California Environmental Protection Agency

Central Coast Regional Water Quality Control Board

Total Maximum Daily Loads to Address Organophosphate Pesticides and Aquatic Toxicity Impairments within the Lower Salinas River Watershed

Monterey County, California

Draft
Water Quality Data Analysis Report

October 2020

TABLE OF CONTENTS

TABLE OF FIGURES

TABLE OF TABLES

LIST OF ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Description
CDPR	California Department of Pesticide Regulation
CDFW	California Department of Fish and Wildlife (formerly California Department of Fish and Game)
CCAMP	Central Coast Ambient Monitoring Program
CCC	Criterion Continuous Concentration
CMC	Criterion Maximum Concentration
CMP	Cooperative Monitoring Program
GIS	Geographic Information System
OP	Organophosphate
PUR	Pesticide Use Report
TIEs	Toxicity Identification Evaluations
TMDL	Total Maximum Daily Load
USEPA	United States Environmental Protection Agency
USGS	United States Geologic Survey

1 BACKGROUND

On May 5, 2011, the Central Coast Regional Water Quality Control Board (Central Coast Water Board) adopted Resolution R3-2011-0005 which established total maximum daily loads (TMDLs) for chlorpyrifos and diazinon in the lower Salinas River watershed. In accordance with the Water Quality Control Policy for Addressing Impaired Waters (SWRCB, 2005), the TMDLs were adopted as a single regulatory action (single vote) rather than an amendment to the Water Quality Control Plan for the Central Coastal Basin (Basin Plan). The single vote approval by the Central Coast Water Board found that the TMDLs for chlorpyrifos and diazinon would be implemented via the Conditional Waiver of Waste Discharge Requirements for Irrigated Lands (Agricultural Order) along with its' accompanying Monitoring and Reporting Program. On October 7, 2011, these TMDLs were subsequently approved by the United States Environmental Protection Agency (USEPA).

Central Coast Water Board staff (staff) is in the process of developing new TMDLs, as contained herein, for chlorpyrifos, diazinon, malathion (organophosphate pesticides), and toxicity in the lower Salinas River watershed. These new TMDLs will be proposed as an amendment to the Basin Plan and will supersede the TMDLs that were formerly approved in 2011.

2 INTRODUCTION

The purpose of this Draft Water Quality Data Analysis Report is to present water quality data that will be used to develop TMDLs for organophosphate pesticides and toxicity in streams of the lower Salinas River watershed. Note that the content of this draft document is a "work in progress", as noted in several sections, and thus subject to future revisions and changes during development of the TMDLs. Future editions of this report will include the regulatory and technical basis for addressing the impairments, identify the sources of pollutants, and propose TMDLs and implementation actions to rectify the waterbody impairments.

Several streams within the lower Salinas River watershed are on the federal Clean Water Act section 303(d) List of impaired waterbodies (303(d) List) due to one or more of the following conditions: excessive concentrations of chlorpyrifos, diazinon, malathion (organophosphate pesticides), or toxicity as shown in Table 2-1.

Table 2-1. Organophosphate pesticide and toxicity impaired waterbodies on the 303(d) List.

Water Body Name	Water Body Identification	Impairment
Alisal Creek	CAR309700951999022213053 7	toxicity
Alisal Slough	CAR3091101020090311204028	diazinon, toxicity
Blanco Drain	CAR309110101998120916150 9	chlorpyrifos, diazinon, toxicity
Chualar Creek	CAR309190002008060416133 7	chlorpyrifos, diazinon, malathion, toxicity
Espinosa Lake	CAL309190002002011715174 4	chlorpyrifos, diazinon,
Espinosa Slough	CAR309110101998123013515 2	diazinon, malathion, toxicity
Gabilan Creek	CAR309190001999030409234 5	toxicity
Merritt Ditch	CAR309110102008060415214 7	diazinon, toxicity
Moro Cojo Slough	CAE306000151998120913224 6	toxicity
Moss Landing Harbor	CAB306000141998121412113 5	chlorpyrifos, diazinon
Old Salinas River Estuary	CAE306000141998121414380 7	chlorpyrifos, diazinon
Natividad Creek	CAR309110102005053112514 0	diazinon, toxicity
Old Salinas River	CAR309110102008061114551 8	chlorpyrifos, diazinon, toxicity
Quail Creek	CAR309190002001122714064 7	chlorpyrifos, diazinon, malathion, toxicity
Salinas Reclamation Canal	CAR309110101998082811222 9	chlorpyrifos, diazinon, malathion, toxicity
Salinas River (lower, estuary to near Gonzales Rd)	CAR309110102002100719310 2	chlorpyrifos, diazinon, toxicity
Salinas River Lagoon (North)	CAE309110101998082814323 2	chlorpyrifos, toxicity
Tembladero Slough	CAR309110101998120913183 0	chlorpyrifos, diazinon, malathion, toxicity

The federal Clean Water Act requires every state to evaluate its waterbodies and maintain a list of waters that are impaired either because the water exceeds water quality standards[1] or does not achieve its designated beneficial uses. For central coast waterbodies that are on the 303(d) List, the Central Coast Water Board must develop and implement a plan to reduce pollutants so that the waterbody is no longer impaired and can be removed from the 303(d) List.

[1] USEPA defines water quality standards as consisting of three elements: designated uses for each waterbody, criteria to protect those uses, and consideration of the antidegradation requirements.

Total maximum daily load (TMDL) is a term used to describe the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards. A TMDL project identifies the probable sources of pollution, establishes TMDLs (the maximum amount of pollution a waterbody can receive and still meet water quality standards), and allocates that amount to all probable contributing sources. TMDL projects are essentially plans or strategies to restore clean water, and thus a TMDL report is a type of planning document. The California Water Plan characterizes TMDLs as *"action plans…to improve water quality."*

Central Coast Water Board staff (staff) anticipates that this TMDL project will ultimately result in a Basin Plan amendment to incorporate TMDLs for chlorpyrifos, diazinon, malathion, and toxicity into the Basin Plan.

3 TMDL PROJECT LOCATION

This project will develop TMDLs for streams of the lower Salinas River watershed (watershed) that are impaired due to excessive levels of chlorpyrifos, diazinon, malathion, and toxicity. Figure 3-1 depicts the project location.

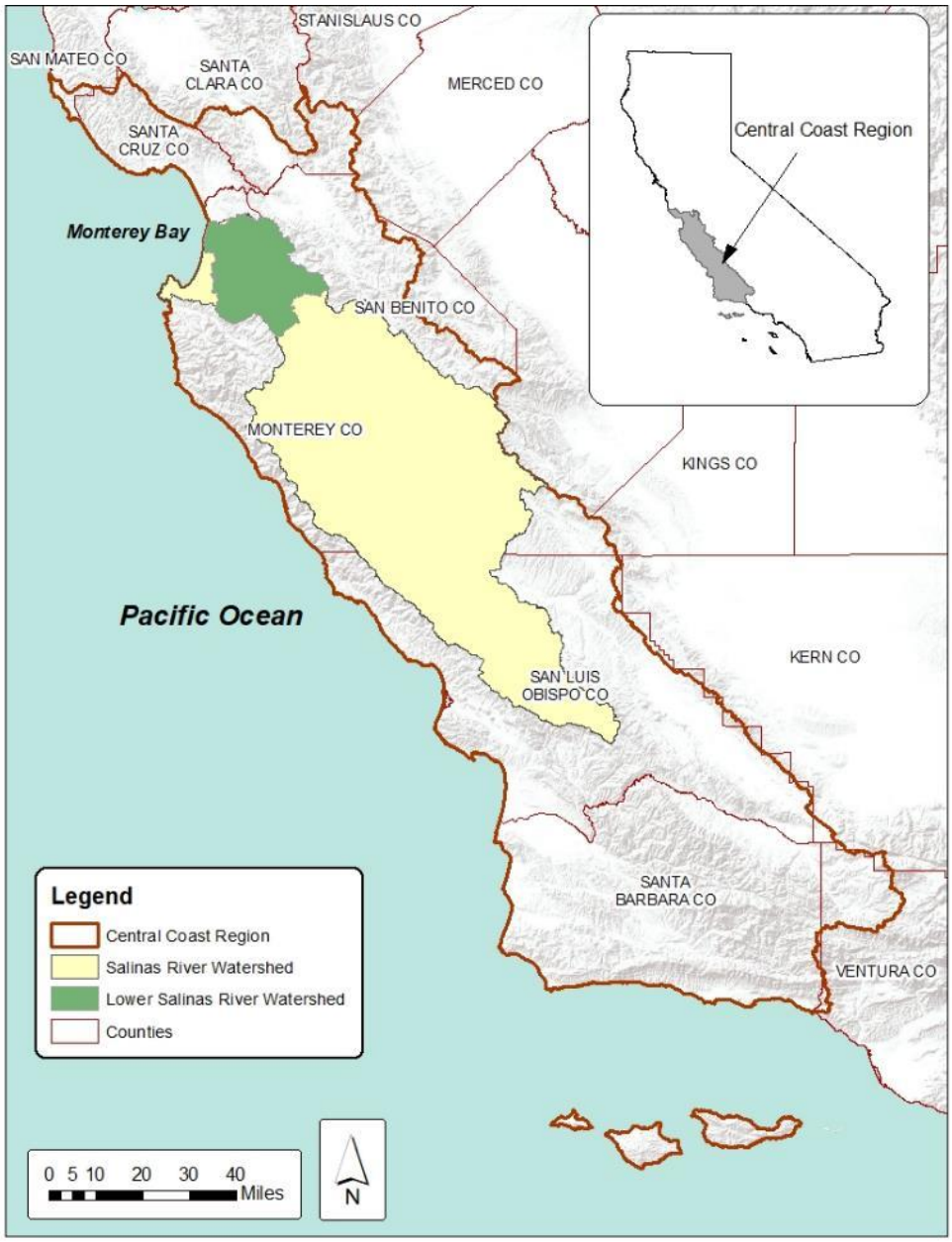

Figure 3-1. General vicinity map of the TMDL project area.

4 WATERSHED DESCRIPTION

The TMDL project area is the lower Salinas River watershed which encompasses an area of approximately 405 square miles in northern Monterey County. The project area extends north from the City of Gonzales to Monterey Bay and the Pacific Ocean. There are two major drainages in the project area which terminate at Moss Landing Harbor, one is the lower Salinas River and its tributaries, and the other is the Salinas Reclamation Canal and its tributaries. Tributaries to the lower Salinas River include Chualar Creek, Esperanza Creek, Quail Creek, Toro Creek,

and Blanco Drain. The lower portion of the Salinas River forms the Salinas River Lagoon (North) where flows are regulated into the Old Salinas River and Moss Landing Harbor. Tributaries to the Salinas Reclamation Canal include Alisal Creek, Natividad Creek, Gabilan Creek, Santa Rita Creek, Alisal Slough, Espinosa Slough, and Merritt Ditch. The lower portion of Salinas Reclamation Canal forms the Tembladero Slough where flows join the Old Salinas River and eventually terminate at Moss Landing Harbor. Moro Cojo Slough is tributary to Moss Landing Harbor.

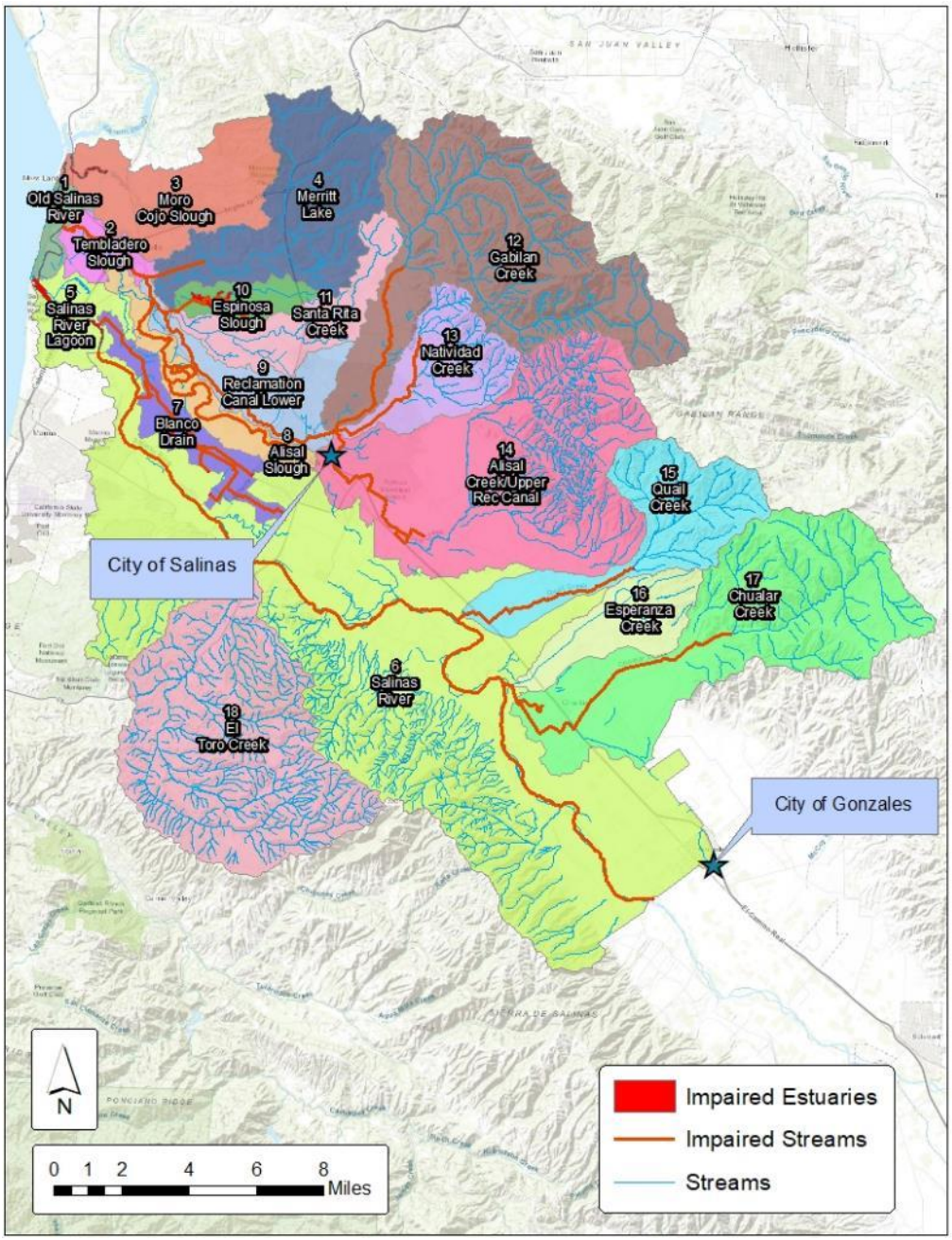

Figure 4-1. Map of subwatersheds and impaired waterbodies in the project area.

Table 4-1. Subwatersheds in the project area and associated size.

Watershed ID	Subwatershed	Acres	Square Miles
1	Old Salinas River	1,492	2.3
2	Tembladero Slough	2,154	3.4
3	Moro Cojo Slough	9,836	15.4
4	Merritt Lake (Merritt Ditch)	14,236	22.2
5	Salinas River Lagoon	3,837	6.0
6	Lower Salinas River	69,774	109.0
7	Blanco Drain	4,442	6.9
8	Alisal Slough	4,621	7.2
9	Salinas Reclamation Canal (Lower)	5,729	9.0
10	Espinosa Slough	2,655	4.1
11	Santa Rita Creek	6,348	9.9
12	Gabilan Creek	27,957	43.7
13	Natividad Creek	7,337	11.5
14	Salinas Reclamation Canal (Upper)/Alisal Creek	29,656	46.3
15	Quail Creek	11,097	17.3
16	Esperanza Creek	5,687	8.9
17	Chualar Creek	25,422	39.7
18	El Toro Creek	27,062	42.3
Total	All subwatersheds	259,342	405.1

4.1 Hydrography

The Lower Salinas River watershed is comprised of two major drainage ways leading to Moss Landing Harbor and Salinas River Lagoon (North). Major drainages to Moss Landing Harbor include Old Salinas River Estuary, Moro Cojo Slough, Old Salinas River, Tembladero Slough, Merritt Ditch, Alisal Slough, Espinosa Slough, Santa Rita Creek, Salinas Reclamation Canal (Lower and Upper/Alisal Creek)[2], Gabilan Creek, and Natividad Creek. The drainages to Salinas River Lagoon (North) include the Salinas River, Blanco Drain, Quail Creek, Chualar Creek, Esperanza Creek, and El Toro Creek. There is hydraulic connectivity between the Salinas River Lagoon (North) and the Old Salinas River via a slide gate at the northwest end of the Salinas River Lagoon (North). There is occasional hydraulic connectivity between Alisal Slough and the Lower Salinas Reclamation Canal via an agricultural ditch.

Streams in the area may be perennial in the mountains and seasonal in the lowlands with agricultural return flows providing all, or the majority, of the flow in

[2] Note that the Salinas Reclamation Canal is segmented into lower and upper portions throughout much of this report with Carr Lake dividing the lower and lower segments. Alisal Creek is tributary to the upper Salinas Reclamation Canal near the airport.

some streams during dry seasons. Some of the waterbodies are tidally influenced, especially those connected to the Moss Landing Harbor; these waterbodies include Moro Cojo Slough, Old Salinas River Estuary, and lower portions of Tembladero Slough. The lower Salinas River receives water released from Lake Nacimiento and Lake San Antonio that is used to replenish groundwater in the Salinas Valley.

4.2 Climate

Monterey County has a generally mild climate. Temperatures near the coast are uniform throughout the year, but the range widens as distance from the water increases. At inland locations, summers are warm to hot and winters have minimum readings below freezing.

The growing season is as short as 150 days in some mountain areas, but ranges from 200 days to more than 350 days in most areas where cultivated crops are grown.

Precipitation is concentrated in winter. Rain totals range from about 10 inches in drier locations to near or slightly above 22 inches in the mountains. Snowfall in the county is generally insignificant, although a limited amount may be observed each winter at the higher elevations.

Winds are generally less than 10 to 15 miles per hour, though stronger winds are common to some areas along the coast. Winter storms may produce damaging winds, particularly in open areas and at higher elevations.

The average annual temperature is about 55° F along the coast and in the mountains along the eastern boundary. Annual temperatures of about 60° F are characteristic of the interior valley (SCS 1978).

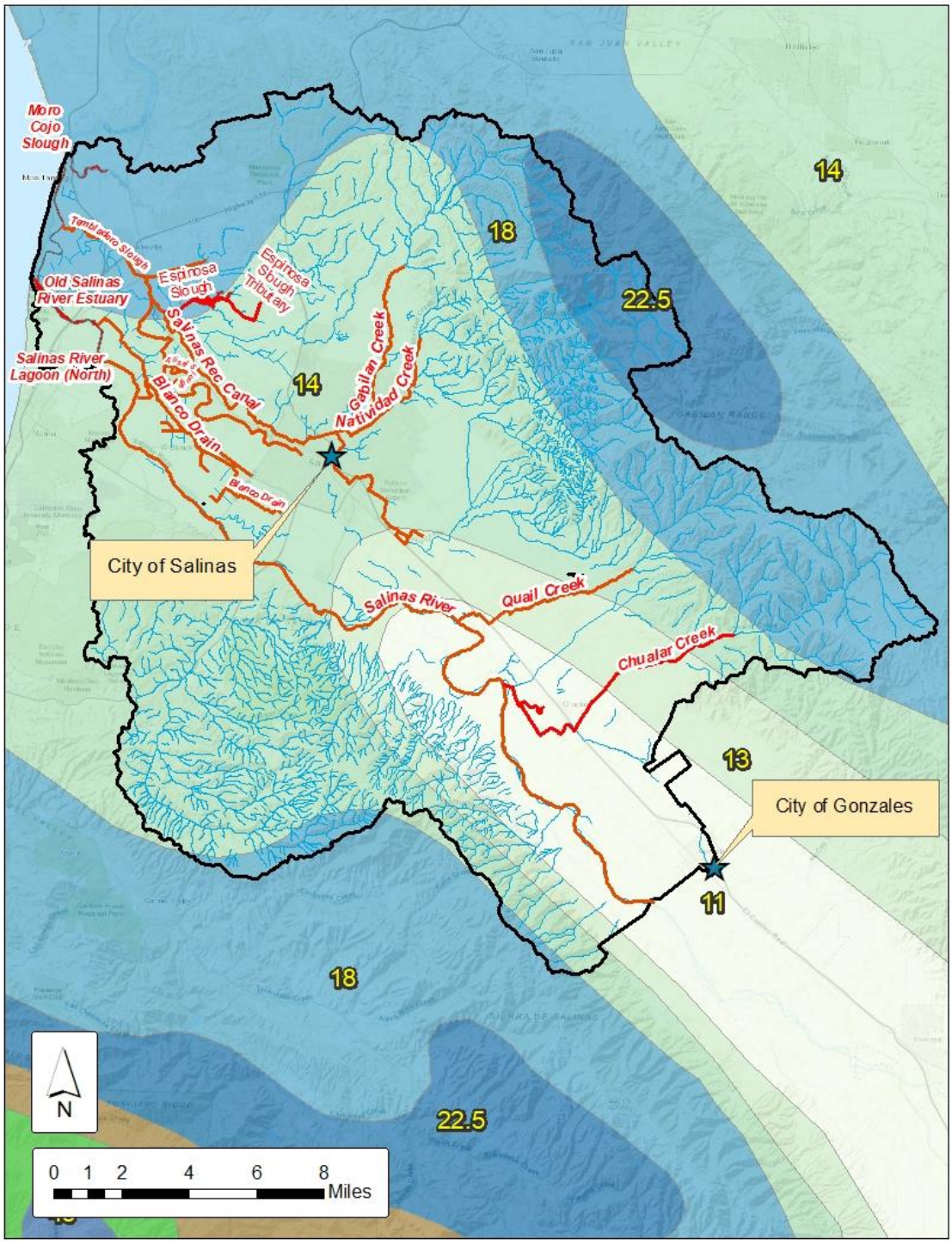

Figure 4-2. Map of precipitation isohyets (inches).
Source: United States Average Annual Precipitation (1981-2010). The PRISM Climate Group at Oregon State University (2006).

4.2.1 Land Use/Land Cover

Land cover analysis using remote sensing tools such as the National Land Cover Database (NLCD) provides a means of interpreting land use and land cover within the TMDL project area. Staff used GIS to summarize the NLCD in the watershed using the latest available 2011 dataset. The NLCD is based on 30-meter Landsat digital satellite imagery of the earth and the data is interpreted into thematic classifications of land cover. A map of the NLCD land use and land cover for the lower Salinas River watershed is presented in Figure 4-3. Table 4-2 and Figure 4-4 provide summaries of the NLCD within the project area. Forest, scrub, and grasslands occupy the mountain and upland areas within the project area (50%) while cultivated crops or croplands are located within the valley floor (29%). Land has been developed at various levels of intensity such as roads, residential, commercial, and industrial uses (17%) and wetlands (open water, woody wetlands, and emergent herbaceous wetlands) comprise only a small area of the total land cover (2%).

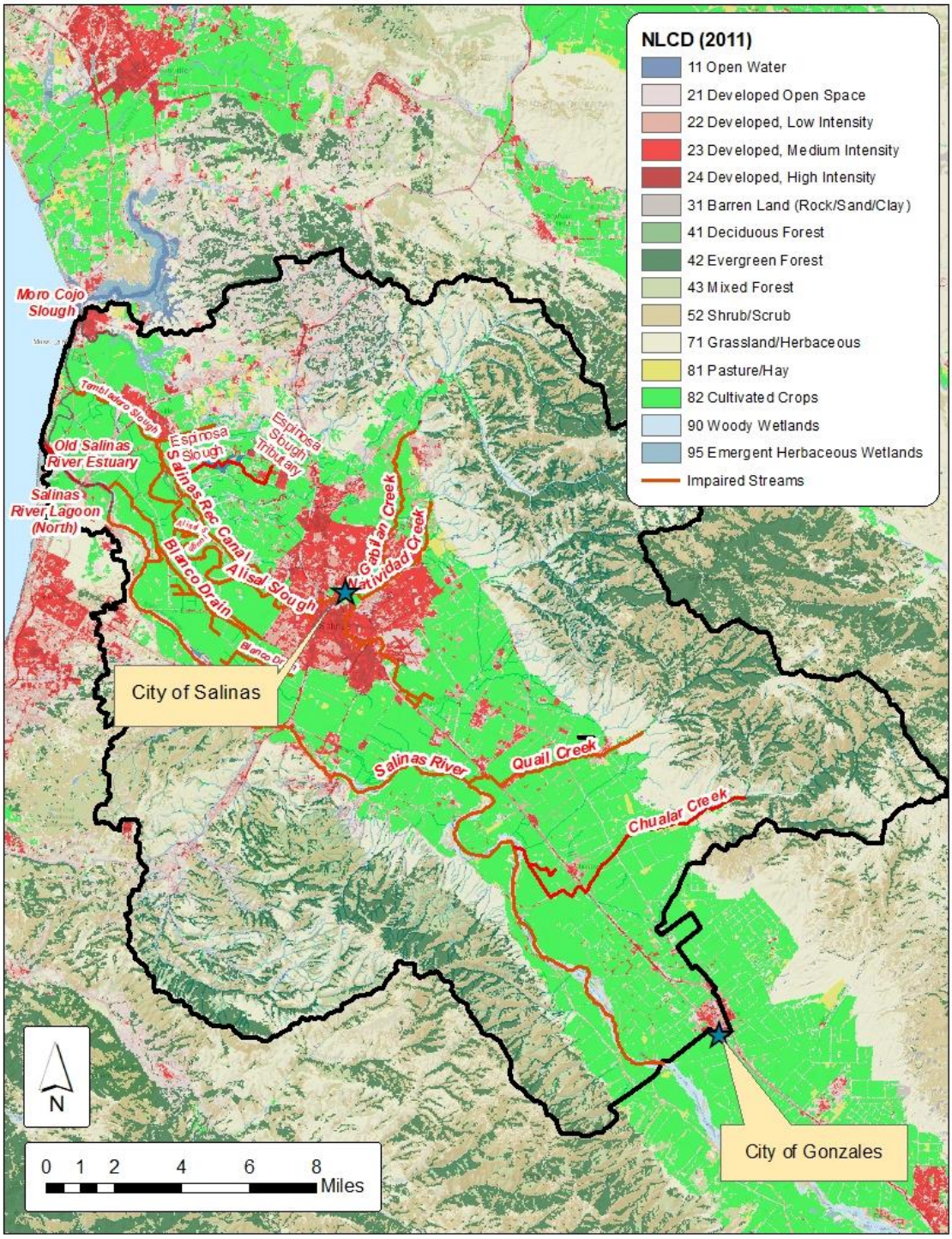

Figure 4-3. Map of project area land use and land cover.

Table 4-2. Land cover in the project area summarized as percent cover and acres.

Id - Land Cover	Percent	Acres
11 - Open Water (Wetlands)	0.2	559.8
21 - Developed Open Space	9.0	23,275.8
22 - Developed, Low Intensity	4.5	11,556.5
23 - Developed, Medium Intensity	4.1	10,674.0
24 - Developed, High Intensity	0.9	2,234.2
31 - Barren Land (Rock/Sand/Clay)	0.2	577.1
41 - Deciduous Forest	< 0.01	5.3
42 - Evergreen Forest	13.6	35,273.3
43 - Mixed Forest	2.8	7,387.5
52 - Shrub/Scrub	16.4	42,428.2
71 - Grassland/Herbaceous	17.2	44,666.4
81 - Pasture/Hay	0.6	1,595.5
82 - Cultivated Crops	28.9	74,851.8
90 - Woody Wetlands	1.2	2,997.4
95 - Emergent Herbaceous Wetlands	0.5	1,258.8
Total	100%	259,341.6

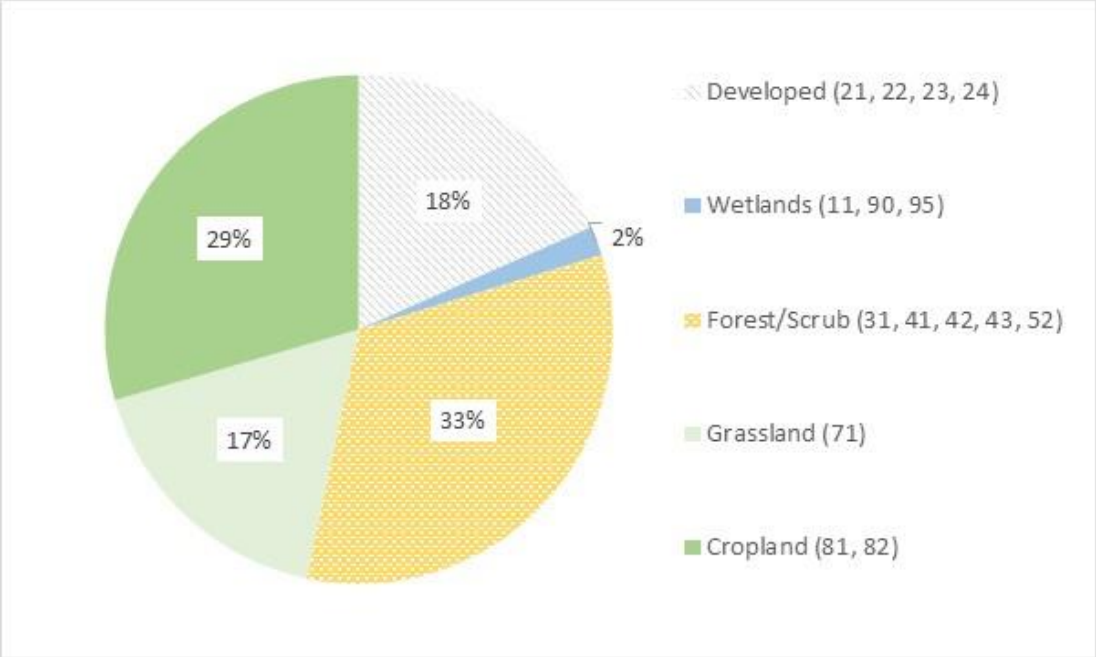

Figure 4-4. Pie chart of percent NLCD 2011 land cover and aggregated land cover type.

4.3 Major Agricultural Crops

The lower Salinas River watershed is located in Monterey County, one of the most productive agricultural regions in the world with annual crop production in the billions of dollars. The value and production of the county's major crops are summarized in Table 4-3 (Monterey, 2019). The highest value crops in Monterey County are lettuce, strawberries, and broccoli. With the exception of grapes, all of the major crops are grown extensively on prime land in the lower Salinas River watershed. Note that mushrooms are reported as pounds, not as acres, and 45,703,000 pounds were reported for 2019.

Table 4-3. Major crops of Monterey County.

Crops	Acres*	Value
Artichokes	**3,835**	**$53,152,000**
Broccoli	**54,027**	**$457,390,000**
Cauliflower	**18,989**	**$212,375,000**
Celery	**10,005**	**$186,391,000**
Grapes (Wine)	**44,683**	**$186,096,000**
Head Lettuce	**40,277**	**$514,088,000**
Leaf Lettuce	**58,846**	**$840,555,000**
Mushrooms	N/A	**$86,836,000**
Nursery Products	**745**	**$143,979,000**
Spinach	**13,550**	**$127,120,000**
Strawberries	**9,232**	**$732,761,000**
Crop Totals	254,189	$3,540,743,000

5 WATER QUALITY STANDARDS

TMDLs are requirements pursuant to the federal Clean Water Act. The broad objective of the federal Clean Water Act is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. Water quality standards are provisions of state and federal law intended to implement the federal Clean Water Act. In accordance with state and federal law, California's water quality standards consist of:

- Beneficial uses: which refer to legally-designated uses of waters of the state that may be protected against water quality degradation (e.g., drinking water supply, recreation, aquatic habitat, agricultural supply, etc.).
- Water quality objectives: which refer to limits or levels (numeric or narrative) of water quality constituents or characteristics that provide for the reasonable protection of beneficial uses of waters of the state.
- Anti-degradation policies: which are implemented to maintain and protect existing water quality, and high quality waters.

Therefore, beneficial uses, water quality objectives, and anti-degradation policies collectively constitute water quality standards. Beneficial uses, relevant water quality objectives pertaining to specific beneficial uses, and anti-degradation requirements that pertain to this TMDL are presented below in Section 5.1, Section 5.2, and Section 5.3, respectively.

5.1 Beneficial Uses

The Central Coast Water Board is required under both State and Federal Law to regulate discharges to waters of the state and to protect beneficial uses designated to all waters of the state.

The Basin Plan designates beneficial uses to all waters of the state. Some waterbodies are designated beneficial uses in Table 2-1 of the Basin Plan. Waterbodies that are not named in Table 2-1 of the Basin Plan are assigned the following designations: municipal and domestic water supply, recreation, and aquatic life beneficial uses. Beneficial uses exist regardless of whether the waterbody is perennial or ephemeral, or the flow is intermittent or continuous.

The Basin Plan specifically identifies beneficial uses for the 303(d) listed waterbodies included in this project. The description of the beneficial uses for waterbodies within the lower Salinas River watershed are shown in Table 5-1.

Table 5-1. Abbreviations and descriptions of beneficial uses.

Abbreviations	Descriptions
AGR	Agricultural supply
BIOL	Preservation of biological habitats of special significance
COLD	Cold fresh water habitat
COMM	Commercial and sport fishing
EST	Estuarine habitat
FRSH	Fresh water replenishment
GWR	Ground water recharge
IND	Industrial service supply
MAR	Marine habitat
MIGR	Migration of aquatic organisms
MUN	Municipal and domestic water supply
NAV	Navigation
PROC	Industrial process supply
RARE	Rare, threatened, or endangered species
REC1	Water contact recreation
REC2	Non-contact water recreation
SHELL	Industrial service supply
SPWN	Spawning, reproduction, and/or early development
WARM	Warm fresh water habitat
WILD	Wildlife habitat

Table 5-2. Waterbodies and beneficial uses that are designated in the Basin Plan.

Waterbodies	Beneficial Uses
Moss Landing Harbor	REC1, REC2, IND, NAV, MAR, SHELL [1], COMM, RARE, WILD
Moro Cojo Slough	GWR, REC1, REC2, WILD, COLD, WARM, SPWN, BIOL, RARE, EST, COMM, SHELL
Old Salinas River Estuary, downstream of Potrero Rd	REC1, REC2, WILD, COLD, WARM, MIGR, SPWN, BIOL RARE, EST, COMM, SHELL
Old Salinas River	REC1, REC2, WILD, COLD, WARM, MIGR, SPWN, BIOL, RARE, EST, COMM
Salinas River Lagoon (North)	REC1, REC2, WILD, COLD, WARM, MIGR, SPWN, BIOL, RARE, EST, COMM, SHELL
Tembladero Slough	REC1, REC2, WILD, WARM, MIGR, SPWN, RARE, EST, COM, SHELL
Espinosa Lake	REC1, REC2, WILD, WARM, COMM
Espinosa Slough	REC1, REC2, WILD, WARM, COMM
Salinas Reclamation Canal	REC1, REC2, WILD, WARM, MIGR, COMM
Gabilan Creek	MUN, AGR, GWR, REC1, REC2, WILD, COLD, WARM, MIGR, SPWN, RARE, COMM
Alisal Creek	MUN, AGR, GWR, REC1, REC2, WILD, COLD, WARM, SPWN, COMM
Blanco Drain	REC1, REC2, WILD, WARM, COMM
Salinas River, downstream of Spreckels Gage	MUN, AGR, REC1, REC2, WILD, COLD, WARM, MIGR, FRSH, COMM
Salinas River, Spreckels Gage-Chualar	MUN, AGR, PROC, IND, GWR, REC1, REC2, WILD, COLD, WARM, MIGR, SPWN, RARE, COMM
Merritt Ditch [2]	MUN, REC1, REC2, WARM, COLD
Alisal Slough [2]	MUN, REC1, REC2, WARM, COLD
Santa Rita Creek [2]	MUN, REC1, REC2, WARM, COLD
Natividad Creek [2]	MUN, REC1, REC2, WARM, COLD
Quail Creek [2]	MUN, REC1, REC2, WARM, COLD
Chualar Creek [2]	MUN, REC1, REC2, WARM, COLD
El Toro Creek [2]	MUN, REC1, REC2, WARM, COLD
Esperanza Creek [2]	MUN, REC1, REC2, WARM, COLD

[1] For Moss Landing Harbor, clamming is an existing beneficial use in the North Harbor and on the south side of the entrance channel to Elkhorn Slough (north of the Pacific Gas and Electric Cooling Water Intake). Presently, no shellfishing use occurs south of the Pacific Gas and Electric Intake.

[2] Waterbody is not specifically named in Table 2-1 of the Basin Plan: however, the Basin Plan specifies general beneficial uses of municipal and domestic water supply, recreation, and aquatic life.

5.2 Water Quality Objectives

The Central Coast Region's Basin Plan contains specific water quality objectives that apply to all inland surface waters, enclosed bays and estuaries (CCRWQCB, 1994, pg. III-4). Relevant water quality objectives for this project include:

5.2.1 Pesticides

No individual pesticide or combination of pesticides shall reach concentrations that adversely affect beneficial uses. There shall be no increase in pesticide concentrations found in bottom sediments or aquatic life.

5.2.2 Toxicity

All waters shall be maintained free of toxic substances in concentrations which are toxic to, or which produce detrimental physiological responses in, human, plant, animal, or aquatic life. Compliance with this objective will be determined by use of indicator organisms, analyses of species diversity, population density, growth anomalies, toxicity bioassays of appropriate duration, or other appropriate methods as specified by the Regional Board.

Survival of aquatic life in surface waters subjected to a waste discharge or other controllable water quality conditions, shall not be less than that for the same water body in areas unaffected by the waste discharge or, when necessary, for other control water that is consistent with the requirements for "experimental water" as described in Standard Methods for the Examination of Water and Wastewater, latest edition. As a minimum, compliance with this objective shall be evaluated with a 96-hour bioassay.

In addition, effluent limits based upon acute bioassays of effluents will be prescribed where appropriate, additional numerical receiving water objectives for specific toxicants will be established as sufficient data become available, and source control of toxic substances is encouraged.

5.3 Anti-degradation Policy

In accordance with Section 3.2 of the Basin Plan, wherever the existing quality of water is better than the quality of water established in the Basin Plan as objectives, **such existing quality shall be maintained** unless otherwise provided by provisions of the state anti-degradation policy. Practically speaking, this means that where water quality is *better* than necessary to support designated beneficial uses, such existing high water quality shall be maintained, and further lowering of water quality is not allowed except under conditions provided for in the anti-degradation policy.

USEPA has also issued detailed guidelines for implementation of federal anti-degradation regulations for surface waters (40 Code of Federal Regulations 131.12). To ensure consistency, the State Water Resources Control Board has

interpreted Resolution No. 68-16 (i.e., the state anti-degradation policy) to incorporate the federal anti-degradation policy. It is important to note that federal policy only applies to surface waters, while state policy applies to both surface and groundwaters.

USEPA recognizes the validity of using TMDLs as a tool for implementing anti-degradation goals, as indicated in the following statement:

> *"Identifying opportunities to protect waters that are not yet impaired: TMDLs are typically written for restoring impaired waters; however, states can prepare TMDLs geared towards maintaining a "better than water quality standard" condition for a given waterbody-pollutant combination, and they can be a useful tool for high quality waters." (USEPA, 2014).*

6 WATER QUALITY DATA ANALYSIS

This section provides an analysis of the water quality data used to assess water quality conditions within the lower Salinas River watershed and includes an assessment of water quality impairments due to excessive levels of chlorpyrifos, diazinon, and malathion, as well as impairments due to toxicity.

To evaluate water quality conditions, staff used published water quality criterion from the California Department of Fish and Wildlife (CDFW) and the Central Valley Regional Water Quality Control Board (CVRWQCB). In 2000, CDFW published freshwater water quality criteria for diazinon and chlorpyrifos (CDFW, 2000). CDFW subsequently revised the diazinon chronic criteria in 2004 (CDFW, 2004). In addition, CVRWQCB developed freshwater invertebrate toxicity criteria for malathion through a contract with UC Davis (Faria et al., 2010). Staff selected the CDFW and the CVRWQCB water quality criteria, as shown in Table 6-1, to interpret the Basin Plan narrative pesticide water quality objective and assess water quality conditions within the lower Salinas River watershed.

Table 6-1. Chlorpyrifos, diazinon, and malathion evaluation criteria.

Compound	CMC [A] (ppb)	CCC [B] (ppb)	Reference
Chlorpyrifos	0.025	0.015	CDFW, 2000
Diazinon	0.16	0.10	CDFW, 2000 CDFW, 2004
Malathion	0.17	0.028	Faria et. al., 2010

[A]. CMC – Criterion Maximum Concentration or acute (1- hour average).

[B]. CCC – Criterion Continuous Concentration or chronic (4-day (96-hour) average).

The Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List (Listing Policy, 2004, amended in 2015) provides guidance on

identifying waters that do not meet water quality standards. The Listing Policy was used by staff in the following data analysis section to confirm impairments on the 303(d) List for chlorpyrifos, diazinon, and malathion. Although the Listing Policy methodology is used in this TMDL data analysis, this analysis is a separate process from the 303(d) List evaluation and additional analysis and information gathering may be necessary before incorporating the results of the TMDL analysis into the 303(d) List.

The Listing Policy has specific guidance for different types of pollutants, for example toxicants or conventional pollutants. Organophosphate pesticides are considered toxicants, therefore Listing Policy guidance for evaluating impairment is provided below in Table 6-2.

Table 6-2. Minimum number of measured exceedances needed to place a water segment on the section 303(d) List for toxicants.

Sample Size	List if the number of exceedances is equal or greater than
2 – 24	2
25 – 36	3
37 – 47	4
48 – 59	5
60 – 71	6
72 – 82	7

It is important to note CDFW and CVRWQCB water quality criteria is expressed as acute and chronic averaging periods. For example, the criterion maximum concentration or acute guideline is a 1- hour average, while the criterion continuous concentration or chronic guideline is a 4-day average (see Table 6-1). Because the available data does not contain multiple sample results collected within these averaging periods, staff will employ guidance provided by the Listing Policy. Section 6.1.5.6 of the Listing Policy states:

> "If sufficient data are not available for the stated averaging period, the available data shall be used to represent the averaging period."

As such, if only one sample was collected withing the averaging period, staff will conclude impairment based on single samples that exceed CDFW and CVRWQCB water quality criteria for both acute and chronic aquatic life toxicity in accordance with the minimum number of measured exceedances needed to place a water segment on the section 303(d) List for toxicants (see Table 6-2).

6.1 Organophosphate Pesticides Data Sources and Assessment

This section describes organophosphate pesticide data sources, associated time periods, and an assessment of monitoring results for a variety of water quality monitoring programs.

Staff used the following data for the development of these TMDLs:

- Cooperative Monitoring Program (CMP), Central Coast Water Quality Preservation, Inc. Surface water quality monitoring data and reporting from 2006 to 2018. Organophosphate pesticides (chlorpyrifos, diazinon, and malathion) data is maintained in the CEDEN database.
- Central Coast Ambient Monitoring Program (CCAMP). Surface water quality monitoring data and reporting from 2010 to 2018. Organophosphate pesticides (chlorpyrifos, diazinon, and malathion) data was collected for projects associated with coastal confluences, lagoons, and special studies. This data is maintained in the CEDEN database.
- California Department of Pesticide Regulation (CDPR). Surface water quality monitoring data and reporting was conducted over the course of several studies between 2003 and 2017 and included laboratory analysis for organophosphate pesticides (chlorpyrifos, diazinon, and malathion). This data is maintained in the CEDEN database.

Data and information from the above programs are detailed in the following sections.

6.1.1 Cooperative Monitoring Program (CMP)

The Cooperative Monitoring Program (CMP) fulfills monitoring and reporting requirements for dischargers enrolled under the Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands in the Central Coast Region (Agricultural Order No. R3-2017-0002). Monitoring and reporting is conducted by Central Coast Water Quality Preservation, Inc. (CCWQP) and the water quality sampling results are uploaded to the CEDEN database. The CMP monitoring was conducted between 2006 and 2018 with two to three organophosphate pesticide samples obtained each year in 2006, 2007, 2014, 2017, and 2018. CMP utilizes United States Environmental Protection Agency (USEPA) analytical test method 625 (EPA 625 using gas chromatography) for organophosphate pesticide analysis and toxicity testing is paired with these analyses four times a year.

Table 6-3 identifies the 17 CMP sites within the lower Salinas River watershed and Figure 6-1 depicts CMP site locations. Table 6-4, Table 6-5, and Table 6-6 provide data summaries and criteria exceedances for chlorpyrifos, diazinon, and malathion, respectively. And finally, a discussion summarizing the exceedances for each of the organophosphate pesticides is provided at the end of this section.

Table 6-3. CMP monitoring sites.

Site Description	Site ID
Moro Cojo Slough @ Hwy 1	306MOR
Old Salinas River @ Monterey Dunes Way	309OLD
Tembladero Slough @ Haro	309TEH
Merritt Ditch upstream from Hwy 183	309MER
Espinosa Slough Upstream of Alisal Slough	309ESP
Alisal Slough @ White Barn	309ASB
Blanco Drain below Pump	309BLA
Salinas Reclamation Canal @ San Jon Rd	309JON
Salinas Reclamation Canal @ La Guardia	309ALG
Santa Rita Creek @ Santa Rita Creek Park	309RTA
Gabilan Creek @ Independence Rd and East Boranda Rd	309GAB
Natividad Creek upstream from Salinas Reclamation Canal	309NAD
Salinas River @ Spreckels Gage	309SSP
Quail Creek @ Hwy 101	309QUI
Chualar Creek west of Highway 101	309CCD
Salinas River @ Chualar River Road	309SAC
Salinas River @ Gonzales River Rd Bridge	309SAG

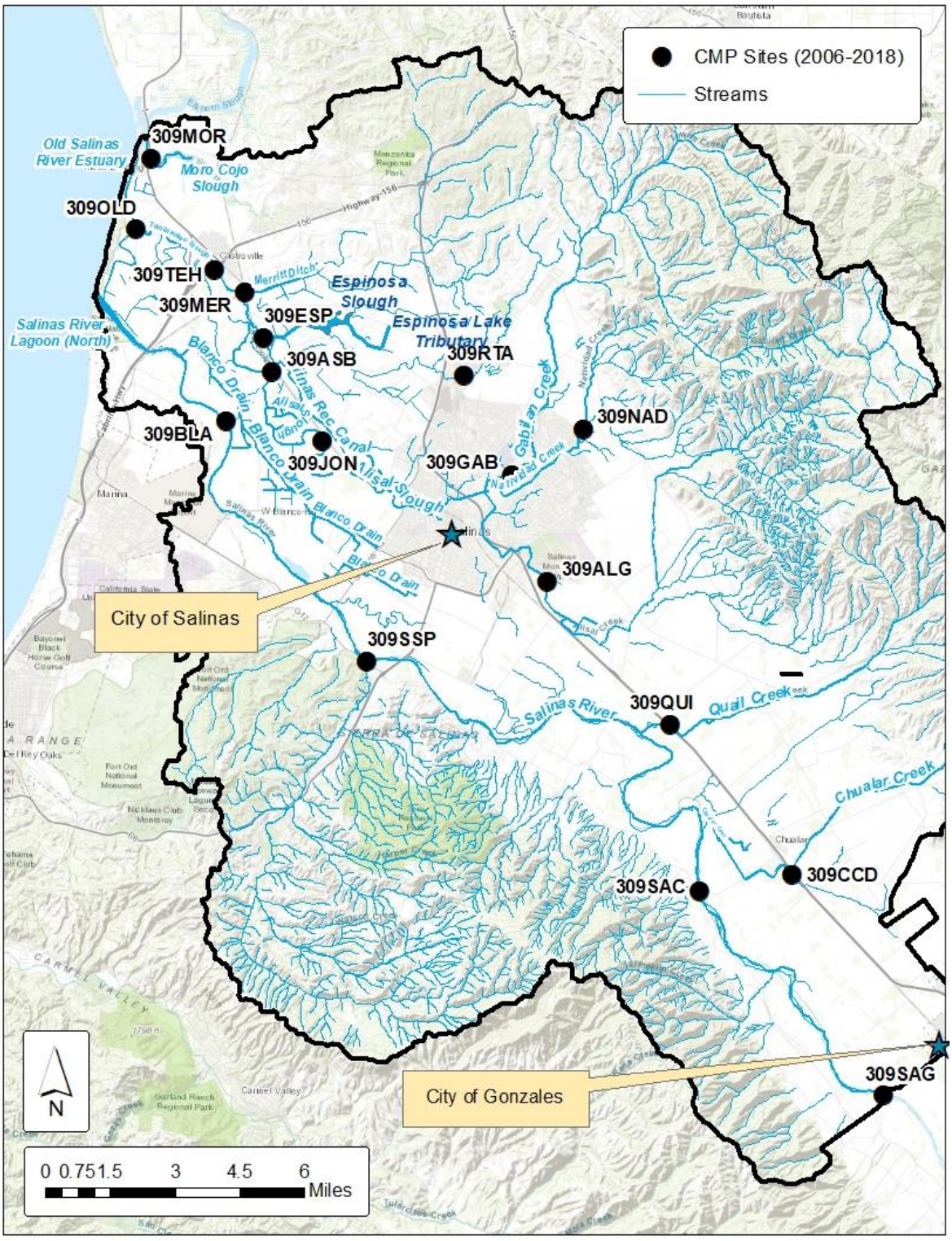

Figure 6-1. Map of CMP monitoring stations (2006-2018).

Table 6-4. Summary of CMP monitoring results for chlorpyrifos.

Site Location	Site code	Count of samples	Acute criteria exceeded[1]	Acute exceeded %	Chronic criteria exceeded[1]	Chronic exceeded %
Salinas Reclamation Canal @ La Guardia	309ALG	13	2	15.4	2	15.4
Alisal Slough @ White Barn	309ASB	13	0	0	0	0
Blanco Drain below Pump	309BLA	13	0	0	1	7.7
Chualar Creek west of Highway 101	309CCD	7	1	14.3	2	28.6
Espinosa Slough upstream of Alisal Slough	309ESP	13	1	7.7	1	7.7
Gabilan Creek @ Independence Rd and East Boranda Rd	309GAB	2	0	0	1	50
Salinas Reclamation Canal @ San Jon Rd	309JON	13	3	23.1	3	23.1
Merritt Ditch upstream from Hwy 183	309MER	13	1	7.7	1	7.7
Moro Cojo Slough @ Hwy 1	306MOR	13	0	0	0	0
Natividad Creek upstream from Salinas Reclamation Canal	309NAD	8	2	25	2	25
Old Salinas River at Monterey Dunes Way	309OLD	13	0	0	0	0
Quail Creek @ Hwy 101	309QUI	11	6	54.5	6	54.5
Santa Rita Creek @ Santa Rita Creek Park	309RTA	4	0	0	0	0
Salinas River at Chualar River Road	309SAC	4	0	0	0	0
Salinas River @ Gonzales River Rd Bridge	309SAG	3	0	0	0	0
Salinas River @ Spreckels Gage	309SSP	6	1	16.7	1	16.7
Tembladero Slough @ Haro	309TEH	13	4	30.8	4	30.8

[1] Chlorpyrifos exceedance criteria of 0.025 µg/L (acute) and 0.015 µg/L (chronic).

Table 6-5. Summary of CMP monitoring results for diazinon.

Site Location	Site code	Count of samples	Acute criteria exceeded[1]	Acute exceeded %	Chronic criteria exceeded[1]	Chronic exceeded %
Salinas Reclamation Canal @ La Guardia	309ALG	13	4	30.8	5	38.5
Alisal Slough @ White Barn	309ASB	13	2	15.4	3	23.1
Blanco Drain below Pump	309BLA	13	1	7.7	3	23.1
Chualar Creek west of Highway 101	309CCD	7	0	0	1	14.3
Espinosa Slough upstream of Alisal Slough	309ESP	13	6	46.2	6	46.2
Gabilan Creek @ Independence Rd and East Boranda Rd	309GAB	2	0	0	0	0
Salinas Reclamation Canal @ San Jon Rd	309JON	13	6	46.2	6	46.2
Merritt Ditch upstream from Hwy 183	309MER	13	2	15.4	3	23.1
Moro Cojo Slough @ Hwy 1	306MOR	13	0	0	0	0
Natividad Creek upstream from Salinas Reclamation Canal	309NAD	8	5	62.5	6	75.0
Old Salinas River at Monterey Dunes Way	309OLD	13	1	7.7	2	15.4
Quail Creek @ Hwy 101	309QUI	11	5	45.5	5	45.5
Santa Rita Creek @ Santa Rita Creek Park	309RTA	4	0	0	0	0
Salinas River at Chualar River Road	309SAC	4	0	0	0	0
Salinas River @ Gonzales River Rd Bridge	309SAG	3	0	0	0	0
Salinas River @ Spreckels Gage	309SSP	6	1	16.7	1	16.7
Tembladero Slough @ Haro	309TEH	13	3	23.1	5	38.5

[1] Diazinon exceedance criteria of 0.16 µg/L (acute) and 0.1 µg/L (chronic).

Table 6-6. Summary of CMP monitoring results for malathion.

Site Location	Site code	Count of samples	Acute criteria exceeded[1]	Acute exceeded %	Chronic criteria exceeded[1]	Chronic exceeded %
Alisal Creek/Salinas Reclamation Canal @ La Guardia	309ALG	13	1	7.7	2	15.4
Alisal Slough @ White Barn	309ASB	13	1	7.7	3	23.1
Blanco Drain below Pump	309BLA	13	0	0	2	15.4
Chualar Creek west of Highway 101	309CCD	7	0	0	0	0
Espinosa Slough upstream of Alisal Slough	309ESP	13	0	0	3	23.1
Gabilan Creek @ Independence Rd and East Boranda Rd	309GAB	2	0	0	1	50
Salinas Reclamation Canal @ San Jon Rd	309JON	13	0	0	3	23.1
Merritt Ditch upstream from Hwy 183	309MER	13	3	23.1	4	30.8
Moro Cojo Slough @ Hwy 1	306MOR	13	0	0	0	0
Natividad Creek upstream from Salinas Reclamation Canal	309NAD	8	2	25	3	37.5
Old Salinas River at Monterey Dunes Way	309OLD	13	0	0	1	7.7
Quail Creek @ Hwy 101	309QUI	11	0	0	0	0
Santa Rita Creek @ Santa Rita Creek Park	309RTA	4	1	25	2	50
Salinas River at Chualar River Road	309SAC	4	0	0	0	0
Salinas River @ Gonzales River Rd Bridge	309SAG	3	0	0	1	33.3
Salinas River @ Spreckels Gage	309SSP	6	0	0	0	0
Tembladero Slough @ Haro	309TEH	13	1	7.7	4	30.8

[1] Malathion exceedance criteria of 0.17 µg/L (acute) and 0.028 µg/L (chronic).

Based on the chlorpyrifos data shown above in Table 6-4 and following the methodology from the Listing Policy to determine impairment, staff concluded chlorpyrifos impairments for the Salinas Reclamation Canal (309ALG, 309JON), Chualar Creek (309CCD), Natividad Creek (309NAD), Quail Creek (309QUI), and Tembladero Slough (309TEH).

As shown in the diazinon information presented in Table 6-5 above, staff concluded diazinon impairments for Alisal Slough (309ASB), Blanco Drain (309BLA), Chualar Creek (309CCD), Espinosa Slough (309ESP), Merritt Ditch (309MER), Natividad Creek (309NAD), Old Salinas River (309OLD), Quail Creek (309QUI), and Tembladero Slough (309TEH), but not for stations located on the Salinas Reclamation Canal (309ALG and 309JON).

Although the information contained in Table 6-5 above indicate impairments for Salinas Reclamation Canal (309ALG, 309JON), subsequent data analysis indicate that concentrations have decreased significantly following approval of the 2011 TMDL. As a result, staff will recommend de-listing the Salinas Reclamation Canal for diazinon impairment. See Section 6.2 for further discussion on staff recommendations to de-list Salinas Reclamation Canal for diazinon impairments.

For the malathion data presented in Table 6-6, staff concluded malathion impairments for the Salinas Reclamation Canal (309ALG, 309JON), Alisal Slough (309ASB), Blanco Drains (309BLA), Espinosa Slough (309ESP), Merritt Ditch (309MER), Natividad Creek (309NAD), Santa Rita Creek (309RTA), and Tembladero Slough (309TEH). Sites where the limited available data do not indicate impairment from malathion include Chualar Creek (309CCD), Quail Creek (309QUI), and the Salinas River at Chualar and Spreckels (309SAC and 309SSP).

6.1.2 Central Coast Ambient Monitoring Program (CCAMP)

The Central Coast Ambient Monitoring Program (CCAMP) is the Central Coast Regional Water Quality Control Board's regionally scaled water quality monitoring and assessment program. CCAMP staff conducted chlorpyrifos, diazinon, and malathion sampling as part of three monitoring projects and the water quality sampling results were uploaded to the CEDEN database. The CCAMP data set evaluated for these TMDLs includes data collected between 2010 and 2018. The Coastal Confluence project was conducted in 2010 and 2012 and three to four organophosphate pesticide samples were collected from three sites. The Lagoons project was conducted in 2016 with three samples for each organophosphate pesticide obtained from three sites. Finally, Special Study projects were conducted in 2013 and 2018 with four samples for each organophosphate pesticide obtained from four sites. The analytical test method used by CCAMP for most samples was EPA 8141 with EPA method EPA 625 used for only a few samples.

Table 6-7 identifies the CCAMP sites and associated projects within the lower Salinas River watershed and Figure 6-2 depicts CCAMP site locations. Table 6-8, Table 6-9, and Table 6-10 provide data summaries and criteria exceedances for chlorpyrifos, diazinon, and malathion, respectively. Finally, a discussion summarizing the exceedances for each of the organophosphate pesticides is provided at the end of this section.

Table 6-7. CCAMP monitoring sites.

Site Description	Site ID	Project
Old Salinas River @ Monterey Dunes Way	309OLD	Coastal Confluences
Tembladero Slough @ Monterey Dunes Way	309TDW	Coastal Confluences
Salinas River@ Davis Road	309DAV	Coastal Confluences
Old Salinas River @ Potrero Road	309POT	Lagoons
Salinas River Estuary Lower near Old Salinas River Flap Gate	309SAL00L	Lagoons
Salinas River Estuary Upper near RR bridge	309SAL00U	Lagoons
Salinas Reclamation Canal @ Boranda Road	309ALD	Special Studies
Blanco Drain below Pump	309BLA	Special Studies
Alisal Creek @ Hartnell Road dogleg	309HRT	Special Studies
Tembladero Slough @ Preston Road	309TEM	Special Studies

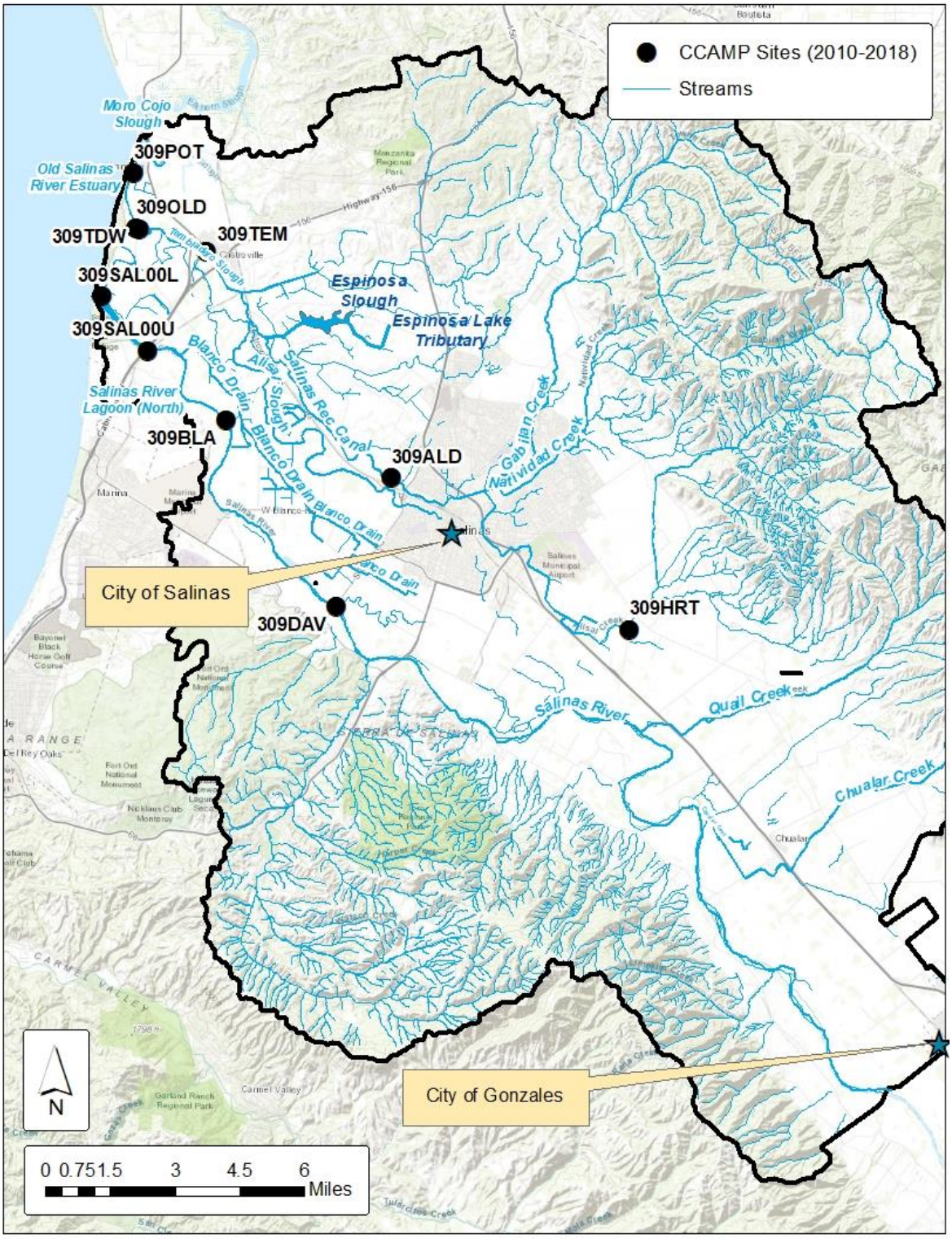

Figure 6-2. Map of CCAMP monitoring stations (2010-2018)]

Table 6-8. Summary of CCAMP monitoring results for chlorpyrifos.

Site Description (Monitoring Program [1])	Site ID	Count of acute samples	Acute criteria exceeded [2]	Acute exceeded %	Count of chronic samples	Chronic criteria exceeded [2]	Chronic exceeded %	Count of samples where method detection limit exceeds chronic criteria
Old Salinas River @ Monterey Dunes Way (CC)	309OLD	2	0	0	0	NA [3]	NA	2
Tembladero Slough @ Monterey Dunes Way (CC)	309TDW	4	1	25	1	1	100	3
Salinas River@ Davis Road (CC)	309DAV	5	0	0	1	0	0	4
Old Salinas River @ Potrero Road (LAG)	309POT	1	0	0	0	NA	NA	1
Salinas River Estuary Lower near Old Salinas River Flap Gate (LAG)	309SAL00L	1	0	0	0	NA	NA	1
Salinas River Estuary Upper near RR bridge (LAG)	309SAL00U	1	0	0	0	NA	NA	1
Salinas Reclamation Canal @ Boranda Road (SS)	309ALD	1	0	0	1	0	0	0
Blanco Drain below Pump (SS)	309BLA	1	0	0	0	NA	NA	1
Alisal Creek @ Hartnell Road dogleg (SS)	309HRT	1	0	0	1	0	0	0
Tembladero Slough @ Preston Road (SS)	309TEM	1	0	0	1	0	0	0

[1] Monitoring Program abbreviations: coastal confluences (CC), lagoons (LAG), special studies (SS).
[2] Chlorpyrifos exceedance criteria of 0.025 µg/L (acute) and 0.015 µg/L (chronic).
[3] NA indicates that an evaluation of chronic criteria exceedance cannot be determined because the laboratory method detection limit for the sample is greater than the chronic exceedance criteria.

Table 6-9. Summary of CCAMP monitoring results for diazinon.

Site Description (Monitoring Program [1])	Site ID	Count of acute samples	Acute criteria exceeded[2]	Acute exceeded %	Count of chronic samples	Chronic criteria exceeded[2]	Chronic exceeded %	Count of samples where method detection limit exceeds chronic criteria
Old Salinas River @ Monterey Dunes Way (CC)	309OLD	2	0	0	2	0	0	0
Tembladero Slough @ Monterey Dunes Way (CC)	309TDW	4	0	0	4	0	0	0
Salinas River@ Davis Road (CC)	309DAV	5	0	0	5	0	0	0
Old Salinas River @ Potrero Road (LAG)	309POT	1	0	0	1	0	0	0
Salinas River Estuary Lower near Old Salinas River Flap Gate (LAG)	309SAL00L	1	0	0	1	0	0	0
Salinas River Estuary Upper near RR bridge (LAG)	309SAL00U	1	0	0	1	0	0	0
Salinas Reclamation Canal @ Boranda Road (SS)	309ALD	1	0	0	1	0	0	0
Blanco Drain below Pump (SS)	309BLA	1	0	0	1	0	0	0
Alisal Creek @ Hartnell Road dogleg (SS)	309HRT	1	0	0	1	0	0	0
Tembladero Slough @ Preston Road (SS)	309TEM	1	0	0	1	0	0	0

[1] Monitoring Program abbreviations: coastal confluences (CC), lagoons (LAG), special studies (SS).
[2] Diazinon exceedance criteria of 0.16 µg/L (acute) and 0.1 µg/L (chronic).

Table 6-10. Summary of CCAMP monitoring results for malathion.

Site Description (Monitoring Program [1])	Site ID	Count of acute samples	Acute criteria exceeded[2]	Acute exceeded %	Count of chronic samples	Chronic criteria exceeded[2]	Chronic exceeded %	Count of samples where method detection limit exceeds chronic criteria
Old Salinas River @ Monterey Dunes Way (CC)	309OLD	2	0	0	2	0	0	0
Tembladero Slough @ Monterey Dunes Way (CC)	309TDW	4	0	0	2	0	0	2
Salinas River@ Davis Road (CC)	309DAV	5	0	0	3	0	0	2
Old Salinas River @ Potrero Road (LAG)	309POT	1	1	100	1	1	100	0
Salinas River Estuary Lower near Old Salinas River Flap Gate (LAG)	309SAL00L	1	0	0	1	0	0	0
Salinas River Estuary Upper near RR bridge (LAG)	309SAL00U	1	0	0	1	0	0	0
Salinas Reclamation Canal @ Boranda Road (SS)	309ALD	2	0	0	2	0	0	0
Blanco Drain below Pump (SS)	309BLA	1	0	0	1	0	0	0
Alisal Creek @ Hartnell Road dogleg (SS)	309HRT	1	0	0	1	0	0	0
Tembladero Slough @ Preston Road (SS)	309TEM	1	0	0	1	0	0	0

[1] Monitoring Program abbreviations: coastal confluences (CC), lagoons (LAG), special studies (SS).
[2] Malathion exceedance criteria of 0.17 µg/L (acute) and 0.028 µg/L (chronic).

Based on the chlorpyrifos analytical results presented above in Table 6-8, only one of the 18 CCAMP samples (obtained from Tembladero Slough at Monterey Dunes Way, site 309TDW) exceeded both the acute and chronic criteria for chlorpyrifos. Note that exceedance of the chlorpyrifos chronic criteria could not be evaluated for 13 of the 18 samples collected because the results were reported as non-detects (concentration is below the method detection limit), but the method detection limit was greater than the chronic criteria.

As shown in the diazinon information presented Table 6-9 above, none of the 18 CCAMP samples exceeded the acute or chronic criteria for diazinon.

The results in Table 6-10 summarize the malathion data and show that one of the 19 CCAMP samples (obtained from the Old Salinas River at Potrero Rd., site 309POT) exceeded both the acute and chronic criteria for malathion. Note that exceedance of the malathion chronic criteria could not be evaluated for 4 of the 18 samples collected because the results were reported as non-detects (concentration is below the method detection limit), but the method detection limit was greater than the chronic criteria.

6.1.3 California Department of Pesticide Regulation (CDPR)

California Department of Pesticide Regulation (CDPR) conducted chlorpyrifos, diazinon, and malathion sampling during several CDPR surface water studies. Water quality sampling results from these studies were uploaded to the CEDEN database. For these CDPR studies, samples were obtained between 2003 and 2017 at 18 sites. The primary analytical test method used by CDPR was California Department of Food and Agriculture, Environmental Monitoring Section Method 46.0 (EMON-SM-46.0) which uses gas chromatography.

It is important to note that the method detection limit (MDL) was not reported for several of the analytical results in the CDPR dataset (approximately 18% of the samples for each of the organophosphate pesticides between 2003 and 2005) and many of these samples were reported as non-detect. When the MDL was not reported and the result was non-detect, staff used the reporting limit (RL) to compare minimum concentrations to the exceedance criteria. Where the RL is greater than the chronic evaluation guideline and the test result was non-detect, staff omitted the sample from the data summary and exceedance tables below. In the data summary and exceedance tables below, staff has indicated the number of samples that were not included because they were reported and non-detects, without an MDL, and the RL is greater than the exceedance criteria. And, as a result, staff could not determine whether the sample exceeds the criteria or not.

Table 6-11 identifies the CDPR monitoring sites within the lower Salinas River watershed along with CMP and CCAMP monitoring sites and Figure 6-3 depicts the site locations. Table 6-12, Table 6-13, and Table 6-14 provide data summaries and criteria exceedances for chlorpyrifos, diazinon, and malathion, respectively. Finally,

a discussion summarizing the exceedances for each of the organophosphate pesticides is provided at the end of this section.

Table 6-11. CDPR monitoring sites.

Site Description	CDPR Site ID	CMP or CCAMP Site ID	Start Date	End Date
Moro Cojo Slough at HWY 1	Monterey 48	306MOR	1/7/2008	1/7/2008
Old Salinas River at Potrero Rd	309POT	309POT	9/13/2004	6/11/2013
Old Salinas R. at Monterey Dunes Way	Monterey 50	309OLD	5/18/2010	8/13/2015
Tembladero Sl. at Molera	Monterey 58	309TDW	7/22/2008	8/13/2015
Tembladero Slough at Haro	309SMHR43	309TEH	8/27/2007	9/11/2017
Espinosa Slough at HWY 183	Monterey 15	N/A	6/6/2012	6/6/2012
Salinas Reclamation Canal at San Jon Rd	309JON	309JON	9/13/2004	9/11/2017
Gabilan Creek near E. Boronda at drain pipe	Monterey 16	309GAB	6/6/2012	6/6/2012
Gabilan Creek	309ST0509	309GAB	6/6/2012	6/6/2012
Natividad Creek	309NC3799	N/A	6/6/2012	6/11/2013
Rec Ditch III near Airport Blvd	309SLRC66	N/A	6/16/2003	9/15/2015
Alisal Creek at Hartnell Rd	309SLHR83	309HRT	4/15/2008	9/12/2017
Quail Creek at SR-101	309SLQL69	309QUI	6/16/2003	9/11/2017
Chualar Creek at Chualar River Road	309CHUCRR	N/A	6/16/2003	9/11/2017
Blanco Drain at Cooper Rd (0.2 mi. S of Nashua Rd, drains to Salinas R.)	Monterey 9	N/A	6/17/2003	8/13/2015
Salinas River at HWY 1 Bridge	309ST1345	309SAL00U	9/13/2004	8/13/2015
Salinas River at Davis Rd	Monterey 13	309DAV	9/13/2004	9/11/2017
Salinas River at Chualar River Road	309SAC	309SAC	6/5/2012	6/5/2012

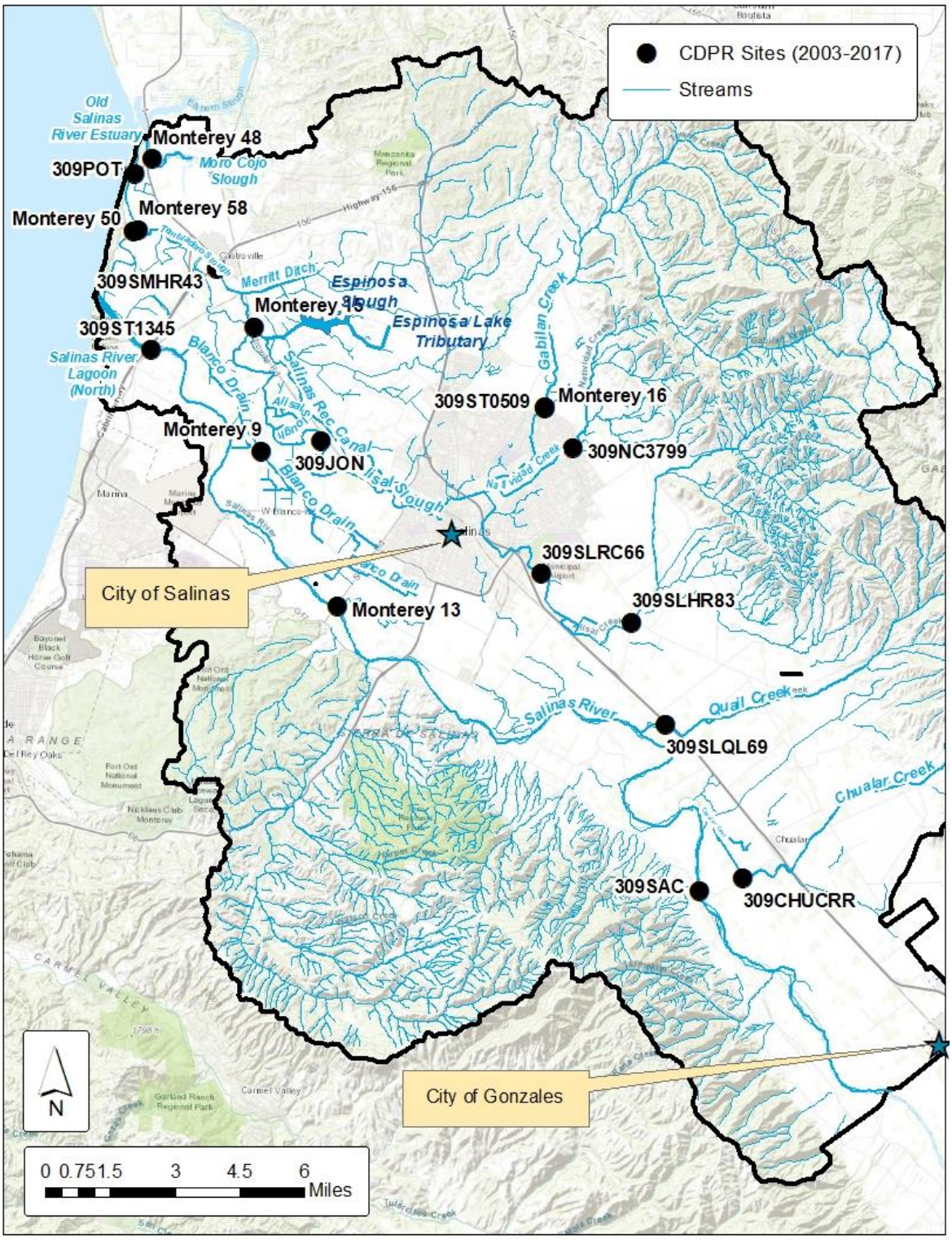

Figure 6-3. Map of CDPR monitoring stations.

Table 6-12. Summary of CDPR monitoring results for chlorpyrifos.

Site location	Site code	Count of acute samples	Acute criteria exceeded[1]	Acute criteria exceeded %	Count of chronic samples	Chronic criteria exceeded[1]	Chronic criteria exceeded %	Count of NDs, without MDL, and RL is greater than 0.025 µg/L [2]
Moro Cojo Slough at HWY 1	Monterey 48	1	0	0	1	0	0	0
Old Salinas River at Potrero Rd	309POT	39	4	10.3	39	7	17.9	0
Old Salinas R. at Monterey Dunes Way	Monterey 50	9	0	0	9	0	0	0
Tembladero Sl. at Molera	Monterey 58	11	0	0	11	1	9.1	0
Tembladero Slough at Haro	309SMHR43	67	3	4.5	67	7	10.4	0
Espinosa Slough at HWY 183	Monterey 15	1	0	0	1	0	0	0
Salinas Reclamation Canal at San Jon Rd	309JON	29	5	17.2	29	5	17.2	0
Gabilan Creek near E. Boronda at drain pipe	Monterey 16	1	0	0	1	0	0	0
Gabilan Creek	309ST0509	1	0	0	1	0	0	0
Natividad Creek	309NC3799	2	1	50	2	1	50	0
Rec Ditch III near Airport Blvd	309SLRC66	46	18	39.1	46	18	39.1	15
Alisal Creek at Hartnell Rd	309SLHR83	53	18	34.0	53	21	39.6	0
Quail Creek at SR-101	309SLQL69	72	40	55.6	72	46	63.9	0
Chualar Creek at Chualar River Road	309CHUCRR	68	42	61.8	68	44	64.7	4
Blanco Drain at Cooper Rd (0.2 mi. S of Nashua Rd, drains to Salinas R.)	Monterey 9	7	1	14.3	7	1	14.3	15
Salinas River at HWY 1 Bridge	309ST1345	33	0	0	33	0	0	0
Salinas River at Davis Rd	Monterey 13	27	0	0	27	0	0	0
Salinas River at Chualar River Road	309SAC	1	0	0	1	0	0	0

[1] Chlorpyrifos exceedance criteria of 0.025 µg/L (acute) and 0.015 µg/L (chronic).
[2] Count of samples in the CEDEN database reported as non-detect (ND), without a method detection limit (MDL), and the reporting limit (RL) is greater than the acute exceedance criteria of 0.025 µg/L. Samples not included in the exceedance summary table above.

Table 6-13. Summary of CDPR monitoring results for diazinon.

Site location	Site code	Count of acute samples	Acute criteria exceeded[1]	Acute criteria exceeded %	Count of chronic samples	Chronic criteria exceeded[1]	Chronic criteria exceeded %
Moro Cojo Slough at HWY 1	Monterey 48	1	0	0	1	0	0
Old Salinas River at Potrero Rd	309POT	41	6	14.6	41	11.0	26.8
Old Salinas R. at Monterey Dunes Way	Monterey 50	5	0	0	5	1	20
Tembladero Sl. at Molera	Monterey 58	7	1	14.3	7	4	57.1
Tembladero Slough at Haro	309SMHR43	62	15	24.2	62	19	30.6
Espinosa Slough at HWY 183	Monterey 15	1	0	0.0	1	0.0	0
Salinas Reclamation Canal at San Jon Rd	309JON	23	2	8.7	23	2	8.7
Gabilan Creek near E. Boronda at drain pipe	Monterey 16	1	0	0.0	1	0.0	0
Gabilan Creek	309ST0509	1	0	0	1	0	0
Natividad Creek	309NC3799	2	0	0.0	2	0.0	0
Rec Ditch III near Airport Blvd	309SLRC66	58	34	58.6	58	37	63.8
Alisal Creek at Hartnell Rd	309SLHR83	48	9	18.75	48	12	25
Quail Creek at SR-101	309SLQL69	68	19	27.9	68	24.0	35.3
Chualar Creek at Chualar River Road	309CHUCRR	67	26	38.8	67	35	52.2
Blanco Drain at Cooper Rd (0.2 mi. S of Nashua Rd, drains to Salinas R.)	Monterey 9	18	6	33.3	18	8	44.4
Salinas River at HWY 1 Bridge	309ST1345	31	2	6.5	31	3	9.7
Salinas River at Davis Rd	Monterey 13	20	0	0	20	0	0
Salinas River at Chualar River Road	309SAC	1	0	0.0	1	0.0	0

[1] Diazinon exceedance criteria of 0.16 µg/L (acute) and 0.1 µg/L (chronic).

Table 6-14. Summary of CDPR monitoring results for malathion.

Site location	Site code	Count of acute samples	Acute criteria exceeded[1]	Acute criteria exceeded %	Count of chronic samples	Chronic criteria exceeded[1]	Chronic criteria exceeded %	Count of NDs, without MDL, and RL is greater than 0.028 µg/L [2]
Moro Cojo Slough at HWY 1	Monterey 48	1	0	0	1	0	0	0
Old Salinas River at Potrero Rd	309POT	39	1	2.6	36	1	2.8	3
Old Salinas R. at Monterey Dunes Way	Monterey 50	9	0	0	9	0	0	0
Tembladero Sl. at Molera	Monterey 58	11	0	0	11	1	9.1	0
Tembladero Slough at Haro	309SMHR43	67	3	4.5	67	11	16.4	0
Espinosa Slough at HWY 183	Monterey 15	1	0	0	1	0	0	0
Salinas Reclamation Canal at San Jon Rd	309JON	29	1	3.4	26	5	19.2	3
Gabilan Creek near E. Boronda at drain pipe	Monterey 16	1	0	0	1	0	0	0
Gabilan Creek	309ST0509	1	0	0	1	0	0	0
Natividad Creek	309NC3799	2	0	0	2	0	0	0
Rec Ditch III near Airport Blvd	309SLRC66	61	7	11.5	46	16	34.8	15
Alisal Creek at Hartnell Rd	309SLHR83	53	14	26.4	53	23	43.4	0
Quail Creek at SR-101	309SLQL69	72	3	4.2	56	12	21.4	16
Chualar Creek at Chualar River Road	309CHUCRR	72	2	2.8	59	8	13.6	13
Blanco Drain at Cooper Rd (0.2 mi. S of Nashua Rd, drains to Salinas R.)	Monterey 9	22	0	0	6	0	0	16
Salinas River at HWY 1 Bridge	309ST1345	33	0	0	30	0	0	3
Salinas River at Davis Rd	Monterey 13	27	1	3.7	24	1	4.2	3
Salinas River at Chualar River Road	309SAC	1	0	0	1	0	0	0

[1] Malathion exceedance criteria of 0.17 µg/L (acute) and 0.028 µg/L (chronic).

[2] Count of samples in the CEDEN database reported as non-detect (ND), without a method detection limit (MDL), and the reporting limit (RL) is greater than the chronic exceedance criteria of 0.028 µg/L. Samples not included in the exceedance summary table above.

Based on the CDPR data contained in Table 6-12 and following the methodology from the Listing Policy to determine impairment, staff has concluded chlorpyrifos water quality impairments for the Old Salinas River (309POT), Tembladero Slough (309SMHR43), Salinas Reclamation Canal (309JON and 309SLRC66), Alisal Creek (309SLHR83), Quail Creek (309SLQL69), and Chualar Creek (309CHUCRR).

As shown in Table 6-13, staff has concluded diazinon impairments for the Old Salinas River (309POT), Alisal Creek (309SLHR83), Quail Creek (309SLQL69), Chualar Creek (309CHUCRR), Tembladero Slough (Monterey 58 and 309SMHR43), and Blanco Drain (Monterey 9). Although Table 6-5 shows diazinon exceedances for Salinas Reclamation Canal (309JON and 309SLRC66), subsequent data analysis indicate that concentrations have decreased significantly following approval of the 2011 TMDL. As a result, staff will recommend de-listing the Salinas Reclamation Canal for diazinon impairment. See Section 6.2 for further discussion on staff's recommendation to de-list Salinas Reclamation Canal for diazinon impairments.

For the malathion data presented in Table 6-14, staff has concluded malathion impairments for Tembladero Slough (309SMHR43), Salinas Reclamation Canal (309JON and 309SLRC66), Alisal Creek (309SLHR83), Quail Creek (309SLQL69) and Chualar Creek (309CHUCRR).

6.2 Recommendation to De-list Salinas Reclamation Canal for Diazinon Impairment

Following approval of the previous TMDL in 2011, staff evaluated the results of all diazinon water quality data and found concentrations within the Salinas Reclamation Canal no longer exceed the acute or chronic evaluation criteria. As a result, staff will recommend de-listing the Salinas Reclamation Canal for diazinon impairment during the next listing cycle (2020-2022). This recommendation is consistent with table 4-1 of Listing Policy which defines the minimum number of measured exceedances allowed to remove a water segment from the CWA section 303(d) List for toxicants as shown below in Table 6-15.

Table 6-15. Maximum number of measured criteria exceedances allowed to remove a water segment from the CWA section 303(d) List for toxicants.

Sample Size	De-list if the number of exceedances equals or is less than
28 – 36	2
37 – 47	3
48 – 59	4

Following approval of the previous TMDL on October 7, 2011, a total of 59 diazinon samples were collected from the Salinas Reclamation Canal which included monitoring sites 309ALD (n=5), 309ALG (n=8), 309ALU (n=4), 309JON (n=28), and 309SLRC66 (n=14). Only one of the 59 samples from the Salinas Reclamation Canal exceeded the acute and chronic evaluation criteria for diazinon. Figure 6-4 shows diazinon concentrations over time for all Salinas Reclamation Canal monitoring sites (309ALD, 309ALG, 309ALU, 309JON, and 309SLRC66).

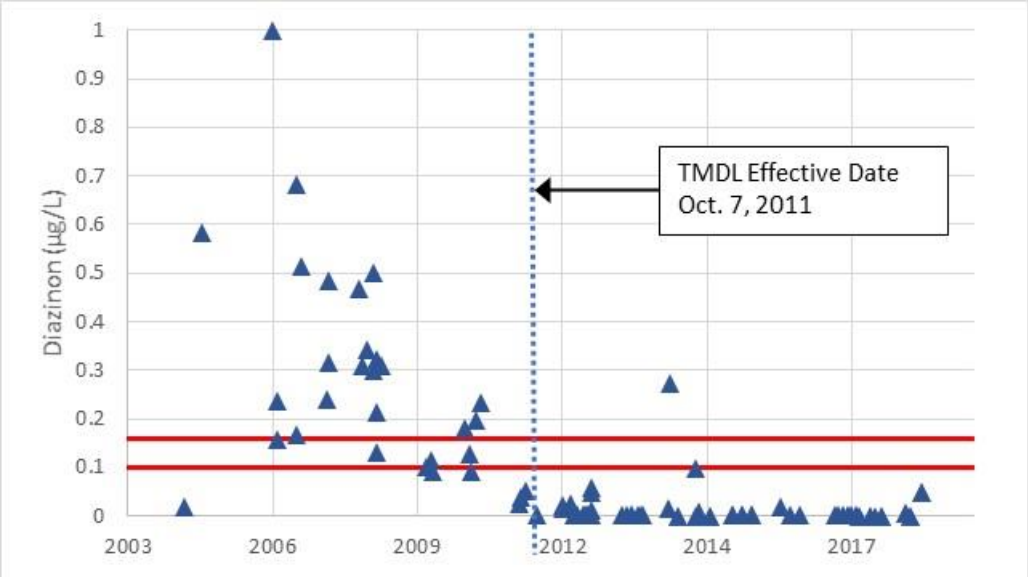

Figure 6-4. Graph of diazinon concentrations for all Salinas Reclamation Canal monitoring sites.
Note: Red horizontal lines represent diazinon criteria of 0.16 µg/L (acute) and 0.1 µg/L (chronic). Not shown are concentrations of 1.16 µg/L (9/13/2004) and 3.16 µg/L (8/23/2006) for 309JON and 1.68 µg/L (3/22/2007) for 309ALG.

Diazinon use in Monterey County has been declining rapidly since 2007. Pesticide use reporting provided by CDPR indicates that peak diazinon use in Monterey County occurred in 2004, where 171,840 pounds of diazinon was used. The most recent year of pesticide use reporting for diazinon is 2017, where 107 pounds of diazinon was used. Figure 6-5 depicts the total amount of diazinon used each year in Monterey County from 1991 to 2018 and its' rapid decline since 2004.

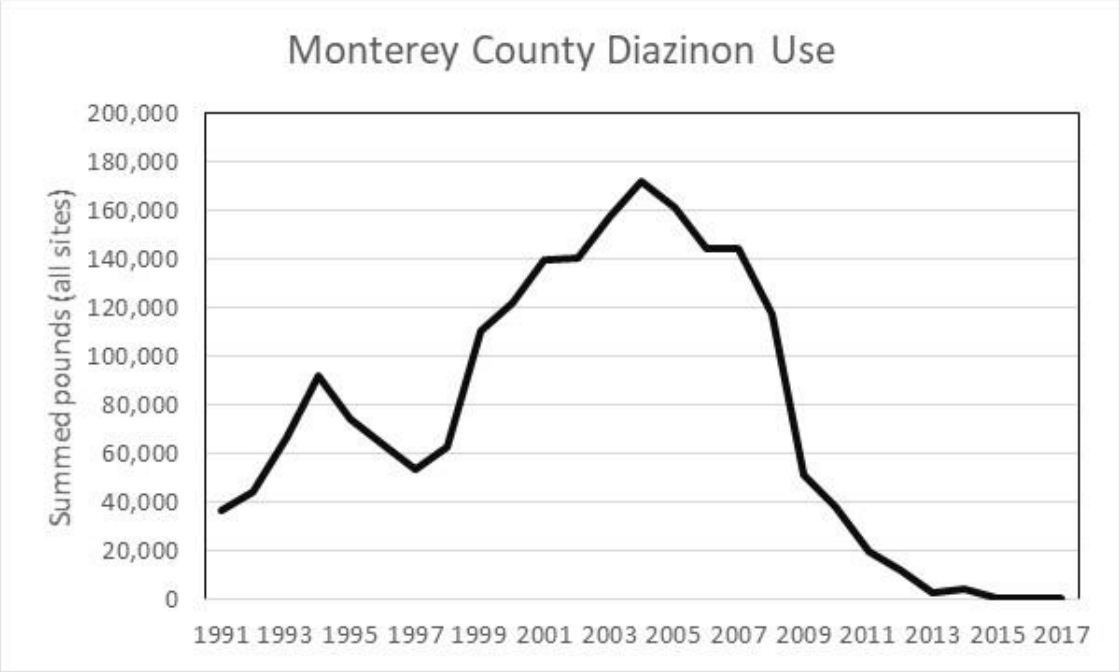

Figure 6-5. Graph of Monterey County diazinon use (1991 to 2017).

6.3 Summary of Organophosphate Pesticides Data

This section summarizes the organophosphate pesticide data provided through the monitoring programs presented in Section 6.1 above. Table 6-16, Table 6-17, and Table 6-18 are tabulations of chlorpyrifos, diazinon, and malathion water quality monitoring results respectively. Staff has summarized the data for each waterbody and respective water quality monitoring sites, along with staff's determination of water quality impairments. To determine waterbody impairment due to excessive levels of chlorpyrifos, diazinon, or malathion, staff compared the monitoring results to the exceedance frequencies defined by the Listing Policy as shown in Table 6-2.

A summary of waterbody impairments for all organophosphate pesticides is provided as Table 6-19.

Table 6-16. Summary of monitoring programs, monitoring sites, exceedances, and chlorpyrifos impaired waterbodies.

Waterbody	Program/Site Code	Count of acute samples	Acute criteria exceeded [1]	Acute criteria exceeded %	Count of chronic samples	Chronic criteria exceeded [1]	Chronic criteria exceeded %	Chlorpyrifos impaired
Moro Cojo Slough	CMP/306MOR	13	0	0	13	0	0	No
Moro Cojo Slough	CDPR/Monterey 48	1	0	0	1	0	0	No
Old Salinas R.	CMP/309OLD	13	0	0	13	0	0	No
Old Salinas R.	CCAMP/309OLD	2	0	0	0	NA [2]	NA	No
Old Salinas R.	CDPR/Monterey 50	9	0	0	9	0	0	No
Old Salinas R.	CDPR/309POT	39	4	**10.3**	39	7	**17.9**	**Yes**
Old Salinas R.	CCAMP/309POT	1	0	0	1	NA	NA	No
Salinas R. Lagoon	CDPR/309ST1345	33	0	0	33	0	0	No
Salinas R. Lagoon	CCAMP/309SAL00L	1	0	0	0	NA	NA	No
Salinas R. Lagoon	CCAMP/309SAL00U	1	0	0	0	NA	NA	No
Tembladero Slough	CMP/309TEH	13	4	30.8	13	4	30.8	**Yes**
Tembladero Slough	CDPR/309SMHR43	67	3	4.5	67	7	**10.4**	**Yes**
Tembladero Slough	CCAMP/309TDW	4	1	25 [3]	1	1	100 [3]	No
Tembladero Slough	CDPR/Monterey 58	11	0	0	11	1	9.1	No
Tembladero Slough	CCAMP/309TEM	1	0	0	1	0	0	No
Merritt Ditch	CMP/309MER	13	1	7.7 [3]	13	1	7.7 [3]	No
Alisal Slough	CMP/309ASB	13	0	0	13	0	0	No
Alisal Creek	CCAMP/309HRT	1	0	0	1	0	0	No
Alisal Creek	CDPR/309SLHR83	53	18	34	53	21	39.6	**Yes**
Blanco Drain	CMP/309BLA	13	0	0	13	1	7.7 [3]	No
Blanco Drain	CCAMP/309BLA	1	0	0	0	NA	NA	No
Blanco Drain	CDPR/Monterey 9	7	1	14.3 [3]	7	1	14.3 [3]	No
Salinas Reclamation Canal (Lower)	CMP/309JON	13	3	23.1	13	3	23.1	**Yes**
Salinas Reclamation Canal (Lower)	CCAMP/309ALD	1	0	0	1	0	0	No
Salinas Reclamation Canal (Lower)	CDPR/309JON	29	5	**17.2**	29	5	**17.2**	Yes

Waterbody	Program/Site Code	Count of acute samples	Acute criteria exceeded [1]	Acute criteria exceeded %	Count of chronic samples	Chronic criteria exceeded [1]	Chronic criteria exceeded %	Chlorpyrifos impaired
Salinas Reclamation Canal (Upper)	CMP/309ALG	13	2	15.4	13	2	15.4	**Yes**
Salinas Reclamation Canal (Upper)	CDPR/309SLRC66	46	18	**39.1**	46	18	**39.1**	Yes
Salinas River	CMP/309SSP	6	1	16.7 [3]	6	1	16.7 [3]	No
Salinas River	CMP/309SAC	4	0	0	4	0	0	No
Salinas River	CDPR/309SAC	1	0	0	1	0	0	No
Salinas River	CMP/309SAG	3	0	0	3	0	0	No
Salinas River	CDPR/Monterey 13	27	0	0	27	0	0	No
Salinas River	CCAMP/309DAV	5	0	0	1	0	0	No
Espinosa Slough	CMP/309ESP	13	1	7.7 [3]	13	1	7.7 [3]	No
Espinosa Slough	CDPR/Monterey 15	1	0	0	1	0	0	No
Gabilan Creek	CMP/309GAB	2	0	0	2	1	50 [3]	No
Gabilan Creek	CDPR/Monterey 16	1	0	0	1	0	0	No
Gabilan Creek	CDPR/309ST0509	1	0	0	1	0	0	No
Natividad Creek	CMP/309NAD	8	2	25	8	2	25	**Yes**
Natividad Creek	CDPR/309NC3799	2	1	50 [3]	2	1	50 [3]	No
Santa Rita Creek	CMP/309RTA	4	0	0	4	0	0	No
Quail Creek	CMP/309QUI	11	6	54.5	11	6	54.5	**Yes**
Quail Creek	CDPR/309SLQL69	72	40	**55.6**	72	46	**63.9**	Yes
Chualar Creek	CMP/309CCD	7	1	14.3 [3]	7	2	28.6	**Yes**
Chualar Creek	CDPR/309CHUCRR	68	42	**61.8**	68	44	**64.7**	Yes

[1] Chlorpyrifos criteria of 0.025 µg/L (acute) and 0.015 µg/L (chronic).

[2] NA (not assessed) indicates that an evaluation of chronic criteria exceedance is not assessable because the laboratory method detection limit is greater than the chronic exceedance criteria.

[3] Exceedance count is less than two, the minimum number of exceedances required to determine impairment in accordance with the Listing Policy, regardless of the calculated exceedance frequency.

Table 6-17. Summary of monitoring programs, monitoring sites, exceedances, and diazinon impaired waterbodies.

Waterbody	Program/Site Code	Count of acute samples	Acute criteria exceeded [1]	Acute criteria exceeded %	Count of chronic samples	Chronic criteria exceeded [1]	Chronic criteria exceeded %	Diazinon impaired
Moro Cojo Slough	CMP/306MOR	13	0	0	13	0	0	No
Moro Cojo Slough	CDPR/Monterey 48	1	0	0	1	0	0	No
Old Salinas R.	CMP/309OLD	13	1	7.7 [2]	13	2	15.4	**Yes**
Old Salinas R.	CCAMP/309OLD	2	0	0	2	0	0	No
Old Salinas R.	CDPR/Monterey 50	5	0	0	5	1	20 [2]	No
Old Salinas R.	CDPR/309POT	41	6	**14.6**	41	11	**26.8**	Yes
Old Salinas R.	CCAMP/309POT	1	0	0	1	0	0	No
Salinas R. Lagoon	CDPR/309ST1345	31	2	6.5	31	3	**9.7**	Yes
Salinas R. Lagoon	CCAMP/309SAL00L	1	0	0	1	0	0	No
Salinas R. Lagoon	CCAMP/309SAL00U	1	0	0	1	0	0	No
Tembladero Slough	CMP/309TEH	13	3	23.1	13	5	38.5	**Yes**
Tembladero Slough	CDPR/309SMHR43	62	15	24.2	62	19	30.6	**Yes**
Tembladero Slough	CCAMP/309TDW	4	0	0	4	0	0	No
Tembladero Slough	CDPR/Monterey 58	7	1	14.3 [2]	7	4	**57.1**	**Yes**
Tembladero Slough	CCAMP/309TEM	1	0	0	1	0	0	No
Merritt Ditch	CMP/309MER	13	2	15.4	13	3	23.1	**Yes**
Alisal Slough	CMP/309ASB	13	2	15.4	13	3	23.1	**Yes**
Alisal Creek	CCAMP/309HRT	1	0	0	1	0	0	No
Alisal Creek	CDPR/309SLHR83	48	9	18.75	48	12	25	**Yes**
Blanco Drain	CMP/309BLA	13	1	7.7 [2]	13	3	23.1	**Yes**
Blanco Drain	CCAMP/309BLA	1	0	0	1	0	0	No
Blanco Drain	CDPR/Monterey 9	18	6	**33.3**	18	8	**44.4**	**Yes**
Salinas Reclamation Canal (Lower)	CMP/309JON	13	6	46.2	13	6	46.2	Note 1
Salinas Reclamation Canal (Lower)	CCAMP/309ALD	1	0	0	1	0	0	No
Salinas Reclamation Canal (Lower)	CDPR/309JON	23	2	8.7	23	2	8.7	Note 1

Waterbody	Program/Site Code	Count of acute samples	Acute criteria exceeded [1]	Acute criteria exceeded %	Count of chronic samples	Chronic criteria exceeded [1]	Chronic criteria exceeded %	Diazinon impaired
Salinas Reclamation Canal (Upper)	CMP/309ALG	13	4	30.8	13	5	38.5	Note 1
Salinas Reclamation Canal (Upper)	CDPR/309SLRC66	58	34	58.6	58	37	63.8	Note 1
Salinas River	CMP/309SSP	6	1 [2]	16.7	6	1 [2]	16.7	No
Salinas River	CMP/309SAC	4	0	0	4	0	0	No
Salinas River	CDPR/309SAC	1	0	0	1	0	0	No
Salinas River	CMP/309SAG	3	0	0	3	0	0	No
Salinas River	CDPR/Monterey 13	20	0	0	20	0	0	No
Salinas River	CCAMP/309DAV	5	0	0	5	0	0	No
Espinosa Slough	CMP/309ESP	13	6	46.2	13	6	46.2	**Yes**
Espinosa Slough	CDPR/Monterey 15	1	0	0	1	0	0	No
Gabilan Creek	CMP/309GAB	2	0	0	2	0	0	No
Gabilan Creek	CDPR/Monterey 16	1	0	0	1	0	0	No
Gabilan Creek	CDPR/309ST0509	1	0	0	1	0	0	No
Natividad Creek	CMP/309NAD	8	5	62.5	8	6	75.0	**Yes**
Natividad Creek	CDPR/309NC3799	2	0	0	2	0	0	No
Santa Rita Creek	CMP/309RTA	4	0	0	4	0	0	No
Quail Creek	CMP/309QUI	11	5	45.5	11	5	45.5	**Yes**
Quail Creek	CDPR/309SLQL69	68	19	**27.9**	68	24	**35.3**	**Yes**
Chualar Creek	CMP/309CCD	7	0	0	7	1 [2]	14.3	No
Chualar Creek	CDPR/309CHUCRR	67	26	**38.8**	67	35	**52.2**	**Yes**

[1] Diazinon criteria of 0.16 µg/L (acute) and 0.1 µg/L (chronic).

[2] Exceedance count is less than two, the minimum number of exceedances required to determine impairment in accordance with the Listing Policy, regardless of the calculated exceedance frequency.

Note 1: Exceedance of diazinon criteria for this site occurred prior to October 2011 and since this time no exceedances have occurred. As such, staff is recommending to de-list the Salinas Reclamation Canal as presented in Section 6.2.

Table 6-18. Summary of monitoring programs, monitoring sites, exceedances, and malathion impaired waterbodies.

Waterbody	Program/Site Code	Count of acute samples	Acute criteria exceeded [1]	Acute criteria exceeded %	Count of chronic samples	Chronic criteria exceeded [1]	Chronic criteria exceeded %	Malathion impaired
Moro Cojo Slough	CMP/306MOR	13	0	0	0	0	0	No
Moro Cojo Slough	CDPR/Monterey 48	1	0	0	1	0	0	No
Old Salinas R.	CMP/309OLD	13	0	0	13	1	7.7 [3]	No
Old Salinas R.	CCAMP/309OLD	2	0	0	2	0	0	No
Old Salinas R	CDPR/Monterey 50	9	0	0	9	0	0	No
Old Salinas R	CDPR/309POT	39	1	2.6 [3]	36	1	2.8 [3]	No
Old Salinas R.	CCAMP/309POT	1	1	100 [3]	1	1	100 [3]	No
Salinas R. Lagoon	CDPR/309ST1345	33	0	0	6	0	0	No
Salinas R. Lagoon	CCAMP/309SAL00L	1	0	0	1	0	0	No
Salinas R. Lagoon	CCAMP/309SAL00U	1	0	0	1	0	0	No
Tembladero Slough	CMP/309TEH	13	1	7.7 [3]	13	4	30.8	**Yes**
Tembladero Slough	CDPR/309SMHR43	67	3	4.5	67	11	**16.4**	**Yes**
Tembladero Slough	CCAMP/309TDW	4	0	0	2	0	0	No
Tembladero Slough	CDPR/Monterey 58	11	0	0	11	1	9.1 [3]	No
Tembladero Slough	CCAMP/309TEM	1	0	0	1	0	0	No
Merritt Ditch	CMP/309MER	13	3	23.1	13	4	30.8	**Yes**
Alisal Slough	CMP/309ASB	13	1	7.7 [3]	13	3	23.1	**Yes**
Alisal Creek	CCAMP/309HRT	1	0	0	1	0	0	No
Alisal Creek	CDPR/309SLHR83	53	14	**26.4**	53	23	**43.4**	**Yes**
Blanco Drain	CMP/309BLA	13	0	0	13	2	15.4	**Yes**
Blanco Drain	CCAMP/309BLA	1	0	0	1	0	0	No
Blanco Drain	CDPR/Monterey 9	22	0	0	6	0	0	No
Salinas Reclamation Canal (Lower)	CMP/309JON	13	0	0	13	3	23.1	**Yes**
Salinas Reclamation Canal (Lower)	CCAMP/309ALD	2	0	0	2	0	0	No
Salinas Reclamation Canal (Lower)	CDPR/309JON	29	1	3.4 [3]	26	5	**19.2**	**Yes**

Waterbody	Program/Site Code	Count of acute samples	Acute criteria exceeded [1]	Acute criteria exceeded %	Count of chronic samples	Chronic criteria exceeded [1]	Chronic criteria exceeded %	Malathion impaired
Salinas Reclamation Canal (Upper)	CMP/309ALG	13	1	7.7 [3]	13	2	15.4	**Yes**
Salinas Reclamation Canal (Upper)	CDPR/309SLRC66	61	7	**11.5**	46	16	**34.8**	**Yes**
Salinas River	CMP/309SSP	6	0	0	6	0	0	No
Salinas River	CMP/309SAC	4	0	0	4	0	0	No
Salinas River	CDPR/309SAC	1	0	0	1	0	0	No
Salinas River	CMP/309SAG	3	0	0	3	1	33.3 [3]	No
Salinas River	CDPR/Monterey 13	17	1	3.7 [3]	24	1	4.2 [3]	No
Salinas River	CCAMP/309DAV	5	0	0	3	0	0	No
Espinosa Slough	CMP/309ESP	13	0	0	13	3	23.1	**Yes**
Espinosa Slough	CDPR/Monterey 15	1	0	0	1	0	0	No
Gabilan Creek	CMP/309GAB	2	0	0	2	1	50 [3]	No
Gabilan Creek	CDPR/Monterey 16	1	0	0	1	0	0	No
Gabilan Creek	CDPR/309ST0509	1	0	0	1	0	0	No
Natividad Creek	CMP/309NAD	8	2	25	8	3	37.5	**Yes**
Natividad Creek	CDPR/309NC3799	2	0	0	2	0	0	No
Santa Rita Creek	CMP/309RTA	4	1	25 [3]	4	2	50	**Yes**
Quail Creek	CMP/309QUI	11	0	0	11	0	0	No
Quail Creek	CDPR/309SLQL69	72	3	4.2	56	12	**21.4**	**Yes**
Chualar Creek	CMP/309CCD	7	0	0	0	0	0	No
Chualar Creek	CDPR/309CHUCCR	72	2	2.8	59	8	**13.6**	**Yes**

[1] Malathion criteria of 0.17 µg/L (acute) and 0.028 µg/L (chronic).

[2] NA (not assessed) indicates that an evaluation of chronic criteria exceedance is not assessable because the laboratory method detection limit is greater than the chronic exceedance criteria.

[3] Exceedance count is less than two, the minimum number of exceedances required to determine impairment in accordance with the Listing Policy, regardless of the calculated exceedance frequency.

Table 6-19. Organophosphate pesticide impaired waterbodies.

Waterbody	Chlorpyrifos impaired	Diazinon impaired	Malathion impaired
Moro Cojo Slough	No	No	No
Old Salinas River	Yes	Yes	No
Salinas River Lagoon	No [1]	Yes [2]	No
Tembladero Slough	Yes	Yes	Yes
Merritt Ditch	No	Yes	Yes [2]
Alisal Slough	No	Yes	Yes [2]
Alisal Creek	Yes [2]	Yes [2]	Yes [2]
Blanco Drain	No [3]	Yes	Yes [2]
Salinas Reclamation Canal (Lower)	Yes	Note 1	Yes
Salinas Reclamation Canal (Upper)	Yes	Note 1	Yes
Salinas River	No [1]	No [1]	No
Espinosa Slough	No	Yes	Yes
Gabilan Creek	No	No	No
Natividad Creek	Yes [2]	Yes	Yes [2]
Santa Rita Creek	No	No	Yes [2]
Quail Creek	Yes	Yes	Yes
Chualar Creek	Yes	Yes	Yes

[1] Waterbody is on the current 303(d) List, however exceedance frequencies and sample sizes indicate the waterbody meets the Listing Policy requirements for de-listing. As such, staff will recommend de-listing this waterbody.

[2] Waterbody is not included on the current 303(d) List, but it has been identified as a new impairment.

[3] Waterbody is on the current 303(d) List and current data indicates the waterbody is not impaired. The exceedance frequency and sample size are insufficient and do not meet the Listing Policy requirements for staff to recommend de-listing at this time.

Note 1: Exceedance of diazinon criteria for this waterbody occurred prior to October 2001 and since this time no exceedances have occurred. As such, staff is recommending to de-list the Salinas Reclamation Canal as presented in Section 6.2.

6.4 Temporal Trends Organophosphate Pesticides

Staff calculated temporal trends by computing the Kendall's T correlation coefficient (Kendall's tau) for each organophosphate pesticide. For this analysis, staff used CMP monitoring results (2006 to 2018) for stations within the lower Salinas River watershed (17 monitoring stations). Staff used CMP data because it utilized the same analytical method for all samples and the method detection limit for all samples was sufficient to assess exceedances of each organophosphate pesticide evaluation criteria. See Section 6.1.1 for CMP monitoring results. Kendall's tau is a nonparametric correlation coefficient that measures the monotonic association between two variables (Helsel 2012), for example concentration over time. The Kendall's tau correlation between all each organophosphate pesticide concentration versus time (in years) was performed with the *cenken*() function in the NADA package for R (Lee 2013). The *cenken*() function also returns the significance of the tau statistic as a P-value between 0 and 1. Trends can be

significantly increasing or significantly decreasing. Time series with non-significant Kendall's tau correlations are neither significantly increasing nor significantly decreasing.

Temporal trends of concentration versus time were calculated for chlorpyrifos, diazinon, and malathion. P-values of 0.10 or less were considered statistically significant. The analysis identified significant decreasing trends in chlorpyrifos and diazinon concentrations, while malathion concentrations significantly increased over time.

Table 6-20. Trend statistics for CMP monitoring site concentrations of chlorpyrifos, diazinon, and malathion.

Analyte Name (µg/L)	Slope (conc./yr)	Intercept	tau	P-value	N (samples)	Significant Trend
Chlorpyrifos	-0.006	12.736	-0.107	0.028	162	Decreasing
Diazinon	-0.054	108.464	-0.421	<0.001	162	Decreasing
Malathion	0.009	-17.654	0.078	0.099	162	Increasing

Figure 6-6, Figure 6-7, and Figure 6-8 show time series plots for chlorpyrifos, diazinon, and malathion, respectively. The plots also show the computed Akritas-Theil-Sen nonparametric line in red, which estimates the median of slopes of all lines through pairs of censored points.

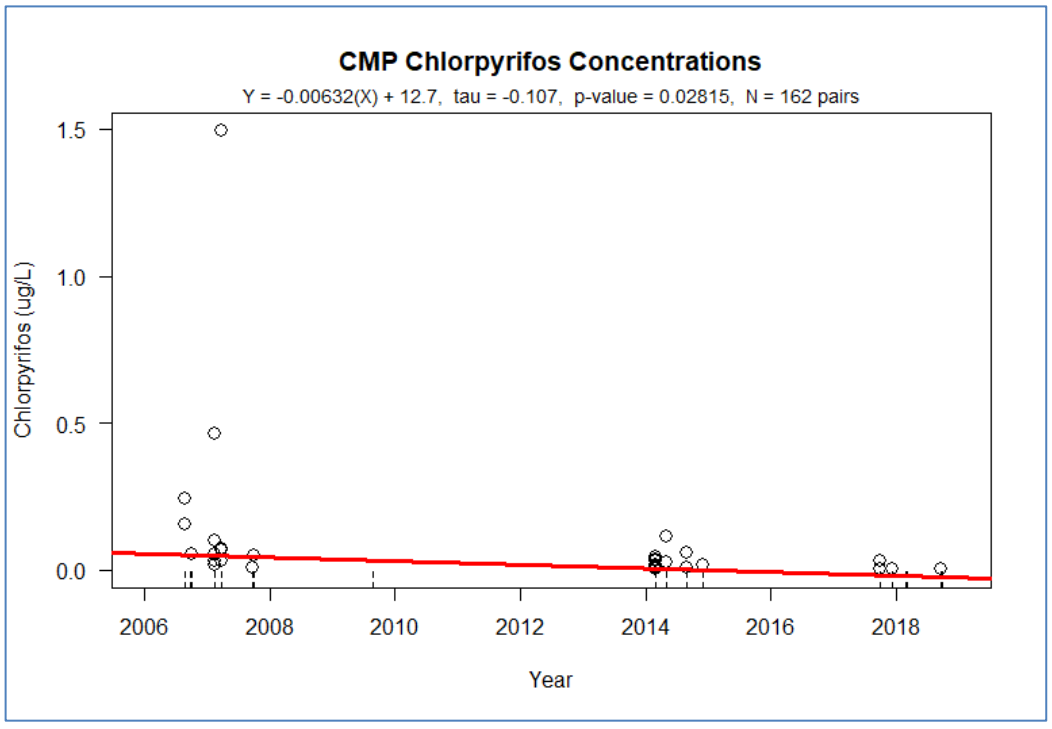

Figure 6-6. Time series graph of chlorpyrifos concentrations (µg/L) from 17 CMP monitoring sites in the project area.

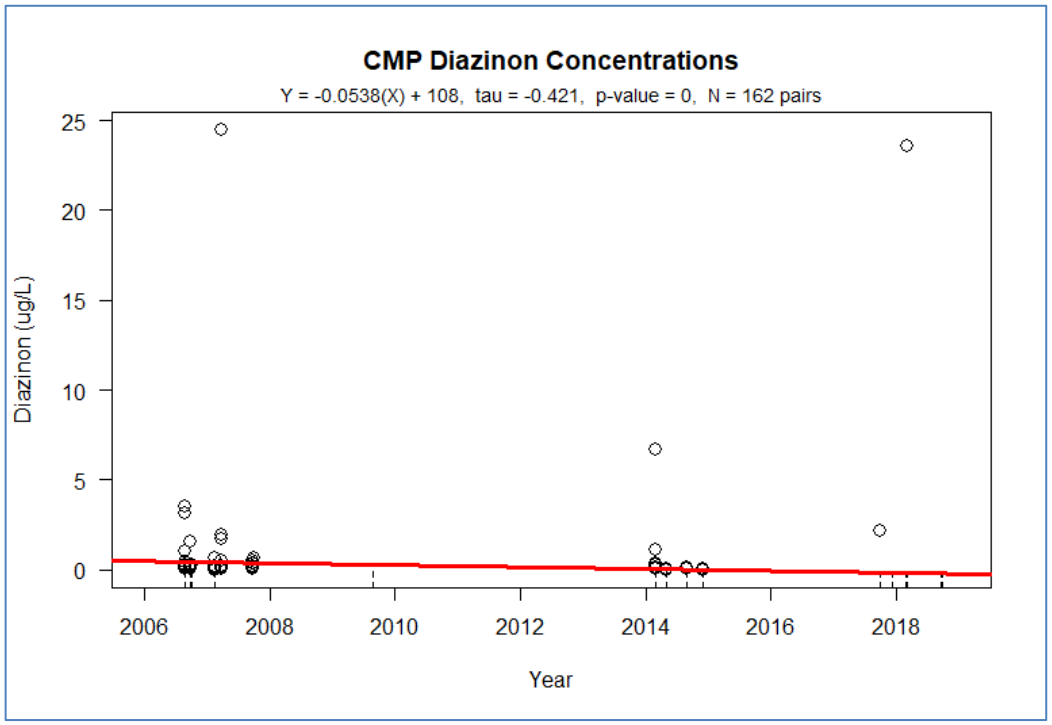

Figure 6-7. Time series graph of diazinon concentrations (µg/L) from 17 CMP monitoring sites in the project area.
Note: The p-value is less than 0.001.

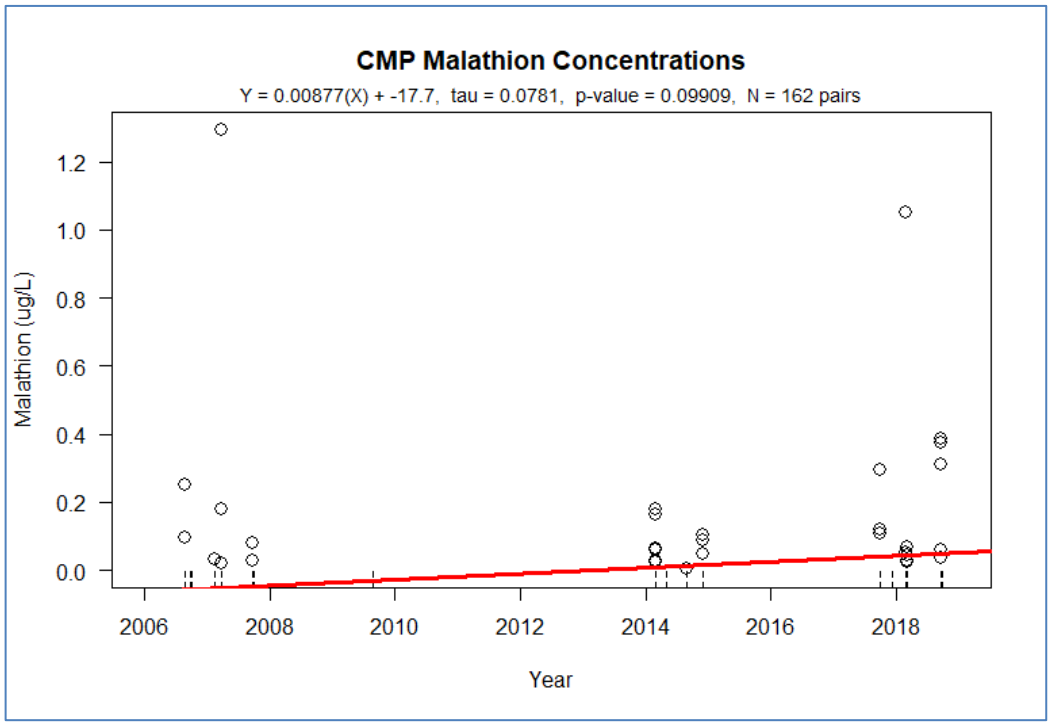

Figure 6-8. Time series graph of malathion concentrations (µg/L) from 17 CMP monitoring sites in the project area.

6.5 Aquatic Toxicity

This section describes the results of aquatic toxicity (bioassay) testing for monitoring sites within the lower Salinas River watershed. Aquatic toxicity testing was conducted using the invertebrate test species *Ceriodaphnia dubia* (water flea), *Chironomus dilutes* (midge fly larva), *Hyalella azteca* (an amphipod crustacean), and *Americamysis bahia* (mysid shrimp). The aquatic toxicity test endpoints for each species is survival, as measured in water samples as well as in non-toxic control samples. A statistical test is then applied to determine significant differences in organism survival between the water and control samples.

Where the salinity of ambient waters exceeded the tolerance of the standard freshwater test species (*C. dubia* and *C. dilutes*), the alternative salinity-tolerant species *H. azteca* or *A. bahia* were used for toxicity tests. In general, most tests were conducted as 6 to 10-day tests for mortality (i.e., chronic bioassay), however a few 96-hour tests (i.e., acute bioassay) are included in the result summaries presented herein.

Detailed data analyses of aquatic toxicity sublethal effects, as measured by growth or reproduction endpoints, are not included in this water quality assessment because all waterbodies in the project area are impaired due to significant toxic effects to the survival endpoints (see Table 6-29) and consequently, the sublethal endpoints (growth and reproduction) are also impaired. Staff reviewed available aquatic toxicity sublethal effects data and confirmed that all waterbodies exhibiting toxicity impairment due to the significant mortality also exhibit significant sublethal effects (growth and/or reproduction).

Toxicity monitoring was performed by the Cooperative Monitoring Program (CMP) from 2005 to 2019, through several monitoring projects coordinated by the Central Coast Ambient Monitoring Program (CCAMP) from 2005 to 2019, and by the California Department of Pesticide Regulation (CDPR) in September 2014. Figure 6-9 is a map of the aquatic toxicity monitoring sites. Note that many of these site locations are the same as the organophosphate pesticide monitoring site locations and many toxicity samples coincide with pesticide monitoring samples. Table 6-21, Table 6-23, Table 6-25, and Table 6-27 describe the monitoring sites, programs, and time period for each of the invertebrate test species.

A summary of aquatic toxicity test results for each of the four test species, along with a determination of water quality impairment is contained in Table 6-22, Table 6-24, Table 6-26, and Table 6-28.

To determine waterbody impairment due to significant aquatic toxicity, staff compared these results to the exceedance frequencies shown in Table 6-2.

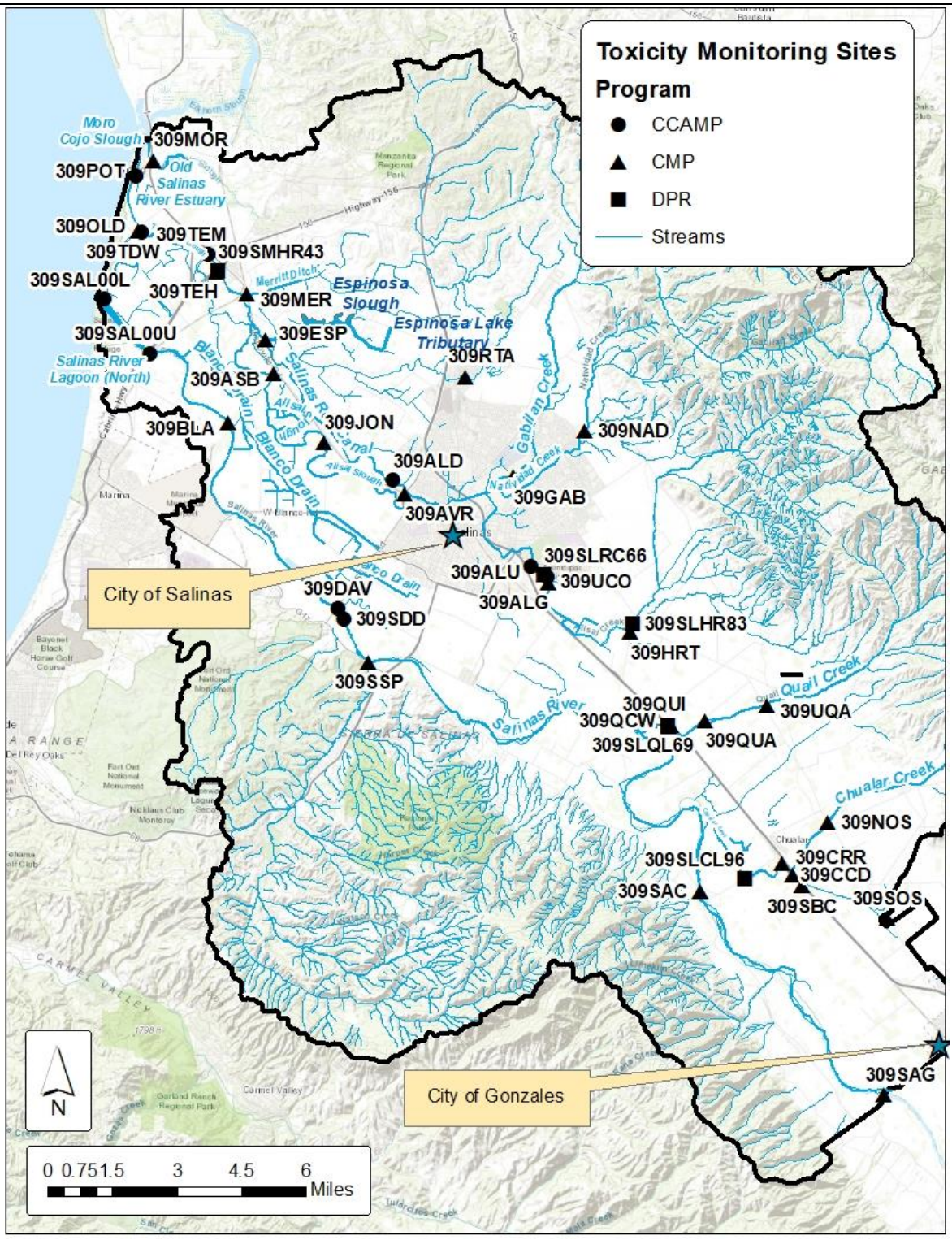

Figure 6-9. Map of toxicity monitoring sites.

Table 6-21. Toxicity monitoring sites, descriptions, programs, and time period (*Ceriodaphnia dubia*).

Site Description	Site Code	Program	Date Begin	Date End
Moro Cojo Slough @ Hwy 1	309MOR	CMP	3/30/2011	3/30/2011
Old Salinas River @ Monterey Dunes Way	309OLD	CMP	1/27/2008	1/18/2019
Tembladero Slough @ Haro	309TEH	CMP	7/26/2005	12/3/2019
Tembladero Slough @ Monterey Dunes Way	309TDW	CCAMP	2/23/2010	12/5/2018
Tembladero Slough @ Preston Rd	309TEM	CCAMP	9/5/2012	12/5/2018
Merritt Ditch upstream from Hwy 183	309MER	CMP	7/26/2005	12/3/2019
Alisal Slough @ White Barn	309ASB	CMP	7/27/2005	12/3/2019
Alisal Creek @ Hartnell Road dogleg	309HRT	CMP	1/25/2008	1/17/2018
Blanco Drain below Pump	309BLA	CMP	7/27/2005	12/3/2019
Salinas Reclamation Canal @ San Jon Rd	309JON	CMP	7/27/2005	12/3/2019
Salinas Reclamation Canal @ Boranda Rd	309ALD	CCAMP	9/27/2011	12/5/2018
Salinas Reclamation Canal @ Victor Rd	309AVR	CMP	1/26/2008	9/30/2008
Salinas Reclamation Canal at Airport Rd	309ALU	CCAMP	2/28/2012	12/5/2018
Salinas Reclamation Canal u/s City Outfall	309UCO	CCAMP	9/27/2011	3/24/2012
Salinas Reclamation Canal @ La Guardia	309ALG	CMP	7/27/2005	12/2/2019
Salinas River @ Davis Road	309DAV	CCAMP	3/25/2009	12/5/2018
Salinas River near Davis Rd d/s of City Outfall	309SDD	CCAMP	9/27/2011	3/24/2012
Salinas River @ Spreckels Gage	309SSP	CMP	7/27/2005	12/3/2019
Salinas River @ Chualar River Road	309SAC	CMP	7/27/2005	9/18/2019
Salinas River @ Gonzales River Rd Bridge	309SAG	CMP	2/23/2006	9/18/2019
Espinosa Slough upstream of Alisal Slough	309ESP	CMP	7/26/2005	12/3/2019
Gabilan Creek @ Independence Rd and East Boranda Rd	309GAB	CMP	7/27/2005	12/2/2019
Natividad Creek upstream from Salinas Reclamation Canal	309NAD	CMP	7/27/2005	12/2/2019

Site Description	Site Code	Program	Date Begin	Date End
Santa Rita Creek @ Santa Rita Creek Park	309RTA	CMP	2/28/2012	12/2/2019
Quail Creek @ Old Stage Rd	309UQA	CMP	1/25/2008	10/2/2008
Quail Creek @ Potter Rd	309QUA	CMP	1/25/2008	10/2/2008
Quail Creek @ Hwy 101	309QUI	CMP	7/27/2005	12/2/2019
Quail Creek west of Hwy 101 @ RR tracks	309QCW	CMP	1/25/2008	10/2/2008
Chualar Creek @ Old Stage Rd (north branch)	309NOS	CMP	1/25/2008	2/24/2008
Chualar Creek @ Chualar River Rd	309CRR	CMP	1/25/2008	3/27/2012
Chualar Creek @ Old Stage Rd (south branch)	309SOS	CMP	1/25/2008	10/2/2008
Chualar Creek west side of Hwy 101 (south branch)	309SBC	CMP	1/25/2008	10/2/2008
Chualar Creek west of Highway 101	309CCD	CMP	3/26/2013	12/2/2019

Table 6-22. Summary of aquatic toxicity results (*Ceriodaphnia dubia*, survival).

Waterbody	Site Code	Count of samples	Count of significant toxicity	Percent of significant toxicity	Toxicity impaired
Moro Cojo Slough	309MOR	1	1	100	TBD
Old Salinas River	309OLD	15	6	40	Yes
Tembladero Slough	309TEH	50	16	32	Yes
Tembladero Slough	309TDW	4	2	50	Yes
Tembladero Slough	309TEM	4	0	0	No
Merritt Ditch	309MER	49	12	24.5	Yes
Alisal Slough	309ASB	18	3	16.7	Yes
Alisal Creek	309HRT	5	3	60	Yes
Blanco Drain	309BLA	41	3	7.3	No
Salinas Reclamation Canal (Lower)	309JON	50	22	44	Yes
Salinas Reclamation Canal (Lower)	309ALD	17	3	17.6	Yes
Salinas Reclamation Canal (Lower)	309AVR	3	2	66.7	Yes
Salinas Reclamation Canal (Upper)	309ALU	4	0	0	No
Salinas Reclamation Canal (Upper)	309UCO	3	1	33.3	No
Salinas Reclamation Canal (Upper)	309ALG	47	26	55.3	Yes

Waterbody	Site Code	Count of samples	Count of significant toxicity	Percent of significant toxicity	Toxicity impaired
Salinas River	309DAV	7	0	0	No
Salinas River	309SDD	3	1	33.3	No
Salinas River	309SSP	27	5	18.5	Yes
Salinas River	309SAC	26	2	7.7	Yes
Salinas River	309SAG	23	2	8.7	Yes
Espinosa Slough	309ESP	44	13	29.5	Yes
Gabilan Creek	309GAB	19	7	36.8	Yes
Natividad Creek	309NAD	39	22	56.4	Yes
Santa Rita Creek	309RTA	13	5	38.5	Yes
Quail Creek	309UQA	3	3	100	Yes
Quail Creek	309QUA	3	3	100	Yes
Quail Creek	309QUI	37	21	56.8	Yes
Quail Creek	309QCW	3	3	100	Yes
Chualar Creek	309NOS	2	2	100	Yes
Chualar Creek	309CRR	10	10	100	Yes
Chualar Creek	309SOS	3	2	66.7	Yes
Chualar Creek	309SBC	3	3	100	Yes
Chualar Creek	309CCD	25	7	28	Yes

TBD: To be determined. Additional information is necessary because a minimum of two samples are required to assess impairment.

Based on the information shown above in Table 6-22, staff has concluded impairments due to aquatic toxicity to *Ceriodaphnia dubia* in every waterbody in the project area with the exception of Moro Cojo Slough and Blanco Drain. Specifically, the following waterbodies and stations are impaired due to significant toxic effects to *C. dubia:* the Old Salinas River (309OLD), Tembladero Slough (309TEH and 309TDW), Merritt Ditch (309MER), Alisal Slough (309ASB), Alisal Creek (309HRT), lower Salinas Reclamation Canal (309JON, 309ALD, and 309AVR), upper Salinas Reclamation Canal (309ALG), Salinas River (309SSP, 309SAC, 309SAG), Espinosa Slough (309ESP), Gabilan Creek (309GAB), Natividad Creek (309NAD), Santa Rita Creek (309RTA), Quail Creek (309UQA, 309QUA, 309QUI, and 309QCW), and Chualar Creek (309NOS, 309CRR, 309SOS, 309SBC, and 309CCD). Moro Coho Slough has only one sample and two or more samples are required to assess impairment.

Table 6-23. Toxicity monitoring sites, descriptions, programs, and time period (*Hyalella azteca*).

Site Description	Site Code	Program	Date Begin	Date End
Moro Cojo Slough @ Hwy 1	309MOR	CMP	4/12/2005	12/3/2019
Old Salinas River @ Monterey Dunes Way	309OLD	CMP	4/11/2005	12/3/2019
Old Salinas River at Potrero Rd	309POT	CCAMP	8/24/2016	8/24/2016
Salinas River Estuary Lower near Old Salinas River Flap Gate	309SAL00L	CCAMP	8/23/2016	8/23/2016
Salinas River Estuary Upper near RR bridge	309SAL00U	CCAMP	8/23/2016	8/23/2016
Tembladero Slough @ Haro	309TEH	CCAMP	4/12/2005	9/16/2019
Tembladero Slough @ Monterey Dunes Way	309TDW	CCAMP	2/28/2012	12/5/2018
Tembladero Slough @ Preston Rd	309TEM	CCAMP	1/17/2018	12/5/2018
Merritt Ditch upstream from Hwy 183	309MER	CMP	4/12/2005	8/26/2009
Alisal Slough @ White Barn	309ASB	CMP	4/11/2005	9/17/2019
Alisal Creek @ Hartnell Road dogleg	309HRT	CCAMP	10/18/2017	9/16/2019
Blanco Drain below Pump	309BLA	CMP	4/13/2005	8/30/2016
Salinas Reclamation Canal @ San Jon Rd	309JON	CCAMP	4/11/2005	9/16/2019
Salinas Reclamation Canal @ Boranda Rd	309ALD	CCAMP	10/18/2017	12/5/2018
Salinas Reclamation Canal at Airport Rd	309ALU	CCAMP	8/15/2018	12/5/2018
Salinas Reclamation Canal @ La Guardia	309ALG	CMP	4/13/2005	4/13/2005
Salinas River @ Davis Road	309DAV	CCAMP	4/18/2017	9/16/2019
Salinas River @ Spreckels Gage	309SSP	CMP	4/14/2005	4/14/2005
Salinas River @ Chualar River Road	309SAC	CCAMP	4/14/2005	8/15/2018
Espinosa Slough upstream of Alisal Slough	309ESP	CMP	4/12/2005	8/26/2015
Gabilan Creek @ Independence Rd and East Boranda Rd	309GAB	CMP	4/13/2005	4/13/2005
Natividad Creek upstream from Salinas Reclamation Canal	309NAD	CMP	4/13/2005	4/13/2005
Santa Rita Creek @ Santa Rita Creek Park	309RTA	CCAMP	12/5/2018	12/5/2018
Quail Creek @ Hwy 101	309QUI	CMP	4/14/2005	4/14/2005

Table 6-24. Summary of aquatic toxicity results (*Hyalella azteca*, survival).

Waterbody	Site Code	Count of samples	Count of significant toxicity	Percent of significant toxicity	Toxicity impaired
Moro Cojo Slough	309MOR	14	5	35.7	Yes
Old Salinas River	309OLD	34	21	61.8	Yes
Old Salinas River	309POT	1	0	0	TBD
Salinas R. Lagoon	309SAL00L	1	0	0	TBD
Salinas R. Lagoon	309SAL00U	1	0	0	TBD
Tembladero Slough	309TEH	6	2	33.3	Yes
Tembladero Slough	309TDW	4	1	25	No
Tembladero Slough	309TEM	3	2	66.7	Yes
Merritt Ditch	309MER	2	2	100	Yes
Alisal Slough	309ASB	32	3	9.4	Yes
Alisal Creek	309HRT	5	5	100	Yes
Blanco Drain	309BLA	12	0	0	No
Salinas Reclamation Canal (Lower)	309JON	4	2	50	Yes
Salinas Reclamation Canal (Lower)	309ALD	4	1	25	No
Salinas Reclamation Canal (Upper)	309ALU	2	2	100	Yes
Salinas Reclamation Canal (Upper)	309ALG	1	1	100	TBD
Salinas River	309DAV	6	0	0	No
Salinas River	309SSP	1	0	0	TBD
Salinas River	309SAC	2	0	0	No
Espinosa Slough	309ESP	5	3	60	Yes
Gabilan Creek	309GAB	1	1	100	TBD
Natividad Creek	309NAD	1	1	100	TBD
Santa Rita Creek	309RTA	1	1	100	TBD
Quail Creek	309QUI	1	1	100	TBD

TBD: To be determined. Additional information is necessary because a minimum of two samples are required to assess impairment.

Based on the information shown above in Table 6-24, staff has concluded impairments due to aquatic toxicity to *Hyalella azteca* for Moro Cojo Slough (309MOR), Old Salinas River (309OLD), Tembladero Slough (309TEH and 309TEM), Merritt Ditch (309MER), Alisal Slough (309ASB), Alisal Creek (309HRT), lower Salinas Reclamation Canal (309JON), upper Salinas Reclamation Canal (309ALU), and Espinosa Slough (309ESP). Many stations have only one sample and two or more samples are required to assess impairment.

Table 6-25. Toxicity monitoring sites, descriptions, programs, and time period (*Chironomus dilutes*).

Site Description	Site Code	Program	Date Begin	Date End
Old Salinas River @ Monterey Dunes Way	309OLD	CMP	1/11/2017	1/18/2019
Old Salinas River at Potrero Rd	309POT	CCAMP	8/24/2016	8/24/2016
Salinas River Estuary Lower near Old Salinas River Flap Gate	309SAL00L	CCAMP	8/23/2016	8/23/2016
Salinas River Estuary Upper near RR bridge	309SAL00U	CCAMP	8/23/2016	8/23/2016
Tembladero Slough @ Haro	309TEH	CMP	1/11/2017	12/3/2019
Tembladero Slough at Haro	309SMHR43	CDPR	9/16/2014	9/16/2014
Tembladero Slough @ Monterey Dunes Way	309TDW	CCAMP	8/15/2018	12/5/2018
Tembladero Slough @ Preston Rd	309TEM	CCAMP	1/17/2018	12/5/2018
Merritt Ditch upstream from Hwy 183	309MER	CMP	1/11/2017	12/3/2019
Alisal Slough @ White Barn	309ASB	CMP	3/1/2018	12/3/2019
Alisal Creek @ Hartnell Road dogleg	309HRT	CCAMP	10/18/2017	9/16/2019
Alisal Creek at Hartnell Rd	309SLHR83	CDPR	9/16/2014	9/16/2014
Blanco Drain below Pump	309BLA	CMP	1/25/2017	12/3/2019
Salinas Reclamation Canal @ San Jon Rd	309JON	CMP	1/25/2017	12/3/2019
Salinas Reclamation Canal @ Boranda Rd	309ALD	CCAMP	10/18/2017	12/5/2018
Salinas Reclamation Canal at Airport Rd	309ALU	CCAMP	8/15/2018	12/5/2018
Rec Ditch III near Airport Blvd	309SLRC66	CDPR	9/16/2014	9/16/2014
Salinas Reclamation Canal @ La Guardia	309ALG	CMP	1/12/2017	12/2/2019
Salinas River @ Davis Road	309DAV	CCAMP	4/18/2017	9/16/2019
Salinas River @ Spreckels Gage	309SSP	CMP	4/26/2017	12/3/2019
Salinas River @ Chualar River Road	309SAC	CMP	1/13/2017	9/18/2019
Salinas River @ Gonzales River Rd Bridge	309SAG	CMP	1/13/2017	9/18/2019
Espinosa Slough upstream of Alisal Slough	309ESP	CMP	1/11/2017	12/3/2019
Gabilan Creek @ Independence Rd and East Boranda Rd	309GAB	CMP	1/12/2017	12/2/2019
Natividad Creek upstream from Salinas Reclamation Canal	309NAD	CMP	1/12/2017	12/2/2019

Site Description	Site Code	Program	Date Begin	Date End
Santa Rita Creek @ Santa Rita Creek Park	309RTA	CMP	7/31/2017	12/2/2019
Quail Creek @ Hwy 101	309QUI	CMP	1/13/2017	12/2/2019
Quail Creek at SR-101	309SLQL69	CDPR	9/16/2014	9/16/2014
Chualar Creek west of Highway 101	309CCD	CMP	1/25/2017	12/2/2019
Chualar Creek at Chualar River Rd	309SLCL96	CDPR	9/16/2014	9/16/2014

Table 6-26. Summary of aquatic toxicity results (*Chironomus dilutes,* survival).

Waterbody	Site Code	Count of samples	Count of significant toxicity	Percent of significant toxicity	Toxicity impaired
Old Salinas River	309OLD	4	1	25	No
Old Salinas River	309POT	1	0	0	TBD
Salinas R. Lagoon	309SAL00L	1	0	0	TBD
Salinas R. Lagoon	309SAL00U	1	0	0	TBD
Tembladero Slough	309TEH	16	5	31.3	Yes
Tembladero Slough	309SMHR43	1	0	0	TBD
Tembladero Slough	309TDW	3	2	66.7	Yes
Tembladero Slough	309TEM	3	1	33.3	No
Merritt Ditch	309MER	12	7	58.3	Yes
Alisal Slough	309ASB	3	3	100	Yes
Alisal Creek	309HRT	6	5	83.3	Yes
Alisal Creek	309SLHR83	1	1	100	TBD
Blanco Drain	309BLA	12	2	16.7	Yes
Salinas Reclamation Canal (Lower)	309JON	15	11	73.3	Yes
Salinas Reclamation Canal (Lower)	309ALD	4	2	50	Yes
Salinas Reclamation Canal (Upper)	309ALU	3	3	100	Yes
Salinas Reclamation Canal (Upper)	309SLRC66	1	1	100	TBD
Salinas Reclamation Canal (Upper)	309ALG	12	10	83.3	Yes
Salinas River	309DAV	5	0	0	No
Salinas River	309SSP	10	3	30	Yes
Salinas River	309SAC	6	1	16.7	No
Salinas River	309SAG	6	1	16.7	No
Espinosa Slough	309ESP	12	5	41.7	Yes
Gabilan Creek	309GAB	7	5	71.4	Yes

Waterbody	Site Code	Count of samples	Count of significant toxicity	Percent of significant toxicity	Toxicity impaired
Natividad Creek	309NAD	9	8	88.9	Yes
Santa Rita Creek	309RTA	10	7	70	Yes
Quail Creek	309QUI	8	6	75	Yes
Quail Creek	309SLQL69	1	1	100	TBD
Chualar Creek	309CCD	12	9	75	Yes
Chualar Creek	309SLCL96	1	1	100	TBD

TBD: To be determined. Additional information is necessary because a minimum of two samples are required to assess impairment.

Based on the information shown above in Table 6-26, staff has concluded impairments due to aquatic toxicity to *Chironomus dilutes* for Tembladero Slough (309TEH and 309TDW), Merritt Ditch (309MER), Alisal Slough (309ASB), Alisal Creek (309HRT), Blanco Drain (309BLA), lower Salinas Reclamation Canal (309JON and 309ALD), upper Salinas Reclamation Canal (309ALG), Salinas River (309SSP), Espinosa Slough (309ESP), Gabilan Creek (309GAB), Natividad Creek (309NAD), Santa Rita Creek (309RTA), Quail Creek (309QUI, and Chualar Creek (309CCD). Many stations have only one sample and two or more samples are required to assess impairment.

Table 6-27. Toxicity monitoring sites, descriptions, programs, and time period (*Americamysis bahia*).

Site Description	Site Code	Program	Date Begin	Date End
Moro Cojo Slough @ Hwy 1	309MOR	CMP	7/26/2005	9/17/2019
Old Salinas River @ Monterey Dunes Way	309OLD	CMP	8/26/2009	9/28/2011

Table 6-28. Summary of aquatic toxicity results (*Americamysis bahia*, survival).

Waterbody	Site Code	Count of samples	Count of significant toxicity	Percent of significant toxicity	Toxicity impaired
Moro Cojo Slough	309MOR	35	3	8.6	Yes
Old Salinas River	309OLD	2	0	0	No

Based on the information shown above in Table 6-28, staff has concluded impairments due to aquatic toxicity to *Americamysis bahia* for the Moro Cojo Slough (309MOR).

Error! Not a valid bookmark self-reference. below provides a summary of aquatic toxicity impairments (survival endpoint) for all waterbodies and test species referenced in this section.

Table 6-29. Summary of waterbody impairments due to aquatic toxicity (survival endpoint) for all test species.

Waterbody	Significant toxicity impairment (*C. dubia*)	Significant toxicity impairment (*H. azteca*)	Significant toxicity impairment (*C. dilutes*)	Significant toxicity impairment (*A. bahia*)	**Waterbody toxicity impaired**
Moro Cojo Slough	No	Yes	NT	Yes	Yes
Old Salinas River	Yes	Yes	No	No	Yes
Salinas River Lagoon	NT	No	No	NT	Yes [1]
Tembladero Slough	Yes	Yes	Yes	NT	Yes
Merritt Ditch	Yes	Yes	Yes	NT	Yes
Alisal Slough	Yes	Yes	Yes	NT	Yes
Alisal Creek	Yes	Yes	Yes	NT	Yes
Blanco Drain	No	No	Yes	NT	Yes
Salinas Reclamation Canal (Lower)	Yes	Yes	Yes	NT	Yes
Salinas Reclamation Canal (Upper)	Yes	Yes	Yes	NT	Yes
Salinas River	Yes	No	Yes	NT	Yes
Espinosa Slough	Yes	Yes	Yes	NT	Yes
Gabilan Creek	Yes	No	Yes	NT	Yes
Natividad Creek	Yes	No	Yes	NT	Yes
Santa Rita Creek	Yes	No	Yes	NT	Yes [2]
Quail Creek	Yes	No	Yes	NT	Yes
Chualar Creek	Yes	No	Yes	NT	Yes

[1] Waterbody is on the current 303(d) List, but analysis of the data herein does not confirm impairment. Current impairment is based on data collected in 2008 and 2009, but not included in this assessment.

[2] Waterbody is not included on the current 303(d) List, but it has been identified as a new impairment.

NT: Not tested

All waterbodies within the lower Salinas River watershed exhibit significant aquatic toxicity to one or more test species using the survival endpoint.

7 WATER QUALITY NUMERIC TARGETS

This section describes the numeric targets used to develop the TMDL. Numeric targets are water quality targets used to ascertain when and where water quality objectives are achieved, and hence, when beneficial uses are protected. Recall that the pesticide and toxicity water quality objectives are narrative objectives. Numeric targets are used to interpret the narrative objectives.

7.1 Organophosphate Pesticide Numeric Targets

Staff reviewed various criteria/screening values that could be used as numeric target values. Staff selected water column numeric target values for chlorpyrifos, diazinon, and malathion as a direct measure of water quality conditions for the protection of aquatic life that are consistent with the pesticide and toxicity objectives described in Section 5.2.

In 2000, CDFW published freshwater water quality criteria for diazinon and chlorpyrifos (CDFW, 2000) using USEPA methodology (USEPA, 1985). Using this data set, CDFW recalculated the diazinon criteria excluding questionable *Grammarus fasciatus* data and revised water quality criteria for diazinon (CDFW, 2004). In addition, CVRWQCB developed freshwater invertebrate toxicity criteria for malathion through a contract with UC Davis (Faria et al., 2010). The UC Davis study developed acute and chronic malathion criteria based on a new methodology for deriving freshwater water quality criteria for the protection of aquatic life (TenBrook, et al. 2009). Staff selected the CDFW and the CVRWQCB water quality criteria as numeric targets for these TMDLs.

The individual OP pesticide numeric targets are presented in Table 7-1.

Table 7-1. Water column numeric targets for organophosphate pesticides.

Compound	CMC [A] (ppb)	CCC [B] (ppb)	Reference
Chlorpyrifos [C]	0.025	0.015	CDFW, 2000
Diazinon [C]	0.16	0.10	CDFW, 2000
Malathion	0.17	0.028	Faria et. al., 2010

[A]. CMC – Criterion Maximum Concentration or acute (1- hour average). Not to be exceeded more than once in a three year period

[B]. CCC – Criterion Continuous Concentration or chronic (4-day (96-hour) average). Not to be exceeded more than once in a three year period

[C]. A toxicity ratio is used to account for the additive nature of these compounds. The ratio calculation is provided in Section 7.2 below.

These water column numeric targets for organophosphate pesticides are consistent with the Basin Plan narrative water quality objective which states, in part:

"No individual pesticide or combination of pesticides shall reach concentrations that adversely affect beneficial uses. There shall be no increase in pesticide concentrations found in bottom sediments or aquatic life."

7.2 Additive Toxicity Numeric Target Chlorpyrifos, Diazinon, and Malathion

Chlorpyrifos, diazinon, and malathion have the same mechanism of toxic action and exhibit additive toxicity to aquatic invertebrates when they co-occur (Bailey et al., 1997; CDFW, 2000). Mixtures of compounds acting through the same mechanism suggest there is no concentration below which a compound will no longer contribute to the overall toxicity of the mixture (Deneer et al., 1988). Therefore, the total potential toxicity of co-occurring chlorpyrifos, diazinon, and malathion needs to be assessed, even when one or more of their individual concentrations would otherwise be below thresholds of concern. Technical guidance developed by staff of the Central Valley Regional Water Quality Control Board (CVRWQCB) ("Policy for Application of Water Quality Objectives" and policy on "Pesticide Discharges from Nonpoint Sources") include formulas for addressing additive toxicity. Additive toxicity can be evaluated by the following formula from *Basin Plan Amendments to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins for Diazinon and Chlorpyrifos Runoff into the Sacramento and Feather Rivers* (CVRWQCB, 2007). The additive toxicity numeric target, when two or more organophosphate pesticides are present in the water column, is defined as the concentration of chlorpyrifos divided by the numeric target for chlorpyrifos plus the concentration of diazinon divided by the numeric target for diazinon plus the concentration of malathion divided by the numeric target for malathion is equal to or less than one. Figure 7-1 depicts the equation for the additive toxicity numeric target.

The numeric target for OP pesticide additive toxicity is S ≤ 1, calculated using the formula depicted in Figure 7-1.

$$\frac{C\ \text{Chlorpyrifos}}{NT\ \text{Chlorpyrifos}} + \frac{C\ \text{Diazinon}}{NT\ \text{Diazinon}} + \frac{C\ \text{Malathion}}{NT\ \text{Malathion}} = S;\ S \leq 1$$

Where:
C = the concentration of a pesticide measured in the receiving water.
NT = the numeric target for each pesticide present.
S = the sum; a sum exceeding one (1.0) indicates that beneficial uses may be adversely affected.

Figure 7-1. Equation for additive toxicity numeric target (S≤1).

These water column numeric targets for the additive toxicity of organophosphate pesticides are consistent with the Basin Plan narrative water quality objective which states, in part:

"No individual pesticide or combination of pesticides shall reach concentrations that adversely affect beneficial uses. There shall be no increase in pesticide concentrations found in bottom sediments or aquatic life."

7.3 Toxicity Numeric Target

Numeric targets for toxicity include the organophosphate pesticides numeric targets contained in the previous section, as well as numeric targets for aquatic toxicity testing as described herein. Any invertebrate species and acceptable test methods (as defined by regulatory Orders or ambient monitoring study designs) shall be used to assess whether the toxicity numeric target is achieved. Assessments will be conducted with receiving water(s) sampled at key indicator sites, which will be defined in proper sampling plans with quality assurance and quality controls consistent with California Surface Water Ambient Monitoring Program (SWAMP) protocols.

Toxicity to invertebrates shall be tested using chronic or acute toxicity tests. It is recommended (not required) that toxicity determinations be based on a comparison of the test organisms' response to the receiving water sample compared to the control using the Test of Significant Toxicity, also referred to as the TST statistical approach (USEPA 2010; Denton et al., 2011). If a sample is declared "fail" (i.e., toxic), then the target is not met and additional receiving water sample(s) should be collected and evaluated to determine the pattern of toxicity and whether a toxicity identification evaluation, also referred to as a TIE, needs to be conducted to determine the causative toxicant(s). Other toxicity test methods, where determined appropriate for use, may be used to determine attainment of the numeric target. Using these methods, a significant toxicity is determined for samples where: 1) the statistical test confirms significant differences in test organism when compared to the control sample, and 2) a test organism performance is more than 20% lower in the sample than in the control sample.

The aquatic toxicity numeric targets for this TMDL are stated as the following:

No significant toxic effect to the survival or sublethal (i.e., growth, reproduction, etc.) test endpoint.

This aquatic toxicity numeric target is consistent with the Basin Plan narrative water quality objective which states, in part:

"All waters shall be maintained free of toxic substances in concentrations which are toxic to, or which produce detrimental physiological responses in, human, plant, animal, or aquatic life. Compliance with this objective will be determined by use of indicator organisms, analyses of species diversity, population density, growth anomalies, toxicity

bioassays of appropriate duration, or other appropriate methods as specified by the Regional Board."

8 SOURCE ANALYSIS (IN PROGRESS)

9 TOTAL MAXIMUM DAILY LOADS AND ALLOCATIONS (IN PROGRESS)

10 IMPLEMENTATION STRATEGY (IN PROGRESS)

11 PUBLIC PARTICIPATION (IN PROGRESS)

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