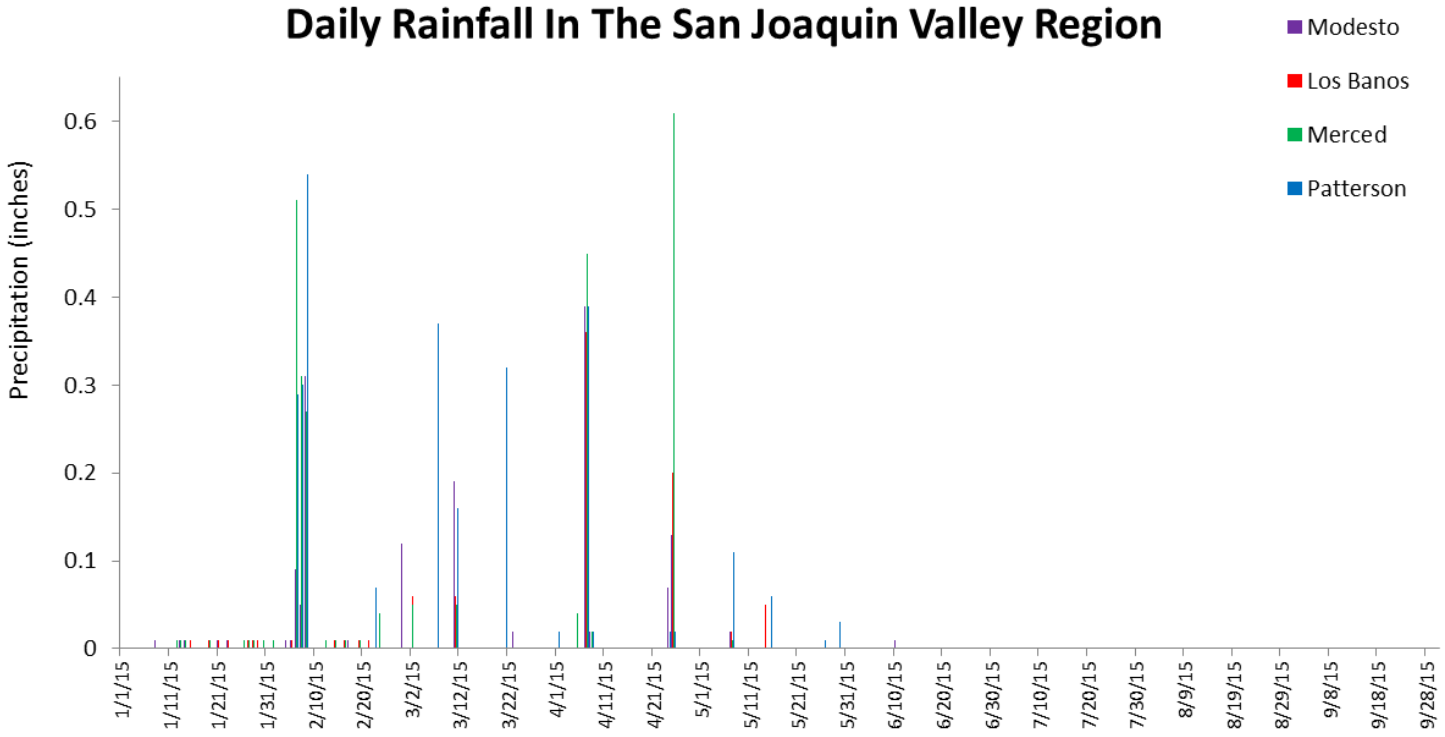


Figure 6. Precipitation history from January 1, 2015 through September 30, 2015.
Rainfall data from CIMIS stations located in Modesto, Merced, Los Banos, and Patterson, CA.



SAMPLING AND ANALYTICAL METHODS

Information on sample collection containers, volumes, preservations and holding times is provided in Table 7; field instrument information is included in Table 8. The methods used for collecting discharge measurements are described for each site in Table 9; analytical methods and reporting limits (RL) are provided in Table 10. The complete ESJWQC and Westside Coalition field sampling SOPs were included in Appendix I of the 2010 San Joaquin River Chlorpyrifos and Diazinon TMDL AMR (submitted October 31, 2010); no deviations from these procedures occurred during 2015 WY monitoring.

The ESJWQC sampled the San Joaquin River at the Airport Way Bridge near Vernalis, San Joaquin River at Hills Ferry Road, and San Joaquin River at the Maze Boulevard (Highway 132) Bridge according to field sampling procedures outlined in the standard operating procedures (SOPs) provided in the ESJWQC QAPP (approval on February 23, 2011, Appendices I-X, Pages 67-73). Integrated river water samples were collected using a three liter polytetrafluoroethylene (PFTE) bottle from a bridge crossing. Amber glass bottles were filled from the integrated sample collected in the PFTE bottle.

The Westside Coalition sampled the San Joaquin River at Highway 165 near Stevinson, San Joaquin River at Las Palmas Avenue near Patterson, and San Joaquin River at Sack Dam according to the field sampling procedures and methods described in the Westside Coalition QAPP (approved January 7, 2014, Pages 24-29). The Westside Coalition field samplers collected sample water directly into amber glass bottles from the LSJR bank at each site. Due to safety concerns, Westside Coalition samplers avoid sampling from bridges whenever possible.

Samples from both Coalitions were analyzed for chlorpyrifos and diazinon by APPL Inc. according to the Environmental Protection Agency (EPA) 8141A method. The SOPs for the EPA 8141A method were submitted with both Coalitions' QAPPs; as Appendix XII to the ESJWQC's QAPP (Pages 143-159) and as Appendix D, Attachment 7, to the Westside Coalition's QAPP.

In addition to LSJR monitoring data, both Coalitions use tributary monitoring data as applicable to assess compliance with the TMDL program. The ESJWQC performed field sampling procedures and methods, including discharge measurements at tributary sites as outlined in the SOPs outlined in the ESJWQC QAPP (Appendices I-X, Pages 67-73). The laboratory procedures used to analyze samples collected from ESJWQC tributary sites are contained in Appendices XI-XXXIII of the ESJWQC QAPP (Pages 108-394). Any deviations from these procedures are documented in the Precision, Accuracy, and Completeness section of this report.

The Westside Coalition conducted field sampling procedures and methods, including discharge measurements, at tributary sites as described in the Westside Coalition QAPP (Appendix B); no deviations from these procedures occurred during the monitoring. The laboratory procedures used to analyze samples collected from Westside Coalition tributary sites can be found in the Westside Coalition QAPP (Appendix D, Attachment 7).

Table 7. Sampling procedures.

Analytical Parameter	Sample Volume[1]	Sample Container	Initial Preservation/Holding Requirements	Holding Time[2]
Organophosphates	1 L	1x L Amber Glass	Store at <6°C; extract within 7 days	40 Days

[1] Additional volume is collected at designated quality control (QC) sites.
[2] Holding time after initial preservation or extraction.

Table 8. Field parameters and instruments used to collect measurements.

Parameter	Instrument
Dissolved Oxygen	YSI Model 556 and Professional Plus
Temperature	YSI Model 556 and Professional Plus
pH	YSI Model 556 and Professional Plus
Specific Conductance	YSI Model 556 and Professional Plus
Discharge	DWR or USGS Gauge/CDEC Website

DWR – California Department of Water Resource
USGS – United States Geological Survey
CDEC – California Data Exchange Center

Table 9. Site specific discharge methods.

Responsible Coalition	Site Name	Discharge Method	Gauge
Westside	San Joaquin River at Sack Dam	DWR Gauge	CDEC San Joaquin River near Dos Palos (SDP)
Westside	San Joaquin River at Highway 165 near Stevinson	DWR Gauge	CDEC San Joaquin River near Stevinson (SJS)
ESJWQC	San Joaquin River at Hills Ferry Road	USGS and DWR Gauge	CDEC San Joaquin River Near Newman (NEW)
Westside	San Joaquin River at Las Palmas Avenue near Patterson	DWR Gauge	CDEC San Joaquin River near Patterson (SJP)
ESJWQC	San Joaquin River at the Maze Boulevard (Highway 132) Bridge	DWR Gauge	CDEC San Joaquin River at Maze Rd Bridge (MRB)
ESJWQC	San Joaquin River at the Airport Way Bridge near Vernalis	USGS and DWR Gauge	CDEC San Joaquin River near Vernalis (VNS)

DWR – Department of Water Resources
USGS – United States Geological Survey

Table 10. Field and laboratory analytical methods.

Constituent	Matrix	Analyzing Lab	RL	MDL	Analytical Method
Physical Parameters					
pH	Water	Field Measure	0.1 pH units	NA	SM 4500-H
Specific Conductance	Water	Field Measure	100 µmhos/cm	NA	EPA 120.1
Dissolved Oxygen	Water	Field Measure	0.1 mg/L	NA	SM 4500-O
Temperature	Water	Field Measure	0.1 °C	NA	SM 2550
Organophosphates					
Chlorpyrifos	Water	APPL Inc.	0.015 µg/L	0.0026 µg/L	EPA 8141A
Diazinon	Water	APPL Inc.	0.02 µg/L	0.004 µg/L	EPA 8141A

EPA - Environmental Protection Agency
MDL – Minimum Detection Limit
NA – Not Applicable
RL – Reporting Limit
SM – Standard Method

MONITORING RESULTS

Monitoring data collected from October 2014 through September 2015 are included in Appendices I-III, in addition to the supplementary data submitted on cd with this report.

Appendices I and II contain complete monitoring results from sampling conducted at the compliance points on the LSJR. Appendix I contains the monitoring results for field parameters (DO, SC, pH, temperature, and discharge) and laboratory analyses for chlorpyrifos and diazinon. Monitoring results are evaluated in the Comparison with TMDL Objectives, Objective 1 section of this report. Appendix II contains field and laboratory Quality Assurance/Quality Control (QA/QC) data, including results from field duplicate (FD) and blank (FB), laboratory duplicate and blank, laboratory control spike (LCS), and matrix spike (MS). All QA data are discussed in the Precision, Accuracy, and Completeness section.

Appendix III contains all loading capacity and load allocation calculations for samples collected during the reporting period. Loading capacities and compliance status for samples collected from the LSJR are reported in Appendix III, Table III-1. Load allocations and compliance status for samples collected from each of the five tributary subareas are reported in Tables III-2 through 8. Loading capacities and load allocations are both discussed in the Comparison with TMDL Objectives section of this report (Objective 1 and Objective 2; respectively).

Supplementary data located on the CD submitted with this report contains all original field sheets, site photos, Chain of Custody (COC) forms, and laboratory reports (as pdfs and electronic files).

SAMPLE DETAILS

Table 11 includes sample dates for each LSJR sample location, and tributaries in both Coalition areas. All sampling times for these sites and events are located in Appendix II. During the 2015 WY, the ESJWQC collected storm samples at tributary sites on December 3, 2014. The Westside Coalition collected storm samples at tributary sites on December 4, 2014. Both Coalitions conducted stormwater sampling at LSJR compliance locations in addition to tributary sites on February 10, 2015 (Table 11).

Table 11. Dates of monitoring at San Joaquin River and upstream tributary sites during the 2015 WY.
During the 2015 WY, Westside Coalition (WC) and the ESJWQC (ES) monitoring occurred during storm (Storm), irrigation (Irr), and non-irrigation events (NI).

Sampling Date	San Joaquin River above Maze Boulevard	San Joaquin River at Airport Way near Vernalis	LSJR @ Hills Ferry	San Joaquin River at Highway 165 near Stevinson	San Joaquin River at Las Palmas Avenue near Patterson	San Joaquin River at Sack Dam	Westside Tributaries	ESJWQC Tributaries
10/14/2014				WC-NI	WC-NI	WC-NI	WC-NI	ES-NI
11/11/2014				WC-NI	WC-NI	WC-NI	WC-NI	
11/12/2014								ES-NI
12/3/2014								ES-Storm
12/4/2014				WC-Storm	WC-Storm	WC-Storm	WC-Storm	
1/13/2015				WC-NI	WC-NI	WC-NI	WC-NI	ES-NI
2/10/2015	ES-Storm	ES-Storm	ES-Storm	WC-Storm	WC-Storm	WC-Storm	WC-Storm	ES-Storm

Sampling Date	San Joaquin River above Maze Boulevard	San Joaquin River at Airport Way near Vernalis	LSJR @ Hills Ferry	San Joaquin River at Highway 165 near Stevinson	San Joaquin River at Las Palmas Avenue near Patterson	San Joaquin River at Sack Dam	Westside Tributaries	ESJWQC Tributaries
3/10/2015				WC-NI	WC-NI	WC-NI	WC-NI	ES-NI
4/14/2015				WC-Irr	WC-Irr	WC-Irr	WC-Irr	ES-Irr
5/12/2015	ES-Irr	ES-Irr	ES-Irr	WC-Irr	WC-Irr	WC-Irr	WC-Irr	ES-Irr
6/9/2015	ES-Irr	ES-Irr	ES-Irr	WC-Irr	WC-Irr	WC-Irr	WC-Irr	ES-Irr
7/14/2015	ES-Irr	ES-Irr	ES-Irr	WC-Irr	WC-Irr	WC-Irr	WC-Irr	ES-Irr
8/11/2015	ES-Irr	ES-Irr	ES-Irr	WC-Irr	WC-Irr	WC-Irr	WC-Irr	ES-Irr
9/8/2015	ES-Irr	ES-Irr	ES-Irr					ES-Irr
9/15/2015				WC-Irr	WC-Irr	WC-Irr	WC-Irr	

PRECISION, ACCURACY AND COMPLETENESS

The sections below include an assessment of completeness, precision, and accuracy for the data generated for the six TMDL LSJR compliance sites (ESJWQC and Westside) during the 2015 WY. Completeness is determined based on whether samples were collected according to the schedule, received and analyzed by the laboratory, and the required QC was performed. Table 12 through Table 13 include counts and percentages for completeness per method and analyte for the 2015 WY.

Precision and accuracy are evaluated based on data quality objectives (DQOs) as outlined in the QAPP. Table 15 includes counts of each measure of precision and accuracy evaluated for the TMDL LSJR sites. Data generated for the Coalitions must meet Data Quality Objectives (DQOs) 90% of the time for QC samples within the reporting period. When data do not meet DQOs within the 90% completeness, data are reviewed for overall quality on batch and sample levels for usability. This section details the instances when DQOs did not achieve that 90% requirement and provides rationale for accepting the data.

All results that do not meet DQOs are flagged accordingly using California Environmental Data Exchange Network (CEDEN) codes. The Coalition works with the Central Valley Regional Data Center (CV RDC) to ensure that all data remain SWAMP comparable and that all data are suitable to be uploaded to CEDEN. Data generated for the 2015 WY can be accessed from Appendix I and II submitted with this report.

COMPLETENESS

Completeness is assessed on three levels: field and transport completeness, analytical completeness, and batch completeness. Field and transport completeness may be less than 100% due to bottle breakage during sample transport to the laboratory or inability to access a site. Analytical completeness is based on the number of samples successfully analyzed by the laboratory. Analytical completeness may be less than 100% due to bottles breaking while at the laboratory or if an analysis failed or was not performed due to laboratory error. Batches discussed in this section of the report refer to samples (both field and QC samples) that are analyzed together on the same instrument. Batches comprise of no more than 20 QC and field samples in a single analysis. Batch completeness assesses whether chemistry and toxicity batches were processed with the required QC samples as prescribed in the QAPP.

Field and Transport Completeness

Field and transport completeness is measured by counting the number of sampled sites divided by the number scheduled sites. The ESJWQC and Westside Coalition share sampling responsibilities and each Coalition was responsible for three sites per sampling event and collecting QC samples. Monitoring occurred 12 times at the three Westside compliance sites and six times at the three ESJWQC compliance sites. Both Coalitions coordinated sampling events to occur on the same day, with the exception of the September sampling event; sampling occurred on September 15, 2015 for the ESJWQC and September 15, 2015 for the Westide Coaliton. Sample collection is performed following the same sampling methods for both Coalitions.

Measurements for the field parameters, DO, pH, SC, and water temperature were taken at each site sampled. The six TMDL compliance sites are too large to measure discharge by sampling crew. Discharge is measured by utilizing California Data Exchange Center (CDEC) gauges near each sampling locations (Table 9). When field sampling is complete, the CDEC website is accessed to record the discharge measured by the gauge that occurred around the same time samples were collected. Field parameter and discharge completeness is 100% for the 2015 WY (Table 12).

Environmental, field duplicate, and field blank samples that were collected in the field, and received and analyzed by the laboratory. Field QC samples (field duplicates and field blanks) may be collected from tributaries or the LSJR as long as all samples are collected on the same day during the same sampling event. Field blanks and field duplicates must be collected for each monitoring event and make up 5% of the total samples collected. Field blank and field duplicate samples made up 20% of the total samples collected by the ESJWQC and Westside Coalition sites during the 2015 WY (Table 13). Therefore, field duplicates and field blank samples met the 5% requirement for completeness.

Table 12. The ESJWQC and Westside Coalition field and transport completeness for chlorpyrifos and diazinon samples and field parameters.

Method	Analyte	Environmental Samples Scheduled	Environmental Samples Collected	Field and Transport Completeness
EPA 8141A	Chlorpyrifos	54	54	100%
EPA 8141A	Diazinon	54	54	100%
CDEC at CRS	Discharge, cfs	54	54	100%
SM 4500-O	Dissolved Oxygen, mg/L	54	54	100%
EPA 150.1	pH	54	54	100%
EPA 120.1	Specific Conductivity, µg/cm	54	54	100%
SM 2550	Water Temperature, °C°	54	54	100%
	Total	**378**	**378**	**100%**

EPA – Environmental Protection Agency
CDEC - California Data Exchange Center
SM – Standard Method

Analytical Completeness

Analytical completeness is assessed by counting the number of samples collected divided by the number of sample analyzed. During the 2015 WY, 90 samples were collected for the analysis of chlorpyrifos and diazinon. All scheduled samples were collected and analytical completeness was 100% (Table 13).

Table 13. The ESJWQC and Westside Coalition analytical completeness for chlorpyrifos and diazinon samples.

Method	Analyte	Environmental and Field QC Samples Collected	Environmental and Field QC Samples Analyzed	Environmental Sample completeness (%)	Field Blanks Samples	Field Blank Samples (%)	Field Duplicate Samples	Field Duplicate Samples (%)
EPA 8141A	Chlorpyrifos	90	90	100.0	18	20.0	18	20.0
EPA 8141A	Diazinon	90	90	100.0	18	20.0	18	20.0
	Total	**180**	**180**	**100.0**	**36**	**20.0**	**36**	**20.0**

Batch Completeness

Batch completeness is measured to assess that all batch QC samples were analyzed in all TMDL batches. A complete batch must have a minimum of one laboratory blank (method blank), one laboratory duplicate, one LCS, and one MS. Tributary samples can be used to evaluate the accuracy and/or precision of a laboratory batch containing LSJR samples. When ESJWQC tributary sites are used to fulfill batch requirements for batches containing LSJR samples, they are logged in as non-project samples (NONPROJ). However, QC samples collected from Westside tributary sites are logged in as the same project. During the 2015 WY, 20 batches containing LSJR sites were run and all batch requirements were met.

Hold Time Compliance

Hold times are assigned to samples analyzed following certain methods to assure sample integrity and representativeness is captured at the time of collection. Hold times assigned to samples analyzed for chlorpyrifos and diazinon are summarized in Table 14. All samples were extracted and analyzed within hold time (Table 14).

Table 14. The ESJWQC and Westside Coalition summary of holding time evaluations for environmental, Field Blank, Field Duplicate, and Matrix Spike samples.

Method	Analyte	Data Quality Objective	Number of Samples Analyzed	Samples analyzed within hold time	Acceptability Met (%)
EPA 8141A	Chlorpyrifos	Extract within 7 days, analyze in 40 days	129	129	100.0
EPA 8141A	Diazinon	Extract within 7 days, analyze in 40 days	126	126	100.0
		Total	**255**	**255**	**100.0**

SUMMARY OF PRECISION AND ACCURACY

Data quality objectives (DQOs) are established criteria that QC samples must meet to demonstrate precision and accuracy as well as rule out sources of contamination in procedures conducted in the fields and in the laboratory. Accuracy is demonstrated by evaluating the percent recovery (PR) of chlorpyrifos and diazinon in Matrix Spikes (MS), Laboratory Control Spikes (LCS), and surrogate samples. Laboratory precision is demonstrated by evaluating the relative percent difference (RPD) between MS and MSD and LCS and LCSD samples. In turn, field precision is demonstrated by evaluating the RPD between duplicated environmental samples. Contamination is assessed by analyzing field blank and laboratory blank samples.

For some chemical constituents, the concentration in the environmental sample may exceed the highest point on the calibration curve and could only be accurately quantified by diluting the sample. The result reported is the concentration of the diluted sample multiplied by the dilution factor to represent the amount of the analyte present in the original sample. Diluted samples are flagged accordingly in the database. The reporting limit (RL) associated with a diluted sample is multiplied by the dilution factor, thereby, increasing the reporting limit. Therefore, for each dilution that occurs, there is a corresponding increase in the limit of quantification.

Reporting limits are set according to the QAPP guidelines to assure that instruments can reliably detect analytes in samples. Laboratories report all detections, even when analytes are detected below the RL. All such results are "J flagged" in the final laboratory reports and assigned "DNQ" for the result qualifier in the database. Results are considered estimates when they are reported below the RL because they are associated with more variability.

The acceptable DQOs for all QC samples analyzed with chlorpyrifos and diazinon are listed in Table 15. All QC samples analyzed for chlorpyrifos met acceptability 100% of the time. Diazinon did not recover within the acceptable limits in one MSD samples collected on January 13, 2015 (PR=45.6%) and the MS sample collected on April 14, 2015 (PR=52.4%). The RPD for the MS (PR=45.6%) and the MSD (PR=74.8%) was 48.5%, which is above the ≤25% acceptable RPD. Despite these instances, all samples met acceptability within the 90% requirement and overall acceptability was 97.5%. Therefore, all the data were accepted and are useable.

Table 15. The The ESJWQC and Westside Coalition summary of QC sample evaluations for the 2015 WY.
Samples that did not meet the 90% or greater acceptability requirement are bolded in black.

QC Sample Type	Analyte	Data Quality Objective	Number of Samples	Samples Meeting Acceptability Criterion	Acceptability Met (%)
Field Blank	Chlorpyrifos	<RL or < (env sample/5)	18	18	100.0
Field Blank	Diazinon	<RL or < (env sample/5)	18	18	100.0
		FB Total	**36**	**36**	**100.0**
Field Duplicate	Chlorpyrifos	RPD ≤ 25%	18	18	100.0
Field Duplicate	Diazinon	RPD ≤ 25%	18	18	100.0
		FD Total	**36**	**36**	**100.0**
Laboratory Blank	Chlorpyrifos	<RL	20	20	100.0
Laboratory Blank	Diazinon	<RL	18	18	100.0
		LB Total	**38**	**38**	**100.0**
Surrogate	Tributylphosphate	PR 60%-150%	114	114	100.0
Surrogate	Triphenyl phosphate	PR 56%-129%	96	96	100.0
		Surrogate Total	**210**	**210**	**100.0**
MS	Chlorpyrifos	PR 61%-125%	39	39	100.0
MS	Diazinon	PR 57%-130%	34	32	94.1
		MS Total	**73**	**71**	**97.3**
MSD pairs	Chlorpyrifos	RPD ≤ 25%	20	20	100.0
MSD pairs	Diazinon	RPD ≤ 25%	16	15	93.8
		MSD Total	36	35	97.2
LCS	Chlorpyrifos	PR 61%-125%	20	20	100.0
LCS	Diazinon	PR 57%-130%	18	18	100.0
		LCS Total	**38**	**38**	**100.0**
LCSD pairs	Chlorpyrifos	RPD ≤ 25%	0	0	NA
LCSD pairs	Diazinon	RPD ≤ 25%	0	0	NA
		LCSD Total	**0**	**0**	**NA**
Overall acceptability	**Chlorpyrifos**	**≥90%**	**135**	**135**	**100.0**
	Diazinon	**≥90%**	**122**	**119**	**97.5**
	Tributylphosphate	**≥90%**	**114**	**114**	**100.0**
	Triphenyl phosphate	**≥90%**	**96**	**96**	**100.0**

Corrective Actions

Corrective actions are decisions made by the laboratory to demonstrate their capabilities to carry out analyses and maintain the integrity of the data. The laboratories routinely address analytical

discrepancies, such as re-analyses or confirmation analyses, prior to submitting final laboratory reports and EDDs. In some cases, the Coalition will address corrective action options to improve QC measures that are consistently demonstrating failure to meet DQOs. During the 2015 WY, corrective actions implemented by the laboratory or Coalitions were not necessary.

COMPARISON WITH TMDL OBJECTIVES

Monitoring of the six compliance points in the LSJR during the 2015 WY was designed to assess compliance with Objective 1. Objectives 2 through 7 are addressed individually by each Coalition through an assessment of results and outcomes of actions taken (e.g. monitoring and outreach) to meet the specifications of either Coalition's ILRP monitoring program. The following sections assess the ESJWQC's and Westside Coalition's compliance with the seven TMDL objectives.

OBJECTIVE 1: DETERMINE COMPLIANCE WITH ESTABLISHED WATER QUALITY OBJECTIVES AND THE LOADING CAPACITY APPLICABLE TO DIAZINON AND CHLORPYRIFOS IN THE LOWER SAN JOAQUIN RIVER

Water Quality Objectives

During 2015 WY, the Coalitions evaluated compliance with the chlorpyrifos and diazinon WQOs (listed in the Monitoring Objectives section of this report in Table 1) by reviewing monitoring results from the LSJR compliance points listed in Table 3. Chlorpyrifos and diazinon were not detected in any samples collected from the LSJR sites during the 2015 WY; therefore, no exceedances of the WQOs for chlorpyrifos or diazinon occurred. Complete environmental monitoring results are listed in Appendix I; complete quality control monitoring results, including field duplicates, are listed in Appendix II.

Loading Capacity

All samples collected from the LSJR sites during the 2015 WY were in compliance with loading capacity since there were no detections of either chlorpyrifos or diazinon (Appendix III, Table III-1).

The Basin Plan Amendment required compliance with the loading capacity for the chlorpyrifos and diazinon TMDL in the LSJR by December 1, 2010. Table 16 includes a tally of the number of samples in compliance with the LSJR loading capacity before and after December 1, 2010. Prior to the compliance date, 13 samples (7%) collected from the LSJR compliance locations were out of compliance with the loading capacity (Table 16). Since the December 1, 2010 compliance date, 99% of the samples collected by the ESJWQC and Westside Coalition from the LSJR have been in compliance with loading capacity.

Overall, 454 samples have been collected from the LSJR compliance points since July 2004, a total of 14 samples have been out of compliance and 97% have been in compliance with the load capacity (Table 16).

Table 16. Tally of chlorpyrifos and diazinon TMDL load capacity compliance per site before and after the compliance date of December 1, 2010.

Site Name	Sample Dates	Compliant	Out of Compliance	Total Samples Collected	Percent Compliant
Prior to Compliance Date (Dec. 1, 2010)[1]					
San Joaquin River at Sack Dam	Jul 2004 - Nov 2010	37	3	40	93%

Site Name	Sample Dates	Compliant	Out of Compliance	Total Samples Collected	Percent Compliant
San Joaquin River at Highway 165 near Stevinson	Jul 2004 - Nov 2010	82	2	84	98%
San Joaquin River at Hills Ferry Road	Mar 2010 - Oct 2010	4	0	4	100%
San Joaquin River at Las Palmas Avenue near Patterson	Apr 2008 - Nov 2010	28	8	36	78%
San Joaquin River at the Maze Boulevard (Highway 132) Bridge	Mar 2010 - Oct 2010	4	0	4	100%
San Joaquin River at the Airport Way Bridge near Vernalis	Jan 2006 - Aug 2006	32	0	33	97%
	Total	**187**	**13**	**201**	**93%**
After Compliance Date (Dec. 1, 2010)					
San Joaquin River at Sack Dam	Dec 2010 - Sep 2015	57	0	57	100%
San Joaquin River at Highway 165 near Stevinson[2]	Dec 2010 - Sep 2015	54	0	54	100%
San Joaquin River at Fremont Ford[2]	Dec 2010 - Sep 2015	4	0	4	100%
San Joaquin River at Hills Ferry Road	Dec 2010 - Sep 2015	27	0	27	100%
San Joaquin River at Las Palmas Avenue near Patterson	Dec 2010 - Sep 2015	57	1	57	98%
San Joaquin River at the Maze Boulevard (Highway 132) Bridge	Dec 2010 - Sep 2015	27	0	27	100%
San Joaquin River at the Airport Way Bridge near Vernalis	Dec 2010 - Sep 2015	27	0	27	100%
	Total	**253**	**1**	**253**	**99%**
	Grand Total	**440**	**14**	**454**	**97%**

[1] Data before December 2010 are from the Westside Coalition ILRP monitoring program and from the monitoring conducted by the Regional Board to support the development and implementation of the chlorpyrifos and diazinon TMDL in the LSJR (Organophosphate TMDL Monitoring for the San Joaquin River (Region 5) project).

[2] Compliance monitoring occurred at the San Joaquin River at Fremont Ford site from November 2011 through February 2012 because road construction prevented access to the San Joaquin River at Highway 165 near Stevinson site.

OBJECTIVE 2: DETERMINE COMPLIANCE WITH ESTABLISHED LOAD ALLOCATIONS FOR DIAZINON AND CHLORPYRIFOS.

The ESJWQC and Westside Coalitions are required to assess compliance with load allocations for agricultural discharges to the LSJR for each of the five subareas (Table 3). The two Coalitions each characterize and assess water quality within their respective regions through their own strategies of representative monitoring at tributary sites (described in the ESJWQC approved 2015 WY MPU and the Westside Coalition MRP). The following sections include a review of monitoring results from the Coalition's respective tributary monitoring during the 2015 WY. The formula in Equation 1 is applied to tributary monitoring results to assess compliance with chlorpyrifos and diazinon load allocations.

ESJWQC Load Allocation Compliance

The ESJWQC monitored 17 tributary sites for chlorpyrifos and/or diazinon from October 2014 through September 2015 for a total of 117 monitoring events (Table 17). Of those 117 events, sites were dry 42 times (no water or not enough volume to collect samples); these sites were considered 'dry' and no samples were collected. Dry sites count as a monitored event in the total number of sites monitored.

In total, 109 of the 117 tributary monitoring events during the 2015 WY were in compliance with load allocation (including dry sites). There were eight exceedances of WQTLs for chlorpyrifos during ESJWQC tributary monitoring (Table 18). Further information concerning all exceedances of the WQTL for chlorpyrifos can be referenced in the ESJWQC Annual Report (submitted May 1, 2016).

The calculation of load allocations for all tributaries sampled during the 2015 WY is included in Appendix III (Tables III-2 -III-8). Note that concentrations of chemicals in Appendix III include only environmental samples collected. Samples not collected because the waterbody was considered dry (42 events) are not included in Appendix III. To identify the sources contributing to the exceedances of the WQOs in these samples, the PUR database was queried for applications of the constituents to parcels within the associated site subwatersheds four weeks prior to each exceedance.

Table 17. The ESJWQC tributary monitoring schedule for chlorpyrifos (C) and diazinon (D) during the 2015 WY.

Subarea	Tributary Site Name	Monitoring Type	10/14/2014	11/12/2014	12/3/2014	1/13/2015	2/10/2015	3/10/2015	4/14/2015	5/12/2015	6/9/2015	7/14/2015	8/11/2015	9/8/2015
Bear Creek, Fresno-chowchilla	Berenda Slough along Ave 18 1/2	MPM							C			C		C
	Black Rascal Creek @ Yosemite Rd	MPM								C		C	C	C
	Cottonwood Creek @ Rd 20	CSM, MPM	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D
	Deadman Creek @ Gurr Rd	MPM						C	C				C	C
	Dry Creek @ Rd 18	MPM	C				C		C			C		
	Howard Lateral @ Hwy 140	MPM							C	C	C	C	C	
	Livingston Drain @ Robin Ave	MPM				C	C		C		C	C	C	
	Miles Creek @ Reilly Rd	MPM					D				C	C	C	C
	Deadman Creek @ Hwy 59	MPM							C				C	C
	Duck Slough @ Gurr Rd	CSM, MPM	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D
	Canal Creek @ West Bellevue Rd	RSM								C			C	
Stanislaus	Mootz Drain downstream of Langworth Pond	MPM			C						C			
Turlock, Merced	Highline Canal @ Hwy 99	CSM, MPM	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D
	Merced River @ Santa Fe	CSM, MPM	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D
	Prairie Flower Drain @ Crows Landing Rd	CSM, MPM	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D
Tuolumne River, Northeast Bank	Dry Creek @ Wellsford Rd	CSM, MPM	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D	C,D
	Lateral 2 1/2 near Keyes Rd	MPM, RSM							C	C	C	C	C	
	Westport Drain @ Vivian Rd	MPM, RSM				C		C				C	C	

CSM – Core Site Monitoring
MPM – Management Plan Monitoring
RSM – Represented Site Monitoring

Table 18. Chlorpyrifos and diazinon load allocation calculations for tributary sites in the ESJWQC out of compliance during the 2015 WY.

LSJR Subarea	Site Name	Sample Date	Chlorpyrifos	Diazinon	Load	Load Allocation Compliance
Bear Creek, Fresno-chowchilla	Duck Slough @ Gurr Rd	7/14/2015	0.190	<0.004	12.7	Out of compliance
Turlock, Merced	Highline Canal @ Hwy 99	1/13/2015	0.070	<0.004	4.7	Out of compliance
Turlock, Merced	Prairie Flower Drain @ Crows Landing Rd	3/10/2015	4.200	<0.004	280	Out of compliance
Turlock, Merced	Prairie Flower Drain @ Crows Landing Rd	4/14/2015	0.200	<0.004	13.3	Out of compliance
Turlock, Merced	Prairie Flower Drain @ Crows Landing Rd	5/12/2015	0.200	<0.004	13.3	Out of compliance
Turlock, Merced	Prairie Flower Drain @ Crows Landing Rd	6/9/2015	0.061	<0.004	4.1	Out of compliance
Turlock, Merced	Prairie Flower Drain @ Crows Landing Rd	7/14/2015	0.044	<0.004	2.9	Out of compliance
Turlock, Merced	Prairie Flower Drain @ Crows Landing Rd	8/11/2015	0.017	<0.004	1.1	Out of compliance

The concentration of chlorpyrifos in the sample collected during the storm event from Duck Slough @ Gurr Rd on July 14, 2015 was above the 0.015 µg/L WQTL (0.190 µg/L; Table 18). There was no observed water flow in the waterbody at the time of collection. The last exceedance of the WQTL for chlorpyrifos to occur in the site subwatershed was on March 3, 2014. The PUR data associated with the July 2015 exceedance indicate 10 applications of chlorpyrifos totaling of 2,480 lbs of Active Ingredient (AI) across 1799 acres of alfalfa and almonds occurred on July 7, 2015. Applications were made by aerial spray methods where it is possible for chlorpyrifos to enter the waterway via spray drift. There was no rainfall reported in the ESJWQC region during the time of, or following the application of chlorpyrifos. The site was sampled as a non-contiguous water body in February, April, and June 2015.

The concentration of chlorpyrifos in the sample collected from Highline Canal @ Hwy 99 on January 13, 2015 was above the 0.015 µg/L WQTL (0.070 µg/L; Table 18). The last exceedance of the WQTL for chlorpyrifos to occur in the site subwatershed was on July 21, 2009. The PUR data indicate a single application totaling 2 lbs of AI across 3.91 acres of cherries occurred on January 7, 2015. There was no rainfall reported within the ESJWQC region between the application of chlorpyrifos and the subsequent sampling event.

The concentration of chlorpyrifos in samples collected from Prairie Flower Drain @ Crows Landing Rd between March 10 and August 11, 2015 was above the 0.015 µg/L WQTL six times (concentrations ranged from 4.2 µg/L to 0.017 µg/L, Table 18). The PUR data associated with the exceedances indicate that from February 18 through March 5, 2015 there were 18 applications of chlorpyrifos totaling 370.3 lbs of AI across 908.6 acres of alfalfa.

During the 2015 WY, 93% of the samples were compliant (Table 19) with load allocation. None of the exceedances of the WQTL for chlorpyrifos in the ESJWQC tributaries affected load compliance in the LSJR. Overall, 95% of samples collected from ESJWQC tributaries have been compliant with load allocations since the inception of TMDL monitoring in January 2010. Further information about exceedances from the 2015 WY is included in the ESJWQC Annual Report (submitted May 1, 2016).

Table 19. Tally of ESJWQC chlorpyrifos and diazinon TMDL load allocation compliance for each subarea since inception of San Joaquin River monitoring (January 2010 through September 2015).

Subarea	WY	In Compliance	Out of compliance	Samples Collected	Percent in Compliance
Bear Creek, Fresno-Chowchilla	2010	19	5	24	79%
	2011	56	3	59	95%
	2012	34	0	34	100%
	2013	49	1	50	98%
	2014	67	1	68	99%
	2015	59	1	60	98%
Stanislaus River, North Stanislaus	2010	9	0	9	100%
	2011	10	0	10	100%
	2012	12	0	12	100%
	2013	9	0	9	100%
Stevinson, Grassland	2013	10	0	10	100%
	2014	2	0	2	100%
Tuolumne River, Northeast Bank	2010	7	3	10	70%
	2011	12	0	12	100%
	2012	3	0	3	100%
	2013	4	1	5	80%
	2014	19	2	21	90%
	2015	21	0	21	100%
Turlock, Merced	2010	12	1	13	92%
	2011	34	0	34	100%
	2012	29	0	29	100%
	2013	32	0	32	100%
	2014	38	0	38	100%
	2015	29	7	36	81%
Totals					
2010 WY		47	9	56	84%
2011 WY		112	3	115	97%
2012 WY		78	0	78	100%
2013 WY		104	2	106	98%
2014 WY		126	3	129	98%
2015 WY		109	8	117	93%
Grand Total		**450**	**22**	**472**	**95%**

Data in the table represents complete data sets for 2010 through 2015 WY.

Westside Coalition Load Allocation Compliance

The Westside Coalition collected monthly samples from tributary sites entering the LSJR from October 2014 through September 2015 in accordance with its MRP. The 2015 WY was a critically dry year, and there were few significant storm events during the non-irrigation season. The Westside Coalition collected storm samples from tributary sites on December 4, 2014 and February 10, 2015.

Table 20. Westside Coalition tributary monitoring schedule during the 2015 WY.

Monitoring Site	Non-Irrigation Season					Irrigation Season						Non-Irrigation
	Event 118	Event 119	Event R16	Event 120	Event R17	Event 121	Event 122	Event 123	Event 124	Event 125	Event 126	Event 127
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept
Discharge Sites												
Hospital Cr at River Road	NF,P	NF,P	P	NF,P	P	P	P	P	NF,P	P	P	P
Ingram Cr at River Road	P	P	P	P	NF,P	P	P	P	P	P	P	P
Westley Wasteway near Cox Road	P	P	NA	P	NA	P	P	P	P	P	NF,P	NF,P
Del Puerto Cr near Cox Road	P	NF,P	P	NF,P	P	P	P	P	P	P	NF,P	P
Del Puerto Cr at Hwy 33	NF,P	NF,P	NF,P	P	P	N	N	N	N	N	N	N
Ramona Lake near Fig Avenue	NF,P	NF,P	P	P	P	P	P	P	P	NF,P	NF,P	NF,P
Marshall Road Drain near River Road	P	P	P	NF,P	NF,P	NF,P	NF,P	P	NF,P	NF,P	NF,P	P
Orestimba Cr at River Road	NF,P	NF,P	NF,P	NF,P	NF,P	NF,P	NF,P	NF,P	NF,P	NF,P	NF,P	NF,P
Orestimba Cr at Hwy 33	NF,P	NF,P	P	P	P	P	P	NF,P	P	NF,P	NF,P	NF,P
Newman Wasteway near Hills Ferry Road	P	P	P	P	P	P	P	P	P	P	P	P
Mud Slough u/s San Luis Drain	P	P	P	P	P	P	P	P	P	NF,P	NF,P	P
Salt Slough at Lander Avenue	P	P	P	P	P	P	P	P	P	P	P	P
Salt Slough at Sand Dam	P	P	P	P	P	P	P	P	P	P	P	P
Los Banos Creek at Highway 140	P	P	P	P	P	P	P	P	P	P	P	P
Los Banos Creek at China Camp Road	P	P	P	P	P	P	P	P	P	P	P	P
Blewett Drain near Highway 132	P	NF,P	NF,P	NF,P	NA	P	P	P	P	P	NF,P	P
Poso Slough at Indiana Avenue	P	P	P	NF,P	NF,P	P	P	P	P	P	NF,P	P
Source Water Sites												
Delta Mendota Canal at Del Puerto WD	P	P	P	P	P	P	P	P	P	P	P	P

N -- Sample not tested for pesticides
NF -- Not sampled due to lack of flow
NA -- Not Sampled due to lack of safe access
P -- Sample tested for chlorpyrifos & diazinon if adequate water is present.

Although there were no exceedances of either the chlorpyrifos or diazinon WQTL in the LSJR samples, chlorpyrifos was detected in samples collected from twelve tributary sites (during four different monitoring events). Three of these detections were below the chlorpyrifos WQO but the remaining nine were in excess of the load criteria. There was one detection of diazinon (Newman Wasteway, February 10, 2015; Table 21), which was in excess of the load criteria.

Table 21 lists the sites and dates where chlorpyrifos was detected. The Westside Coalition's November 2015 SAMR includes a discussion of these detections, as well as other pesticide detections. A tabulation of load allocations for all tributary results is included in Appendix III.

Table 22 provides load allocations for Westside Coalition tributaries for each subarea. Overall, the percentage of load allocations was in compliance during the 2015 WY (93%) and indicates some improvement since the 2014 WY (89%) and since the 2010 (January – September; 79%) when implementation of the TMDL program first began.

Table 21. Chlorpyrifos and diazinon load allocation calculations for tributary sites in the Westside Coalition out of compliance during the 2015 WY.

Main Stem Monitoring Point	Tributary Site	Sample Date	Sample Event	Flow (cfs)	Chlorpyrifos (µg/L)	Diazinon (µg/L)	Load	Load Allocation Compliance
Greater Orestimba	Marshall Road Drain near River Road	9/15/2015	127	3	0.009	<0.004	0.60	In compliance
	Orestimba Creek At Hwy33	2/10/2015	R17	125	0.013	<0.004	0.87	In compliance
Stevinson, Grassland	Newman Wasteway near Hills Ferry Road	2/10/2015	R17	275	<0.0026	0.96	9.60	Out of compliance
Westside Creek	Blewett Drain at Hwy 132	9/15/2015	127	1.8	0.014	<0.004	0.93	In compliance
	Del Puerto Creek at Hwy 33	1/13/2015	120	0.5	0.063	<0.004	4.20	Out of compliance
	Del Puerto Creek near Cox Rd	2/10/2015	R17	3	0.021	<0.004	1.40	Out of compliance
	Del Puerto Creek near Cox Rd	3/10/2015	121	12.5	0.027	<0.004	1.80	Out of compliance
	Hospital Creek at River Rd	2/10/2015	R17	0	0.37	<0.004	24.67	Out of compliance
	Hospital Creek at River Rd	3/10/2015	121	4.2	0.016	<0.004	1.07	Out of compliance
	Ingram Creek at River Rd	1/13/2015	120	0	0.58	<0.004	38.67	Out of compliance
	Ramona Lake near Fig Ave	1/13/2015	120	0	0.022	<0.004	1.47	Out of compliance
	Westley Wasteway near Cox Rd	1/13/2015	120	0	0.040	<0.004	2.67	Out of compliance

Table 22. Tally of Westside Coalition chlorpyrifos and diazinon TMDL load allocation compliance per each of the subareas.

Subarea	WY	In Compliance	Out of compliance	Samples Collected	Percent in Compliance
Greater Orestimba	2010	18	12	30	60%
	2011	26	7	33	79%
	2012	30	1	31	96%
	2013	16	3	19	84%
	2014	19	1	20	95%
	2015	16	0	16	100%
Stevinson, Grassland	2010	70	4	74	95%

Subarea	WY	In Compliance	Out of compliance	Samples Collected	Percent in Compliance
	2011	87	3	90	97%
	2012	87	4	91	96%
	2013	65	6	71	92%
	2014	61	11	72	85%
	2015	71	1	72	99%
Westside Creeks	2010	18	13	31	58%
	2011	30	6	36	83%
	2012	36	5	41	88%
	2013	19	6	25	76%
	2014	31	2	33	94%
	2015	37	8	45	82%
Totals					
2010 WY		106	29	135	79%
2011 WY		143	16	159	90%
2012 WY		153	10	163	94%
2013 WY		100	15	115	87%
2014 WY		111	14	125	89%
2015 WY		124	9	133	93%
Grand Total		**737**	**93**	**830**	**89%**

Data in the table represents complete data sets for 2010 through 2015 WY.

The PUR data listed in Table 23 have been provided by the county agricultural commissioners and are summarized for the sites listed in Table 21. The PUR data summary is organized by site and material AI, and includes the number of treatments and total acres treated of each commodity. Available PUR data identified 38 separate pesticide applications within subwatersheds where chlorpyrifos was detected during sampling.

Table 23. Chlorpyrifos and diazinon applications made four weeks prior in subwatersheds with exceedances in the Westside Coalition region.

Only listed applications based on available PUR data are shown.

Tributary Name	Material	Application Month	Commodity	Number of Applications*	Acres Treated*
Blewett Drain	Chlorpyrifos	September	Walnuts	2	120
Del Puerto Creek	Chlorpyrifos	February	Alfalfa	15	635
	Chlorpyrifos	January	Almonds	4	348
	Chlorpyrifos	January	Turf/Sod	1	10
Hospital Creek	Chlorpyrifos	January	Almonds	12	1376
Newman Wasteway	Diazinon	January	Almonds	1	115
Ramona Lake	Chlorpyrifos	December	Almonds	1	17
Westley Wasteway	Chlorpyrifos	January	Almonds	2	630

*PUR data is provisional and subject to change.

OBJECTIVE 3: DETERMINE DEGREE OF IMPLEMENTATION OF MANAGEMENT PRACTICES AND STRATEGIES TO REDUCE OFF-SITE MOVEMENT OF DIAZINON AND CHLORPYRIFOS

Each Coalition developed their own management practice tracking and evaluation strategies suitable for their regions and members (ESJWQC Management Plan submitted September 30, 2008 and Westside Coalition Management Plan and Focused Management Plan submitted October 23, 2008). The ESJWQC

revised the Surface Water Quality Management Plan (SQMP) on May 1, 2014 (resubmitted March 10, 2015 and approved November 4, 2015). The Coalitions review the results of their respective strategies to determine the degree of implementation of management practices and strategies to reduce the offsite movement of chlorpyrifos and diazinon.

ESJWQC Implementation of Management Practices to Reduce Offsite Movement of Diazinon and Chlorpyrifos

If one exceedance of the WQO for chlorpyrifos or diazinon occurs at a tributary monitoring location in the ESJWQC region, the ESJWQC must establish a management plan for the site subwatershed. To allow for source identification, focused outreach, and evaluation, the strategy employed by the Coalition in the 2014 SQMP is to address the same constituents across the entire Coalition region in as timely a manner as practicable. The ESJ WDR requires management plans to be complete within the shortest amount of time as practical and the compliance date must not exceed 10 years from the date the management plan is reported to the Regional Board. When a site subwatershed is scheduled for focused outreach, the ESJWQC develops a three year process designed to document current management practices (Year 1), encourage and document the implementation of new management practices (Years 1 and 2), and evaluate the effectiveness of outreach in the site subwatershed via Management Plan Monitoring (MPM) for management plan constituents (Years 1-3). Members with the greatest potential to influence water quality are targeted. These are growers with the potential for direct drainage and growers with past applications of management plan constituents (i.e. chlorpyrifos or diazinon). The focused outreach and management practice documentation rotates to additional site subwatersheds annually.

The ESJWQC outreach activities and actions to address water quality exceedances during the 2015 WY are documented in the ESJWQC May 1, 2016 Annual Report. A major goal of ESJWQC outreach is to assist members in identifying management practices that can be implemented to eliminate the offsite movement of agricultural constituents. Below are five categories of management practices identified as being effective in reducing the offsite movement of chlorpyrifos and diazinon:

- Irrigation Water Management
- Storm Drainage Management
- Erosion and Sediment Management
- Pest Management
- Dormant Spray Management

The ESJWQC has completed its focused outreach strategy in the first through sixth priority site subwatersheds and documented all current and newly implemented management practices for targeted member parcels. The ESJWQC is in the process of conducting individual meetings with targeted growers and documenting new management practices for the seventh priority site subwatersheds (Howard Lateral @ Hwy 140, Levee Drain @ Carpenter Rd, and Mootz Drain downstream of Langworth Pond). In addition, ESJWQC has developed a target grower list for 2016 Focused Outreach to documenting currently implemented practices in the Dry Creek @ Wellsford Rd, Duck Slough @ Gurr Rd, Highline

Canal @ Hwy 99, and Prairie Flower Drain @ Crows Landing Rd site subwatersheds due to recent chlorpyrifos exceedances. These data will be assessed in the ESJWQC May 1, 2017 Annual Report.

Targeted growers in the first through six priority site subwatersheds indicated they implemented management practices within each of the above categories before focused ESJWQC outreach. Several growers implemented new management practices in each of these categories following outreach. Figure 7 includes the acreage associated with management practices implemented before ESJWQC outreach (previously implemented) and after ESJWQC focused outreach (newly implemented) in the first through sixth priority site subwatersheds. The acreage represented in Figure 7 is associated with at least one management practice per each of the five categories, but acreage may have multiple practices implemented within a category (acreage is only counted once per each category). The majority of the targeted acres have at least one management practice designed to address erosion and sediment management, irrigation management, and pest management. The newly implemented practices are focused on irrigation management, pest management, and storm drainage management.

Within each of the five categories, growers implemented various management practices (Table 24). Pest management practices such as adjusting spray nozzles to match crop canopy profile and using nozzles that provide the largest effective droplet size to minimize drift are utilized by almost every targeted grower. Other common practices include laser leveling fields and planting or allowing vegetation to grow along ditches.

Figure 7. Acreage with one or more implemented management practice per each category in the ESJWQC first through sixth priority subwatersheds. Targeted acreage associated with grower displayed if one or more practice(s) are implemented per category. Several practices serve multiple purposes and fall into more than one category, but practices are counted only once with their primary category.

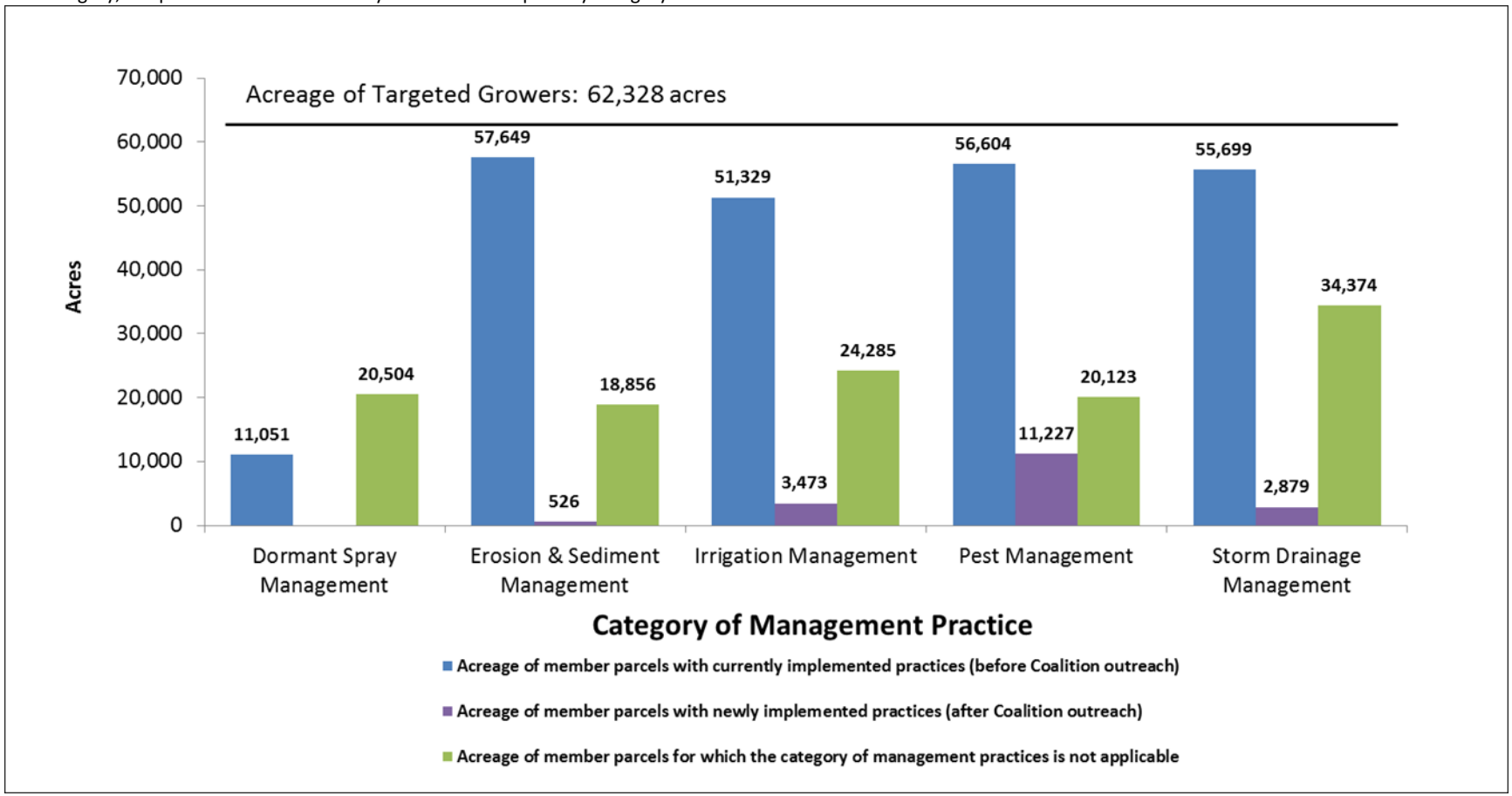


Table 24. Current and newly implemented management practices designed to reduce offsite movement of chlorpyrifos and diazinon in the ESJWQC first through sixth priority subwatersheds listed by TMDL subarea.

Category	Management Practice	Bear Creek, Fresno-Chowchilla		Tuolumne River, Northeast Bank		Turlock, Merced		Total	
		Growers	Acres	Growers	Acres	Growers	Acres	Growers	Acres
Dormant Spray Management	Check weather conditions prior to spraying (i.e. storm status)	20	8,248	5	382	13	3,777	38	12,408
	Do not apply dormant spray when moisture is at field capacity	8	3,301	4	302	9	3,056	21	6,659
	Maintain setback zones	20	8,248	3	131	10	2,824	33	11,204
	Vegetation cover and/or disked	16	5,565	10	712	3	201	29	6,478
Erosion & Sediment Management	Constructed wetlands	2	363	1	2,450	2	921	5	3,734
	Grass Row Centers (Orchards, Vineyards)	114	29,847	41	6,927	37	12,375	192	49,149
	Maintain vegetated filter strips around field perimeter at least 10' wide	114	26,381	24	6,227	37	9,895	175	42,503
	Riparian vegetation / fences prevents livestock access to water	6	640	2	53	0	0	8	693
	Vegetation is planted along or allowed to grow along ditches	98	27,311	24	6,532	25	11,561	147	45,403
Irrigation Management	Determine Irrigation Schedule by Actual Moisture Levels in Soil/Crop Needs	164	37,007	24	5,753	42	10,602	230	53,362
	Drainage basins (sediment ponds)	38	13,863	5	3,203	13	4,353	56	21,419
	Drip irrigation, other	6	408	1	77	37	6,765	44	7,250
	Laser leveled fields	123	26,810	43	7,230	23	8,722	189	42,762
	Microirrigation	101	27,624	25	6,721	3	269	129	34,614
	Polyacrylamide (PAM)	1	15	1	2,450	18	8,062	20	10,527
	Recirculation - Tailwater return system	54	15,834	8	4,116	4	468	66	20,418
	Reduce Amount of Water Used in Surface Irrigation	12	1,903	1	162	4	317	17	2,382
Pest Management	Adjust spray nozzles to match crop canopy profile	148	36,006	51	8,503	56	15,600	255	60,109
	Calibrate spray equipment prior to each application	146	33,551	69	9,832	48	12,382	263	55,765
	Shut off outside nozzles when spraying outer rows next to sensitive sites	145	34,489	49	8,372	56	16,054	250	58,915
	Spray areas close to waterbodies when the wind is blowing away from them	157	36,508	50	8,335	65	16,479	272	61,321
	Use air blast applications when wind is between 3-10 mph and upwind of a sensitive site	94	18,753	31	6,263	30	7,352	155	32,368
	Use electronic controlled sprayer nozzles	9	1,981	3	2,555	8	807	20	5,343
	Use nozzles that provide largest effective droplet size to minimize drift	156	37,794	50	8,405	61	15,453	267	61,652
Storm Drainage	Berms Between Field & Waterway	22	4,752	1	368	13	7,934	36	13,055
	Device Controls Timing of Pump/Drain into Waterway	22	6,389	2	3,147	8	1,445	32	10,981
	No Storm Drainage	26	7,835	3	119	57	21,688	86	29,642
	Recirculation - Tailwater return system	35	12,046	2	96	3	681	40	12,823
	Settling Pond	31	13,374	3	2,499	11	4,888	45	20,762

Westside Coalition Implementation of Management Practices to Reduce Offsite Movement of Diazinon and Chlorpyrifos

In 2008, the Westside Coalition adopted a Management Plan to address water quality exceedances detected by the monitoring order. Although the Management Plan outlined area specific measures based on the exceedances in that region, identified management practices for pesticides (including chlorpyrifos and diazinon) are uniform for the entire Westside Coalition. These measures include:

- Construct sediment basins to intercept tailwater.
- Install high-efficiency irrigation systems such as sprinkler or drip irrigation, tailwater recirculation, gated pipes, shorter runs, etc., where warranted by the crops that are grown.
- Implement additional use of polyacrylamide (PAM) to address sedimentation discharge.
- Reduce use of pesticides, or incorporate use of pesticides that are less likely to be transported to the State waterways, or which breakdown quickly and are less likely to impact water quality.
- Calibrate ground spray rigs utilized on farmed acres to address possible overspray.
- Address potential aerial overspray by identifying the sensitive regions for all aerial applicators, or elimination of this as an acceptable application procedure.
- Increase size of vegetated buffer zones along the perimeters waterways.

As a mechanism to encourage and track the implementation of management practices, the Westside Coalition implemented an aggressive outreach program that included field meetings with individual growers, workshops, sponsorship of integrated pest management programs (such as the Sustainable Cotton Program) and a detailed management practice inventory survey to determine what management practices have already been implemented. A status update of management plan implementation is included in Attachment 6 of each SAMR. Table 25 summarizes the management practice inventory data for the Westside Coalition region. In addition to these actions, a staff person of the Westside Coalition travels through the Coalition area frequently to review irrigation activities, drainage conditions, and meet with growers to review management practice implementation. All of these management practices are implemented at the farm-level and driven by a variety of factors, including water supply, crop values, soil quality, and regulatory pressures.

In response to the diazinon and chlorpyrifos exceedances during the irrigation season, the Westside Coalition mailed out newsletters to growers within the entire Coalition. The newsletter emphasized importance of implementing management practices to prevent pesticide discharge.

Table 25. Management practice inventory data for subwatersheds in the Westside Coalition region.

Subwatersheds	Year	Data Type	Survey Area	Surveys Collected	Irrigated acreage	Furrow/Flood (% Irrig. Ac.)	Drip/Micro/Sprinkler (% Irrig. Ac.)	Fallow/Non Irrigated (% Irrig. Ac.)	Mix of Irrigation Methods (% Irrig. Ac.)	Tree Crops (% Irrig. Ac.)	Field Crops (% Irrig. Ac.)	Open / Other (% Irrig. Ac.)	Sedimentation Ponds (% Field Crops)	Tailwater Return System (% Field Crops)	Use of PAM (% Irrig. Ac.)	Tailwater Leaves Property (% Irrig. Ac.)	Stormwater Leaves Property (% Irrig. Ac.)	Dormant Spray Usage (% Tree Crops)	Horticultural Oil Usage (% Tree Crops)
Salt Slough	2011/12	Acres	64,996	874	63,978	49,575	14,403	1,056	0	1,203	62,890	1,039	370	0	710	58,704	57,490		
		%	100%	100%	98%	77%	23%	2%	0%	1.90%	98%	1.60%	0.60%	0%	1%	92%	90%		
Westley Wasteway	2010	Acres	5,248	70	4,565	1,489	2,891	0	185	2,891	1,670	662	1,092	150	3,346	2,234	2,517	905	905
		%	100%	100%	87%	33%	63%	0%	4%	63%	37%	15%	65%	9%	73%	49%	55%	31%	31%
Del Puerto Creek	2010	Acres	9,195	274	7,926	3,210	3,952	230	535	4,237	3,678	325	3,331	402	2,955	3,471	5,050	1,147	748
		%	100%	100%	86%	41%	50%	3%	7%	53%	46%	4%	36%	4%	37%	44%	64%	27%	18%
Orestimba Creek	2010	Acres	12,851	160	11,714	4,491	5,821	1,354	48	5,481	5,626	847	5,019	2,154	3,408	4,134	6,384	400	806
		%	100%	100%	91%	38%	50%	12%	0%	47%	48%	7%	89%	38%	29%	35%	55%	7%	15%
Hospital Creek	2009	Acres	7,142	91	5,193	1,678	3,515	1,949		3,621	1,583	1949	1,085	205	488	1,473	4,118	926	
		%	100%	100 %	69%	32%	68%	38%		48%	21%	26%	14%	3%	29%	28%	79%	12%	
Ingram Creek	2009	Acres	5,779	55	5,526	4,599	927	3		876	4,665	3	935	828	4,375	4,393	5,204	22	
		%	100%	100%	96%	80%	16%	<1%		16%	84%	<1%	17%	15%	95%	76%	90%	<1%	
Blewett	2014	Acres	2,592	32	2,519	763	1,756	80	0	1,662	857	80	811		348	818	1,506		
		%	100%	100%	97%	30%	70%	3%	0%	66.00%	34%	3%	32.00%		14%	32%	60%		
Marshall Road Drain	2014	Acres	6,909	199	5,778	2,470	3,308	877	0	2,339	3,900	416	2,309		1,515	1,811	3,686		
		%	100%	100%	84%	43%	57%	15%	0%	40%	68%	7%	40%		26%	31%	64%		
Spanish Land Grant Drain	2014	Acres	4,398	74	4,262	2,743	1,519	4	0	1,161	3,101	4	2,193		1,912	2,805	2,321		
		%	100%	100%	97%	64%	36%	0%	0%	27%	73%	0%	51%		45%	66%	54%		

OBJECTIVE 4: DETERMINE DEGREE OF EFFECTIVENESS OF MANAGEMENT PRACTICES AND STRATEGIES TO REDUCE OFF-SITE MOVEMENT OF DIAZINON AND CHLORPYRIFOS

The Coalitions review management practice effectiveness at the site subwatershed level within their regions to demonstrate management practice effectiveness in addition to improved water quality in the LSJR.

ESJWQC Effectiveness of Management Practices to Reduce Offsite Movement of Diazinon and Chlorpyrifos

The ESJWQC uses monitoring results to evaluate the effectiveness of current and newly implemented management practices. The following evaluation is based on the monitoring results from 2015 WY.

The ESJWQC began conducting focused outreach in 2008. The result of focused outreach has been the implementation of new management practices in site subwatersheds across the ESJWQC region designed to address the offsite movement of agricultural constituents, including chlorpyrifos and diazinon (Figure 7 and Table 24). Results from MPM during months of past exceedances and months of high use, in addition to monthly monitoring at Core sites, indicate focused outreach and implementation of new management practices since outreach began through the 2015 WY coincided with an overall decrease in chlorpyrifos and diazinon exceedances (Table 26). In 2008, prior to focused outreach and implementation of new management practices, there were 22 exceedances of the WQTL for chlorpyrifos (11% of samples collected) in the first through sixth priority subwatersheds (Table 26). There have been only three exceedances of the diazinon WQTL since 2008 (< 1% of samples collected; Table 26).

Eight exceedances of the WQTL for chlorpyrifos occurred during the 2015 WY in site subwatersheds where focused outreach occurred previously (Duck Slough @ Gurr Rd, Highline Canal @ Hwy 99, and Prairie Flower Drain @ Crows Landing Rd). ESJWQC members were targeted in the Prairie Flower Drain @ Crows Landing Rd site subwatershed with first priority site subwatersheds. The ESJWQC established a management plan for chlorpyrifos in the Prairie Flower Drain @ Crows Landing Rd site subwatershed in 2006; the Coalition completed focused outreach in 2010; and in 2012, chlorpyrifos was approved for management plan completion in the site subwatershed due to improved water quality. However, due to the exceedances of the WQTL for chlorpyrifos during the 2015 WY, the management plan was reinstated for the 2016 WY. Six samples collected from Prairie Flower Drain @ Crows Landing Rd resulted in exceedances of the WQTL for chlorpyrifos from March through August 2015. Based on PUR data, the exceedance of the WQTL in March and April were both associated with chlorpyrifos applications made by two members who were previously contacted during focused outreach, and seven non-member dairy farmers. The exceedances of the WQTL for chlorpyrifos from May through August were potentially the result of residual effects of the chemical remaining in the waterbody from applications in March. The amount of chlorpyrifos could have remained in the waterbody across multiple monitoring events until finally degrading to the point of non-detection due to the stagnant non-flowing water of Prairie Flower Drain during these monitoring events. The Coalition will conduct focused outreach in the Prairie Flower Drain @ Crows Landing Rd site subwatershed during 2016 Focused Outreach efforts.

Members in the Duck Slough @ Gurr Rd and Highline Canal @ Hwy 99 site subwatersheds were targeted with second priority sites and contacted for focused outreach from 2010 through 2012. The ESJWQC established a management plan for chlorpyrifos in both site subwatersheds in 2007; and the chlorpyrifos management plans were approved for completion at both sites in 2012 due to improved water quality. However, due to a recent exceedance of the WQTL for chlorpyrifos in samples collected from Duck Slough @ Gurr Rd on March 3, 2014 the management plan was reinstated in the 2015 WY. In addition, there was an exceedance at Highline Canal @ Lombardy Rd on January 1, 2015 and a management plan will be reinstated during the 2016 WY. The Coalition will target members in both site subwatersheds during 2016 Focused Outreach. Samples collected during MPM at Duck Slough @ Gurr Rd on July 14, 2015 resulted in an exceedance of the WQTL for chlorpyrifos. Based on PUR data, the exceedance of the WQTL was most likely caused by aerial spray drift from parcels being treated with chlorpyrifos near the waterway by a single member not previously contacted for focused outreach in 2010.

Non-contiguous samples collected from Highline Canal @ Hwy 99 on January 13, 2015 resulted in an exceedance of the WQTL for chlorpyrifos. Based on PUR data, only one application was made by a member of the Coalition. Because those parcels do not directly drain to the waterway, the member was not targeted in 2010 during focused outreach. The member will be targeted for 2016 Focused Outreach. However, it is unlikely that the application of chlorpyrifos was significant enough to cause an exceedance level detection of the chemical. The source of this exceedance was most likely caused by non-reported applications.

Overall, management practices implemented by growers in site subwatersheds in the ESJWQC have been effective in improving water quality. Of the 151 samples analyzed for chlorpyrifos during the 2015 WY, eight exceedances occurred (5% of the total samples collected; Table 26). The Coalition will continue to conduct general outreach in all site subwatersheds and inform growers of the water quality and concerns through mailings and meetings in the ESJWQC region.

On December 4, 2015, the ESJWQC received approval for management plan completion of 12 constituents in seven site subwatersheds, including two chlorpyrifos management plans. The completion of these management plans indicates effective management practices were implemented by members of the ESJWQC resulting in improved water quality. A total of 11 chlorpyrifos management plans have been approved for completion in the first through sixth priority site subwatersheds since outreach began (three have been reinstated due to recent exceedances, as discussed above).

Table 26. Count of exceedances and samples collected for high priority pesticides in first through sixth priority subwatersheds.

Year	Chlorpyrifos				Diazinon			
	Count of Exceedances	Count of Samples[1]	% Exceedance	Lbs Applied[2]	Count of Exceedances	Count of Samples[1]	% Exceedance	Lbs Applied[2]
2008	22	193	11%	71,490	2	182	1%	2,748
2009	4	81	5%	139,101	0	65	0%	2,179
2010	8	73	11%	91,035	0	55	0%	1,149
2011	3	122	2%	61,194	0	107	0%	1,109
2012	0	40	0%	57,302	0	30	0%	414
Jan-Sept 2013	1	64	2%	94,278	1	32	3%	376
2014 WY	3	114	3%	55,606	0	71	0%	611
2015 WY	8	151	5%	48,181	0	93	0%	315
Total	**49**	**838**	**6%**	**618,187**	**3**	**635**	**<1%**	**8,901**

[1]Refers to all samples scheduled for constituent analysis (dry sites are included).

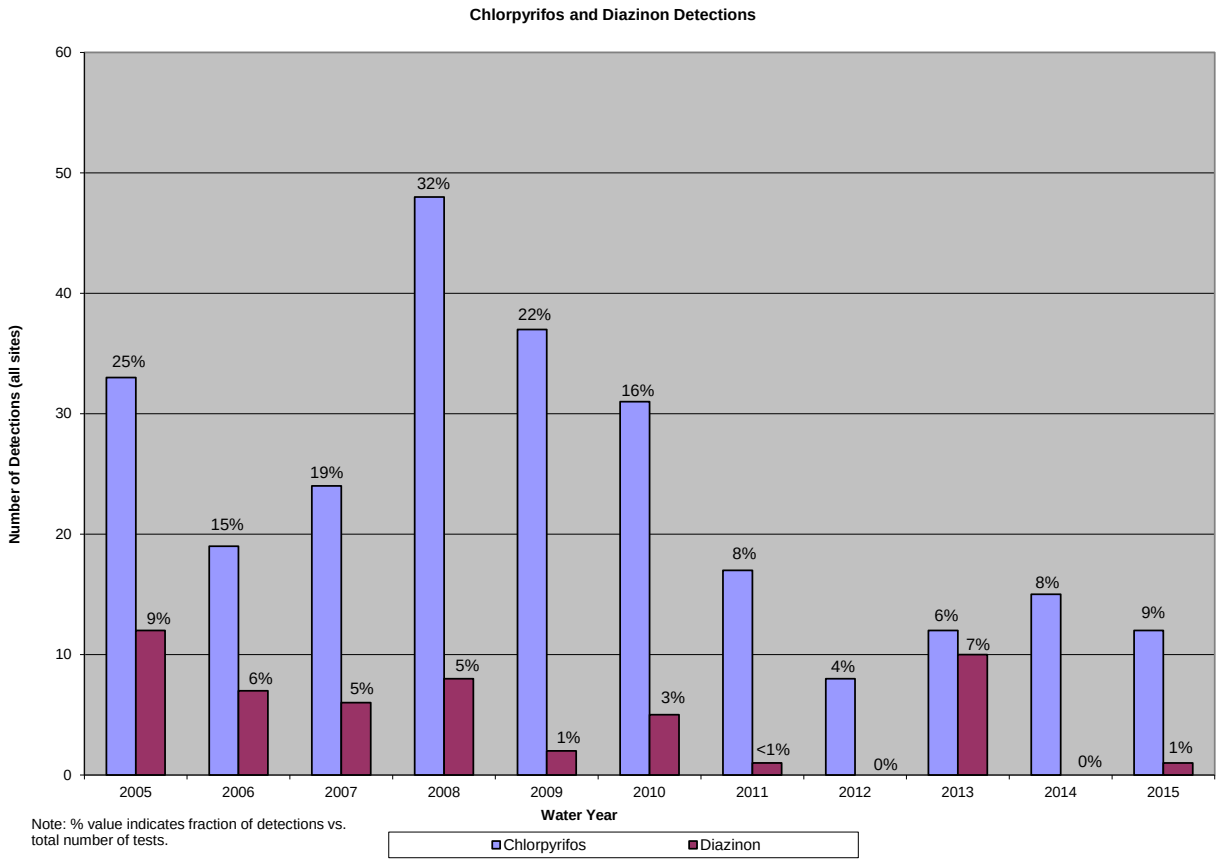
[2]All PUR data are considered preliminary until received from California Pesticide Information Portal (CalPIP); CalPIP data are available through December 2013.

Westside Coalition Effectiveness of Management Practices to Reduce Offsite Movement of Diazinon and Chlorpyrifos

The Westside Coalition continues to struggle with chlorpyrifos exceedances at tributary monitoring sites. Since 2010, the Westside Coalition has mailed more than 600 notices regarding chlorpyrifos and diazinon exceedances and followed up with field visits to review water quality impairments and farming activities with individual growers.

A review of chlorpyrifos and diazinon detections since the beginning of the Westside Coalition's monitoring program provides a promising trend. Figure 8 shows the number of detections of both materials since 2005. The numbers of chlorpyrifos detections are substantially lower when compared to monitoring results prior to the implementation of the Westside Coalition Management Plan (2010 and prior).

Figure 8. Count of chlorpyrifos and diazinon detections from 2006 through 2015 in the Westside Coalition tributaries



OBJECTIVE 5: DETERMINE WHETHER ALTERNATIVES TO DIAZINON AND CHLORPYRIFOS ARE CAUSING SURFACE WATER QUALITY IMPACTS

Since 2004, the overall use of diazinon and chlorpyrifos in the LSJR watershed has declined (Figure 9). Chlorpyrifos continues to be a widely used pesticide due to 1) the large number of crops for which it is registered, 2) it's relatively low cost, and 3) it effectively controls a variety of pest species even when pest pressures are high. However, chlorpyrifos has been designated a restricted material in California effective July 1, 2015. Growers are aware of the water quality implications and there is evidence suggesting that they have been using alternative products throughout the WY to reduce pest pressures and avoid harming beneficial insects.

During grower outreach, ESJWQC and Westside Coalition representatives encourage growers to switch to products that are lower risk alternatives to chlorpyrifos and diazinon, and workshops are offered to educate growers about the selection of these alternatives. The use of alternatives to chlorpyrifos and diazinon depend on many factors including but not limited to registration, commodity type, pest pressure, cost, and timing of pest control. In addition, pesticide groups have to be rotated to prevent insects from developing resistance. The Coalitions do not analyze for all chemicals in new pesticides due

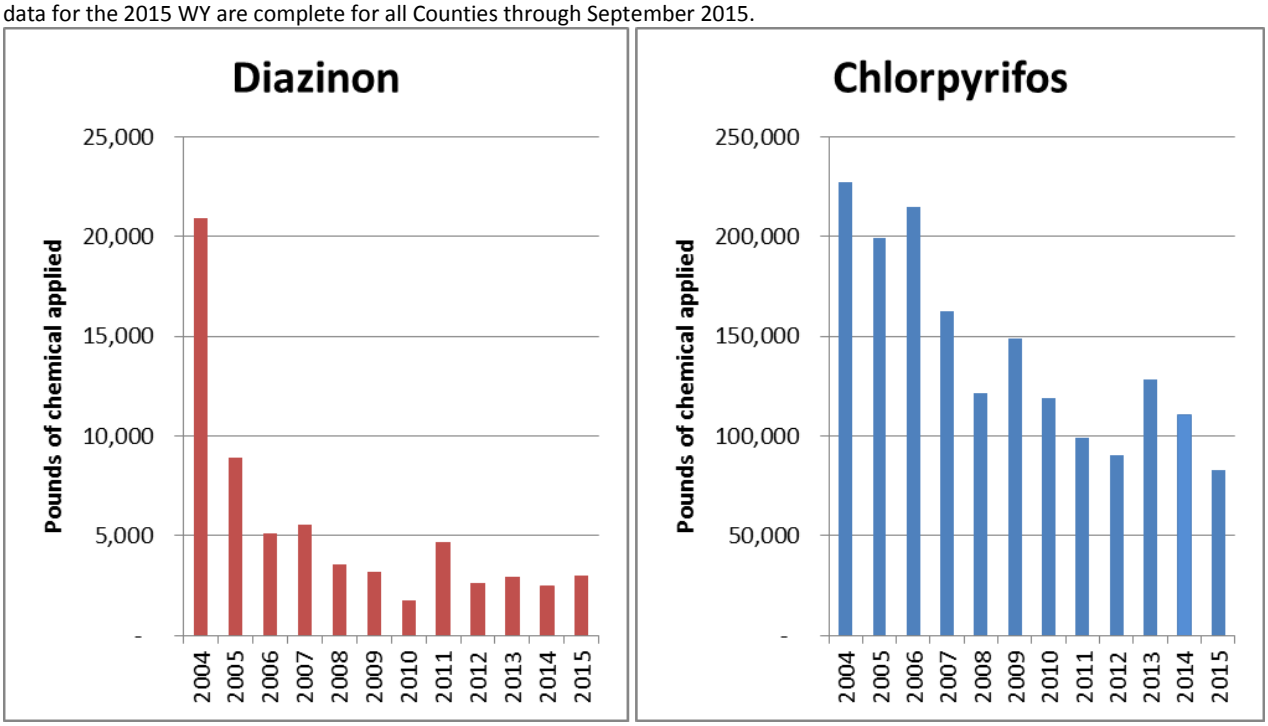
to a lack of analytical methods and, in many cases, relatively limited use. However, PUR data can provide insight to the products being applied and how pesticide use changes over time.

ESJWQC Assessment of Alternatives to Diazinon and Chlorpyrifos

Figure 9 details the significant decline in diazinon and chlorpyrifos use since 2004 across the ESJWQC region. The PUR data available from the counties in the ESJWQC region are incomplete through 2015, but the current PUR data seem to follow the same trend of previous years. In 2014, the amount of diazinon applied in the LSJR watershed was only 12% of 2004 applications (Figure 9). The use of chlorpyrifos has declined slower than diazinon; however, in 2014 chlorpyrifos use was 49% of its use in 2004.

Figure 9. Pounds of diazinon and chlorpyrifos applied in the ESJWQC region from 2004 through 2015 calendar years.

All PUR data are considered preliminary until received from CalPIP; CalPIP data are available through December 2013. The PUR data for the 2015 WY are complete for all Counties through September 2015.



To evaluate the use of alternatives to chlorpyrifos and diazinon, the Coalition reviewed 1) the commodities with the most use of diazinon or chlorpyrifos in the region, 2) the highest priority pests associated with those commodities, and 3) the pesticides available to control them. Since 2004, almonds, walnuts, alfalfa, grapes, corn, peaches, and prunes were identified as the commodities with the most pounds of chlorpyrifos (order from highest to lowest use; Table 27). Commodities with the most diazinon applied include almonds, peaches, prunes, grapes, walnuts, and corn (order from highest to lowest use; Table 27). The highest priority pests are defined as pests that are of major concern for the commodity and are geographically widespread in the ESJWQC region. The ESJWQC reviewed alternative pesticides and other management strategies (i.e. applications of plant growth regulators)

recommended for each high priority pest in each commodity (CA DWR 2013; Elliott et al., 2004; IRAC, 2005; Rice et al., 1972; Summers et al., 2007; UC ANR, 2013; Zalom et al., 1999; Table 28).

Table 27. Commodities with the most pounds of chlorpyrifos and diazinon use in the ESJWQC region from 2004 through September 2015.

All PUR data are considered preliminary until received from CalPIP; CalPIP data are available through December 2013. The PUR data for the 2015 WY are complete for all Counties through September 2015.

Commodity	Total Pounds Chlorpyrifos	Total Pounds Diazinon
Alfalfa	198,589	0
Almonds	612,956	31,419
Corn	101,373	110
Grapes	148,215	1,206
Peaches	14,011	17,834
Prunes	2,138	7,158
Walnuts	240,772	176

Table 28. High concern pests for commodities using the most diazinon and/or chlorpyrifos in the ESJWQC region, with alternative pesticides recommended for those pests.

Commodity	Pest	Pesticide Class[1]	Active Ingredient
Alfalfa	Alfalfa weevil	Organophosphate	Chlorpyrifos, Malathion, Phosmet
		Oxadiazine	Indoxacarb
		Pyrethroid	Lambda-cyhalothrin, Cyfluthrin
	Blue and pea aphid	Botanical	Azadirachtin
		Organophosphate	Chlorpyrifos, Dimethoate
		Pyrethroid	Pyrethrin
	Spotted alfalfa aphid	Botanical	Azadirachtin
		Organophosphate	Chlorpyrifos, Dimethoate
		Pyrethroid	Pyrethrin
Almond	Navel orange worm	Avermectin	Emamectin benzoate
		Bacterium	Bacillus thuringiensis
		Diacylhydrazine	Methoxyfenozide
		Diamide	Chlorantraniliprole, Flubendiamide
		Organophosphate	Chlorpyrifos, Diazinon, Phosmet
		Pyrethroid	Bifenthrin, Esfenvalerate, Fenpropathrin, Lambda-cyhalothrin
		Spinosyn	Spinetoram, Spinosad
		Unclassified	Buprofezin
	Peach twig borer	Avermectin	Emamectin benzoate
		Bacterium	Bacillus thuringiensis
		Benzoylurea	Diflubenzuron
		Diacylhydrazine	Methoxyfenozide
		Diamide	Chlorantraniliprole, Flubendiamide
		Neonicotinoid	Acetamiprid
		Organophosphate	Chlorpyrifos, Diazinon
		Pyrethroid	Bifenthrin, Esfenvalerate, Lambda-cyhalothrin, Cyfluthrin,
		Spinosyn	Spinetoram, Spinosad
		Unclassified	Buprofezin
	San Jose scale	Carbamate	Carbaryl

Commodity	Pest	Pesticide Class[1]	Active Ingredient
		Hormone	Pyriproxyfen
		Organophosphate	Chlorpyrifos, Diazinon, Methidathion
		Unclassified	Buprofezin
Corn	Corn earworm	Bacterium	Bacillus thuringiensis
		Carbamate	Methomyl
		Organophosphate	Chlorpyrifos
		Pyrethroid	Esfenvalerate, Permethrin
		Spinosyn	Spinosad, Spinetoram
Grape	Vine mealybug	Carbamate	Methomyl
		Neonicotinoid	Acetamiprid, Imidacloprid
		Organophosphate	Chlorpyrifos, Dimethoate
		Unclassified	Buprofezin
Peach	Apricot scale (lecanium)	Organophosphate	Diazinon
	Peach twig borer	Bacterium	Bacillus thuringiensis
		Benzoylurea	Diflubenzuron
		Diacylhydrazine	Methoxyfenozide
		Diamide	Chlorantraniliprole, Flubendiamide
		Organophosphate	Diazinon
		Pyrethroid	Esfenvalerate, Permethrin
		Spinosyn	Spinetoram, Spinosad
		Unclassified	Buprofezin
	San Jose scale	Carbamate	Carbaryl
		Hormone	Pyriproxyfen
		Organophosphate	Diazinon
		Unclassified	Buprofezin
Prune	Peach twig borer	Bacterium	Bacillus thuringiensis
		Benzoylurea	Diflubenzuron
		Diacylhydrazine	Methoxyfenozide
		Organophosphate	Chlorpyrifos, Diazinon, Methidathion, Phosmet
		Pyrethroid	Esfenvalerate, Lambda-cyhalothrin
		Spinosyn	Spinosad
	San Jose scale	Carbamate	Carbaryl
		Hormone	Pyriproxyfen
		Organophosphate	Chlorpyrifos, Diazinon, Methidathion
Walnut	Codling moth	Avermectin	Emamectin benzoate
		Benzoylurea	Diflubenzuron
		Carbamate	Carbaryl
		Diacylhydrazine	Methoxyfenozide
		Diamide	Chlorantraniliprole, Flubendiamide
		Organophosphate	Chlorpyrifos, Phosmet
		Pyrethroid	Bifenthrin, Cyfluthrin, Esfenvalerate, Lambda-cyhalothrin, Permethrin
		Spinosyn	Spinetoram, Spinosad
	Walnut husk fly	Neonicotinoid	Imidacloprid
		Organophosphate	Chlorpyrifos, Malathion, Phosmet
		Pyrethroid	Cyfluthrin, Esfenvalerate
		Spinosyn	Spinetoram, Spinosad

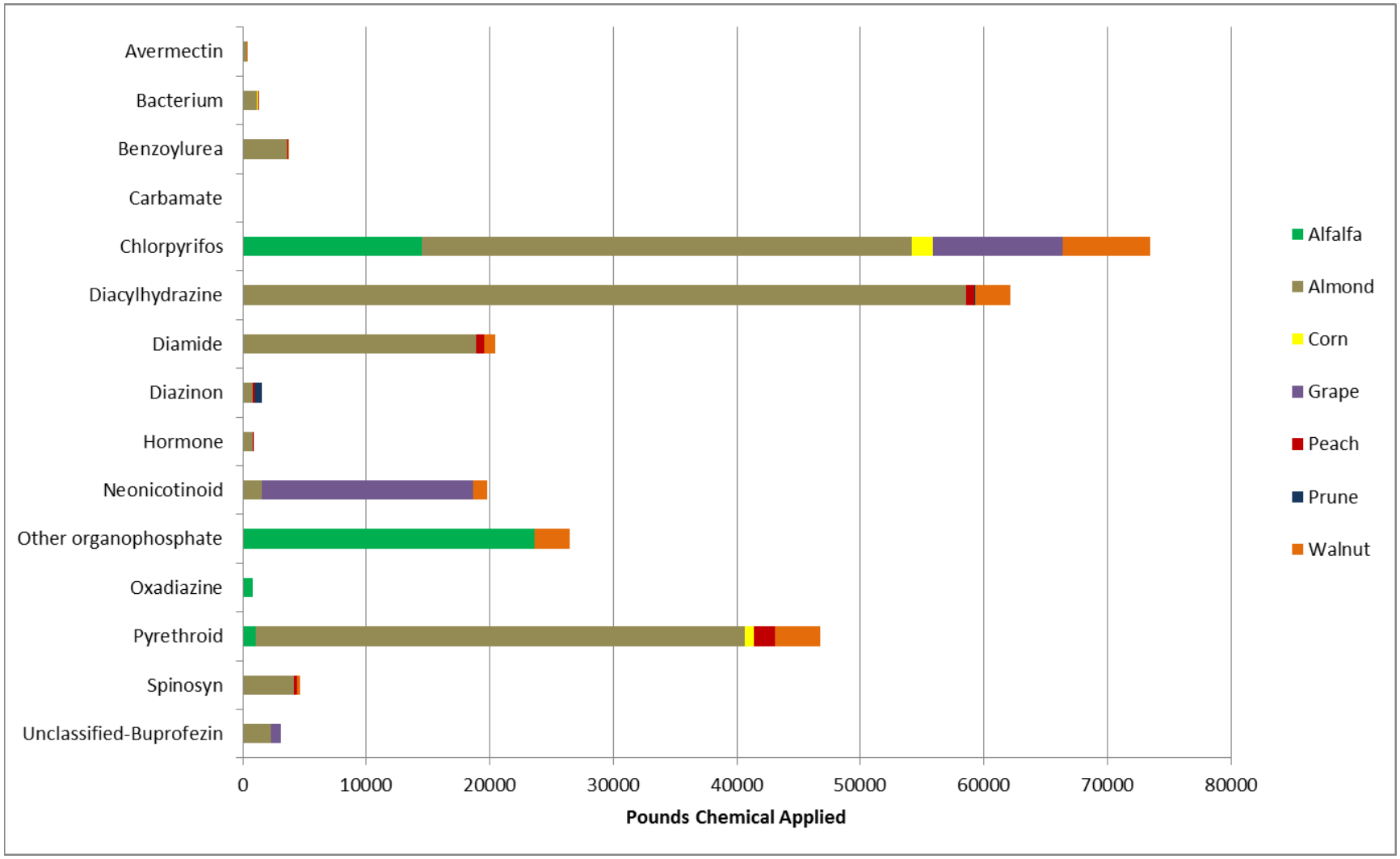
[1] For organization purposes, Pesticide Class includes categories that are not pesticides, such as bacterium.
NA – Not available; no PUR data available
Sources: (California Department of Water Resources, 2015; Daane, et al., 1993; Elliott, et al., 2004; Insecticide Resistance Action Committee, 2005; Zalom, et al., 1999; Summers, et al., 2007; Rice et al., 1972; University of California Agriculture and Natural Resources, n.d)

Several alternative options exist to manage pests per each commodity (Table 28). For example, the pests of concern for alfalfa are alfalfa weevil, blue and pea aphid, and spotted alfalfa aphid. Nine different pesticides (organophosphates, pyrethroids, oxadiazines, and botanicals) are recommended and could be used to manage those pests (Table 28). The pests of concern for almonds are navel orange worm, peach twig borer, and San Jose scale. Over 10 different classes of pesticides can be used to manage these pests in almonds (Table 28). Ten pesticides can be used to manage peach twig borer and San Jose scale in peaches, and eight for prunes.

To assess the use of alternatives to chlorpyrifos and diazinon, the ESJWQC reviewed PUR data for pesticides listed in Table 28 for each commodity. Total pounds of chlorpyrifos, diazinon, and alternative pesticide applied during the 2015 WY are included in Figure 10. This data indicates the amounts of each pesticide used in the region; however, it cannot be used to 1) determine if pesticides were used in place of chlorpyrifos or diazinon or if they were applied in response to the presence of a different pest, or 2) applied during a different phase of the life cycle of a common insect pest.

As depicted in Figure 9, both chlorpyrifos and diazinon use has declined since 2004. A total of 1,565 lbs of diazinon was used during the 2015 WY, and made up 0.6% of the total insecticides used within the ESJWQC region. During the 2015 WY, 73,449 lbs of chlorpyrifos was applied, which accounted for 28% of the total pounds of insecticides applied in the region.

Figure 10. Pounds of major pesticides applied to the top seven commodities with the most chlorpyrifos and/or diazinon applications during the 2015 WY.
PUR data for the 2015 WY are complete for all Counties through September 2015.



During the 2015 WY, the ESJWQC monitored 23 tributary sites for several alternative pesticides in addition to chlorpyrifos and diazinon (Table 29). Monitoring for these constituents also coincided with water column and sediment toxicity monitoring which could indicate the presence of alternative pesticides.

During the 2015 WY, a single sample collected from Duck Slough @ Gurr Rd on March 10, 2015 resulted in a detection (2.0 µg/L) of malathion (Table 30). Since there is a prohibition of discharge of malathion for all Coalitions except for the Rice Coalition, any detection of malathion is considered an exceedance. Duck Slough @ Gurr Rd was monitored for the full suite of constituents monthly and malathion was monitored during every event. This is the second exceedance of the WQTL for malathion at Duck Slough @ Gurr Rd during the past two WYs and therefore a management plan is for the constituent is now required in the site subwatershed. The PUR data associated with the March exceedance indicate there were 28 applications of malathion from February 12 through March 6, 2015. These applications totaled 1,839 lbs AI across 1,778 acres of alfalfa, barley, corn, triticale, and wheat. Applications were made by aerial and ground methods indicating a potential for spray drift from parcels treated adjacent to Duck Slough. In addition, there were two rainfall events that occurred in the timeframe between the applications of malathion and the sampling event; which could have transported the pesticide into the waterway through stormwater runoff. Malathion is known to be toxic to *C. dubia* (LC50 = 3.35 µg/L); and samples collected during the same monitoring event resulted in complete mortality.

Samples collected on March 10, 2015 from Unnamed Drain @ Hogin Rd resulted in an exceedance (8.4 µg/L) of the 1.0 µg/L WQTL of dimethoate (Table 30). During the 2015 WY, dimethoate was monitored during the months of March and August at Unnamed Drain @ Hogin Rd. This was the first exceedance of the WQTL for dimethoate at this site since monitoring began there in 2013. The PUR data associated with the March exceedance indicate there were 3 applications of dimethoate from February 20 through February 24, 2015 totaling 87 lbs AI across 175 acres of alfalfa. Applications were made using ground methods indicating a potential for spray drift from parcels treated adjacent to Unnamed Drain. In addition, there were two rainfall events that occurred in the timeframe between the applications of dimethoate and the sampling event; which could have transported the pesticide into the waterway through stormwater runoff. The only samples collected for toxicity monitoring that coincided with the dimethoate exceedance was sediment toxicity samples to test for toxicity to *H. azteca*; no toxicity was detected (104% survival compared to the control).

Table 29. The ESJWQC tributary monitoring schedule for potential alternatives to chlorpyrifos and diazinon and toxicity during the 2015 WY.

Subarea	Site Name	Site Type	Organophosphates											Carbamates						Toxicity		
			Azinphos-methyl	Dichlorvos	Dimethoate	Demeton-s	Disulfoton	Malathion	Methamidophos	Methidathion	Parathion, methyl	Phorate	Phosmet	Aldicarb	Carbaryl	Carbofuran	Methiocarb	Methomyl	Oxamyl	*C. dubia*	*P. promelas*	*H. azteca*[1]
Bear Creek, Fresno-chowchilla	Black Rascal Creek @ Yosemite Rd	R																		X*		
	Canal Creek @ West Bellevue Rd	R																		X		
	Cottonwood Creek @ Rd 20	C	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Deadman Creek @ Gurr Rd	R																		X*	X*	
	Dry Creek @ Rd 18	R																				X*
	Duck Slough @ Gurr Rd	C	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X*	X*	X*
	Miles Creek @ Reilly Rd	R																		X*		X*
Stanislaus River, North Stanislaus, Vernalis North	Mootz Drain downstream of Langworth Pond	R																				X
Tuolumne River, Northeast Bank, Westside Creek	Dry Creek @ Wellsford Rd	C	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X*
	Lateral 2 ½ near Keyes Rd	R			X																	X
	Westport Drain @ Vivian Rd	R																				X
Turlock, Merced, Greater Orestimba	Hatch Drain @ Tuolumne Rd	R			X															X		X*
	Highline Canal @ Hwy 99	C	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X*	X	X*
	Highline Canal @ Lombardy Rd	R																				X*
	Hilmar Drain @ Central Ave	R			X																	X*
	Lateral 5 1/2 @ South Blaker Rd	R			X															X	X	X
	Lateral 6 and 7 @ Central Ave	R			X															X	X	X
	Levee Drain @ Carpenter Rd	R			X															X*	X	X*
	Lower Stevinson @ Faith Home Rd	R			X															X	X	X
	Merced River @ Santa Fe	C	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X*	X	X
	Mustang Creek @ East Ave	R																				X*
	Prairie Flower Drain @ Crows Landing	C	X	X	X*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X*	X*	X*
	Unnamed Drain @ Hogin Rd	R			X															X	X	X

X - Monitoring occurred during the 2015 WY

C - Core site; R-Represented site; X*- Monitoring due to a management plan.

[1]If *H. azteca* survival is less than 80% compared to the control, the following pesticides are analyzed: bifenthrin, cyfluthrin, cypermethrin, deltamethrin, esfenvalerate, lambda-cyhalothrin, permethrin, fenpropathrin, and chlorpyrifos. Sediment samples are only collected twice a year.

Table 30. Water column detections of potential alternative pesticides in ESJWQC tributaries during the 2015 WY.

Bold indicates results in exceedance of the associated WQTL.

Subarea	Site Name	Sample Date	Analyte Name	Result (µg/L)	WQTL (µg/L)
Bear Creek, Fresno-chowchilla	Duck Slough @ Gurr Rd	3/10/2015	Malathion	**2.0**	> 0
Turlock, Merced, Greater Orestimba	Unnamed Drain @ Hogin Rd	3/10/2015	Dimethoate	**8.4**	> 1.0

Since the Coalition monitoring scheme may or may not include analysis of the full suite of constituents at each site with exceedances or toxicity, additional chemistry results are utilized when available from Phase I and Phase III Toxicity Identification Evaluations (TIEs) on surface water samples and additional chemistry analysis on sediment samples. Toxicity Identification Evaluation analyses are required for toxic water column samples when survival 50% or below that of the control. When sediment toxicity results in *H. azteca* survival below 80% compared to the control, the sample is also analyzed for bifenthrin, chlorpyrifos, cyfluthrin, cyhalothrin – lambda, cypermethrin, deltamethrin: tralomethrin, esfenvalerate/fenvalerate, fenpropathrin, permethrin, and piperonyl butoxide. Monitoring from the 2015 WY resulted in nine instances of toxicity. Eight surface water samples were toxic to *C. dubia*, and zero to *Pimephales promelas*. Of the eight water samples that were toxic to *C. dubia,* five underwent TIE analysis (Table 31). Of those samples, four samples that were shown to coincide with exceedance level detections of chlorpyrifos, and the remaining sample was shown to coincide with an exceedance level detection of malathion. One sediment sample was toxic to *H. azteca* (Table 31). The single toxic sediment sample was analyzed for additional sediment chemistry and resulted in detections of bifenthrin (5.1 ng/g), chlorpyrifos (1,400 ng/g), lambda-cyhalothrin (29 ng/g), and permethrin (1.1 ng/g) (Table 31).

In summary, monitoring results from the 2015 WY indicate malathion, dimethoate, and pyrethroids were present in ESJWQC tributaries (Table 30 and Table 31). Pyrethroids are among the top alternatives applied to alfalfa, almonds, corn, peaches, and walnuts. Table 32 includes TIE Phase III results from toxic surface water samples with calculated Toxic Units (TUs).

Table 31. The ESJWQC tributary water column and sediment toxicity exceedance summary for the 2015 WY.

During 2014 WY there were instances of toxicity to *Selenastrum capricornutum* in the ESJWQC. These are not included in this table because algae toxicity is associated with herbicides, not with insecticides that can be used as alternatives to chlorpyrifos or diazinon.

Site Name	Sample Date	Species	Sample Mean (% survival)	Percent Control	Toxicity Significance	Summary Comments
Duck Slough @ Gurr Rd	3/10/2015	*C. dubia*	0	0	SL	Toxicity coincides with an exceedance level detection of malathion (2.0 µg/L).
Duck Slough @ Gurr Rd	6/9/2015	*C. dubia*	75	75	SL	No TIE was conducted
Duck Slough @ Gurr Rd	7/14/2015	*C. dubia*	0	0	SL	Toxicity coincides with an exceedance level detection of chlorpyrifos (0.19 µg/L).
Prairie Flower Drain @ Crows Landing Rd	3/10/2015	*C. dubia*	0	0	SL	Toxicity coincides with an exceedance level detection of chlorpyrifos (4.2 µg/L).
Prairie Flower Drain @ Crows Landing Rd	3/10/2015	*H. azteca*	0	0	SL	Sediment detections of bifenthrin (5.1 ng/g), chlorpyrifos (1,400 ng/g), lambda-cyhalothrin (29 ng/g), and permethrin (1.1 ng/g) were detected in sediment samples.
Prairie Flower Drain @ Crows Landing Rd	4/14/2015	*C. dubia*	0	0	SL	Toxicity coincides with an exceedance level detection of chlorpyrifos (0.20 µg/L).
Prairie Flower Drain @ Crows Landing Rd	5/12/2015	*C. dubia*	0	0	SL	Toxicity coincides with an exceedance level detection of chlorpyrifos (0.20 µg/L).
Prairie Flower Drain @ Crows Landing Rd	6/9/2015	*C. dubia*	70	70	SL	No TIE was conducted
Prairie Flower Drain @ Crows Landing Rd	7/14/2015	*C. dubia*	60	60	SL	No TIE was conducted

SL-Statistically significant difference from control; less than 80% threshold
SG-Statistically significant difference from control; greater than 80% threshold

Table 32. Summary of water column phase III TIE results and conclusions.

Phase III analysis results are calculated and provided by Aqua-Science Laboratory. The table includes Phase III analyses on toxic samples that have chemical results for the same sample date to calculate toxic units (TUs). Baseline TUs were calculated using the formula: 100/baseline toxicity EC_{50}. Phase III TUs were calculated using the formula: concentration of analyte detected in the sample/Phase III EC_{50}.

Station Name	Sample Date	Species	Baseline Toxicity Result		Phase III TIE Result			Phase III Conclusions
			EC_{50}	TU	Chemical, concentration	EC_{50} (µg/L)	TU	
Duck Slough @ Gurr Rd	3/10/2015	*C. dubia*	47.6	2.1	Malathion, 2 µg/L	1.0-3.4	0.6-2.0	Malathion accounted for some or most of the toxicity in the sample.
Duck Slough @ Gurr Rd	7/14/2015	*C. dubia*	43.5	2.3	Chlorpyrifos, 0.19 µg/L	0.08	2.4	Chlorpyrifos accounted for most of the toxicity in the sample. Toxicity due to the concentration of copper in sample is negligible.
					Dissolved copper, 2.4 µg/L	159	<0.01	
Prairie Flower Drain @ Crows Landing Rd	3/10/2015	*C. dubia*	58.8	1.7	Chlorpyrifos, 4.2 µg/L	0.08	52.5	Chlorpyrifos accounted for all the in the sample.
Prairie Flower Drain @ Crows Landing Rd	4/14/2015	*C. dubia*	17.7	5.6	Chlorpyrifos, 4.2 µg/L	0.08	52.5	Chlorpyrifos accounted for most of the toxicity in the sample.
Prairie Flower Drain @ Crows Landing Rd	5/12/2015	*C. dubia*	35.4	2.8	Chlorpyrifos, 0.2 µg/L	0.08	2.5	Chlorpyrifos accounted for most of the toxicity in the sample.

The Westside Coalition tests collected samples for a variety of carbamate, OP, and organochlorine insecticides (depending on the site). During the 2015 WY, there were 103 detections of insecticides at sites monitored by the Westside Coalition. Of these, 14 represented legacy insecticides that are no longer in use (dieldrin, DDT, DDE and toxaphene). Of the remaining detections, 24 were OP insecticides (12 detections of chlorpyrifos, 1 of diazinon, 7 of dimethoate, and 3 malathion), and 58 were herbicides (cyanazine, diuron, pendimethalin, and simazine). The remaining 7 were carbamates (carbaryl and methomyl).

The Westside Coalition collects water samples for targeted aquatic toxicity testing during the irrigation season and rain events. During the 2015 WY, toxicity to *C. dubia* (the species most likely to be affected by chlorpyrifos or diazinon) was observed five times, with chlorpyrifos the likely cause for two of those observations, and diazinon the likely cause for one. The other two observations did not detect any current-use insecticides.

The Westside Coalition collects sediment samples for toxicity testing in March and September of 2015, and sediment pesticide analyses are performed as a follow-up to observations of sediment toxicity with a difference from control of greater than 20%. During the 2015 WY, thirteen samples were collected (including one duplicate) and tested for toxicity to *H. azteca* on March 9th, 2015. Statistically significant toxicity was measured at seven sites, although three of the sites with observed toxicity measured survival greater than 80%. Four samples exhibited sufficient toxicity to warrant follow-up analysis (>20% difference from control). Follow-up analysis included pesticide testing for a variety of pyrethroids, legacy organochlorines, and selected OP insecticides. On September 14th, 2015 nine sediment samples were collected and tested for sediment toxicity (including one duplicate). Of these, four showed significant toxicity and were tested for selected pesticides. Of the eight sediment samples tested for pesticides (over both events), chlorpyrifos was detected above the RL in six samples, and two samples where chlorpyrifos was detected above the detection limit but below the reporting limit. Sediment toxicity and pesticide detections are discussed in greater detail in Section 8 and Attachment 4 of the Westside Coalition's SAMRs.

The Westside Coalition also reviewed available PUR data to evaluate applications of insecticides. Table 33 lists the most applied insecticides (based on total application area, October 2014 to September 2015).

Table 33. Insecticide applications within the Westside Coalition in order of highest application area.

Fresno County	Merced County	Stanislaus County
Abamectin	Abamectin	Abamectin
Imidacloprid	Flonicamid	Lambda-Cyhalothrin
Dimethoate	Imidacloprid	Bifenthrin
Chlorantraniliprole	Dimethoate	Dimethoate
Gifenthrin	Etoxazole	Esfenvalerate
Thiamethoxam	Chlorantraniliprole	Imidacloprid
Acetamiprid	Chlropyrifos	Chlorantraniliprole
Chlorpyrifos	Beta-Cyfluthrin	Metaflumizone

Fresno County	Merced County	Stanislaus County
Spinetoram	Thiamethoxam	Chlorpyrifos
Malathion	1,3-Dichloropropene	1,3-Dichloropropene
Beta-Cyfluthrin	Lambda-Cyhalothrin	Permethrin
Lambda-Cyhalothrin	Malathion	Acetamiprid
Methomyl	Bifenthrin	Spinosad
Clothianidin	Acetamiprid	Methomyl
Cyfluthrin	Spinetoram	Fenpropathrin
Tributyl Phosphorotrithioate	Cypermethrin	Beta-Cyfluthrin
Cypermethrin	Acephate	Diazinon
Carbaryl	Permethrin	Cypermethrin

Summary of Alternatives Detected

The ESJWQC and Westside Coalition detected several pesticides that are alternatives to chlorpyrifos and/or diazinon, including alternatives recommended by the Pest Control Advisors for use on grapes, almonds, and walnuts. Some of these alternative pesticides were found to impair water quality by either exceeding their respective WQOs or contributing to toxicity. Below is a brief description of the detected pesticides:

- Bifenthrin is a pyrethroid insecticide used to treat a variety of insects in orchards and field crops such as alfalfa, cotton, tomatoes, and corn but also has significant residential use.
- Carbaryl is a wide-spectrum carbamate insecticide used to control a wide range of insects in citrus, fruit, nuts, cotton, corn, and other vegetable crops.
- Cyfluthrin is a pyrethroid insecticide used to treat a variety of insects in orchards and field crops such as alfalfa, corn, tomatoes, and cotton.
- Cypermethrin is a pyrethroid insecticide used to treat a variety of insects in field crops such as alfalfa, cotton, onions, and cabbage.
- Dimethoate is an OP pesticide used to control a wide range of insects. It is used on a variety of field crops including alfalfa, beans, tomatoes, and cotton.
- Esfenvalerate/Fenvalerate is a pyrethroid insecticide which is used on a wide range of pests on vegetable crops, tree fruits, and nut crops. It may be mixed with a wide variety of other types of pesticides such as carbamate compounds or organophosphates
- Lambda cyhalothrin is a pyrethroid insecticide used to treat a variety of insects in orchards and field crops such as corn, tomatoes, and cotton.
- Malathion is an OP insecticide used on a variety of crops including alfalfa, walnuts, lettuce, grapes, and cotton.
- Methidathion is an OP insecticide used to control insects and mites in many crops such as fruits, vegetables, tobacco, alfalfa, and sunflowers.
- Methomyl is a carbamate insecticide used to control a variety of pests on vegetable, fruit, and field crops.
- Permethrin is a pyrethroid insecticide used to treat a variety of insects in orchards and field crops such as corn, tomatoes, and cotton and is also used for mosquito and residential insect control.

- Phosmet is an OP insecticide primarily used on apple trees for control of coddling moth, though it is used on a wide range of fruit crops, ornamentals, and vines for the control of aphids, suckers, mites, and fruit flies.

Although the Coalitions detected twelve different insecticides in waterways during this reporting period, it is not possible to determine with certainty if any of these materials were selected as an alternative to chlorpyrifos or diazinon, or were used as part of a grower's pesticide management rotation. Pesticide Control Advisors are recommending the use of some of these pesticides, but the PUR and monitoring data do not provide sufficient information for the Coalitions to establish if the detected pesticides were indeed from applications of pesticides used in an alternative capacity. It is a necessary cultural practice to rotate pesticide selection through specific modes of action (i.e. pyrethroids to organophosphates to carbamates) in order to minimize the risk of pesticide resistance. As a result of this practice, a material other than chlorpyrifos or diazinon may be selected simply because it was next in the rotation rather than as a specific alternative. Based on the Coalition's conversations with growers and Pest Control Advisors, regulatory pressure on diazinon use has phased that material out of the pest management rotation. Chlorpyrifos continues to be a preferred material due to its wide range of allowable use and effectiveness. The Coalitions continue to educate growers through outreach of other applicable alternatives to chlorpyrifos.

OBJECTIVE 6: DETERMINE WHETHER THE DISCHARGE CAUSES OR CONTRIBUTES TO TOXICITY IMPAIRMENT DUE TO ADDITIVE OR SYNERGISTIC EFFECTS OF MULTIPLE POLLUTANTS.

The formula used to calculate loading capacity and load allocation (Equation 1) for chlorpyrifos and diazinon is based on current understanding of the two pesticides' additive effects. As part of each Coalition's tributary monitoring strategies, the ESJWQC and Westside Coalition sample for a wide range of pesticides and toxicity. The TIEs are conducted on toxic water samples to determine the cause of toxicity (if survival is 50% or less compared to the control). Toxic sediment samples are subject to further analysis for chlorpyrifos, Piperonyl butoxide (PBO), and pyrethroids (if survival is less than 80% compared to the control). From these results, the Coalitions are able to analyze the additive and/or synergistic effects of multiple pollutants.

ESJWQC Evaluation of Toxicity Impairment Due to Additive or Synergistic Effects of Multiple Pollutants

To assess if toxicity occurred due to the additive or synergistic effects of a combination of chlorpyrifos or diazinon and another pollutant, the ESJWQC reviewed toxicity results for *C. dubia* and *P. promelas* in the water column and *H. azteca* in sediment samples. During the 2015 WY, eight water column samples were toxic to *C. dubia*, zero to *P. promelas*, and one sediment sample was toxic to *H. azteca* (Table 31).

Additional sediment chemistry analysis for chlorpyrifos, PBO, and pyrethroids was required on the single toxic sediment sampled collected from Prairie Flower Drain @ Crows Landing Rd on March 10, 2015 (0% compared to the control; Table 31).

The sediment chemistry analyses indicated the presence of bifenthrin (5.1 ng/g), chlorpyrifos (1,400 ng/g), lambda cyhalothrin (29 ng/g), and permethrin (1.1 ng/g). Those compounds could have acted additively or synergistically to cause the toxicity; however with the available data, it is not possible to evaluate if the detected pesticides interacted in an additive or synergistic manner to cause the sediment toxicity.

Westside Coalition Evaluation of Toxicity Impairment Due to Additive or Synergistic Effects of Multiple Pollutants

The Westside Coalition reviewed aquatic and sediment toxicity results to assess if toxicity occurred due to the additive or synergistic effects of chlorpyrifos or diazinon and another pollutant. During the 2015 WY, two samples were toxic to *S. capricornutum*, five samples were toxic to *C. dubia*, and eleven sediment samples were toxic to *H. azteca*. All of the samples exhibiting toxicity were from tributary sites and not the San Joaquin River. Table 34 and Table 35 provide details regarding the survival, follow-up testing, and apparent causes of these toxicity events. Diuron was present in both of the samples exhibiting aquatic toxicity to *S. capricornutum*.

Chlorpyrifos was detected in 12 separate water samples, and apparently contributed to *C. dubia* toxicity in two samples. Diazinon was present in one sample and was the apparent cause of *C. dubia* toxicity in that sample.

Table 34. Westside Coalition tributary water column toxicity exceedance summary for 2015 WY.

Station Name	Sample Date	Reactive Species	Results	Units	TIE Comments	Apparent Cause
Hospital Creek @ River Rd	12/4/2014	*C. dubia*	20	% Survival	TIE indicates pesticides are the likely cause	DDE (0.015 µg/L)
Hospital Creek @ River Rd	12/4/2014	*S. capricornutum*	61	% Difference	TIE indicated foreign algal species	Diuron (0.84 µg/L) Pendimethalin (1.6 µg/L)
Ingram Creek @ River Road	1/13/2015	*C. dubia*	0	% Survival	Tie indicated pesticides are the likely cause	Chlorpyrifos (0.58 µg/L)
Newman Wasteway near Hills Ferry Rd	2/10/2015	*C. dubia*	0	% Survival	Tie indicated pesticides are the likely cause	Diazinon (0.96 µg/L)
Hospital Creek @ River Rd	2/10/2015	*C. dubia*	0	% Survival	Tie indicated pesticides are the likely cause	Chlorpyrifos (0.37 µg/L) DDE (0.013 µg/)
Salt Sl @ Sand Dam	2/10/2015	*S. capricornutum*	36	% Difference	TIE not required	Diuron (8.3 µg/L)
Mud Sl u/s of San Luis Drain	6/9/2015	*C. dubia*	45	% Survival	TIE indicated and sample salinity contributed to toxicity.	No detected pesticides: EC = 6465

March 2015 Sediment Toxicity Follow Up

Sediment toxicity tests were performed on 13 samples (including one duplicate) collected in March 2015 (Event 121). Statistically significant toxicity was measured in seven of those samples, although three of those samples measured survival >80% (Table 35), follow up pesticide testing was performed on the four samples exhibiting severe toxicity. These results were compared to literature values for the purpose of determining the probable cause of toxicity in each sample. In all cases pesticides were present in sufficient quantity to have caused the toxicity.

Blewett Drain at Highway 132 (50.0% survival): A total of 1.69 sediment toxic units (TUs) were calculated based on the detected pesticides. Bifenthrin accounted for 1.28 TUs, esfenvalerate 0.21 TUs, lambda-cyhalothrin 0.08 TUs, permethrin 0.01 TUs, and chlorpyrifos accounted for 0.11 TUs.

Hospital Creek at River Road (27.5% Survival): 2.04 TUs were calculated, with bifenthrin 1.20 TUs, and lambda cyhalothrin 0.44 TUs, esfenvalerate 0.11 TUs, permethrin 0.02 TUs, and chlorpyrifos accounted for 0.27 TUs.

Ingram Creek at River Road (20.0% Survival): A total of 2.53 TUs were calculated with bifenthrin 0.66 TUs, cypermethrin 0.50 TUs, lambda cyhalothrin 0.99 TUs, esfenvalerate 0.06 TUs, and chlorpyrifos, accounted for 0.32 TUs.

Orestimba Creek at Highway 33 (85.0% survival): 1.47 TUs were calculated, with bifenthrin 1.38 TUs, cyfluthrin 0.01 TUs, lambda cyhalothrin 0.06 TUs, esfenvalerate 0.02, and chlorpyrifos accounted for 0.01 TUs.

Westley Wasteway at Cox Road (65.7% survival): 0.73 TUs were calculated, with bifenthrin 0.65 TUs, lambda cyhalothrin 0.05 TUs, esfenvalerate 0.06, and chlorpyrifos accounted for 0.02 TUs.

September 2015 Sediment Toxicity Follow-Up

Sediment toxicity tests were performed on nine samples (including one duplicate) collected in September 2015 (Event 127). Statistically significant toxicity was measured at four sites and were sufficient to require follow-up pesticide analysis (Table 35). These results were compared to literature values for the purpose of determining the probable cause of toxicity in each sample.

The Blewett Drain at Highway 132 sample had a total of 17.52 TUs, with bifenthrin accounting for 14.36 TUs and lambda-cyhalothrin accounting for 3.03 TUs. Chlorpyrifos accounted for 0.05 TUs. There were sufficient pyrethroid TUs to account for the 1.25% survival observed.

The Hospital Creek sample had a total of 27.47 TUs. Bifenthrin accounted for 23.63 TUs, and lambda-cyhalothrin accounted for 3.64 TUs. Chlorpyrifos accounted for 0.07 TUs. There were sufficient pyrethroid TUs to account for the 0% survival observed.

The Ingram Creek sample had a total of 11.08 TUs, with bifenthrin accounting for 9.50 TUs and lambda-cyhalothrin accounting for 1.45 TUs. Chlorpyrifos accounted for 0.04 TUs. There were sufficient pyrethroid TUs to account for the 0% survival observed in the sample.

The Del Puerto Creek near Cox Road sample had a total of 1.86 TUs, with bifenthrin accounting for 1.56 TUs, lambda-cyhalothrin accounting for 0.20. Chlorpyrifos accounted for 0.01 TUs. There were sufficient pyrethroid TUs to account for the 56.3% survival observed in the sample.

In each of the sediment samples where follow-up pesticide analyses were performed, at least one pyrethroid insecticide was detected at a level sufficient to cause the observed toxicity itself and the toxic unit contribution from chlorpyrifos was insignificant. Hence, synergistic effects between chlorpyrifos and other materials were unlikely.

Table 35. The Westside Coalition tributary sediment toxicity exceedance summary for the 2015 WY.

Station Name	Sample Date	Reactive Species	% Survival	Detected Pesticides
Blewett Drain @ Hwy 132	3/9/2015	*H. azteca*	50	Bifenthrin (3.3ng/g), Chlorpyrifos (0.98 ng/g), Lambda-cyhalothrin (0.18j), DDE (5.3j ng/g), Es/Fenvalerate (1.6 ng/g), Permethrin (0.29j ng/g)
Hospital Creek @ River Rd	3/9/2015	*H. azteca*	27.5	Bifenthrin (3.8 ng/g), Chlorpyrifos (2.9 ng/g), Lambda-cyhalothrin (1.2 ng/g), DDE (180 ng/g), DDT (62 ng/g), Es/Fenvalerate (1 ng/g), Permethrin (1.1 ng/g)
Ingram Creek @ River Rd	3/9/2015	*H. azteca*	20	Bifenthrin (2.7 ng/g), Chlorpyrifos (4.5 ng/g), Lambda-cyhalothrin (3.5 ng/g), Cypermethrin (1.5 ng/g), DDD (5.1j ng/g), DDE (130 ng/g), Es/Fenvalerate (0.69 ng/g)
Westley Wasteway near Cox Rd	3/9/2015	*H. azteca*	65.7	Bifenthrin (8 ng/g), Chlorpyrifos (0.31j ng/g), Lambda-cyhalothrin (0.56 ng/g), DDE (34 ng/g), Es/Fenvalerate (0.73 ng/g)
Ramona Lake near Fig Ave	3/9/2015	*H. azteca*	91.3	No follow-up testing required
Orestimba Creek @ Hwy 33	3/9/2015	*H. azteca*	85	Bifenthrin (20 ng/g), Chlorpyrifos (1.1 ng/g), Cyfluthrin (0.18j), Lambda-cyhalothrin (0.71 ng/g), DDD (17 ng/g), DDE (230 ng/g), DDT (6.5j ng/g), Es/Fenvalerate (0.4 ng/g), Permethrin (0.31j ng/g)
Newman Wasteway @ Hills Ferry Rd	3/9/2015	*H. azteca*	86.3	No follow-up testing required
Blewett Drain @ Hwy 132	9/14/2015	*H. azteca*	1.3	Bifenthrin (40 ng/g), Chlorpyrifos (0.43 ng/g), Lambda-cyhalothrin (7.3 ng/g), DDE (54 ng/g), Esfenvalerate (0.58 ng/g), Permethrin (0.75 ng/g)
Hospital Creek @ River Rd	9/14/2015	*H. azteca*	0	Bifenthrin (42 ng/g), Chlorpyrifos (0.44 ng/g), Lambda-cyhalothrin (5.6 ng/g), DDE (25 ng/g), Esfenvalerate (0.53 ng/g), Permethrin (0.89 ng/g)
Ingram Creek @ River Rd	9/14/2015	*H. azteca*	0	Bifenthrin (28 ng/g), Chlorpyrifos (0.38 ng/g), Lambda-cyhalothrin (3.7 ng/g), DDE (62 ng/g), Esfenvalerate (0.63 ng/g), Permethrin (1.3 ng/g)
Del Puerto Creek near Cox Rd	9/14/2015	*H. azteca*	56.3	Bifenthrin (10 ng/g), Chlorpyrifos (0.14j ng/g), Lambda-cyhalothrin (1.1 ng/g), DDE (78 ng/g), DDT (25 ng/g), Es/Fenvalerate (1.6 ng/g), Permethrin (0.28j ng/g)

OBJECTIVE 7: DEMONSTRATE THAT MANAGEMENT PRACTICES ARE ACHIEVING THE LOWEST PESTICIDE LEVELS TECHNICALLY AND ECONOMICALLY ACHIEVABLE

A determination of technical and economic feasibility needs to be done at the individual farm level and, consequently, is expected to vary with the specific operation and commodity farmed. The goal of the ESJWQC and Westside Coalition is for their members to have no discharge of pesticides to surface waters. Economic feasibility is determined by factors outside the control of the Coalitions. Profitable operations can afford to implement management practices such as constructing sediment basins or installing pressurized irrigation, both of which can significantly reduce the runoff of irrigation and stormwater carrying agricultural discharges. Marginally profitable operations may not be able to afford these practices. Consequently, efforts by the ESJWQC and Westside Coalition to obtain additional funding for growers have been important to achieving the Coalitions' goal. Both Coalitions have been instrumental in helping growers obtain AWEP funding and publicizing the current funding available. Through the 2015 WY farmers from the two Coalitions had access to funds from the Proposition 84 grant program run by the Coalition for Urban/Rural Environmental Stewardship (CURES), NRCS funding, and internal grant/loan funding provided by local water agencies. These programs offer several million dollars towards the implementation of structural management practices within their respective regions. However, there remain many growers in the eastside drainage area of the LSJR who are not members of either Coalition and not influenced by the Coalitions' efforts.

It is technically feasible to eliminate all discharges of chemicals to surface waters, although it could require steps that are not economically feasible for even the most profitable operations. Given the success in the ESJWQC and Westside Coalition regions in the 2015 WY, it seems possible to reduce discharges to surface waters to the point that they do not impair beneficial uses.

During the 2015 WY, there were more exceedances of the WQTLs of both chlorpyrifos and diazinon within tributary subareas compared to the 2014 WY. The new membership enrollment in ESJWQC increased in 2015; however there still are numerous non-members in both Coalitions that could be contributing to exceedances and who have not received focused outreach. Until each Coalition reaches 100% grower membership it's not entirely possible to determine who is discharging and therefore it is not possible to determine if growers in the ESJWQC or the Westside Coalition are achieving the lowest pesticide levels achievable. However, the management practices implemented by members of each Coalition appear to be resulting in a reduction of discharges, and are in the process of achieving the lowest pesticide levels technically and economically feasible.

CONCLUSIONS AND RECOMMENDATIONS

The ESJWQC and Westside Coalition assessed compliance with the seven Monitoring Objectives of the chlorpyrifos and diazinon TMDL program by evaluating results collected from their joint chlorpyrifos and diazinon TMDL monitoring program and their individual Coalition tributary monitoring programs. During the 2015 WY there were no exceedances of the WQO for chlorpyrifos in samples collected from the LSJR TMDL monitoring locations.

There were eight detections of chlorpyrifos above the WQO in samples collected from ESJWQC tributaries during the 2015 WY. There were no detections of Diazinon in samples collected from ESJWQC tributaries during the 2015 WY. In the Westside Coalition, chlorpyrifos was detected in eleven samples (over four different monitoring events), eight of which were in excess of the load criteria. There was one detection of diazinon during this report period, which was in excess of the load criteria. Of the nine tributaries with chlorpyrifos or diazinon exceedances during the 2015 WY, two of them (Newman Wasteway and Ramona Lake) were not in a management plan. Duck Slough @ Gurr Rd was the only tributary with a chlorpyrifos exceedance in the ESJWQC region that was under a management plan for chlorpyrifos during the 2015 WY. Both Highline Canal @ Hwy 99 and Prairie Flower Drain @ Crows Landing Rd will have their previously completed chlorpyrifos management plans reinstated following the exceedances detected during the 2015 WY.

Both Coalitions determined the degree of implementation and evaluated the effectiveness of management practices designed to reduce the off-site movement of chlorpyrifos and diazinon. The ESJWQC and Westside evaluated alternatives to chlorpyrifos and diazinon including use within the two Coalition regions and water quality impairments due to other pesticides. Alternative pesticides may be impairing water and sediment quality. However, due to the lack of available monitoring data it is not possible to determine if synergistic and/or additive effects are occurring in ESJWQC and Westside Coalition tributaries.

The PUR data indicate chlorpyrifos use in recent years has declined and is expected to decline further due to restrictions applied to this chemical during the 2015 WY (Figure 9). Diazinon use declined dramatically in the LSJR watershed over the past few years (Figure 9). In addition, growers are informed of water quality concerns related to OP pesticides and implement management practices to prevent off-site movement of chlorpyrifos and diazinon. Both Coalitions include discussions of chlorpyrifos, diazinon, as well as all water quality impairments during focused outreach to growers.

The monitoring frequency of the chlorpyrifos and diazinon TMDL program was originally designed to occur quarterly in the LSJR and monitoring would occur during one month of each quarter to coincide with the greatest applications (2010 WY). Beginning on the 2011 WY, monitoring frequency was increased to include monthly samples for three of the six compliance points, and beginning on the 2012 WY frequency was increased to six times a year for the other three compliance points. Despite the four-fold increase in monitoring frequency since 2010, there has been only one single exceedance of chlorpyrifos and no detections of diazinon in samples collected from the LSJR.

REFERENCES

California Department of Water Resources (2015). *California Irrigation Management Information System.* [Online] Available at: http://wwwcimis.water.ca.gov/. [Accessed 2015].

Daane, K. M., Yokota, G. Y. & Dlott, J. W. (1993). Dormant-season sprays affect the mortality of peach twig borer (Lepidoptera: Gelechiidae) and its parasitoids. *Journal of Economic Entomology,* Volume 86, pp. 1679-1685.

Elliott, B., Wilhoit, L., Brattesani, M. & Gorder, N. (2004). *Pest management assessment for almonds: Reduced-risk alternatives to dormant organophosphate insecticides,* Sacramento, CA: California Department of Pesticide Regulation (DPR).

Insecticide Resistance Action Committee (2005). *Resistance Management for Sustainable Agriculture and Improved Public Health - Crop Information.* [Online] Available at: http://www.irac-online.org/crops/. [Accessed 12 February 2013].

Rice, R. E., Jones, R. A. & Black, J. H. (1972). Dormant sprays with experimental insecticides for control of peach twig borer. *California Agriculture,* Volume 26, pp. 14-15.

Summers, C., Godfrey, L. & Natwick, E. (2007). Managing insects in alfalfa. In: C. G. Summers & D. H. Putnam, eds. *Irrigated alfalfa management for Mediterranean and Desert zones.* Oakland: University of California Agriculture and Natural Resources Publication 8295.

University of California Agriculture and Natural Resources, n.d. *Statewide Integrated Pest Management Program - Agricultural pests.* [Online] Available at: http://www.ipm.ucdavis.edu/PMG/crops-agriculture.html. [Accessed 10 February 2013].

Zalom, F., Oliver, M. & Hinton, D. (1999). *Alternatives to chlorpyrifos and diazinon dormant sprays.,* Davis, CA: Statewide Integrated Pest Management Project, University of California Agricultural and Natural Resources.