Management Plan

San Joaquin County Delta Water Quality Coalition

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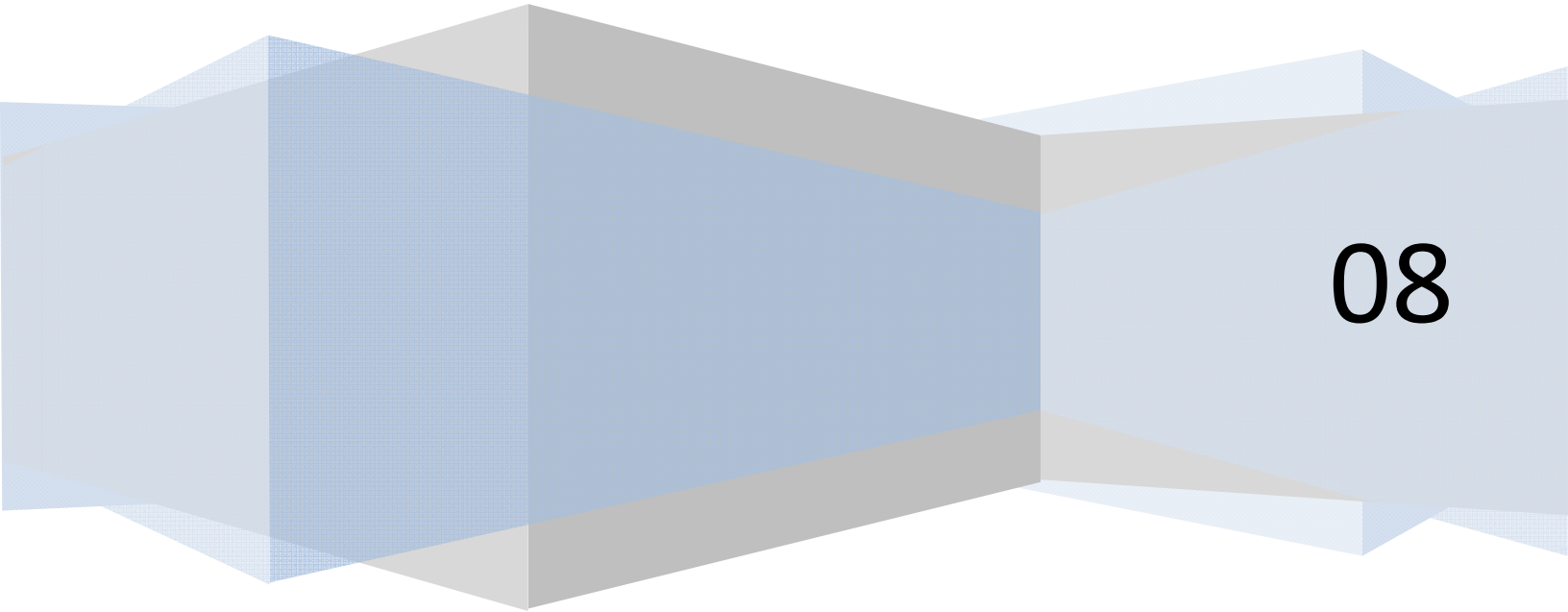
Irrigated Lands Regulatory Program
Central Valley Regional Water Quality Control Board



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List of Acronyms

AI	Active Ingredient
APN	Assessor Parcel Number
BMP	Best Management Practice
BOD	Biological Oxygen Demand
BU	Beneficial Use
CURES	Coalition for Urban and Rural Environmental Stewardship
CVRWQCB	Central Valley Regional Water Quality Control Board
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
DFG	California (Department of Fish and Game)
DHS	(California) Department of Health Services
DO	Dissolved Oxygen
DPR	California (Department of Pesticide Regulation)
DWR	(California) Department of Water Resources
E	Environmental sample
EC	Specific Conductance
EC_{50}	Effective Concentration of 50% of the measured endpoint
EQIP	Environmental Quality Incentives Program
EPA	Environmental Protection Agency
ILRP	Irrigated Land and Regulatory Program
IPM	Integrated Pesticide Management
IRIS	Integrated Risk Information System
K_{oc}	Organic Carbon Partitioning Coefficient
LC_{50}	Lethal Concentration at 50% mortality
MCL	Maximum Contaminant Level
MLJ-LLC	Michael L. Johnson, LLC
MP	Management Plan (monitoring)
MPN	Most Probable Number
MRP	Monitoring and Reporting Program Order No. R5-2005-00833
MUN	Municipal and Domestic Supply (beneficial use)
NA	Not Applicable
ND	Not Detected
NiCd	Nickel-cadmium
NM	Normal Monitoring
OP	Organophosphate
PAM	Polyacrylamide
PCA	Pesticide Control Advisor
pH	Power of Hydrogen
PUR	Pesticide Use Report

QAPP	Quality Assurance Project Plan
RB	Regional Board
RfD	Reference Dose
SAMR	Semi-Annual Monitoring Report
SG	Statistically significantly different from control; Greater than 80% threshold
SJCDWQC	San Joaquin County & Delta Water Quality Coalition
SL	Statistically significantly different from control; Less than 80% threshold
TDS	Total Dissolved Solids
TIE	Toxicity Identification Evaluation
TKN	Total Kjeldahl Nitrogen
TMDL	Total Maximum Daily Load
TOC	Total Organic Carbon
TRS	Township, Range, Section
UC	University of California
USEPA	United States Environmental Protection Agency
WQG	Water Quality Guidelines
WQTL	Water Quality Trigger Limit

List of Units

cfs	cubic feet per second
L	Liter
lbs	pounds
mg	milligram
NTU	Nephelometric Turbidity Units
ppm	parts per million
sec	second
TUa	Toxic Unit (acute)
TUc	Toxic Unit (chronic)
µg	microgram

INTRODUCTION

As required by the California Regional Water Quality Control Board Central Valley Region Monitoring and Reporting Program Order No. R5-2008-0005 for Coalition Groups under Amended Order No. R5-2006-0053 Coalition Group Conditional Waiver of Waste Discharge Requirements for Discharge from Irrigated Lands (Conditional Waiver), the San Joaquin County and Delta Water Quality Coalition (SJCDWQC or Coalition) is submitting a management plan to identify agriculture sources, implemented management practices, and performance goals in response to water quality impairments within the Coalition as assessed by the most recent water quality trigger limits and monitoring information. The Management Plan has been developed to work with the Coalition's Monitoring and Reporting Program Plan (MRPP) and identifies when waste-specific monitoring will occur to identify sources and evaluate effectiveness of management practices. In addition, this document includes management plan implementation schedules and timelines for reporting to the Central Valley Regional Water Quality Control Board (CVRWQCB or Regional Board) on the effectiveness of the management plan.

The SJCDWQC Management Plan includes all site subwatersheds and constituents that have had more than one exceedance within three years (as required by the Conditional Waiver). The Coalition first identified locations and constituents that would require a management plan in April 2007. At that time 12 individual management plans were submitted to the Regional Board for review. Since that time, the Coalition has performed additional monitoring, and discussions have taken place between Regional Board staff and the Coalition about the management plans submitted in April 2007. The Coalition agreed to submit a single updated management plan for data collected between August 2004 and September 2007 discussing the Coalition's Management Plan strategy and Management Plan activities in each of the individual site subwatersheds. The SJCDWQC Management Plan will be updated on a yearly basis to assess monitoring results and the effectiveness of Coalition outreach efforts from the year before. Yearly updates allow the Coalition to conduct outreach to growers, collect information about pesticide use, and obtain water quality data for both irrigation and dormant seasons when pesticide uses are highest.

It is important for the Coalition to assess management of water quality at two levels: a Coalition wide level and an individual site subwatershed level. Therefore the SJCDWQC Management Plan is divided into two parts: a Group Management Plan followed by Individual Site Subwatershed Management Plans. The Group Management Plan gives an overview of the Coalition's Management Plan strategy including a brief background of watershed information, Coalition monitoring history, the Management Plan process of prioritization, overview of general constituent sources and characteristics and overall goals, performance measures and schedules. The Individual Site Subwatershed Management Plans addresses specific water quality issues for each site subwatershed including all exceedances of water quality trigger limits, analysis of sourcing techniques, recommendations of management practices that can be

used to improve water quality and specific schedules for outreach and evaluation of management practice effectiveness.

The MRP Order requires that the Coalition answer five key Program questions relating to waters of the State that receive agricultural drainage or are affected by other irrigated agriculture activities within the Coalition's boundaries. The SJCDWQC Management Plan will be used to evaluate the magnitude and extent of water quality problems as determined using monitoring information (Q#2), identify contributing source(s) from irrigated agriculture to water quality problems (Q#3), identify management practices that are being implemented to reduce the impacts of irrigation agriculture (Q#4) and assess whether water quality conditions are getting better or worse through implementation of management practices (Q#5). In addition the MRP Order requires that the Coalition's Management Plan includes eight components to address the above five questions. Table 1 identifies each of these components and the corresponding SJCDWQC Management Plan section where they can be found. In addition, Table 2 identifies in which sections of the Individual Site Subwatershed Management Plans each of the requirements and MRP Order questions will be addressed.

Table 1. SJCDWQC Management Plan sections that address the MRP Order components and requirements.

Management Plan Sections	MRP Order Management Plan Components	Section Description
Introduction	Not Required.	Describes the Management Plan organization and outlines the purpose of the Management Plan.
Watershed Setting	Not Required.	Provides background of the Coalition area and soil, crop and water flow characteristics. For more detail see the SJCDWQC MRPP.
History of Coalition Monitoring	(Q#2) Evaluate the magnitude and extent of water quality problems as determined using monitoring information.	Includes a tally of water quality trigger exceedances and a brief description of when and where monitoring has occurred.
Management Plan Process	Not Required.	Overview of the process that the Coalition will use to manage a Management Plan site and associated Management Plan constituents for four years.
Constituent Specific Traits	1. Identification of irrigated agriculture source (general sources). (Q#3) Identify contributing source(s) from irrigated agriculture to water quality problems. 2. Identification of management practices to be implemented to address the exceedances (general practices).	General background of Management Plan constituents including description of solubility characteristics, general transport and agricultural source.
Prioritization of Exceedances	Not required.	Overview of the process that the Coalition will use to prioritize exceedances.
Priority-specific Management Goals and Plans	(Q#5) Assess whether water quality conditions are getting better or worse through implementation of management practices. 4. Management practice performance goals with a schedule.	Priority-specific strategy to identify sources, perform outreach and conduct evaluations. Assessments of site specific water quality improvements and management practice implementations are included in the Individual Site Specific Management Plans.
Management Plan Schedules	(Q#4) Identify management practices that are being implemented to reduce the impacts of irrigation agriculture. 3. Management practice implementation schedule. 5. Waste-specific monitoring schedule. 6. A process and schedule for evaluating management practice effectiveness. 7. Identification of the participants and the Coalition Group(s) that will implement the Management Plan. 8. An identified routine schedule of reporting to the Regional Water Board.	Schedules of management plan monitoring, outreach meetings and handouts, management practice implementation and management practice implementation and evaluation.
Individual Site Subwatershed Management Plans	Q#2-5 and requirements 1-7.	See Table 2 for specific section descriptions.

Table 2. SJCDWQC individual Site Subwatershed Management Plan sections that address the MRP Order components and requirements (for priority site subwatersheds).

Individual Site Subwatershed Management Plan Sections	MRP Order Management Plan Components	Section Description
Description of Site Subwatershed	Not required.	Provides background of the Coalition area and soil, crop and water flow characteristics. For more detail see the SJCDWQC MRPP.
Subwatershed Monitoring History	Not required.	Description of what constituents have been sampled and when.
Exceedance History	(Q#2) Evaluate the magnitude and extent of water quality problems as determined using monitoring information.	Overview of water quality exceedances.
2007 Management Plan Monitoring Results	(Q#2) Evaluate the magnitude and extent of water quality problems as determined using monitoring information.	Overview of results from Management Plan Monitoring (for sites that are in at least their second year of the Management Plan).
Load Calculations	Not required.	Calculation of instantaneous loads for conserved constituents.
Source Identification (by priority)	1. Identification of irrigated agriculture source. (Q#3) Identify contributing source(s) from irrigated agriculture to water quality problems. 2. Identification of management practices to be implemented to address the exceedances. 5. Waste-specific monitoring schedule.	Constituent specific identification and analysis of agricultural sources. Identification of possible management practices that could reduce agricultural impairment of water quality. Strategy for further understanding agricultural sources.
Outreach	(Q#4) Identify management practices that are being implemented to reduce the impacts of irrigation agriculture. 7. Identification of the participants and the Coalition Group(s) that will implement the Management Plan.	Outline of strategy of the Coalition to identify management practices within this site subwatershed.
Evaluation	(Q#5) Assess whether water quality conditions are getting better or worse through implementation of management practices. 3. Management practice implementation schedule. 4. Management practice performance goals with a schedule. 6. A process and schedule for evaluating management practice effectiveness.	Strategy and schedule for evaluating management practice implementation within this site subwatershed.

WATERSHED SETTING

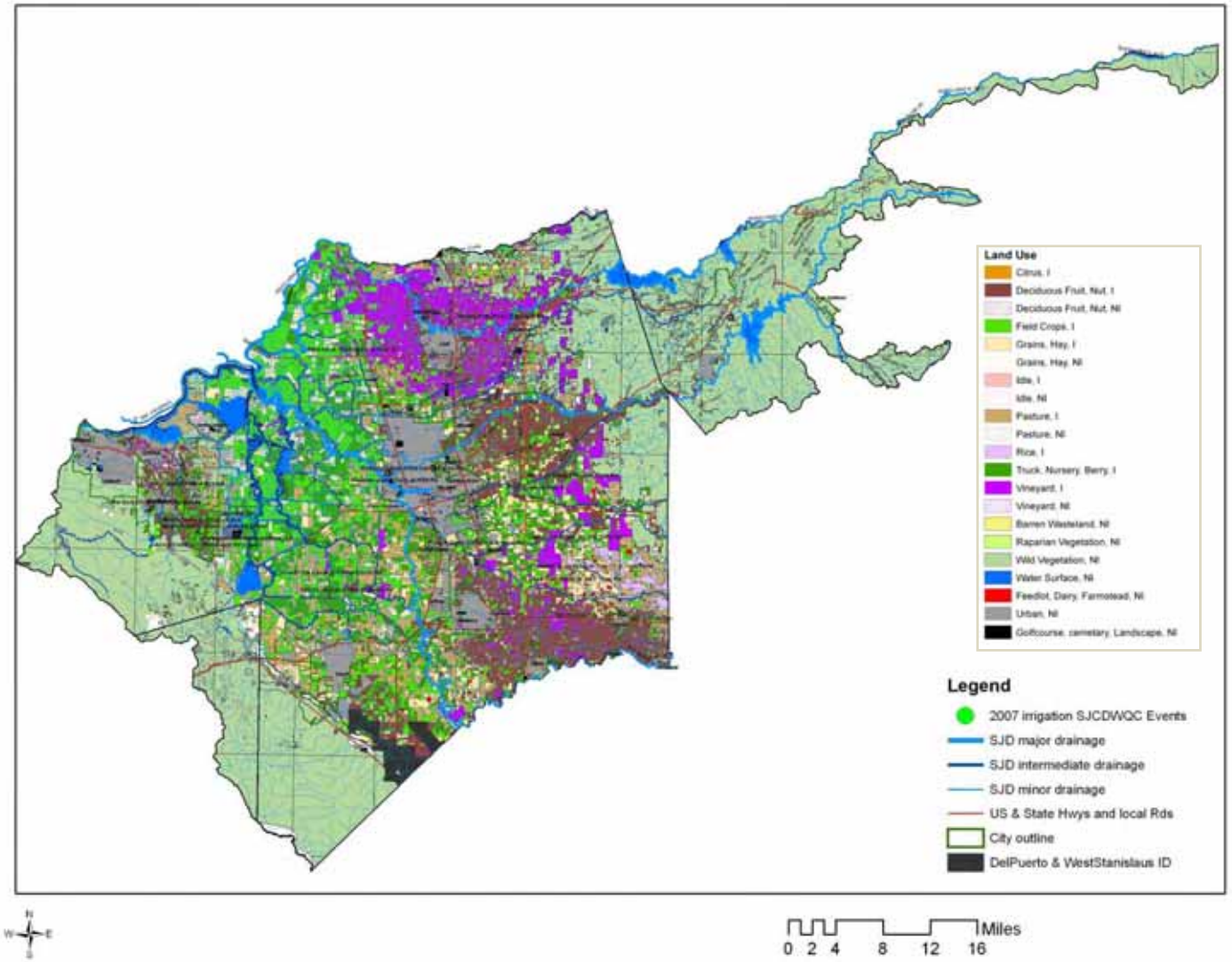
The SJCDWQC area includes parts of San Joaquin, Contra Costa, Alameda, and Calaveras counties and comprises approximately 1,057,350 acres of which 52% are considered irrigated agriculture (DWR, 2001). The northern border of the Coalition area corresponds to the county line between San Joaquin and Sacramento Counties. The eastern portion of the Coalition area was expanded in April of 2004 and now includes portions of Calaveras County that are the upper Calaveras River, Bear Creek, and Mokelumne River subwatersheds. These subwatersheds extend from San Joaquin County into Calaveras County. Agricultural land use in this part of the Coalition area is primarily orchards and vineyards and includes a very small amount of irrigated agriculture. The southern border of the Coalition area is the Stanislaus River with the exception of the Del Puerto and West Stanislaus Irrigation Districts at the southern edge of the Coalition area, which are not covered by the Coalition. As such, the Coalition boundary at the southwest corner of San Joaquin County is approximately that of the Delta Mendota Canal and California Aqueduct. The western boundary of the Coalition area has also been expanded and now lies along the western CVRWQCB Region 5 boundary in Contra Costa County and Alameda County. There are several small subwatersheds in this portion of the Coalition region including the Kellogg Creek, Marsh Creek, Sand Creek, and Brushy Creek subwatersheds that drain the northern hills of Mount Diablo. These water bodies flow east through urban areas on the western edge of the central Delta. Growers from these areas joined the Coalition at its inception and the expansion of the Coalition boundary is a formal recognition of their membership in the Coalition.

The impact of urban areas on water quality may be equal to the effects from agricultural land use, especially due to the rapid and ongoing growth of urban centers. The rapid growth of cities such as Lodi, Stockton, Lathrop, and Manteca on the east side of the Delta and Antioch, Sand Hill, Knightsen, and Brentwood on the west side of the Delta are consuming large amounts of irrigated agricultural land. Land designated as agricultural only a few years ago, is now covered by housing developments and shopping malls.

Although exact acreage is difficult to estimate due to rapidly changing land use, the Coalition area contains approximately 548,362 acres that are considered irrigated agriculture (based on 2001 DWR data at http://www.landwateruse.water.ca.gov/annualdata/landuse/2001/landuselevels.cfm). A variety of crops are grown within the Coalition boundaries and different crops are often found in regions specific to microclimate, soil type, and local farming history (Figures 1 and 2). A more detailed discussion of crop type is provided in the SJCDWQC MRPP submitted for review on July 25, 2008.

Figure 1. Agriculture lands in the SJCDWQC area.

The area shown in Calaveras County is the Upper Mokelumne and Upper Calaveras subwatersheds. Irrigated agriculture is located only in western Calaveras County and consequently the entire county is not shown on this map.



Within the Coalition area, the lower reaches of the San Joaquin River drain the eastern and western parts of the California Central Valley (Valley). Drainage water is either exported to the San Francisco Bay through the Delta, or conveyed southward via the State Water Project and the Delta Mendota Canal. There are three major rivers in the Coalition area other than the San Joaquin River: Stanislaus River, Calaveras River, and Mokelumne River. These east side tributaries of the San Joaquin River drain a major portion of the Sierra Nevada Mountain range from east to west. The watershed of the Coalition area is the crest of the Sierra Nevada, and the drainage area is bounded by the San Joaquin River on the west, the Stanislaus River on the south, and the Mokelumne River on the north. Intermediate sized water bodies in the Coalition area (Littlejohns Creek, Duck Creek, Lone Tree Creek, Bear Creek, French Camp Slough, Dry Creek, Marsh Creek, Mormon Slough, Mosher Creek, and Pixley Slough) are tributaries to either one of the major rivers or empty into the San Joaquin Delta. Smaller water bodies found in the Coalition area are primarily canals and ditches that convey water to one of the larger rivers or intermediate creeks/sloughs, or are used to drain Delta islands. Figure 1 is a map of the agricultural lands in the Coalition region. More discussion of hydrology specific to each of the water bodies monitored by the Coalition can be found in the MRPP.

There is an increased propensity for runoff with increased slope, soil water saturation, and volume of water, conditions that arise primarily due to large amounts of rainfall and are more likely in the relatively greater sloped valley margins. During the winter, runoff is moved through the myriad of creeks, rivers, and drains. Runoff can also occur during the irrigation season if water entering the field is greater than the amount that can infiltrate the soil. In Delta islands, water is pumped in and out of supply and drainage canals. Ordinarily, drains pumping water off the islands could be turned off thus eliminating runoff. This cannot occur because water is continually entering the islands through groundwater recharge (essentially seepage from the greater in elevation water source on the river side of the levee) thus requiring off-island draining.

HISTORY OF COALITION MONITORING

Coalition ambient water and sediment quality monitoring was initiated in 2004 in the SJCDWQC region following the inception of the Irrigated Lands Program in 2002. Each year both the number of sites monitored and the constituents analyzed have been increased in accordance with the most recent CVRWQCB adopted orders and resolutions for the Irrigated Lands Regulatory Program (ILRP). During the first season of monitoring in 2004, samples were collected from six sites and were sent to laboratories to test for nine constituents/analytes plus water column toxicity testing for three different species. By 2007, 15 monitoring sites were sampled and over 50 analytes tested in addition to toxicity analysis. Table 3 lists the sites monitored during each the storm and irrigation seasons across years of sampling. Specific subwatershed sampling information, including number of constituents and events when the site was dry, are included in the subwatershed management plan section of this document.

Table 3. Sample sites and years monitored.

A site marked as "Dry" was dry for all sampling events during that season. A blank box means that this location was not sampled for during that year and season.

Station Name	2004	2005		2006		2007		2008
	Irrigation	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation	Storm
Littlejohns Creek @ Jack Tone Rd	x	x	x	x	x	x	x	x
Lone Tree Creek @ Jack Tone Rd	x	x	x	x	x	x	x	x
Mokelumne River @ Bruella Rd	x	x	x	x	x	x	x	x
Potato Slough @ Hwy 12	x	x	x	x				
Duck Creek @ Hwy 4	x				x	x	x	x
Calaveras River @ Belotta Intake	x							
French Camp Slough @ Airport Way		x	x	x	x	x	x	x
Grant Line Canal @ Clifton Court Rd		x	x	x	x	x	x	x
Grant Line Canal near Calpack Rd		x	x	x	x	x	x	x
Terminous Tract Drain @ Hwy 12		x	x	x	x	x	x	x
Delta Drain- Terminous Tract off Glasscock Rd		x	x	x				
Delta Drain- Terminous Tract off Guard Rd		x	x	x				
Kellogg Creek @ Hwy 4		x	x	x				
Marsh Creek @ Balfour Ave		x	x	x				
Kellogg Creek along Hoffman Ln			x	x	x	x	x	x
Marsh Creek @ Concord Ave			x	x	x	x	Dry	x
Lone Tree Creek @ Bernnan Rd			x	x				
Mokelumne River @ Fish Hatchery			x					
Mormon Slough @ Jack Tone Rd					x	x	x	x
Roberts Island Drain @ Holt Rd					x	x	x	x
Roberts Island Drain along House Rd					x	x	x	x
Sand Creek @ Hwy 4 Bypass					x	x	x	x
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd					x	x	x	x

Overview of 2007 Monitoring

The Coalition's Management Plan will be updated yearly starting April 1, 2009 and the previous year's monitoring will be reviewed and assessed for water quality improvements and exceedances. Generally, the update will include an assessment of water quality during the last 12 months including new exceedances and new site/constituents requiring management plans. This is the first update since the original individual site subwatershed Management Plans were submitted in early 2007 and therefore this Management Plan will focus on changes to water quality within the Coalition area during the irrigation season of 2007.

During 2007, storm and irrigation monitoring was conducted as outlined in the Coalition's MRPP submitted in 2006. In addition, Management Plan sampling was initiated during irrigation months. Management Plan sampling involved collection of an additional sample for constituents that exhibited more than one exceedance within three years of water quality trigger limits (WQTL). The Coalition's Semi Annual Monitoring Report (SAMR) submitted on December 30, 2007 lists the locations, dates and type of sampling that was conducted during the irrigation season including Management Plan sampling (MP), Normal monitoring (NM) and sediment. Table 4 lists the locations, dates and type of sampling that was conducted during the irrigation season including management plan sampling (MP), normal monitioring (NM) and sediment. There were a total of 15 sites that were monitored during 2007 and 13 sites where management plan monitoring was conducted.

Overview of 2007 Water Quality Trigger Limit Exceedances

At this time, 14 water bodies in the Coalition region require a management plan (Table 4). The Coalition has monitored and experienced water quality exceedances in the past at Potato Slough however this water body is no longer monitored by the Coalition due to limited access (unable to collect a representative sample from mid channel). Marsh Creek @ Concord Ave (previously sampled at Balfour Ave) has also been dropped from the SJCDWQC list of monitoring locations due to increased urbanization within the area.

Beneficial Uses

The Regional Board has assigned beneficial uses (BU) to many water bodies within the Coalition region, but many water bodies monitored by the Coalition do not have assigned BUs. Using the tributary rule, the Coalition applied BUs to upstream tributaries based on the assigned BU in downstream water bodies as listed in the Water Quality Control Plan for the Sacramento River and San Joaquin River Basin (Basin Plan) (Table 4). Water Quality Trigger Limits (WQTLs) are based on the BUs applied to the specific water body. Consequently, identifying an appropriate group of BUs specifies the appropriate WQTLs which in turn determine the exceedances managed by the Coalition and outlined in this document.

Water Quality Trigger Limits

Water quality trigger limits (WQTLs) have been established to preserve water quality within the Valley. The most recent WQTLs are listed in Table 5. For sites and constituents that have exceeded a WQTL two or more times within a three year period, a management plan is required to be implemented. A tally of WQTL exceedances have been compiled in Table 6 for all years and all sampling locations. WQTLs have changed over years of monitoring and therefore the Coalition may have reported exceedances in the past that are no longer considered exceedances of current WQTL and there may also be exceedances reported in this document that have not been reported in previous documents. Table 6 includes WQTL that were updated by the Regional Board in March 2008. The Coalition received updated WQTLs on September 18, 2008 and the Coalition will use this information to review water quality data in the next Management Plan update to be submitted on April 1, 2009. Objectives and limits listed in the WQTL table are based on the following beneficial uses: Agricultural Supply; Cold Freshwater Habitat; Municipal and Domestic Supply; Spawning, Reproduction, and/or Early Development of Freshwater Aquatic Life; Water Contact Recreation; and Wildlife Habitat.

2007 Exceedances

An important aspect of this management plan is to maintain yearly updates of exceedances. Table 7 depicts a tally of exceedances that occurred during the 2007 irrigation season. Management plans submitted during 2007 included exceedances experienced from 2004 through the storm season of 2007. Therefore, the tally in Table 7only includes the 2007 irrigation season.

Table 4. Management plan sample sites that drain directly into the major rivers of the SJCDWQC region and the beneficial use for each of the major river reaches.

A list of beneficial uses is listed below the table. Water bodies that were sampled during the 2008 storm season are bolded.

Site subwatershed (site name)	Immediate Downstream River	Beneficial Use of Immediate Downstream River*
Duck Creek @ Highway 4	Sacramento San Joaquin Delta[2]	1-5, 7-12, 14, 15
French Camp Slough @ Airport Way	Sacramento San Joaquin Delta[2]	1-5, 7-12, 14, 15
Grant Line Canal @ Clifton Court Rd	Sacramento San Joaquin Delta[2]	1-5, 7-12, 14, 15
Grant Line Canal near Calpack Rd	Sacramento San Joaquin Delta[2]	1-5, 7-12, 14, 15
Kellogg Creek along Hoffman Lane	Sacramento San Joaquin Delta[2]	1-5, 7-12, 14, 15
Littlejohns Creek @ Jack Tone Rd	Sacramento San Joaquin Delta[2]	1-5, 7-12, 14, 15
Lone Tree Creek @ Jack Tone Rd	Sacramento San Joaquin Delta[2]	1-5, 7-12, 14, 15
Mokelumne River @ Bruella Rd	Mokelumne River[1]	2, 3, 7-14
Mormon Slough @ Jack Tone Road	Sacramento San Joaquin Delta[2]	1-5, 7-12, 14, 15
Roberts Island Drain @ Holt Rd	Sacramento San Joaquin Delta[2]	1-5, 7-12, 14, 15
Roberts Island Drain along House Rd	Sacramento San Joaquin Delta[2]	1-5, 7-12, 14, 15
Sand Creek @ Hwy 4 Bypass	Sacramento San Joaquin Delta[2]	1-5, 7-12, 14, 15
Terminous Tract Drain @ Hwy 12	Sacramento San Joaquin Delta[2]	1-5, 7-12, 14, 15
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	Sacramento San Joaquin Delta[2]	1-5, 7-12, 14, 15

[1] Comanche Reservoir to Delta reach
[2] "Beneficial uses vary throughout the Delta and will be evaluated on a case-by-case basis" (wording from the Central Valley Region Basin Plan).
* See below Beneficial Use code list.
** Marsh Creek has been assigned only recreational beneficial uses

Beneficial Use List
Municipal and Domestic Supply - 1
Agriculture Supply (irrigation) - 2
Agriculture Supply (stock watering) - 3
Industrial Process Supply - 4
Industrial Service Supply - 5
Water Contact Recreation - 6
Non-contact Water Recreation - 7
Warm Freshwater Habitat - 8
Cold Freshwater Habitat - 9
Migration of Aquatic Organisms (warm) - 10
Migration of Aquatic Organisms (cold) - 11
Spawning, Reproduction, and/or Early Development (warm) - 12
Spawning, Reproduction, and/or Early Development (cold) - 13
Wildlife Habitat - 14
Navigation – 15

Table 5. WQT limits for constituents and parameters measured during Coalition monitoring.

Constituent	Water Quality Trigger Limit (WQTL)	Standard Type	Beneficial Use (BU) with most protective limit	Reference for the Trigger Limit
Field and Physical Parameters				
pH	6.5 - 8.5 units	Numeric		Sacramento/San Joaquin Rivers Basin Plan (page III.6.00)
Electrical Conductivity (maximum)	700 umhos/cm	Narrative	Agricultural Supply	Water Quality for Agriculture (Ayers & Westcot)
Dissolved Oxygen (minimum)	7 mg/L	Numeric	Cold Freshwater Habitat, Spawning	Sacramento/San Joaquin Rivers Basin Plan. Water Quality Control Plan for the Tulare Lake Basin.
	5 mg/L		Warm water habitat	Basin Plan Objective, page III-5.00: for waters designated WARM (aquatic life). Tulare Lake Basin Plan
Total Dissolved Solids	variable	Narrative	Agricultural Supply	Water Quality for Agriculture (Ayers & Westcot)
Turbidity	450 mg/L	Numeric	Municipal and Domestic Supply	Basin Plan Objective - increase varies based on natural turbidity
E. coli	variable			EPA ambient water quality criteria, single-sample maximum
Color	235 MPN/100 ml			
TOC	NA			
Pesticides - Carbamates				
Aldicarb	3 ug/L	Narrative	Municipal and Domestic Supply	Basin Plan Chemical Constituents Objective, USEPA Primary MCL (MUN, human health)
Carbaryl	2.53 ug/L	Narrative	Cold Freshwater Habitat, Spawning	Basin Plan Toxicity Objective: Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average (California Department of Fish and Game) (aquatic life). Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average (California Department of Fish and Game)
Carbofuran	ND	Numeric		Sacramento/San Joaquin Basin Plan - Basin Plan Prohibition, page IV-25.00 (MUN, human health)
Methiocarb	0.5 ug/L	Narrative	Cold Freshwater Habitat, Spawning	Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates/Resour.Publ.137, Fish Wildl. Serv., U.S.D.I., Washington, D.C :98 p. (OECDG Data File) -(Detect at .5 ug/L - no limit set)
Methomyl	0.52 ug/L	Narrative	Cold Freshwater Habitat, Spawning	Basin Plan Toxicity Objective, Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average (California Department of Fish and Game) (aquatic life)

Constituent	Water Quality Trigger Limit (WQTL)	Standard Type	Beneficial Use (BU) with most protective limit	Reference for the Trigger Limit
Oxamyl	50 ug/L	Numeric	Municipal and Domestic Supply	Basin Plan, page III-3.00, under "Chemical constituents." Drinking Water Standards - Maximum Contaminant Levels (MCLs). California Dept of Health Services. Primary MCL
Pesticides - Organochlorines				
DDD(p,p')	0.00083 ug/L	Numeric	Municipal and Domestic Supply	Basin Plan (page III-6.00, pesticides, third bullet).
DDE(p,p')	0.00059 ug/L			CTR, Human Health Protection, 30-Day Average -
DDT(p,p')	0.00059 ug/L			Sources of Drinking Water (water & fish consumption)
Dicofol	NA			
Dieldrin	0.00014 ug/L	Numeric	Municipal and Domestic Supply	CTR, Human Health Protection, 30-Day Average - Sources of Drinking Water (water & fish consumption)
Endrin	0.036 ug/L	Numeric	Cold Freshwater Habitat, Spawning	CTR, Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average
Methoxychlor	0.03 ug/L	Narrative	Cold Freshwater Habitat, Spawning	Basin Plan Toxicity Objective, USEPA National Ambient Water Quality Criteria - Freshwater Aquatic Life Protection - instantaneous maximum (aquatic life)
Pesticides - Organophosphates				
Azinphos methyl	0.01 ug/L	Narrative	Cold Freshwater Habitat, Spawning	National Ambient Water Quality Criteria - Freshwater Aquatic Life Protection (Instantaneous)
Chlorpyrifos	0.015 ug/L	Numeric	Cold Freshwater Habitat, Spawning	Sacramento/San Joaquin Rivers Basin Plan, page III-6.01; San Joaquin River & Delta, pending Sacramento & Feather Rivers (aquatic life); more stringent 4-day average selected over less stringent 1-hour average (Central Valley Regional Water Quality Control Board; recent ammendment for Diazinon and Chlorpyrifos in the Lower San Joaquin River).
Diazinon	0.1 ug/L	Numeric	Cold Freshwater Habitat, Spawning	Sacramento San Joaquin Basin Plan, San Joaquin River & Delta numeric standard pending Sacramento & Feather Rivers numeric standard
Dimethoate	1.0 ug/L	Narrative	Cold Freshwater Habitat, Spawning	Basin Plan Toxicity Objective, Notification Level – DHS (MUN, human health). California Notification Levels. (Department of Health Services)
Disulfoton	0.05 ug/L	Narrative	Cold Freshwater Habitat, Spawning	Basin Plan Toxicity Objective, USEPA National Ambient Water Quality Criteria - Freshwater Aquatic Life Protection - instantaneous
Malathion	ND	Numeric		Sacramento/San Joaquin Basin Plan - Basin Plan Discharge Prohibition, page IV-25.00

Constituent	Water Quality Trigger Limit (WQTL)	Standard Type	Beneficial Use (BU) with most protective limit	Reference for the Trigger Limit
Methamidophos	0.35 ug/L	Narrative	Municipal and Domestic Supply	Basin Plan Toxicity Objective, Drinking Water Health Advisories or Suggested No-Adverse-Response Levels for non-cancer health effects. USEPA IRIS Reference Dose (RfD) as a drinking water level.
Methidathion	0.7	Narrative	Municipal and Domestic Supply	Basin Plan Toxicity Objective, USEPA IRIS Reference Dose (MUN, human health)
Parathion, Methyl	ND	Numeric		Sacramento/San Joaquin Basin Plan - Basin Plan Prohibition, page IV-25.00
Phorate	0.7 ug/L	Narrative	Municipal and Domestic Supply	Basin Plan Toxicity Objective, Drinking Water Health Advisories or Suggested No-Adverse-Response Levels for non-cancer health effects. USEPA IRIS Reference Dose (RfD) as a drinking water level.
Phosmet	140 ug/L	Narrative	Municipal and Domestic Supply	Basin Plan Toxicity Objective, Drinking Water Health Advisories or Suggested No-Adverse-Response Levels for non-cancer health effects. USEPA IRIS Reference Dose (RfD) as a drinking water level.
Pesticides – Pyrethroids				
Bifenthrin	110 ug/L	Narrative		Basin Plan Toxicity Objective, USEPA IRIS Reference Dose (human health)
Cypermethrin, total	0.002 ug/L	Narrative	Cold Freshwater Habitat, Spawning	Basin Plan Toxicity Objective, Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average (California Department of Fish and Game)(aquatic life)
Cyhalothrin, lambda, total	35 ug/L	Narrative		Basin Plan Toxicity Objective, USEPA IRIS Reference Dose (MUN, human health)
Permethrin, total	0.03 ug/L	Narrative	Cold Freshwater Habitat, Spawning	Basin Plan Toxicity Objective, Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average (California Department of Fish and Game) (aquatic life). USEPA National Ambient Water Quality Criteria, CA DFG, 2000
Cyfluthrin, total	NA			
Esfenvalerate/ Fenvalerate, total	NA			
Pesticides – Herbicides				
Atrazine	1.0 ug/L	Narrative	Municipal and Domestic Supply	Basin Plan, page III-3.00, under "Chemical constituents." California Primary MCL
Cyanazine	1.0 ug/L	Narrative	Municipal and Domestic Supply	Basin Plan Toxicity Objective, USEPA Health Advisory (human health)

Constituent	Water Quality Trigger Limit (WQTL)	Standard Type	Beneficial Use (BU) with most protective limit	Reference for the Trigger Limit
Diuron	2 ug/L	Narrative	Municipal and Domestic Supply	One-in-a-Million Incremental Cancer Risk Estimates for Drinking Water. USEPA Health Advisory. Likely to be carcinogenic to humans (U.S. Environmental Protection Agency, 2005 Guidelines for Carcinogen Risk Assessment). Value modified using more recent information in USEPA Office of Pesticide Programs Registration Eligibility Decisions Documents. From Reference 36. (August 2007 Update Edition of the WQG)
Glyphosate	700 ug/L	Numeric	Municipal and Domestic Supply	Basin Plan Chemical Constituents Objective, page III-3.00, California Primary MCL (MUN, human health)
Linuron	1.4 ug/L	Narrative	Municipal and Domestic Supply	USEPA IRIS Reference Dose as a drinking water level*
Molinate	ND	Numeric		Sacramento/San Joaquin Basin Plan - Basin Plan Discharge Prohibition, page IV-25.00
Paraquat dichloride	3.2 ug/L	Narrative	Municipal and Domestic Supply	USEPA IRIS Reference Dose as a drinking water level*
Simazine	4.0 ug/L	Numeric	Municipal and Domestic Supply	Basin Plan Chemical Constituents Objective, California Primary MCL (MUN, human health)
Thiobencarb	ND	Numeric		Sacramento/San Joaquin Basin Plan - Basin Plan Discharge Prohibition, page IV-25.00
Metals (c)				
Arsenic	10 ug/L	Narrative	Municipal and Domestic Supply	Basin Plan Chemical Constituents Objective, USEPA Primary MCL (MUN, human health)
Boron	700 ug/L	Narrative	Agricultural Supply	Water Quality for Agriculture (Ayers & Westcot)
Cadmium	for aquatic life; variable (see cadmium worksheet). For MUN, trigger limit is 0.04 regardless of hardness value	Numeric	Cold Freshwater Habitat, Spawning	Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average - Varies with water hardness

Constituent	Water Quality Trigger Limit (WQTL)	Standard Type	Beneficial Use (BU) with most protective limit	Reference for the Trigger Limit
Copper	for aquatic life; variable (see copper worksheet). For MUN, trigger limit is 170 regardless of hardness value	Numeric	Cold Freshwater Habitat, Spawning	Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average - Varies with water hardness
Lead	for aquatic life; variable (see Lead worksheet). For MUN, trigger limit is 2.0 regardless of hardness value	Numeric	Cold Freshwater Habitat, Spawning / Municipal and Domestic Supply	CTR Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average - varies with water hardness; CA Public Health Goal
Nickel	For aquatic life variable (see Nickel worksheet). For MUN nickel trigger limit is 12 ug/L regardless of hardness value	Numeric	Cold Freshwater Habitat, Spawning / Municipal and Domestic Supply	Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average - varies with water hardness; CA Public Health Goal for Drinking Water
Selenium	50 ug/L	Numeric	Municipal and Domestic Supply	California Primary MCL
Selenium	5 ug/L (4-day average)	Numeric	Cold Freshwater Habitat, Spawning	Table III-1: Trace Element Water Quality Objective. Applicable Water Bodies - San Joaquin River, mouth of the Merced River to Vernalis. Also CTR
Zinc	For aquatic life variable (see Zinc worksheet). For MUN nickel trigger limit is 5000 ug/L regardless of hardness value	Numeric	Cold Freshwater Habitat, Spawning	Freshwater Aquatic Life Protection - Continuous Concentration, 4-Day Average - varies with water hardness
Nutrients				
Nitrate as NO3	45,000 ug/L as NO3 10,000 ug/L as N	Numeric	Municipal and Domestic Supply	California Primary MCL

Constituent	Water Quality Trigger Limit (WQTL)	Standard Type	Beneficial Use (BU) with most protective limit	Reference for the Trigger Limit
Nitrite as Nitrogen	1,000 ug/L as N	Numeric	Municipal and Domestic Supply	California Primary MCL
Ammonia	For aquatic life variable (see ammonia worksheet). For MUN ammonia trigger limit is 1.5 mg/L regardless of pH and Temperature values	Numeric	Municipal and Domestic Supply / Cold Freshwater Habitat, Spawning	Taste and Odor Threshold; USEPA Freshwater Aquatic Life Criteria, Continuous Concentration
Hardness	NA			
Phosphorus, total	NA			
Orthophosphate, soluble	NA			
TKN	NA			

NA: Not Available at that time. (May be pending on completion of evaluation studies and MRP Plan submittals with site specific information on beneficial uses.)
ND: Non Detect

Table 6. SJCDWQC exceedance tally based on results up to October 2007 including irrigation and storm sampling events. Sites are listed alphabetically by station name and constituents are listed alphabetically within each of the following groups: field parameters, inorganics, bacteria, metals, pesticides and toxicity. Constituents under a management plan are highlighted.

Station Name	Oxygen, Dissolved, mg/L	pH, none	SpecificConductivity, µS/cm	Color, color units	Dissolved Solids, mg/L	Ammonia as N, mg/L	Nitrate as N, mg/L	E. coli, MPN/100 mL	Arsenic, µg/L	Boron, µg/L	Cadmium, µg/L	Copper, µg/L	Lead, µg/L	Nickel, µg/L	Azinphos methyl, µg/L	Carbofuran, µg/L	Chlorpyrifos, µg/L	Cypermethrin, total, µg/L	DDE(p,p'), µg/L	DDT(p,p'), µg/L	Diazinon, µg/L	Dieldrin, µg/L	Dimethoate, µg/L	Disulfoton, µg/L	Diuron, µg/L	Endrin, µg/L	Linuron, µg/L	Malathion, µg/L	Methidathion, µg/L	Methomyl, µg/L	Permethrin, total, µg/L	Simazine, µg/L	Thiobencarb, µg/L	Ceriodaphnia dubia, Survival (%)	Hyalella azteca, Survival (%)	Pimephales promelas, Survival (%)	Selenastrum capricornutum, Total Cell Count
Delta Drain- Terminous Tract off Glasscock	8		4	9	4			4																										2	1	
Delta Drain- Terminous Tract off Guard Rd	7		10	8	7			2																										1		1
Duck Creek @ Hwy 4	8	2		15				5									5				1												1			1
French Camp Slough @ Airport Way	7	1		22				16			3	12	4	1	1		5				1	1			1			1				2	2	2		1
Grant Line Canal @ Clifton Court Rd	17	6	11	22	10	1		16	6		12	5	8	11		1	4		2	1			1											2		
Grant Line Canal near Calpack Rd	25		30	22	18	1		15	3		7		1	2			4		1					1	1		1						3	6		4
Kellogg Creek @ Hwy 4	3	1	8	9	5			5									1														1			1	2	2	1
Kellogg Creek along Hoffman Ln	5	3	3	15	3		1	4				2	1						3	2														2	2		
Littlejohns Creek @ Jack Tone Rd	10	1		21				6			2	3	1				4				1													2	1	3
Lone Tree Creek @ Bernnan Rd	2		1	3	1			3									1																1		1	3
Lone Tree Creek @ Jack Tone Rd	12	2		24		3		20			3	6	1				5	1	1	1	1				2							1	2	2	1	3
Mokelumne River @ Bruella Rd	4	3										3								1*													5			4
Mormon Slough @ Jack Tone Rd	6			7				1									2																1	1		1
Roberts Island Drain @ Holt Rd	15		15	13	8			2									1		3						1								1	2		1
Roberts Island Drain along House Rd	14	3	11	13	9			6										1	1															2		
Sand Creek @ Hwy 4 Bypass	13		20	13	12			10									2		3	2	1	2				1				1			3	6	1	
Terminous Tract Drain @ Hwy 12	18		10	22	7			8	3		2																	1							1	1
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	2		2	11	1			5									5		1						2				1			1	2	1	1		4

*DDT detected in the field blank sample only and included in summary and tally of exceedances, but not considered representative of water quality at the sample site.

Table 7. SJCDWQC exceedance tally based 2007 irrigation sampling events. All sites are listed that have had at least one exceedance. Sites are listed alphabetically by station name and constituents are listed alphabetically within each of the following groups: field parameters, inorganics, bacteria, metals, pesticides and toxicity. Blue highlighted cells are new management plan constituents and green highlighted cells represent constituents with management plans prior to the irrigation season of 2007.

Sample Site	Oxygen, Dissolved, mg/L	pH, none	SpecificConductivity, µS/cm	Color, color units	Dissolved Solids, mg/L	Ammonia as N, mg/L	E. coli, MPN/100 mL	Arsenic, µg/L	Boron, µg/L	Cadmium, µg/L	Copper, µg/L	Lead, µg/L	Nickel, µg/L	Carbofuran, µg/L	Chlorpyrifos, µg/L	Cypermethrin, total, µg/L	DDE(p,p'), µg/L	DDT(p,p'), µg/L	Dieldrin, µg/L	Disulfoton, µg/L	Diuron, µg/L	Thiobencarb, µg/L	Ceriodaphnia dubia, Survival (%)	Selenastrum capricornutum, Total Cell Count	Hyalella azteca, Survival (%)
Duck Creek @ Hwy 4	4	1		6			1								3										
French Camp Slough @ Airport Way				6			3			1	8	1							1			2			1
Grant Line Canal @ Clifton Court Rd	5		4	6	3		4	4		6	2	3	5	1	1										
Grant Line Canal near Calpack Rd	10		10	6	6		4	1		5			2							1	1			3	
Kellogg Creek along Hoffman Ln	1	2		5							2						1	1					1		1
Littlejohns Creek @ Jack Tone Rd	4			3						2	2				1									1	
Lone Tree Creek @ Jack Tone Rd				6		1	4			1	5	1			1		1	1				2			
Mokelumne River @ Bruella Rd		1									3							1*						1	
Mormon Slough @ Jack Tone Rd	3			1											1								1	1	
Roberts Island Drain @ Holt Rd	9		9	6	5		1										1				1		1	1	
Roberts Island Drain along House Rd	7		5	6	3		2									1									
Sand Creek @ Hwy 4 Bypass	6		10	6	6		3										1								1
Terminous Tract Drain @ Hwy 12	6			6			2			2															
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd			1	5	1		2								2							1			1

*Exceedance detected in field blank only and is included in the Management Plan summary and tally of exceedances but not considered representative of water quality at the sample site.

MANAGEMENT PLAN PROCESS

The SJCDWQC Management Plan process is a combination of years and tiers. The first year that a site is within the Management Plan is termed Year 1 (Figure 2). The SJCDWQC Management Plan will be updated with new sites and constituents requiring management plans on April 1 of each year and will include all Coalition actions and water quality monitoring results from January to December of the previous year. Therefore Year 1 for new monitoring sites/constituent combination begins in January of the same year that the April 1 update is submitted. Each year that a site/constituent remains in the Management Plan requires specific actions by the Coalition. An overview of this process is included in Figure 2. Tiers are determined by whether or not there were exceedances the previous year. Each tier has specific actions determined by the priority and number of years that the site/constituent has been under a management plan (Figure 3).

Year 1

Exceedances are reviewed on a yearly basis to determine if a constituent sampled at a specific location has exceeded a WQTL two or more times. The first year within a Management Plan includes prioritizing individual exceedances based on the constituent as well as the magnitude, frequency and load associated with that exceedance. This process is described further in the section, Prioritization of Exceedances. Depending on the priority given to that constituent within that site subwatershed, appropriate actions are established by the Coalition to address the source of the exceedance, outline appropriate outreach to growers and, where relevant, evaluate previous actions taken by the Coalition (Tier 1 actions, Figure 2).

Year 2

At the end of the first year, monitoring data are reviewed to determine if that site subwatershed experienced additional exceedances. If there are no new exceedances, the Coalition continues to monitor within the site subwatershed to evaluate the actions of the Coalition and effectiveness of management practices within that site subwatershed. If, however, after the first year within the Management Plan there were exceedances, then the Coalition will progress in the number and types of actions which may include individual contact, specific grower meetings, and increased monitoring (Tier 2 actions, Figure 2). All of these actions are focused on identifying the source of the exceedance, increasing the amount of outreach within the site subwatershed of concern and also evaluating the effectiveness of Coalition and grower actions including the implementation of best management practices (BMPs).

Year 3

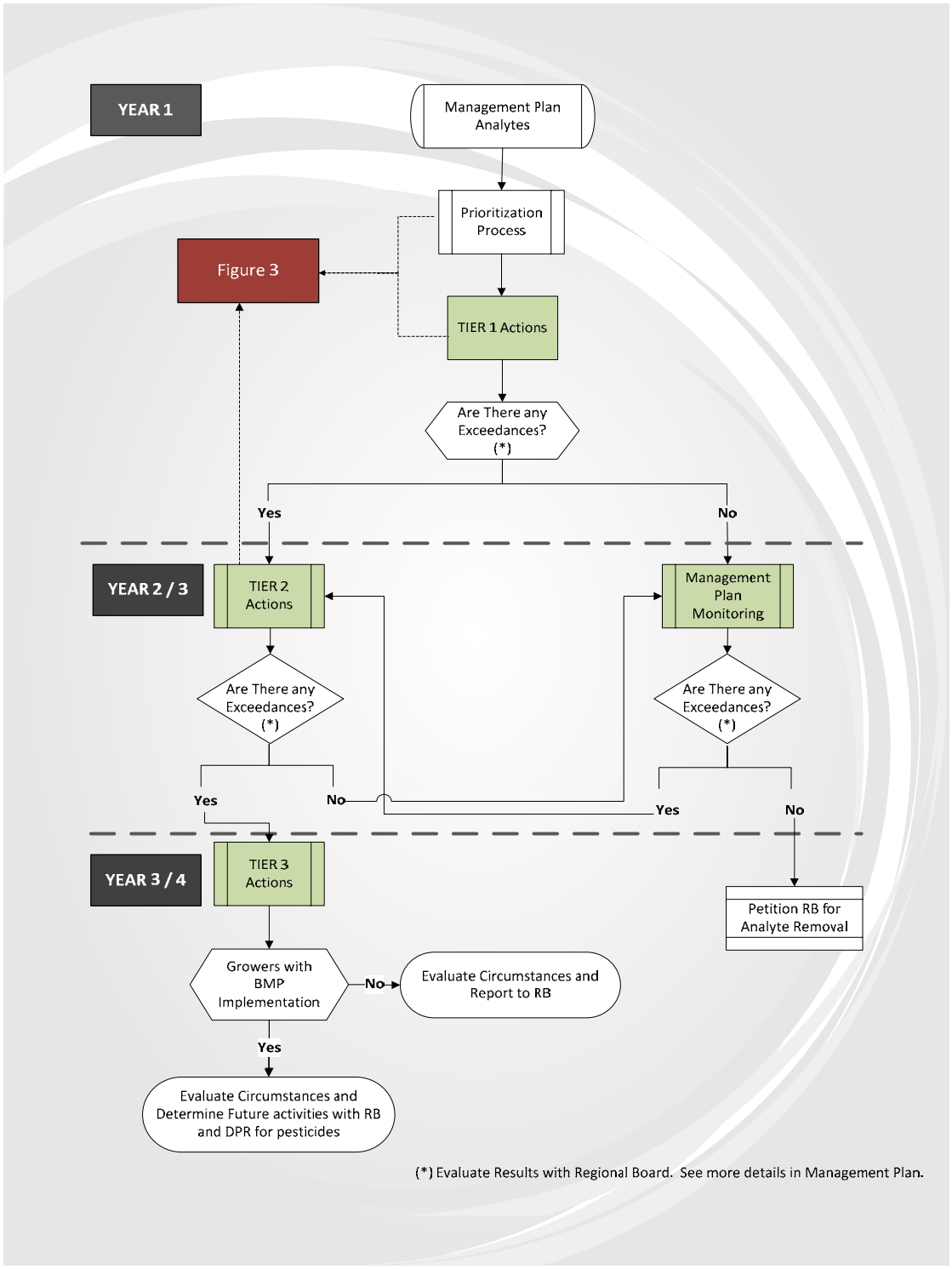
If at the end of the second year there are again no exceedances, the Coalition will petition to remove that constituent in a specific site subwatershed from the Management Plan. At the end of the second year, for a site that has had exceedances within the first year of management plan implementation, the monitoring data are again reviewed to determine whether there were exceedances for the constituent of concern during the second year. If there are no exceedances during the second year after applying Tier 2 actions (see Figure 2), then the Coalition will continue managing that site at the same level of effort in sourcing, outreach and evaluation. If there were exceedances during the second year then the Coalition will follow up with individual growers and determine the level of effort and actions taken by the growers to address and try to prevent water quality impairments (Tier 3 actions, Figure 2). For growers that have implemented BMPs and have changed practices in efforts to reduce runoff, the Coalition will work with the Regional Board to determine the next steps that should be taken to deal with water quality impairments. This may involve a joint agency effort between the Regional Board and Department of Pesticide Regulation (DPR) to determine better practices to prevent water quality impairment. For those growers that have been identified as potential sources of exceedances, and who have not been willing to work with the Coalition or adopted BMPs, the Coalition will provide appropriate information to the Regional Board.

Year 4

Actions in year four are dependent on the sequence of monitoring results in years one through three. If in the second year, there were no exceedances but there were exceedances in the first year, then the Coalition will continue for another year to monitor to better understand sources (if it is not already understood), continue with outreach and additional evaluation. If after this third year of monitoring, there are exceedances again, despite a lack of exceedances during the second year, the same actions will be followed as described in Year 3 for locations that had two year of exceedances while under the Management Plan. If there were no exceedances during this third year, the Coalition will petition the Regional Board for the removal of this constituent from the site subwatershed management plan.

Although this process is described as occurring year to year, it is possible that the actions occurring within a site subwatershed will remain constant across years due to the time lag between the discussion of appropriate management practices and the implementation of those practices. For example, a grower may submit an application for Environmental Quality Incentives Program (EQIP) funds to build a sediment pond and it may take over a year to receive the funds plus another year to build the pond. As these situations arise, they will be documented in the site subwatershed management plans and those locations/constituents may remain at a lower level of action the Coalition documents effectiveness. This will allow the growers to implement practices on a realistic time scale. The Coalition will maintain communication with the Regional Board on any of these situations.

Figure 2. Coalition Management Plan process and associated actions. The prioritization process (including TIER actions) is included in Figure 3.



RB- Regional Board
DPR- Department of Pesticide Regulation
BMP- Best Management Practices

CONSTITUENT SPECIFIC TRAITS

The following section includes information about the possible sources and common characteristics of constituents included in the SJCDWQC Management Plan. Specific actions taken by the Coalition to source, conduct outreach and perform evaluation of management practice implementation are described in the following sections, Prioritization of Exceedances and Priority Specific Management Goals and Plans.

Pesticides

Sourcing

Pesticide applications are identifiable to township, range and section (TRS) through the use of pesticide use reports (PURs). Monitoring results are compared against PURs as soon as they become available from County Agriculture Commissioners. Exceedances of pesticide water quality triggers or significant toxicity experienced in samples collected from high priority site subwatersheds are matched to applications that occurred on parcels (based on Assessor Parcel Numbers or APNs) within the subwatershed upstream of the sample site (the site subwatershed). Determining within a TRS which APN applied the pesticide is difficult and is done by matching the amount of acreage that the active ingredient was applied to with the amount of acreage in the APN. The difficulty is that there are multiple APNs per TRS and sometimes a single APN may occur over multiple TRS'. Therefore the Coalition will only attempt to determine source of pesticide use information down to the APN level in priority site subwatersheds.

Applied Pesticides

Applied pesticides include any chemical that is currently applied to agriculture and is reported in PURs. The Coalition analyzes for a total of 39 pesticides however four (DDD, DDE, DDT and dieldrin) are considered legacy pesticides or degradation products since they are no longer registered for use. In addition, five pesticides have prohibited discharges within the San Joaquin Valley outside of applications to rice: carbofuran, thiobencarb, molinate, malathion and methyl parathion. Of these, two are applied only to rice (thiobencarb and molinate) and are therefore reported to both the Regional Board and the Rice Coalition if a water quality exceedance occurs. There are over 800 chemicals registered as active ingredients. The pesticides in Table 8 are a subset of all pesticides applied within the Coalition area since 2004. The subset was selected based on total pounds active ingredient (AI) applied, toxicity, and data availability. Table 8 includes 109 applied pesticides, including the 39 pesticides currently monitored for by the Coalition, their solubility, half-life and K_{oc}.

Legacy Pesticides

Exceedances of DDT and its breakdown products, DDE and DDD, are a result of applications in the past. DDT, aldrin, and dieldrin are no longer registered or applied within the United States but persist because of their exceptionally high K_{oc} and long half life. It is estimated that the K_{oc} for DDT is between 100,000 and 1,000,000 depending on the source, and the half life in aquatic systems is probably over 150 years (http://www.speclab.com/compound/c50293.htm). DDT was banned in 1972, and the USEPA prohibited application of aldrin and dieldrin in 1974 except for uses on termites and banned all uses in 1987. These pesticides may be bound to sediment in the channels and mobilized periodically by unknown mechanisms.

Metals

In the context of management plans, metals can be divided into two groups: those metals which are currently registered for use by agriculture, and those that are not registered for use or currently applied as soil amendments. The Coalition currently monitors for total metals and dissolved metals. Copper, cadmium, lead, nickel and zinc were analyzed for total metals. Only copper and zinc are known to be used by agriculture within the Coalition region and only copper is applied as a pesticide. Zinc may be applied as a foliar nutrient and is a part of zinc phosphide, a rodenticide used around stored grain products or to control ground squirrels. The rodenticide use is not covered by the Irrigated Lands Regulatory Program.

Each time an exceedance of copper occurs, PUR data for parcels of land upstream of the sample site are reviewed for applications of products containing copper within three months of the sample date. If relevant applications have occurred then it is assumed that these applications may have contributed to the exceedance experienced at the sample site.

For metals that PUR data is not available for the Coalition will consider establishing background levels of specific metals once higher priority (A or B) constituents within the Coalition area are managed (see Figure 3 for the prioritization process) when the metals become a priority.

Arsenic

Arsenic is found in sodium cacodylate which is applied by agriculture for broadleaf weed control and as a cotton defoliant. The registrations on many products with this active ingredient have been cancelled. However, there are four products currently registered for use on citrus, for weed control around ditches, for use on ornamental plants, for nonagricultural weed control, and for weed control around buildings, driveways, sidewalks, rights-of-way, and fencerows. Several products are available for use by homeowners and nonagricultural users (e.g. county road maintenance) (http://www.pesticideinfo.org/List_Products.jsp?Rec_Id=PC34358&Chem_Name=Sodium%20cacodylate&PC_Code=012502) and the product may have been purchased for use by local homeowners for use on their property. California Department of Pesticide Regulation records

indicate no use of sodium cacodylate across the Coalition region between 1998 and 2006 for agricultural use.

At this point the source of arsenic is unclear although native soils can contain elevated concentrations of arsenic. The Coalition is presently investigating methods for establishing background levels of arsenic in surface waters. The Coalition will work with the Regional Board to determine if it is feasible to obtain the necessary data to establish background levels when arsenic becomes a priority.

Boron

Boron is not applied by agriculture in the Coalition region. There are no pesticides or fertilizers that contain boron. Boron is naturally elevated in many locations along the west side of the San Joaquin Valley and surface waters originating in the coastal ranges contain elevated concentrations of boron. Surface waters originating in the Sierra Nevada Mountains do not contain elevated concentrations of boron.

Cadmium

Elevated concentrations of cadmium in a water body may be a result of agricultural application of sludge fertilizer, but also may arise from the erosion of soils and bedrock, atmospheric deposition, discharge from industrial operations or leakage from landfills and contaminated sites. Cadmium has high tendency to adsorb to sediments (high K_{oc}) and persists indefinitely in the environment.

Copper

Copper is commonly applied throughout the Coalition region and is considered an organic herbicide, fungicide, and algicide. Copper is known to contribute to the toxicity of *Selenastrum* reducing growth of the algae. Copper active ingredients (AIs) include copper, copper hydroxide, copper sulfate and copper sulfate pentahydrate. Copper can also become available to water bodies through the weathering of rocks and soils that naturally contain metals. Copper is also found in automobile components and wearing of brakes can add substantial amounts of copper to surface waters that pass through or near urban areas. Since copper does not degrade, it is possible that applications can cause exceedances several months after application.

Lead

Lead is a legacy of any of a number of potential sources including deposition from leaded gasoline, disposal of lead-containing products such as paints, electronic components, and batteries, and old applications of lead arsenate pesticides. Currently, there are no pesticides applied that have lead as a material, although lead arsenate was used in the past. Lead arsenate was used generally only until the 1960s and has been banned on all food crops since 1991. Currently, the most probable source is contaminated soils that originated from old pesticide applications, disposal of products containing lead, or the deposition of automobile exhaust along roadways. Contaminated soils may have caused contaminated sediment and that sediment may be moved into the water body during storm events. Lead is predominantly

particulate bound and not bioavailable in that form. Major roads and highways within subwatersheds may contribute to the leaching of lead into the waterways. In addition, disposal of lead paint in the vicinity, burial of old buildings with lead paint, or leaching lead from lead arsenate deposition could all be contributors to lead detections. Sampling soil in the vicinity in search of lead sources could result in years of sampling with few results because it is not clear how deep the lead may be in the soil or how widespread the lead contamination could be. Also, identifying one source does not eliminate additional source contributions. Regardless of the source, it is in all likelihood not manageable by implementing agricultural BMPs.

Nickel

Nickel is a naturally occurring metal that is found in soils as a normal constituent. It is also applied by agriculture as a foliar nutrient on crops such as cotton and pecans to improve nitrogen utilization when nitrogen is applied as urea. Nickel is also a constituent in fertilizers originating with wastes from industry and sewage treatment plants. It can also be released into the environment from the disposal of nickel-cadmium batteries. Metallic nickel is insoluble in water but complexes with several other compounds in oxidation states from -1 to +4 and the most common oxidation state is +2. Ni^{2+} can be found in the dissolved state and its bioavailability is determined by the amount of organic carbon in the water body. Nickel is also a potential contaminant in sediments where its bioavailability is determined by the amount of organic carbon and acid volatile sulfides. The amount of nickel applied in the Coalition region is unknown but because urea is not the most commonly used form of nitrogen fertilization, its use is assumed to be low.

Selenium

Selenium is a naturally occurring element in soils that is mostly found in the southwestern portions of the San Joaquin Valley. The SJCDWQC region soils are not generally elevated in selenium, and irrigation water originating from ground water in the western portions of the Coalition region do not have elevated concentrations of selenium. Irrigation water originating in the Sierra Nevada Mountains is low in selenium. While acute toxicity from selenium is possible, the bioaccumulation and biotransfer of selenium is far more important. Selenium readily bioaccumulates and is transferred up the trophic chain to upper level consumers such as fish and birds where chronic effects on reproduction and development are well documented.

Zinc

Like nickel, zinc is a naturally occurring metal that is found in soils as a normal constituent. In some locations, zinc is added to fertilizers to improve phosphorus use efficiency on crops such as corn. It is also applied as a foliar nutrient to many crops including grapes and orchard crops. Like nickel, there are numerous anthropogenic sources of zinc including wastes recycled as fertilizer, and storm water runoff from roadways. Zinc is a component in brake pads and is produced in a dust form as pads wear with use. Zinc is also a component of tires although the exact amounts and formulations for tires are considered proprietary information and not available. Tire wear is a large contributor to zinc in the environment. Zinc bioavailability is controlled in the same manner as nickel with organic carbon being the primary factor

determining zinc toxicity in the water column and organic carbon and acid volatile solids determining bioavailability and toxicity in sediments.

Field Parameters (Dissolved Oxygen, pH, Specific Conductance)

Exceedances of the dissolved oxygen (DO) water quality objective are common and have been present throughout the Coalition region since monitoring was implemented. DO and pH are expected to vary diurnally and can exceed the standards as a result of natural processes in the water column such as changing water temperature, photosynthesis and respiration. Changes in DO can be exacerbated by the addition of nutrients which stimulate production of organic material which eventually dies and is eventually released into the water column and sediment where it is broken down by microbial activity. The respiration of the bacteria during the breakdown process is termed Biological Oxygen Demand (BOD).

The Coalition conducted a special study which attempted to determine if BOD was the cause of the low DO. The results of this study were included in Appendix VIII of the December 30, 2007 Semi Annual Monitoring Report. The majority of the samples contained no measurable BOD. The reasons for this could be the long holding time prior to initiation of the test or already depleted dissolved oxygen concentrations in the water column. BOD and Total Organic Carbon (TOC) were positively correlated and TOC was used as a surrogate for BOD in a multiple regression analysis. Water temperature, BOD, and nitrate in the water column were all significant predictors of dissolved oxygen. As water temperature and BOD increased, dissolved oxygen decreased. As nitrate increased, dissolved oxygen increased although the explanation for this latter relationship is not clear. It is clear that both water temperature and BOD are significant factors causing the decrease in DO although other, as yet unknown factors are also important.

Specific conductance (EC) is a measure of salt as is total dissolved solids (TDS). Further discussion of EC, as it is related to TDS, is provided in the next section.

Physical Parameters (Color, TDS/EC, TOC)

Color is a derived parameter in that it is not delivered to surface waters from any single source, with the possible exception of color derived from suspended sediments. Color is a result of other constituents (e.g. organic carbon) or processes (e.g. photosynthesis, turbulent flow and resuspension of particulate matter). Consequently, management of color is not possible unless the process(es) that contribute to color are understood. Color exceedances at different water bodies may be a result of different factors. As the Coalition conducts the special studies to determine the cause(s) of exceedances of constituents such as DO and pH, information may become available that will allow us to address color exceedances.

TDS describes all solids (usually mineral salts) that are dissolved in water and were frequently associated with exceedances of EC. Potential sources of EC and TDS are minerals leached from soils by upstream surface water and ground water, or drain water from irrigated agriculture. There are two general sources of EC (or TDS) in agricultural landscapes; fertilizers and native soils. A commercial fertilizer can be made up of dozens of different chemicals, each of which ionize and contribute to the EC of the solution. Different brands of fertilizer can use different chemicals to make up the total formula indicating that there will not be a universal signal for fertilizer-generated EC or TDS.

Six sites with chronically elevated levels of both EC and TDS- Sand Creek, Marsh Creek, both Grant Line Canal sites, and both Roberts Island Drain sites- are located in the Delta where ground water is very shallow. Water with high TDS is used for irrigation and discharged back to the Delta. This process may concentrate salts, but only to a small degree and is not the primary cause of exceedances of the TDS trigger. The CVRWQCB recognizes that EC/TDS is a region-wide problem and must be solved at that level. The Coalition will work with the CVRWQCB to address the problem over the next several years.

E. coli

E. coli is an indicator of fecal contamination in surface waters. Potential sources of *E. coli* include deposition or runoff from irrigated pasture, dairies, leaky sewer lines, leaky septic systems, application of manure, biosolids and liquid dairy waste, and a large array of wildlife. A study designed to identify the source of fecal contamination in Coalition water bodies was initiated in August 2006. Obligate anaerobic bacteria of the genus *Bacteroides* were extracted from water samples and their DNA analyzed to determine the source(s) of the fecal matter. Anaerobic *Bacteroides* were used because they persist in the environment for only a short period of time (days), meaning any detection of *Bacteroides* DNA in the sample is from a recent contamination event. As a facultative anaerobe, *E. coli* can reproduce and persist in an oxygenated environment for an unknown period of time, thus detecting *E. coli* in a water sample is an indicator of fecal contamination but the timing of the contamination is not possible to determine.

For the study, water sampling occurred at 16 sites (4 baseline and 12 monitoring) within the Coalition region during non-monitoring events. Results of the study indicate that the source of the fecal contamination is a combination of human, cows, and chickens depending on the location. The sampling occurred only during late summer low flow conditions and should be repeated during winter storm events. Samples can be analyzed for additional molecular markers and chemical markers that can confirm the contamination by human sewage, but those analyses will require a much larger research effort that is outside the capabilities of the Coalition.

Toxicity

Water Column Toxicity

Toxicity in the water column can occur as a result of natural or anthropogenic causes, including the discharge, release or re-suspension of metals, pesticides, ammonia or other toxicants. The three species used in water column toxicity analyses can often be associated with detections of one or more contaminants in the same sample water. Table 8 lists the top 109 applied active ingredients and the species (both water column and sediment) to which each chemical has the potential to cause toxicity.

Pesticides that potentially could be detected dissolved in surface water runoff and cause water column toxicity are separated from those that tend to bind to sediment and organic matter and could cause sediment toxicity. The Department of Pesticide Regulation (DPR) provides criteria to identify those pesticides that could leach to ground water which means they could also be mobilized during runoff events and moved to surface waters in the dissolved phase. The Coalition utilizes the DPR criteria to identify those pesticide applications that could be responsible for water column toxicity:

One of the following must be true

- Water solubility: > 3 ppm (mg/L), or
- Soil adsorption coefficient (K_{oc}): < 1,900 cm^3/g

and one of the following must be true

- Hydrolysis half-life: > 14 days, or
- Aerobic soil metabolism half-life: > 610 days, or
- Anaerobic soil metabolism half-life: > 9 days

The DPR criteria do not always identify all pesticides that could be responsible for water column toxicity. For example, bifenthrin (0.1 ppm solubility), dicofol (1 ppm solubility), chlorpyrifos (0.4 ppm solubility), oryzalin (2.5 ppm solubility) and trifluralin (0.3 ppm solubility) are less than the DPR criteria of 3 ppm but are known to be toxic to water column species. Propanil has a solubility of 200 ppm although the soil half-life is 1 day which is less than DPR criteria of 9 days. However, studies have shown that propanil is toxic to *Selenastrum*. Therefore the Coalition has applied toxicity species codes to each of the top 109 applied active ingredients based on the DPR criteria and relevant toxicity studies summarized in various online resources such as Extoxnet and Oregon State University's National Pesticide Information Center (Table 8). The toxicity species codes (cer = *Ceriodaphnia*, sel = *Selenastrum*, pim = *Pimephales*, hya = *Hyalella*) are then used to evaluate PUR data associated with those active ingredients for time periods prior to toxicity.

In addition, specific crops are linked with particular exceedances, e.g. almonds and midwinter dormant applications of organophosphate pesticides, and are also identifiable through PURs. Understanding the potential mechanism by which pesticides are moved to surface waters allows the Coalition to target management practices known to be effective in eliminating the exceedances (Table 9).

Applied Pesticides and Associated Toxicity

Table 8 is a list of the top 109 active ingredients applied to agriculture within the Coalition counties. The table of active ingredients and their chemical properties was developed for two purposes: 1) identifying sources of toxicity when TIEs are not performed or are inconclusive and water chemistry does not indicate any detection of the limited number of constituents for which the Coalition monitors, and 2) to target management practices.

Source Identification

While performing toxicity tests on some samples in the past, the Coalition experienced toxicity for which the TIE indicated a nonpolar organic material was responsible, or the TIE trigger was not reached. In both of these cases, the Coalition does not have sufficient analytical information with which to determine the potential source(s) of the toxicity. As a result, the Coalition has initiated development of an Active Ingredients (AI) properties table. This table is in development and will become more complete as more information becomes available. The number of AIs in the table was determined by taking the total number of AIs used in the Coalition region and eliminating all AIs with less than 5000 lbs applied. The exception to this was any AI for which the Coalition currently analyzes, even if less than 5000 lbs are applied. The list was further reduced by eliminating all adjuvants and multiple formulations for the same AI (e.g. copper hydroxide, copper sulphate). The remaining 109 AIs were assigned a toxicity code based on their prescribed use. For example, any insecticide or miticide was assigned as being potentially toxic to *Ceriodaphnia* and *Pimephales*. Elements such as copper were assigned as being potentially toxic to *Selenastrum*, *Ceriodaphnia*, and *Pimephales*. The literature was then searched for physical/chemical properties such as solubility, half-life, and K_{oc}, and LC50.

In the future, when the Coalition receives information on toxicity with an "unknown" source, PURs will be used to determine the applications in the site subwatershed. If the toxicity is associated with the water column, the AIs applied in the watershed will be screened using the DPR criteria and the properties in Table 8 to identify AIs with sufficient solubility and toxicity to be a potential source. Similarly, sources of toxicity in sediment will be identified by determining which applications in the watershed would be associated with particulate deposition.

Toxicity may occur that is not associated with any pesticide applications because not all applications have been reported, applications have been misreported and/or the toxicity of the chemicals applied is not well understood (i.e. insufficient toxicity studies). If the Coalition

obtains a toxic sample and PUR data indicate that no pesticide use is reported, the Coalition may use past PUR data in that site subwatershed applied in the same month in previous years to continue to conduct outreach and recommend management practices. In all cases, toxicity will be compared to chemistry results from samples collected at the same time including nutrients, metals and pesticides.

Management Practices Implementation

The list of management practices that can be used to keep pesticides out of surface waters is not large. Generally they fall into three categories: those practices that manage movement of surface water, those that manage the movement of sediment and those that manage applications. Managing the movement of surface water will manage pesticides that are soluble in water and managing the movement of sediment will manage pesticides with high K_{oc} that attach to sediment or organic material. In addition, since some chemicals do not follow DPR criteria, the assigned toxicity code (whether the chemical may be toxic to water column species and/or sediment species) will be included in the evaluation of which practices should be implemented (Table 8 and Table 9). Being able to assign pesticides to either of these two categories and associate chemicals with either water column or sediment toxicity will enable the Coalition to effectively conduct outreach.

Table 8. Pesticide characteristic table (top 109 used active ingredients). Each active ingredient is associated with a chemical type and possible species that the chemical could be toxic to (Cer = Ceriodpahnia, Sel = Selenastrum, Pim = Pimephales, Hyl = Hyalella). If the Coalition analysis for the chemical (as of September 2008) it is assigned a pesticide group.

Active Ingredients	Pesticide Group	Ref	Solubility (mg/L)	Soil half-life (days)	K_{OC}	Vapor Pressure (mm HG)	Ceriodaphnia LC50 (mean µg/L)	Selenastrum EC50 (mean µg/L)	Pimephales LC50 (mean µg/L)	Chemical Type	Toxicity Code
(S)-CYPERMETHRIN	Pyrethroid				100000					INSECTICIDE	hyl-cer
(S)-METOLACHLOR		5	240	15	170	2.20E-05	15,930			HERBICIDE	sel
1,3-DICHLOROPROPENE		1	2250	10	32	29		4065	2169.5	FUNGICIDE, HERBICIDE	cer-sel
2,4-D, DIMETHYLAMINE SALT		1	200000	10	26		360,000			INSECTICIDE, HERBICIDE	cer-sel
4(2,4-DB), DIMETHYLAMINE SALT		1	709000	10	20		360,000			HERBICIDE	sel
ACEPHATE		1	818000	3	2	1.700E-06			525000	INSECTICIDE	cer
ALDICARB	Carbamate	1	6000	30	30				1143.6	INSECTICIDE	cer
AZINPHOS-METHYL	Organophosphate	5	20.9	21	1000	1.60E-06			1585.6	INSECTICIDE	cer
AZOXYSTROBIN		1	6.7	65	1590			106		FUNGICIDE	hyl-cer
BENSULIDE		1	5.6	120	1000	8.000E-07		1800		HERBICIDE	sel
BIFENAZATE										INSECTICIDE	cer
BIFENTHRIN	Pyrethroid	1	0.1	26	240000	1.800E-07	0.07			INSECTICIDE	hyl-cer
BOSCALID					809					FUNGICIDE	cer
BROMOXYNIL OCTANOATE		4	0.08	7	10000			210		HERBICIDE	sel
CAPTAN		1	5.1	3	200	0.00		3900	132.5	FUNGICIDE	cer
CARBARYL	Carbamate	1	120	10	300	1.20E-06	12	1100	10364	INSECTICIDE	cer
CARBOFURAN	Carbamate	1	351	50	22	6.00E-06	2	667	853.3	INSECTICIDE	cer
CHLOROPICRIN		1	2270	1	62	18				INSECTICIDE	cer
CHLOROTHALONIL		1	0.6	30	1380	0.001		190		FUNGICIDE	cer
CHLORPYRIFOS	Organophosphate	1	0.4	30	6070		0.055		192.35	INSECTICIDE	hyl-cer
CHLORTHAL-DIMETHYL		3	2890	30.3	29					HERBICIDE	sel
CLETHODIM		1	5400	3	10			43700		HERBICIDE	sel
COPPER		2	421000			0	302	428.78	3631.4	FUNGICIDE	cer-sel
COPPER HYDROXIDE										FUNGICIDE	cer-sel
COPPER OXIDE (OUS)										FUNGICIDE	cer-sel
COPPER OXYCHLORIDE										FUNGICIDE	cer-sel
COPPER OXYCHLORIDE SULFATE										FUNGICIDE	sel-cer-pim

Active Ingredients	Pesticide Group	Ref	Solubility (mg/L)	Soil half-life (days)	K_{OC}	Vapor Pressure (mm HG)	Ceriodaphnia LC50 (mean µg/L)	Selenastrum EC50 (mean µg/L)	Pimephales LC50 (mean µg/L)	Chemical Type	Toxicity Code
COPPER SULFATE (BASIC)		1						67.8	3012.8	INSECTICIDE, HERBICIDE, FUNGICIDE	cer-sel
COPPER SULFATE (PENTAHYDRATE)		1	10000	2200	16720		44	3.1		HERBICIDE, INSECTICIDE, FUNGICIDE	cer-sel
CYCLOATE		1	95	30	430	0.0016				HERBICIDE	sel
CYFLUTHRIN	Pyrethroid	1	0.002	30	100000	1.60E-08				INSECTICIDE	hyl-cer
CYPERMETHRIN	Pyrethroid	6	0.000009	16	160000	40×10^{7}				INSECTICIDE	hyl-cer
CYPRODINIL		1		50	1000	3.80E-06				FUNGICIDE	hyl-cer
DIAZINON	Organophosphate	1	60	40	1000	0.0001	0.39	6400	7150	INSECTICIDE	cer
DICAMBA, DIMETHYLAMINE SALT		3		10	5					INSECTICIDE	cer
DICOFOL	Organochlorine	1	1	60	180000	4.00E-07			556.5	INSECTICIDE	hyl-cer
DIFLUBENZURON		3	0.08	2.08	1110					INSECTICIDE	hyl-cer
DIGLYCOLAMINE SALT OF 3,6-DICHLORO-O-ANISIC ACID					5					HERBICIDE	sel
DIMETHOATE	Organophosphate	1	39800	7	20			35000		INSECTICIDE	cer
DISULFOTON	Organophosphate	1	25	30	600	0.0002			3538	INSECTICIDE	cer
DIURON	Herbicide	1	42	90	480	6.90E-08		2.4	14200	HERBICIDE	sel
EPTC					200	0.024		6451		HERBICIDE	sel
ESFENVALERATE	Pyrethroid	1	0.002	35	5300	1.10E-08			0.256	INSECTICIDE	hyl-cer
ETHEPHON		1	1239000	10	100000	1.00E-07		1400	130000	GROWTH REGULATOR	hyl
ETHOPROP		1	750	25	70	0.0004				INSECTICIDE	cer
FENAMIPHOS		1	400	50	100	1.00E-06				INSECTICIDE	cer
FENBUTATIN-OXIDE		1	0.013	90	2300	1.80E-11			1.9	FUNGICIDE	cer
FENPROPATHRIN		3	0.04	429.1	5000					INSECTICIDE	hyl-cer
FLUMIOXAZIN					105					HERBICIDE	sel
FOSETYL-AL		1	120000	0.1	20	1.00E-07		4990		FUNGICIDE	cer
GLUFOSINATE-AMMONIUM		3		20	785					HERBICIDE	sel
GLYPHOSATE	Herbicide	1	12000	47	24000			14000	97000	HERBICIDE	sel
GLYPHOSATE, DIAMMONIUM SALT					24000					HERBICIDE	sel
GLYPHOSATE, ISOPROPYLAMINE SALT		1	900000	47	24000			6.915	2300	HERBICIDE, FUNGICIDE	sel-hyl-cer

Active Ingredients	Pesticide Group	Ref	Solubility (mg/L)	Soil half-life (days)	K_{OC}	Vapor Pressure (mm HG)	Ceriodaphnia LC50 (mean µg/L)	Selenastrum EC50 (mean µg/L)	Pimephales LC50 (mean µg/L)	Chemical Type	Toxicity Code
GLYPHOSATE, MONOAMMONIUM SALT					24000					HERBICIDE	sel
GLYPHOSATE, POTASSIUM SALT					24000					HERBICIDE	sel
HEXAZINONE		1	33000	90	54	2.00E-07		26.1	274000	HERBICIDE	sel
HEXYTHIAZOX		3	0.12	18.7	22					MITICIDE	hyl
HYDROGEN CYANAMIDE										PLANT GROWTH REGULATOR	sel
IMIDACLOPRID		1	580	127	440					HERBICIDE, INSECTICIDE	sel-cer
INDOXACARB					2200					INSECTICIDE	hyl-cer
IPRODIONE		1	13.9	14	700	1.00E-07		130		FUNGICIDE	cer
KAOLIN										FUNGICIDE, INSECTICIDE	cer
LAMBDA-CYHALOTHRIN		3	0.005	61.8	2341					INSECTICIDE	hyl-cer
LINURON	Herbicide	5	75	60	400	1.43E-06		67		HERBICIDE	sel
MALATHION	Organophosphate	1	130	1	1800	8.00E-06	1.63	10	10460	INSECTICIDE	hyl-cer
MANCOZEB		1	6	70	2000			47		FUNGICIDE	hyl-cer
MANEB		1	6	70	2000			14		FUNGICIDE	hyl-cer
MCPA, DIMETHYLAMINE SALT		1	866000	25	20			71000		HERBICIDE	sel
MEPIQUAT CHLORIDE		1	1000000	1000	1000000			200		PLANT GROWTH REGULATOR	sel
METAM-SODIUM		1	963000	7	10	20				FUNGICIDE, HERBICIDE	cer-sel
METHIDATHION	Organophosphate	1	220	7	400	3.37E-06				INSECTICIDE	cer
METHOMYL	Carbamate	1	58000	30	72	0.0001			2044	INSECTICIDE	cer
METHOXYFENOZIDE					350					INSECTICIDE	cer
METHYL BROMIDE		1	13400	55	22	1824				INSECTICIDE, HERBICIDE	cer-sel
METRIBUZIN		5	1050	40	60	4.55E-07	35,360	43		HERBICIDE	sel
MSMA		1	1400000	180	7000			5630	874500	HERBICIDE	sel
MYCLOBUTANIL		1	142	66	500	1.60E-06		830		FUNGICIDE	cer
NALED		1	2000	1	180	0.0002		20	3300	FUNGICIDE	cer
NAPROPAMIDE		1	74	70	400	1.70E-07		3400		HERBICIDE	sel

Active Ingredients	Pesticide Group	Ref	Solubility (mg/L)	Soil half-life (days)	K_{OC}	Vapor Pressure (mm HG)	Ceriodaphnia LC50 (mean µg/L)	Selenastrum EC50 (mean µg/L)	Pimephales LC50 (mean µg/L)	Chemical Type	Toxicity Code
NORFLURAZON		2	33.7		700	2.89E-08		9.7		HERBICIDE	sel
ORYZALIN		1	2.5	20	600	1.00E-08		42		HERBICIDE	sel
OXAMYL	Herbicide	1	282000	4	25	0.0002			6890	INSECTICIDE	cer
OXYFLUORFEN		1	0.1	35	100000	2.00E-07		26.3		HERBICIDE	sel
PARAQUAT DICHLORIDE	Organophosphate	1	620000	1000	1000000			614.5		HERBICIDE	hyl-sel-cer
PENDIMETHALIN		1	0.275	90	5000	9.40E-06		588.8		FERTILIZER, HERBICIDE	hyl-sel
PERMETHRIN	Pyrethroid	1	0.006	30	100000	1.30E-08	0.55		71.708	INSECTICIDE	hyl-cer
PHOSMET	Organophosphate	1	20	19	820	4.90E-07			8150	INSECTICIDE, FUNGICIDE	cer
POTASSIUM N-METHYLDITHIOCARBAMATE										HERBICIDE, INSECTICIDE	sel-cer
PROMETRYN		1	33	60	400	1.24E-06		21		HERBICIDE	sel
PROPANIL		1	200	1	149		3,833	29	8600	HERBICIDE	sel
PROPARGITE		1	0.5	56	4000	0.003		66.2		INSECTICIDE	hyl-cer
PYRACLOSTROBIN					16000					FUNGICIDE	hyl-cer
PYRIDABEN		3	0.01	86	1553					INSECTICIDE	cer
PYRIMETHANIL					481					FUNGICIDE	cer
S,S,S-TRIBUTYL PHOSPHOROTRITHIOATE		3	2.3	6.18	90			148		PLANT GROWTH REGULATOR	sel-cer-pim-hyl
SETHOXYDIM		1	4390	5	100	1.60E-07		302		HERBICIDE	sel
SIMAZINE	Herbicide	1	6.2	60	130	2.21E-08		1240	53200	HERBICIDE	sel
S-METOLACHLOR		5	240	15	170	2.20E-05	15,930			HERBICIDE	sel
SODIUM CHLORATE		1	100000	200	10			133000	13633333	HERBICIDE, FUNGICIDE	sel-cer
SODIUM TETRATHIOCARBONATE		3		79						FUNGICIDE, INSECTICIDE	cer
SPINOSAD					50					INSECTICIDE	cer
SPIROMESIFEN					43319					INSECTICIDE	hyl-cer
TEBUCONAZOLE		1	25	610	1000			2780		FUNGICIDE	cer
THIOBENCARB	Herbicide	1	28	21	900		510	29.45		HERBICIDE	sel
THIOPHANATE-METHYL		1	3.5	10	1830	1.00E-07		950		INSECTICIDE	hyl-cer
TRIFLOXYSTROBIN		1	0.61	5	2709			77100		FUNGICIDE	hyl-cer
TRIFLURALIN		1	0.3	60	8000	0.0001		673	105	HERBICIDE, INSECTICIDE	hyl-sel-cer

Active Ingredients	Pesticide Group	Ref	Solubility (mg/L)	Soil half-life (days)	K_{OC}	Vapor Pressure (mm HG)	Ceriodaphnia LC50 (mean µg/L)	Selenastrum EC50 (mean µg/L)	Pimephales LC50 (mean µg/L)	Chemical Type	Toxicity Code
ZIRAM		1	65	30	400	1.00E-07		67	126.5	FUNGICIDE	cer

References:

1- ftp://ftp.wcc.nrcs.usda.gov/downloads/pestmgt/AI_LIST.xls
2- http://risk.lsd.ornl.gov/
3- http://www.pesticideinfo.org/
4- http://npic.orst.edu/ppdmove.htm
5- Chemfinder, http://chemfinder.cambridgesoft.com/
6- Extoxnet, http://extoxnet.orst.edu/

Table 9. Table of management practices, target constituents, mechanism and possible improvements to water quality.

Management Practice	Endpoint	Management Practice Target(s)	Management Practice Mechanism	Effected water/sediment quality monitoring parameter(s)
Sediment basin	Reduce discharge	PI, PS, K, S, NP	Settling of sediment, pesticides bound to sediments; allow time for biodegradation of pesticides.	Color, turbidity, EC, TDS, metals, short half-life pesticides, high K_{oc} pesticides, total phosphorous
Vegetated buffers	Reduce discharge	PI, PS, K, S, NP, NN	Removal of sediment, nutrients, and pesticides bound to sediments or any contaminants with low solubility.	Color, turbidity, EC, TDS, metals, pesticides, nutrients
Cover crop, dormant season vegetation	Reduce discharge	K, S, NP	Removal of sediment, pesticides bound to sediments or any contaminants with low solubility; protect soils and soil nutrients for growing season.	Color, turbidity, EC, TDS, metals, pesticides, nutrients
Sprayer calibration	Reduce discharge	D	Reduce potential for spray drift.	All pesticides
Polyacrylamide (PAM)	Reduce discharge	PI, K, S, NP	A surfactant that removes sediment from the water column, thus pulling out pesticides bound to sediments.	Color, turbidity, metals, pyrethroid pesticides, total phosphorous
Dormant season field retainers	Reduce discharge	PS, S	Reduce/eliminate storm runoff.	Color, turbidity, EC, TDS, copper, pyrethroid pesticides, organophosphate pesticides
Micro irrigation	Reduce water use & discharge	D,W	Increase water efficiency, eliminate potential for spray drift.	All pesticides, copper
Tail water return	Reduce water use & discharge	PI , PS, K, S, W, NP, NN	Re-use of irrigation water, eliminate discharge altogether.	Color, turbidity, EC, TDS, metals, all pesticides, all nutrients

Management Practice Targets Code:

D: Chemical (pesticide) drift
PS: Dormant spray pesticide storm runoff
S: Sediment runoff
NP: Nutrients: phosphorous
PI: Pesticide runoff from irrigation
K: High K_{oc} pesticide runoff
W: Water use efficiency
NN: Nutrients: nitrate, nitrite or Kjeldhal nitrogen

PRIORITIZATION OF EXCEEDANCES

The SJCDWQC has developed a prioritization process which allows the Coalition to focus on constituents of the greatest concern. These constituents are included in the Management Plan process outlined in Figure 2. The prioritization process has been developed in collaboration with the Regional Board and allows the Coalition to focus on constituents where sourcing is possible (i.e. pesticide use reports) and for which management practices are available. Following the flow chart in Figure 3, a priority level is assigned to a Management Plan constituent for a specific site subwatershed. Priority levels will determine the level of activity for sourcing, outreach and evaluation. In the Management Plan process diagram (Figure 2), these actions are listed as TIER 1, 2 or 3 actions. The Management Plan process is based on both the history of exceedances and the actions taken to date. The prioritization process is then used to determine which actions the Coalition will perform based on exceedances or lack of exceedances in the previous year. Tier 1 actions begin with the first year of Management Plan implementation. If exceedances occur during the first year, the Coalition will move to Tier 2 actions the second year. If exceedances occur again, the Coalition will move to Tier 3 actions during the third year. If, however, during the first year there were no exceedances the Coalition continues to perform Tier 1 actions. The Management Plan and prioritization processes (Figure 2 and 3) are intended as general guidelines for the Coalition. The Management Plan text will augment the actions listed in the flow diagrams where specifics could not be addressed. If an exceedance occurs for a TMDL constituent, a management plan will be required for that constituent and site subwatershed regardless of whether or not there was a second exceedance.

Using the prioritization process flow chart (Figure 3), analytes are assigned a priority based on responses to a series of questions which take into account information used for sourcing and managing such as whether or not the analyte is an applied pesticide, metal or nutrient. Assessing whether the analyte is found in association with sediment toxicity (i.e. total metals that may be bound to sediment) addresses whether the constituent of concern may be a result of the mobilization of sediment. The Coalition can address sediment-bound analytes with specific management practices. The responses are used to evaluate the water quality impact of the analyte including whether or not there is an established Total Maximum Daily Load (TMDL), whether the analyte is associated with toxicity (samples collected at the same time had toxicity for a species that the analyte of concern could be responsible for) and whether there are exceedances associated with sediment transport. Each priority is described in the following section including actions that will be taken by the Coalition to source, conduct outreach and perform evaluation of management practices. The specifics of how and when this will be done are included in appropriate individual Site Subwatershed Management Plans.

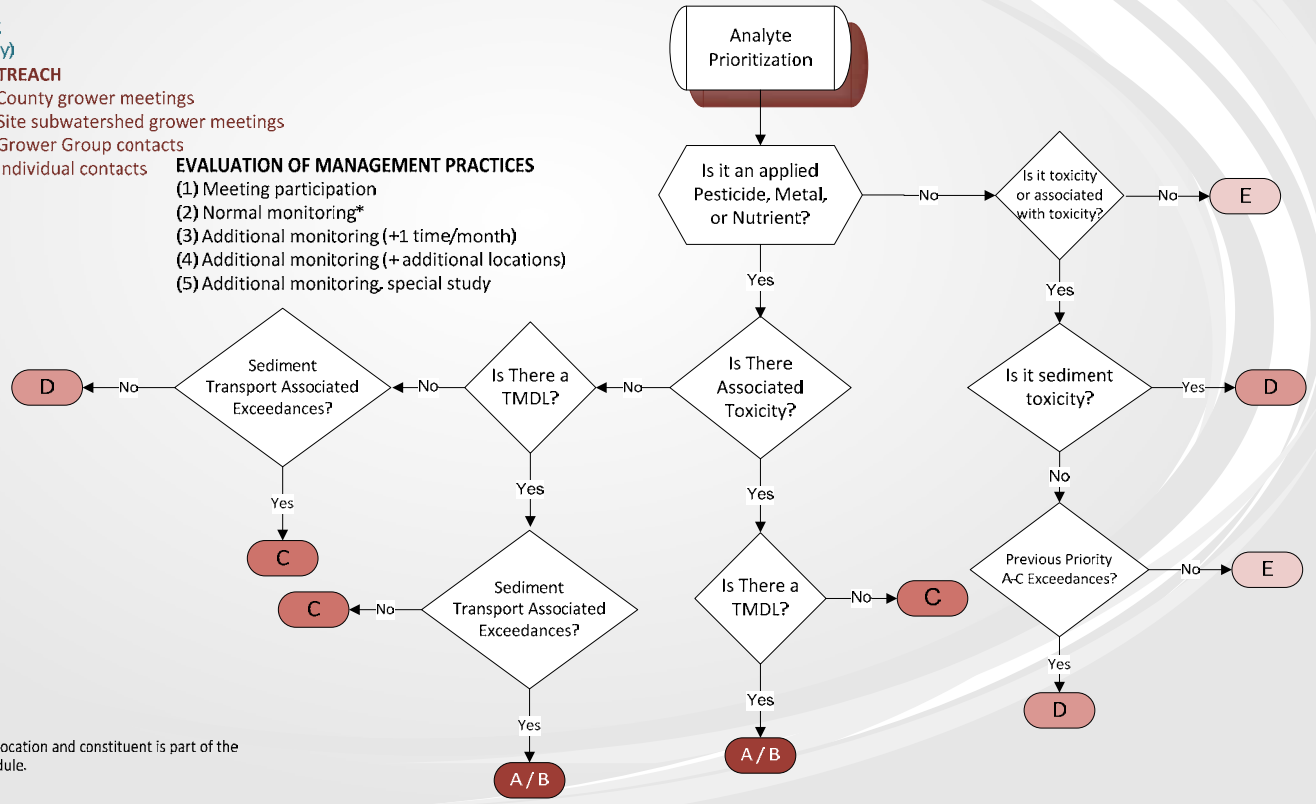
Figure 3. SJCDWQC prioritization process and associated actions for sourcing, outreach and evaluation of management practices.

Priority Level	TIER 1			TIER 2			TIER 3		
	Source	Outreach	Evaluation	Source	Outreach	Evaluation	Source	Outreach	Evaluation
A	1, 2	1, 2	2, 3	1, 2/3	1, 2, 3, 4	1, 2, 3, 4	1, 2, 3	1, 2, 3, 4	1, 2, 3, 4, 5
B	1, 2	1, 2	2, 3	1, 2/3	1, 2, 3	1, 2, 3, 4	1, 2, 3	1, 2, 3, 4	1, 2, 3, 4, 5
C	1, 2	1, 2	2, 3	1, 2/3	1, 2, 3	1, 2, 3, 4	1, 2, 3	1, 2, 3, 4	1, 2, 3, 4, 5
D	1, 2	1, 2	2, 3	1, 2/3	1, 2	2, 3	1, 2, 3	1, 2, 3	1, 2, 3, 4
E		1	2		1	2		1	2

SOURCE
(1) PURs
(2) Additional Monitoring
(upstream/ + frequency)
(3) Special Studies

OUTREACH
(1) County grower meetings
(2) Site subwatershed grower meetings
(3) Grower Group contacts
(4) Individual contacts

EVALUATION OF MANAGEMENT PRACTICES
(1) Meeting participation
(2) Normal monitoring*
(3) Additional monitoring (+1 time/month)
(4) Additional monitoring (+ additional locations)
(5) Additional monitoring, special study



*Normal monitoring will occur if the location and constituent is part of the Core or Assessment Monitoring schedule.

PRIORITY-SPECIFIC MANAGEMENT GOALS AND PLANS

The prioritization of constituents and site subwatersheds is above. Figure 3 includes actions at each tier and priority level for sourcing, outreach and evaluation. The overall Management Plan process from year to year is outlined in Figure 2 and described in the section Management Plan Process. Both Figure 2 and 3 should be used during the following descriptions of prioritization, tier actions and progression within the Management Plan process from year to year. Actions listed in Figure 3 are a guideline by which the Coalition will base its actions. The specific actions will be addressed in the individual Site Subwatershed Management Plans and the Coalition may chose to do more actions than are listed based on the magnitude and frequency of exceedances.

Priority A/B

Priority A/B constituents are applied metals, nutrients and pesticides for which there are Total Maximum Daily Loads (TMDLs) established and/or associated toxicity. Currently TMDLs have been established for chlorpyrifos and diazinon. If at the time of an applied pesticide or metals exceedance there was also an associated toxicity exceedance, then this constituent at this site subwatershed would become a priority A/B (Figure 3). Designation of constituents as priority A or B is based on factors including frequency of the exceedance, magnitude of the exceedance, flows at the time of the exceedance, and size of the site subwatershed and is made by the Coalition in collaboration with the Regional Board. Prioritization drives the allocation of resources to source identification, outreach and management practice evaluation. The primary difference between priority A and B constituents is the level of Coalition outreach in Tier 2.

Sourcing

Sourcing for priority A and B constituents includes using PUR data, and conducting additional monitoring during the first year of the management plan implementation (Figure 3, Tier 1). If an exceedance does not occur during the second year of a Management Plan for the priority A/B constituent within a site subwatershed then the actions of the Coalition stay within Tier 1. If an exceedance does occur during the second year of Management Plan implementation, the Coalition progresses to Tier 2. Tier 2 actions for sourcing include additional effort directed to sourcing of inputs including conducting additional upstream monitoring or a special study. If an exceedance occurs again during the third year of Management Plan implementation the Coalition actions will progress to Tier 3 which includes sourcing with PURs, additional monitoring and possible special studies.

For high priority subwatersheds, the Coalition will attempt to associate PUR data reported at a TRS level with an APN. This can be done by evaluating the size of the acreage to which the chemical was applied and matching that acreage with acreages associated with individual

parcels. The difficulty with associating TRS to APN is that there may be multiple APNs per TRS and one APN may cover more than one TRS.

The association will not work in every case but should be sufficiently accurate to aid the Coalition in focusing outreach to Coalition members within the subwatershed and conducting individual outreach. The PUR data will be evaluated for trends in application rates, application months and crops from year to year and between TRS. The Coalition will also review survey results from members that can be associated with APNs within TRS' that have had applications co-occuring with the exceedance. The baseline survey results will enable the Coalition to determine which members to contact first, focusing on those that have implemented minimal or no management practices and discharge directly into a waterbody. The Coalition will conduct grower and/or individual contacts for the high priority subwatersheds based on this information.

Situations may arise that the Coalition needs to source priority A/B constituents and PUR data are not available. PUR data can take from three to nine months to obtain depending on the county and the number of applications in a month. The Coalition may encounter exceedances of such magnitude that notification and outreach to growers must be done immediately and therefore sourcing cannot wait for the PUR data to be received. There may also be times when there is an exceedance for a chemical where there has been no reported use. Depending on the exact situation the Coalition may conduct specific outreach for growers in the area to discuss the exceedance and talk to growers about current practices. The Coalition can also focus its outreach based on past exceedances, crop types and previous TRS that have applied the constituent of concern during the same month in previous years.

Outreach

Outreach for priority A/B constituents within Tier 1 includes county grower meetings and site subwatershed grower meetings. If actions progress to Tier 2 due to additional exceedances, the Coalition will continue county grower meetings, site subwatershed grower meetings but will also implement grower group contacts. For example, the Coalition may conduct a meeting with almond growers if exceedances continue to occur due to dormant sprays on almond orchards. For priority A constituents the Coalition will conduct additional outreach and perform individual contacts. By Tier 3, both priority A and B constituents will lead to all four types of Coalition outreach from County grower meetings to individual contacts. There may be situations where the Coalition conducts individual contacts regardless of the tier due to magnitude and/or frequency of exceedances.

Evaluation of Management Practices

One of the most difficult actions facing the Coalition is evaluation of the effectiveness of management practices and outreach to growers. During the first year of Management Plan implementation the Coalition will conduct monitoring as outlined in the MRPP as well as additional monitoring (an extra sampling per month during irrigation season) to assess the impact of Coalition outreach. It is the goal of the Coalition that through county and

subwatershed meetings, Coalition efforts will have eliminated exceedances. If however exceedances continue during the first year of Management Plan monitoring, the outreach actions will progress to Tier 2. In Tier 2 the Coalition will monitor meeting attendance to assess grower participation and potential changes to grower practices. Tier 3 actions include assessment of meeting participation and additional monitoring.

The individual Site Subwatershed Management Plans for high priority subwatersheds will evaluate the sources of the priority A/B exceedances and use that information to recommend management practices within the area that could help eliminate exceedances. These will be recommendations that will be discussed at grower group meetings and during individual contacts. These management practice recommendations will be based on the characteristics of the applied active ingredients listed in Table 8 and the appropriate management practices listed in Table 9. In most cases, multiple management practices will need to be implemented to improve water quality. Tracking of management practices and evaluation the effectiveness of newly implemented management practices are described further in the section Management Practice Identification, Evaluation and Outreach.

Priority C

Priority C constituents include applied pesticides and metals that are not associated with toxicity and do not have an implemented TMDL but are associated with sediment, or have an implemented TMDL but are not associated with sediment. Priority C constituents can also be an applied pesticide or metal that has associated toxicity but does not have an implemented TMDL. For example, diuron is a priority C constituent if there are multiple exceedances in a specific site subwatershed at least one of which is associated with toxicity to *Selenastrum*. Priority C constituents have actions for sourcing, outreach and evaluation of management practices identical to priority A constituents but differs from priority A constituents in that there are no individual contacts for priority C constituents in Tier 2.

Priority D

Priority D constituents include applied pesticides and metals with no implemented TMDLs and which are not associated with sediment transported exceedances. Priority D constituents include water column toxicity associated with other water quality exceedances of priority A, B, and C constituents. Priority D constituents include those that can be associated with sediment toxicity. For water column toxicity that is not associated with an applied constituent, it is difficult for the Coalition to identify a source of the water impairment which then makes it difficult to focus outreach and BMP implementation. At this time sediment chemistry is not performed by the Coalition and sediment toxicity is difficult to associate with an applied constituent. Under the new MRPP submitted on August 25, 2008 which will be implemented October 2008, the Coalition will analyze for sediment chemistry in samples that exhibit sediment toxicity. Therefore these exceedances are of a lower priority for the Coalition. The Coalition actions for sourcing are the same as for priority B and C constituents. Outreach in Tier 1 and 2 include county grower meetings and site subwatershed grower meetings. In Tier 3, the

Coalition will increase outreach activities to include grower group contacts. Evaluation of management practices for Tier 1 and 2 will include normal monitoring and additional monitoring during the month when exceedances have occurred. In Tier 3 the Coalition will focus on meeting participation and may include additional locations for monitoring to better evaluate management practices.

Priority E

Priority E constituents include many of the physical parameters including total dissolved solids (TDS), specific conductance (EC), pH, dissolved oxygen (DO), temperature, and any other constituent that is not an applied pesticide or metal. Water column toxicity that has occurred within a site subwatershed where no priority A, B, or C constituent exceedances have occurred will also be classified as priority E. Source identification for these constituents is extremely difficult and can require expensive and sophisticated analytical tools. During grower outreach meetings, priority E exceedances will be addressed although no meetings will be held specifically for these constituents. Normal monitoring will be the only evaluation tool available to assess management of these constituents.

EC and TDS are measures of salt and are often found as exceedances together. EC and TDS exceedances are common in site subwatersheds in the Delta where shallow salty ground water commonly intrudes into the surface water drains. Sites in the Delta are also subject to tidal influence and it is assumed that the EC/TDS exceedances experienced at those sites (i.e. Kellogg Creek) are a result of the tidal prism moving water back into the creek. In addition, irrigation water is salty due to the recirculation of the water from the Delta Mendota Canal back to the San Joaquin River. It is important to note that exceedances of salt reflected as either or both EC and TDS is a problem throughout the Valley. The Coalition recognizes that EC and TDS exceedances need to be to be managed on a regional basis and will work with the Regional Board to develop a management plan when EC/TDS become a priority.

MANAGEMENT PLAN SCHEDULES

Management Plan Development Timelines

The SJCDWQC originally submitted 12 individual management plans during the spring of 2007. Table 10 lists all of the subwatersheds for which management plans were submitted. The Coalition reviewed and compiled the individual Management Plans listed below into a single Management Plan to streamline the approval process and comply with the current Management Plan requirements of the MRP Order No. 2008-0005. The single Management Plan includes updated monitoring results from 2004 through September 2007 and additional site subwatersheds requiring monitoring plans. Potato Slough and Marsh Creek are not included in this single Management Plan. Potato Slough is no longer monitored by the Coalition due to lack of access and Marsh Creek is no longer monitored due to urban influence as explained earlier in this Management Plan. The Calaveras River was sampled in 2004 during the irrigation season and experienced two color exceedances and has not been sampled since then.

Table 10. 2007 Schedule of Management Plans that have been submitted for each site subwatershed.

Subwatershed	Management Plan Due Date
Duck Creek	April 13, 2007
French Camp Slough	April 13, 2007
Grant Line Canal	March 23, 2007
Kellogg Creek	May 4, 2007
Littlejohns Creek	March 23, 2007
Lone Tree Creek	March 23, 2007
Marsh Creek	March 23, 2007
Mokelumne River	May 4, 2007
Potato Slough	May 4, 2007
Roberts Island Drain	May 18, 2007
Sand Creek	March 23, 2007
Terminous Tract	May 4, 2007

Management Plan Performance Goals and Schedules

Management Plan Process

The Coalition Management Plan will be updated yearly in April, after the Annual Monitoring Report has been submitted. The Management Plan will evaluate the impacts on water quality of both monitoring results and Coalition actions during the previous storm and irrigation seasons. An updated exceedance tally will be submitted and each site subwatershed will be evaluated to determine Coalition actions to be implemented during the upcoming year based on Management Plan constituents (both old and new), constituent priority and tier level. Based on updated site subwatershed information (new exceedances, improvements to water quality, implemented BMPs), the Coalition will develop new monitoring and action schedules for the upcoming year. A general overview of the Management Plan process is included in Table 11 listing the Coalition tasks (both actions and processes) and corresponding months in which those tasks will be performed from January 2008 till December 2009.

During October 2008 the Coalition will mail out Best Management Practice (BMP) Handbooks developed by the Center for Urban/Rural Environmental Stewardship (CURES) to all members with 15 or more acres enrolled in the program. The handbooks were originally designed for the Westside Coalition and contain information on farming practices such as sediment basins, polyacrylamide (PAM), enzyme treatments, tailwater return systems, vegetative ditches, irrigation scheduling and others (Attachment 1, example of Westside handbook). These documents are summaries of technical reports developed by the California Water Institute, Ducks Unlimited, California Department of Pesticide Regulation and others.

The Coalition Management Plan has been developed in accordance with an updated MRPP that was submitted to the Regional Board on August 25, 2008. The new MRPP identifies Core and Assessment sites and provides a new monitoring schedule. Management Plan sampling will commence in April 2008 under the previous MRPP (submitted in 2006). Winter sampling in 2009 will be the first season under the new MRPP and therefore when this Management Plan is reviewed in April 2009 it will integrate exceedances of new constituents and will take into account the new sampling design.

The Coalition will meet with the Regional Board prior to submittal of the Management Plan update and discuss the effectiveness of the current Management Plan design. The Coalition will work with the Regional Board to ensure that the Management Plan's performance goals, listed in the section Management Practice Performance Goals and Schedule, meet the requirements of the ILRP from annually.

Table 11. SJCDWQC Management Plan activity schedule.

Coalition Task	2008												2009											
	January	February	March	April	May	June	July	August	September	October	November	December	January	February	March	April	May	June	July	August	September	October	November	December
Additional / Upstream Monitoring				x	x	x	x	x	x							x	x	x	x	x	x			
PUR Data	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
County Grower Meetings*										x	x	x										x	x	x
Exceedance Notifications			x				x			x					x				x			x		
CURES SJCDWQC BMP Handbooks										x														
Quarterly Data Reports															x			x			x			x
Semi and Annual Monitoring Reports						x									x									
Management Plan Updates				x					x							x								
Updated MRPP and QAPP								x																
New MRPP activation										x														
Meetings with Regional Board											x			x			x			x			x	

*Months of meetings with growers will depend on availability of locations and speakers but are anticipated to occur before and after the irrigation season sampling. Grower group and individual contacts will depend on the specific exceedances and will be scheduled at a time to best inform growers of the issues and work with them for the months that there have been exceedances. A general range of dates is included in Table 15.

Management Plan Sampling Schedule

The 2008 Management Plan sampling schedule is outlined in Table 12. The Management Plan monitoring locations and sampling months are based on site subwatershed exceedances, exceedance prioritization and Management Plan tier level. Table 13 lists the sampling coordinates for Management Plan site subwatersheds including upstream sampling locations that were monitored during the 2008 irrigation season.

Table 12. 2008 Management Plan sampling schedule. U = upstream sampling. A = additional sampling.

Sample Site	Month	Type	Chlorpyrifos	Dieldrin	Metals	Copper	*Ceriodaphnia dubia*	*Selenastrum capricornutum*
Kellogg Creek along Hoffman Way	April	A					x	
Duck Creek @ Drais Rd	May	U	x					
Littlejohns Creek @ 26 Mile Rd	May	U			x			
Littlejohns Creek @ Escalon Bellota	May	U			x			
Lone Tree Creek @ Valley Home Rd	May	U			x			
Mokelumne River @ Bruella Rd	May	A						x
Mormon Slough @ Jacktone Rd	May	A	x					
Sand Creek @ Hwy 4 Bypass	May	A	x	x			x	
Littlejohns Creek @ 26 Mile Rd	June	U			x			
Littlejohns Creek @ Escalon Bellota	June	U			x			
Lone Tree Creek @ Valley Home Rd	June	U			x			
Mokelumne River @ Bruella Rd	June	A				x	x	
Sand Creek @ Hwy 4 Bypass	June	A	x	x			x	
Duck Creek @ Drais Rd	July	U	x					
Kellogg Creek along Hoffman Way	July	A				x		
Littlejohns Creek @ 26 Mile Rd	July	U			x			
Littlejohns Creek @ Escalon Bellota	July	U	x					x
Lone Tree Creek @ Brennan Rd	July	U	x		x			
Lone Tree Creek @ Valley Home Rd	July	U			x			
Mokelumne River @ Bruella Rd	July	A				x		x
Sand Creek @ Hwy 4 Bypass	July	A					x	
Unnamed Drain @ Wagner Rd	July	U	x					
Littlejohns Creek @ 26 Mile Rd	August	U			x			
Littlejohns Creek @ Escalon Bellota	August	U	x					x
Lone Tree Creek @ Brennan Rd	August	U	x		x			
Lone Tree Creek @ Valley Home Rd	August	U			x			
Mokelumne River @ Bruella Rd	August	A				x		x
Duck Creek @ Drais Rd	September	U	x					
Littlejohns Creek @ 26 Mile Rd	September	U			x			
Lone Tree Creek @ Brennan Rd	September	U			x			
Lone Tree Creek @ Valley Home Rd	September	U			x			
Mokelumne River @ Bruella Rd	September	A					x	
Mormon Slough @ Jacktone Rd	September	A	x					
Unnamed Drain @ Wagner Rd	September	U	x					

Table 13. 2008 Management Plan sampling locations.

Zone*	Management Plan Site Name	Upstream Site Name	Station Code	Latitude	Longitude
2	Duck Creek @ Highway 4		531XDCAHF	37.9491	-121.1810
		Duck Creek @ Drais Rd	531XDCADR	37.9348	-121.0841
2	French Camp Slough @ Airport Way		531SJC504	37.8817	-121.2493
4	Grant Line Canal @ Clifton Court Rd		544XGLCCR	37.8414	-121.5288
4	Grant Line Canal near Calpack Rd		544XGLCAA	37.8205	-121.4999
4	Kellogg Creek along Hoffman Lane		544XKCAHL	37.8819	-121.6522
2	Littlejohns Creek @ Jack Tone Rd		531XLCAJR	37.8896	-121.1461
		Littlejohns Creek @ 26 Mile Rd	531LCATMR	37.8932	-120.8776
		Littlejohns Creek @ Escalon Bellota Rd	531XLCAER	37.9255	-120.9991
2	Lone Tree Creek @ Jack Tone Rd		531XLTCJR	37.8376	-121.1438
		Lone Tree Creek @ Brennan Rd	535XLTABR	37.8255	-121.0159
		Lone Tree Creek @ Valley Home Rd	535LTCVHR	37.8202	-120.9022
1	Mokelumne River @ Bruella Rd		531XMRABR	38.1601	-121.2051
2	Mormon Slough @ Jack Tone Rd		544MSAJTR	37.9647	-121.1488
4	Roberts Island Drain @ Holt Rd		544RIDAHT	37.9556	-121.4223
4	Roberts Island Drain along House Rd		544RIDAHR	37.9702	-121.4074
6	Sand Creek @ Hwy 4 Bypass		544SCAHFB	37.9475	-121.7430
3	Terminous Tract Drain @ Hwy 12		544XTTHWT	38.1166	-121.4936
2	Unnamed Drain to Lone Tree Creek @ Jack Tone Rd		531UDLTAJ	37.8536	-121.1457
		Unnamed Drain to Lone Tree Creek @ Wagner Rd	531UDLTWR	37.8709	-121.0911

*The SJCDWQC MRPP submitted on August 25, 2008 includes a complete description of each zone.

Management Practice Identification, Evaluation, and Outreach

Each year exceedances are identified and the source of the exceedance is investigated using one or more of the following: PURs, TIEs, past applications, and additional monitoring. Sourcing of priority A and B level exceedances will be used to focus outreach. Depending on the tier and priority of the exceedance, the Coalition will identify management practices that will be effective within that area. If the exceedance is a priority A constituent in Tier 2 or 3, the Coalition will undertake individual contacts if necessary to determine current management practices and inform growers of management practices that can be implemented to improve water quality. Table 14 outlines the site subwatershed by tier level and for each level lists the priority level and Coalition actions that will be performed in 2008/2009.

The Coalition will use various surveys to understand current management practices implemented within the Coalition region and to evaluate changes in practices and effectiveness of both current and new practices on water quality. The Coalition will use three types of surveys: general surveys, grower group surveys and individual surveys. The general survey has been mailed to all members within the Coalition area. Returned surveys have been entered into an Access database and are being linked to member information. The difficulty of using general surveys is that a single grower may fill out a survey for each parcel that he/she manages or they may fill out one survey for multiple parcels in multiple subwatersheds. The Coalition is currently going through all returned surveys and assigning member IDs, APNs and site subwatersheds to the surveys to be used to create a baseline database of management practices. For high priority subwatersheds, grower group and individual surveys will be used to assess at a grower and parcel level management practice implementation and effectiveness. Further descriptions of all three surveys are included below.

General Survey

The SJCDWQC General Survey will be used as a baseline assessment of overall Coalition management practices. The Coalition will link surveys with individual parcels by November 2008 and conduct an analysis of management practices (as indicated by survey results) for all site subwatersheds by December 2008 (see Table 16). The Coalition has previously summarized the results of the surveys by site subwatershed however this analysis will allow the Coalition to evaluate management practices on a parcel level.

Grower Group Survey

The Grower Group Survey will be handed out at grower specific meetings in priority subwatersheds. Groups include specific crop growers (row crops, grapes, orchards) and/or groups who use specific types of pesticides (i.e. organophosphates, herbicides, pyrethroids). These surveys will be included with meeting handouts and will assess whether a member has already filled out a general survey and whether they are interested in having a Coalition representative contact them to do an on-site assessment of their current management practices.

Individual Grower Meetings (Checklist)

The Individual Grower Checklist will be filled out by a Coalition representative during meetings with individual growers in high priority subwatersheds. These growers will be identified and contacted based on the following criteria:

- Within a high priority management plan subwatershed,
- Have been identified as applying a chemical that is associated with a water quality exceedance,
- Active member of the Coalition,
- Close proximity to the watershed that could result in discharge of agricultural water.

The goal of individual grower meetings is to obtain information about current management practices from growers that have applied chemicals at times co-occurring with water quality exceedances. The grower will be asked to meet with Coalition representatives and the Coalition representative will fill out the checklist during the interview with the grower. The grower will be informed of additional management practices that he/she can implement to reduce agricultural discharge as well as information regarding Proposition 84 and NRCS/EQIP funds for management practice implementation. In addition the grower will be asked if he/she is willing to update their practices on a yearly basis. The Coalition representative will return in a year to record newly implemented management practices and discuss water quality monitoring results. In addition, growers that are willing to conduct interviews with Coalition representatives and keep records of management practice implementation will be given higher priority for Proposition 84 funds for additional management practice implementation.

The Individual Grower Checklists are based loosely on the Central Coast Irrigated Lands Regulatory Program Management Practice checklist as well as surveys used in the Butte and Glenn County Best Management Practices Evaluation. Separate checklists were created for pest management, irrigation water management, dormant spray management, erosion and sediment management and nutrient management. Only appropriate checklists will be filled out during each interview. The Coalition representative will be knowledgeable of previous pesticide use, current water quality issues for that site subwatershed, and management practices known to be effective for the particular exceedance and conditions on the farm. Therefore, checklists will be selected and filled out based on the exceedances experienced.

Unlike the General Survey, the checklists will be filled out by the Coalition representative in the presence of the grower. Checklist completion will be an interactive process. The same person will fill out each checklist eliminating bias and misinterpretation. In addition, the Coalition expects a 100% return rate since the checklists will be filled out at the time of the interview. Conducting individual grower contacts is both time and money intensive. The Coalition will conduct the first set of interviews in the Duck Creek @ Hwy 4 subwatershed as a pilot project to determine the effectiveness of this strategy. Effectiveness will be assessed based on:

- Cost to Coalition per interview,
- Ability to compile management practices in one location,

- Ability to link management practices to grower membership information, past survey, results and current subwatershed water quality results, and
- General response of growers during and after the interviews.

EXAMPLE CHECKLIST

Grower Group Survey

First Name: _____
Last Name: _____
Are you a Coalition member? Yes / No Since (list year): _____
How many other Coalition meetings have you attended prior to this one? 0 1 2 3 >4
Did you fill out a General Survey (mailed with membership application)? Yes / No
Are you interested in conducting a farm specific assessment of your current management practices and receive additional information (and possibly support) for future management practice implementation? Yes / No
If yes, when would you prefer to conduct a farm specific assessment? _____
How can the Coalition reach you? Email / Phone / Other _____
Email: _____
Phone: _____
Did you find this meeting useful? Yes / No
What management practice(s) do you intend to employ after attending this meeting?

_____

_____

Comments/suggestions:

_____

_____

_____

EXAMPLE CHECKLIST

Checklist Cover Sheet (applies to all checklists filled out for a grower)

Subwatershed
Grower Name
County

APN(s)	TRS	Crop	Acres
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Crop Type: Field Crop / Row Crop / Orchard / Vineyard / Rice / Pasture / Other: _____
Field properly graded: yes / no
Contaminant pad with sump pump: yes / no
Surface where pesticides/fertilizer mixing/loading takes place: Concrete or asphalt pad / field / soil or gravel / hard packed or paved road
Minimum distance between any pesticide or fertilizer mixing/loading area and any waterway: 0-20 ft / 20-100 ft / > 100 ft
Minimum distance between any pesticide or fertilizer mixing/loading area and any deep well locations: 0-20 ft / 20-100 ft / > 100 ft
Pesticide mixing/loading management practices:

Check for faulty hoses and ensure drain is in place prior to filling the tank
Do not overflow tank
Use an airgap between the fill tube and the tank
During mixing/loading tank is less than full to minimize spills
Someone is present during pesticide/fertilizer mixing/loading operations to watch for spills
Clean up after pesticide/fertilizer spills promptly

How do you dispose of rinsate from your sprayer(s)? Mix with water and reapply to field / Store in a hazardous waste container / dispose in field more than 150 feet from surface waters / dispose in field less than 150 feet from surface waters / Not Applicable

Where do you clean spray application equipment? On a mixing/loading pad / on application site (rinseate re-applied to field) / More than 150 feet from surface waters / Less than 150 feet from surface waters

How do you handle empty pesticide containers? Triple rinsed, taken to landfill or recycling handler / triple rinsed, then put on burn pile / put on burn pile

EXAMPLE CHECKLIST

Pest Management Checklist

Pesticide exceedances within this subwatershed: Analyte (date)
Chemical and products applied in the past (based on PUR data):
At what rate do you apply (product)? _____ lbs/acre
Structural Management Practices:

Spray management practices (applicable / not applicable):

adjust spray nozzles to match crop canopy profile
outside nozzles shut off when spraying outer rows next to sensitive sites
uses of nozzles that provide largest effective droplet size to minimize drift
spray areas close to waterbodies when the wind is blowing away from the waterbodies
Use electronic controlled sprayer nozzles (e.g. Smart Sprayer)
Use air blast applications when wind is between 3-10 mph and upwind of a sensitive site

How often is spray equipment calibrated? Prior to each application / once per month / once per year / never
Have you considered alternative strategies to using diazinon or chlorpyrfios either during the dormant or growing season? Yes / No
Do you normally spot treat or treat an entire field to prevent further infestation? Spot-treat only / Treat whole field always / Both spot-treat and treat whole field depending on conditions
Is crop rotation used to avoid buildup of pest populations? Yes / No / Not applicable

EXAMPLE CHECKLIST

Irrigation Water Management Checklist

Irrigation System: Surface / Sprinkler / Microirrigation / None / Other: _____

Irrigation management practices:

Optimize irrigation efficiency but maintaining appropriate slopes, tillage, furrow lengths, and irrigation set times

Use drainage basins (sediment ponds) or wetlands to capture and retain runoff for 72 hours

Use tailwater return system

Use of Polyacrylamide (PAM) to increase water infiltration and reduce furrow erosion

Schedule irrigations based on actual moisture levels

EXAMPLE CHECKLIST

Dormant Spray Management Checklist

How many acres sprayed with dormant pesticides are within 100' upslope of any surfacewater (including ag ditches)? _____acres

Do you apply when soil moisture is at field capacity? Yes / No

Prior to applying winter dormant sprays, what is the condition of your orchard floor?

Vegetative Cover / Some Vegetation / Vegetated Cover w/Sprayed Berms / Disked / No Vegetation and Not Disked

Do you contain runoff from your orchard(s)? Yes / No / No runoff on property

Have you been informed of methods to reduce the potential of pesticide runoff? Yes / No

Dormant spray management practices:

Check weather conditions prior to spraying

Use vegetative filter stips

Use grass row centers

Tailwater return system

Maintain setback zones

Check droplet size of nozzles

Calibrate nozzles

EXAMPLE CHECKLIST

Erosion and Sediment Management Checklist

Sediment management practices:

Vegetation is planted or allowed to grow in and along ditches

Maintain vegetated filter strips at least 10’ wide

Use of Polyacrylamide (PAM) to increase water infiltration and reduce furrow erosion

Sediment control basins

Settling ponds

Constructed wetlands

EXAMPLE CHECKLIST

Nutrient and Manure Management

What factors are used to determine fertilizer applications? Current crop needs / Current production goals
Is nitrogen supplied in excess of total crop needs? Yes / No
Nutrient management practices:

- Soil samples are collected and analyzed for current nutrient levels prior to planting
- Assess plan fertilizer needs by taking plant tissue samples mid to late season
- Fertilizers are placed where maximum plant uptake can occur
- Proper backflow devices are installed when injecting fertilizer into irrigation water
- Applicators are made aware of sensitive areas to be avoided prior to application

Do you currently apply manure to your irrigated lands? Yes / No
What types of manure are you likely to apply in the next 5 years? Dairy / chicken / other: _____
What is the average rate per acre of manure that you apply annually? _____ lbs/acre
How close are surface water ways to the field where you apply manure? Adjacent / <100 ft / <300 ft / >300 ft

EXAMPLE CHECKLIST

Recommended Practices

Pesticide mixing/loading management practices:

Check for faulty hoses and ensure drain is in place prior to filling the tank
Do not overflow tank
Use an airgap between the fill tube and the tank
During mixing/loading tank is less than full to minimize spills
Someone is present during pesticide/fertilizer mixing/loading operations to watch for spills
Clean up after pesticide/fertilizer spills promptly

Spray management practices (applicable / not applicable):

adjust spray nozzles to match crop canopy profile
outside nozzles shut off when spraying outer rows next to sensitive sites
uses of nozzles that provide largest effective droplet size to minimize drift
spray areas close to waterbodies when the wind is blowing away from the waterbodies
Use electronic controlled sprayer nozzles (e.g. Smart Sprayer)
Use air blast applications when wind is between 3-10 mph and upwind of a sensitive site

Irrigation management practices:

Optimize irrigation efficiency but maintaining appropriate slopes, tillage, furrow lengths, and irrigation set times
Use drainage basins (sediment ponds) or wetlands to capture and retain runoff for 72 hours
Use tailwater return system
Use of Polyacrylamide (PAM) to increase water infiltration and reduce furrow erosion
Schedule irrigations based on actual moisture levels

Dormant spray management practices:

Check weather conditions prior to spraying
Use vegetative filter stips
Use grass row centers
Tailwater return system
Maintain setback zones
Check droplet size of nozzles

Calibrate nozzles

Sediment management practices:

Vegetation is planted or allowed to grow in and along ditches

EXAMPLE CHECKLIST

Maintain vegetated filter strips at least 10’ wide

Use of Polyacrylamide (PAM) to increase water infiltration and reduce furrow erosion

Sediment control basins

Settling ponds

Constructed wetlands

Other:

_____

_____

_____

_____

Comments:

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This winter the Coalition will conduct individual contacts within the Duck Creek @ Hwy 4 site subwatershed and use checklists similar to those provided above to record parcel specific management practices and recommend additional management practices. The recommended management practices will be recorded and participating growers will be visited in a year to determine which, if any, new practices were implemented. After conducting individual contacts in Duck Creek, the Coalition will proceed with individual contacts in the Lone Tree Creek and Unnamed Drain to Lone Tree Creek subwatersheds (Table 16). Individual grower information will remain confidential between the Coalition and grower. This information will be used to evaluate water quality monitoring results to assess any trends/associations between water quality and improved management practices.

Evaluation of management practices will not be based solely on water quality although the goal of implementing management practices is to improve water quality. The Coalition will monitor how many and what types of new management practices are implemented as well as the number of growers that volunteer to work with the Coalition to track practices from year to year. Table 15 describes management practice identification, evaluation and outreach and who will be responsible for implementation of each of those actions. A management practice tracking and evaluation schedule for high priority subwatersheds is included in Table 16. Based on the analysis of source information for high priority subwatersheds, management practices that may reduce agricultural runoff are identified and will be recommended to growers during individual contacts. These practices are outlined in Table 17 including the anticipated implementation date (may be implemented sooner) and the date when the Coalition will evaluate the effectiveness of the management practice. The evaluation date is the date when the Coalition will include an evaluation analysis in the Management Plan update.

Table 14. A list of site subwatershed tiers and corresponding level of actions for 2008. Some site subwatersheds are in both Tier 1 and Tier 2 for different constituents.

		Sourcing			Outreach				Evaluation		
	Priority	PUR Data	Additional / Upstream Monitoring	Special Studies	County Grower Meetings	Site Subwatershed Grower Meetings	Grower Group Contacts	Individual Contacts	Meeting Participation	Normal Monitoring	Additional / Upstream Monitoring / Special Study
Tier 1 Subwatersheds											
French Camp Slough	B	x	x		x	x			x	x	x
Grant Line @ Clifton Ct	A	x	x		x	x			x	x	x
Grant Line near Calpack Rd	A	x	x		x	x			x	x	x
Kellogg Creek	C	x	x		x	x			x	x	x
Littlejohns Creek	C	x	x		x	x			x	x	x
Lone Tree Creek	C	x	x		x	x			x	x	x
Unnamed Drain to Lone Tree Creek	C	x	x		x	x			x	x	x
Mokelumne River	C	x	x		x	x			x	x	x
Mormon Slough	A	x	x		x	x			x	x	x
Roberts Island @ Holt Rd	D	x			x	x			x	x	
Roberts Island along House Rd	D	x			x	x			x	x	
Sand Creek	B	x	x		x	x			x	x	x
Terminous Tract	D	x			x	x			x	x	
Tier 2 Subwatersheds											
Duck Creek	A	x	x		x	x	x	x	x	x	x
Grant Line @ Clifton Ct	B	x	x		x	x			x	x	x
Littlejohns Creek	B	x	x		x	x			x	x	x
Lone Tree Creek	A	x	x		x	x	x	x	x	x	x
Unnamed Drain to Lone Tree Creek	A	x	x		x	x	x	x	x	x	x
Mokelumne River	C	x	x		x	x			x	x	x

Table 15. Management Plan sourcing, outreach and evaluation schedule.

Action	Description	When
SOURCING		
(1) PUR data	Request pesticide use information from County Agricultural Commissioners to identify specific problem applications.	Standing requests with Ag Commissioners to receive data as soon as possible.
(2) Additional Monitoring	Additional monitoring within the subwatershed to either twice during the month to narrow down the temporal source of the problem or move upstream to narrow down possible inputs that may contribute to the exceedance.	Irrigation months when past exceedances occurred.
(3) Special Studies	Special studies will occur when additional information about potential sources needs to be obtained beyond the additional monitoring.	Will be specific to the situation.
OUTREACH		
(1) County grower meetings and (2) site subwatershed grower meetings	Hold meetings for growers in the subwatershed to discuss management practices that can be used to eliminate exceedances and to encourage implementation of new management practices. Provide monitoring results to growers to inform farmers, landowners and/or stakeholders about water quality problems.	Between each season (storm and irrigation)
(3) Grower group meetings	Provide information and outreach materials about management practices that could be used by growers to reduce the impact of agriculture on water quality specific to a group of growers (i.e walnut or alfafa growers).	Between each season (storm and irrigation) and as needed
(4) Individual contacts	Conduct individual interviews with farmers, landowners and/or stakeholders to discuss water quality issues, current management practices and recommended management practices to improve water quality.	Winter (November to February)
EVALUATION		
(1) Meeting participation	Assess effectiveness of Coalition meetings by tracking attendance, documenting management practice implementation and monitoring water quality exceedances. Document where and when management practices have been implemented in order to track effects on water quality at relevant monitoring sites through individual grower meetings.	Annually in Management Plan updates
(2) Normal monitoring	Normal monitoring at Core and Assessment Monitoring locations as part of the SJCDWQC MRPP submitted in 2008. Not all sites will be monitored under the 2008 MRPP. These results will supplement additional monitoring conducted under the Management Plan.	Once a month, every month of the year.
(3) Additional Monitoring (+1 time/month)	Additional monitoring conducted for specific constituents (Priority A-C) during months where previous exceedances have occurred. Results will be used to evaluate improvements in water quality.	Once a month in months where previous exceedances have occurred as part of Tier 1 actions (Figure 3).

Action	Description	When
(4) Additional Monitoring (+additional locations)	Additional monitoring conducted for for specific constituents (Priority A-C) during months where previous exceedances have occurred at locations upstream of the site under the Management Plan. Upstream sampling results will be used to evaluate improvements in water quality.	Once a month in months where previous exceedances have occurred as part of Tier 2 and 3 actions (Figure 3).
(5) Additional Monitoring (special study)	Additional monitoring for special studies will be done to evaluate specific management practice effectiveness.	As specified in the Site Subwatershed Management Plan.

Table 16. Management Plan tracking schedule.

Priority Subwatershed Evaluation of Management Practices	Duck Creek @ Hwy 4	Lone Tree Creek @ Jack Tone Rd	Unnamed Drain to Lone Tree Creek @ Jack Tone Rd
Associate baseline survey responses with member APNs.	November 2008	November 2008	November 2008
Determine number/type of management practices currently in place.	December 2008	December 2008	December 2008
Group Grower Contacts[1]	October 2008 - April 2009	October 2008 – April 2009	October 2008 – April 2009
Individual Contacts	December 2008 – February 2009	January 2009 – March 2009	February 2009 – April 2009
Implementation of new management practices.	April 2009 – February 2010	April 2009 – February 2010	April 2009 – February 2010
Assess number/type of new management practices implemented.	October 2009 -February 2010	October 2009 - February 2011	October 2009 - February 2011
Evaluate effectiveness of new management practices[2].	April 2009 – February 2010	April 2009 – February 2010	April 2009 – February 2010

[1]Grower Group Contacts are outlined in the Site Subwatershed Management Plans and may not be applicable for all constituents.
[2]Evaluating effectiveness will be dependent on the type of management practice implemented. This is general guideline to be used for practices that can be assessed without special study monitoring.

Table 17. Management Plan implementation schedule.

Constituent	Management Practice	Constituents of Concern	Anticipated Implementation Date	Anticipated Evaluation Date
Lone Tree Creek @ Jack Tone Rd	Reduction in application rates	Chlorpyrifos	April - September 2009	April 2010
	Sprinkler or microspray irrigation	Chlorpyrifos	December 2010	April 2011
	Retention pond/holding basin	Chlorpyrifos, Copper, Diuron, *Selenastrum* toxicity, Sediment toxicity	December 2010	April 2011
Duck Creek @ Hwy 4	Reduction in application rates	Chlorpyrifos	April - September 2009	April 2010
	Sprinkler or microspray irrigation	Chlorpyrifos	December 2010	April 2011
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	Reduction in application rates	Chlorpyrifos	April - September 2009	April 2010
	Sprinkler or microspray irrigation	Chlorpyrifos	December 2010	April 2011
	Retention pond/holding basin	Chlorpyrifos	December 2010	April 2011
	Center grass rows, grass waterways, or grass filter strips	Chlorpyrifos, Diuron, *Selenastrum* toxicity	December 2010	April 2011

Management Practice Performance Goals

SJCDWQC Management Practice Performance Goal: *To continue to monitor and analyze the water and sediment quality of SJCDWQC site subwatersheds and to facilitate the implementation of management practices by providing outreach and support to growers in order to effectively enhance water quality in the Coalition region.*

Water Quality Management Practice Performance Goal #1: Identify potential sources of exceedances.

Strategy

Monitoring during irrigation and storm seasons as outlined in the SJCDWQC Quality Assurance Project Plan will continue to provide insight on when and where exceedances, and/or other water quality impairments, are experienced in the Coalition region. As presented in the Coalition's Monitoring and Reporting Program Plan, the primary method of source identification is to use the pesticide use reports (PURs) filed with each County Agricultural Commissioner. For individual pesticide or metals exceedances, results from the PURs are compiled for that specific chemical. For toxicity in either the water column or sediment, PURs are evaluated for pesticides that have either low K_{oc}/high solubility values (water column) or high K_{oc} values (sediment) as outlined above. In situations where PUR data are not available (either no reported use or delays in obtaining PUR information from the Agricultural Commissioner) the Coalition may use PUR data from previous years to focus resources based on trends of crops and applications of the chemical of concern.

Performance Measures

1.1 Continue irrigation and storm monitoring for exceedances at Coalition sites.

1.2 Request pesticide use information from County Agricultural Commissioners.

1.3 Identify applications with the potential to cause toxicity or result in an exceedance of a specific chemical.

Water Quality Management Practice Performance Goal #2: Inform growers with irrigated crop land about water sampling results and obtain information on management practices.

Strategy

Results are provided to all Coalition members through mailings, personal contact, and meetings. Local workshops are organized for the subwatershed to inform growers when and where toxicity or an exceedance occurs. Prior to those meetings landowners and operators (both coalition members and non members) are contacted by the Coalition by mail about the specific exceedances in their site subwatershed. Coalition members also receive the Watershed Coalition News, published by the Coalition for Urban/Rural Environmental Stewardship that

provides information on current Coalition activities including summaries of significant trends in monitoring results across the entire Central Valley. Additionally, the SJCDWQC holds meetings in both of the counties, San Joaquin and Contra Costa, on a seasonal basis. In these meetings results of the Coalition monitoring program are presented, and information on BMPs is provided.

Performance Measures

2.1 Provide monitoring results to all Coalition members and other interested parties.

2.2 Provided monitoring results at annual meetings in the winter of 2008-09.

2.3 Encourage growers to implement new management practices where applicable.

2.4 Document where and when management practices have been implemented in order to track effects on water quality at relevant monitoring sites.

Water Quality Management Practice Performance Goal #3: Provide growers with information on Best Management Practices to address toxicity or exceedances of water quality standards.

Strategy

Exceedances are communicated to growers through Coalition mailings and at meetings at the County and site subwatershed level. Presentations on the use of management practices to address specific constituents are made at these meetings. It is the landowner's responsibility to implement management practices on their farms where appropriate and the Coalition's responsibility to provide appropriate resources and support and track the implementation of management practices. Depending on the causes of the exceedances, actions taken by the Coalition could include a targeted outreach program, meeting, and/or educational material dissemination. The overall goal of this outreach is to encourage the adoption of specific management practices or modify specific farm inputs to prevent movement of the constituent of concern into the impacted surface water. Coalition members who do not implement additional management practices to eliminate water quality exceedances will be removed from the Coalition member list at such time as it is apparent that they are not making a good faith effort to improve water quality.

Performance Measures

3.1 Hold meetings for growers to discuss management practices that can be used to eliminate exceedances.

3.2 When available, provide information on the results of the management practices studies (described below).

3.3 Assess effectiveness of Coalition meetings by tracking attendance, documenting management practice implementation and monitoring water quality exceedances.

Water Quality Management Practice Performance Goal #4: Provide support to growers to implement management practices that will reduce the impact of discharges from agriculture on water quality.

Strategy

Using resources and information available to the Coalition, presentations and materials (by handout or by mail) will provide information and support regarding relevant management practices that could be used by growers based on their land use, pesticide use, and region. Information on management practices will be based on current BMP research results or professional advice from non-profit organizations such as CURES or other relevant agencies such as the County Agricultural Commissioner's office, Department of Pesticide Regulation or registrants of pesticides detected in monitoring. The Coalition will also provide information for funding of structural management practice implementation through Proposition 84 funds and EQIP funds.

Where general outreach and educational efforts do not show beneficial results (such as the implementation of new management practices or improvements in water quality), management practices will be investigated by Coalition representatives and brought forth to growers on a personal basis. Personal or individual contacts will occur in priority subwatersheds (Table 15).

Performance Measures

4.1 Provide information and outreach materials about Management Practices that could be used by growers to reduce the impact of agriculture on water quality.

4.2 Where general outreach and education efforts do not result in the implementation of effective management practices or improvements in water quality in the subwatershed, growers who have the potential to impact water quality through use of specific pesticides will be contacted individually in order to ensure that management practices are being employed.

Water Quality Management Practice Performance Goal #5: Perform evaluations of management practices suitable for San Joaquin County and Delta Water Quality Coalition irrigated agriculture.

Strategy

CURES, the Westside San Joaquin River Watershed Coalition, local irrigation and water districts and Coalition landowners/operators are sponsoring a project addressing water quality in Orestimba Creek which will be applicable to areas of the SJCDWQC. Funded through a State Water Resources Control Board grant (*Western San Joaquin Valley Pesticide BMP*

Implementation Program), the project emphasizes developing information on the effectiveness of several management practices. The SJCDWQC obtained a Proposition 50 grant to evaluate management practices for control of pesticides on several crop types in the Lone Tree Creek and Grant Line Canal watersheds. Projects goals relevant to the SJCDWQC include:

- Evaluate the effectiveness of three management practices installed on commercial farms in the Grant Line Canal and Lone Tree Creek watersheds for mitigation of pesticide runoff (vegetated ditch, constructed wetland, PAM use in row crops).
- Compile and analyze results of the management practice effectiveness studies conducted in Grant Line Canal and the Lone Tree Creek watersheds.
- Perform outreach and education. Present the effects and benefits of the studied management practices to crop advisors and growers. Update informational booklets detailing management practices for row crops and orchard crops.

The Coalition has reviewed use reports and believes that spray drift may be a cause of exceedances of metals, pesticides and toxicity in the Coalition region. Proper application procedures could reduce the amount of drift, and applicator equipment is one aspect that can be addressed. Information on managing spray drift when using pesticides was distributed in direct mailings to landowners in October 2006. Effectiveness of these practices will be evaluated through monitoring in both the irrigation and storm seasons as described in the QAPP.

Performance Measures

5.1 Communicate results of management practices efficiency studies to landowners as results become available.

5.2 Monitoring at sites with exceedances will occur after implementation of management practices to evaluate effectiveness within each subwatershed.

Water Quality Management Practice Performance Goal #6: Work with pesticide retailers and Pest Control Advisors to assist in providing outreach to growers and applicators in the Coalition region.

Strategy

CURES and the Coalition are working with the sales representatives and pest control advisors (who recommend the use of products) to promote use of management practices when applying the product. Coalition meetings have been held with Continuing education credits units and have been attended by numerous pest control advisors over the last year. The Coalition will continue to communicate with pest control advisors that provide recommendations in the management plan area.

Performance Measures

6.1 Provide management practice information to growers by working with sales representatives and pest control advisors to promote BMPs in the management plan region.

Water Quality Management Practice Performance Goal #7: Anticipate potential water quality problems caused by agricultural inputs.

Strategy

Coalition sampling indicates sediment toxicity has been found in many Coalition subwatersheds. Current technology used by commercial laboratories that analyze Coalition samples does not allow for identification of this sediment toxicity. However, studies of numerous water bodies in the San Joaquin River watershed by the University of California indicate presence of pyrethroid insecticides in sediment samples where toxicity is observed. As a result of this information, the Coalition through information provided by CURES is now encouraging growers to adopt various management practices to minimize sediment runoff and spray drift where pyrethroids and other crop inputs are used. Management practices targeted to sediment are outlined in two publications that the Coalition has distributed to growers entitled *"Pyrethroid Insecticides/Orchards; Management Practices for Protecting Water"* and *"Pyrethroid Insecticides/Row Crops, Management Practices for Protecting Water."* These 8-page publications outline numerous practices to manage off site movement of pyrethroids through irrigation runoff or spray drift.

Actions

7.1 Distribute management practices publications on preventing movement of pyrethroids in irrigation runoff or through drift.

Strategy Summary

The activities outlined in this document address the exceedances in Coalition subwatersheds that triggered this Management Plan, and also any exceedances that may arise in the future. Summarized below is the information presented in this management plan (Table 18).

Past Exceedances

- The Coalition has provided information on exceedances in this subwatershed to all Coalition members in the subwatersheds that have shown exceedances. Furthermore, and with the initiation of this Management Plan, the Coalition has:
    - Contacted each grower with an explanation of the exceedances and a request for completion of the management practices survey.
    - Contacted growers and distributed management practices surveys.

- Scheduled meetings for growers to discuss the exceedances and management practices. Regional Board staff is invited to attend all meetings.
- Worked with sales representatives and pest control advisors to promote effective management of chemicals in the management plan region.
- Communicate the results of current management practices studies to growers and operators in the Coalition region.

Future Exceedances

- Contact each grower with an explanation of the exceedances.
- Schedule meetings to discuss the exceedances and management practices. The dates and times of the meetings will be provided to the Regional Water Board when the Coalition can identify meeting locations and available dates. As is true with all meetings with growers, Regional Board staff is invited to attend.

Strategy Planning Table

Management Goal: To continue to monitor and analyze the water and sediment quality of SJCDWQC site subwatersheds and to facilitate the implementation of management practices by providing outreach and support to growers in order to effectively enhance water quality in the Coalition region.

Table 18. Management Plan performance goals, performance measures, outputs (direct results of actions) and outcomes (indirect results of actions).

Performance Goal/Performance Measure	Outputs	Outcomes	Who
Performance Goal 1: *Identify sources of pesticides, toxicity and other exceedances in Coalition subwatersheds.*			
Performance Measure 1.1 - Continue irrigation and storm monitoring for exceedances.	Results show what water quality standards are being exceeded per monitoring location.	Results overtime show trends and problem areas to address.	MLJ LLC*
Performance Measure 1.2 - Request pesticide use information from County Agricultural Commissioners.	PUR reports will indicate where chemicals are being used.	Specific problem applications identified.	MLJ LLC*
Performance Measure 1.3 - Identify applications with the potential to cause toxicity or result in an exceedance of a specific chemical.	Possible source applications will be identified.	Particular landowners or application events will be targeted through outreach.	Terry Pritchard
Performance Goal 2: *Inform growers with irrigated crop land about water sampling results and obtain information on management practices.*			
Performance Measure 2.1 - Provide monitoring results to growers as hard copies through Coalition mailings.	Coalition landowners and interested parties will read results from Coalition monitoring program.	Farmers, Landowners, and/or Stakeholders will be informed about the water quality problems in the subwatershed.	Mike Wackman, MLJ LLC*,
Performance Measure 2.2 – Provided monitoring results at annual meetings in the winter of 2008-09.	New management practices will be implemented.	Chemical or other harmful inputs from agriculture will be reduced.	Growers
Performance Measure 2.3 - Growers implement new management practices where applicable.	Determine location and type of Management Practice implementation.	Evaluate effectiveness of Coalition program to help implement good Management Practices through water quality sampling.	Mike Wackman, MLJ LLC*
Performance Measure 2.4 - Document where and when management practices have been implemented in order to track effects on water quality at relevant monitoring sites.	Record of Management Practices implemented will be available.	The Coalition program can monitor the success or failure of Management Practices implementation from water quality sampling.	Mike Wackman, MLJ LLC*

Performance Goal/Performance Measure	Outputs	Outcomes	Who
Performance Goal 3: *Conduct meetings in Coalition counties to provide growers with information on management practices to address toxicity or exceedances of water quality standards found in sampling results.*			
Performance Measure 3.1 - Hold meetings for growers in to discuss management practices that can be used to eliminate exceedances.	Meetings will be held and best management practices will be discussed.	Growers will implement new management practices where needed.	Mike Wackman, Terry Pritchard, Growers
Performance Measure 3.2 – When available, provide information on the results of the management practices studies.	Management practice handouts and pamphlets.	Growers will have up to date information on effective management practices that they can implement.	Mike Wackman, Terry Pritchard, Growers
Performance Measure 3.2 - Assess effectiveness of Coalition meetings by tracking attendance, documenting management practice implementation and monitoring water quality exceedances.	Coalition will keep track of attendance at meetings, Management Practices changes, and continue to monitor water quality.	Effectiveness of outreach can be judged and Coalition strategies can be shaped around these results.	Mike Wackman
Performance Goal 4: *Provide support to growers to implement management practices that will reduce the impact of agriculture on water quality.*			
Performance Measure 4.1 - Provide information and outreach materials about Management Practices that could be used by growers to reduce the impact of agriculture on water quality.	Educational materials will be provided to growers and outreach will occur in the Coalition region.	Growers will implement new management practices where they are needed.	Mike Wackman, Terry Pritchard
Performance Measure 4.2 - Where general outreach and education efforts do not result in the implementation of better management practices or better water quality in the subwatershed, growers will be dealt with personally in order to ensure that BMPs are being employed.	Growers will be dealt with personally and outreach will occur in the field to implement good management practices.	Water quality will improve where beneficial management practices have been implemented.	Mike Wackman, Terry Pritchard
Performance Goal 5: *Perform evaluations of management practices suitable for San Joaquin County and Delta Water Quality Coalition irrigated agriculture.*			
Performance Measure 5.1 - Communicate results of management practices efficiency studies to landowners as results become available.	Results made available at meetings with growers and mailings.	Grower will use new management practices where it is needed.	Mike Wackman, Terry Pritchard, Growers

Performance Goal/Performance Measure	Outputs	Outcomes	Who
Performance Measure 5.2 - Monitoring at sites with exceedances will occur after implementation of management practices to evaluate effectiveness within each subwatershed.	Sites downstream of farms that have implemented new Management Practices will be evaluated for any changes in water quality.	MPs will be proven to show water quality improvements, and can be shared to other growers.	MLJ LLC*, Mike Wackman, Terry Pritchard, Growers
Performance Goal 6: *Work with pesticide retailers and Pest Control Advisors to assist in providing outreach to growers and applicators in the Coalition region.*			
Performance Measure 6.1 - Provide outreach to growers by working with sales representatives and pest control advisors to promote BMPs in the management plan region.	Collaboration will occur and BMPs will be sufficiently communicated to growers.	Grower will use new management practices where it is needed.	Mike Wackman, Terry Pritchard, Growers
Performance Goal 7: *Anticipate potential water quality problems caused by agricultural inputs.*			
Performance Measure 7.1 - Distribute management practice publications on preventing movement of pyrethroids in irrigation runoff or through drift.	Publications will be mailed/and or distributed at meetings.	Coalition members will be more aware of how to prevent pyrethroid seepage.	Mike Wackman, Terry Pritchard

*Michael L. Johnson Limited Liability Corporation – Technical Advisor to the SJCDWQC

SUMMARY OF COALITION OUTREACH ACTIVITIES

The Semi Annual Monitoring Report submitted on December 30, 2007 included information on Coalition activities, events and deliverables that occurred during the 2007 irrigation monitoring season including all exceedance and communication reports delivered to the Regional Board staff. Coalition activities from April to December of 2007 are categorized into grower notification (Table 19), management practice outreach and evaluation (Table 20), general survey status (Table 21), and collaborations (Table 22) and summarized below.

Table 19. SJCDWQC grower notification of exceedances and management practices relevant to the 2007 irrigation monitoring season.

Grower Notification				
Date	**County or Site Subwatershed**	**Details**	**Constituents Addressed**	**Who**
May 17, 2007	All	Mailing to growers including Coalition bill, summary of exceedances, and a Coalition newsletter.	All exceedances	John Meek, Mike Wackman
May 29, 2007	Marsh Creek	Communication with Barry Margesson of the Contra Costa Parks and Recreation Dept. regarding water quality in the Marsh Creek site subwatershed, to be followed up with contact to growers.	Pesticide exceedances	May 29, 2007
November - December, 2007	All	Exceedance notification flyers provided to growers at all Agricultural Commissioners Annual Meetings.	All exceedances	John Meek

Table 20. SJCDWQC management practice outreach and education to growers relevant to the 2007 irrigation monitoring season.

Management Practice Outreach and Education				
Date	**County or Site Subwatershed**	**Details**	**Constituents Addressed**	**Who**
May, 2007	All	Coalition website built to provide useful information to growers such as BMPs, Coalition information, Coalition meetings and outreach schedules, etc. (http://sjdeltawatershed.org/).	Pesticides	Mike Wackman
May 15, 2007	Sand Creek	Meeting with grower regarding management practices and drainage in the Sand Creek site subwatershed.	Pesticide exceedances	John Meek

Management Practice Outreach and Education				
Date	**County or Site Subwatershed**	**Details**	**Constituents Addressed**	**Who**
May 16, 2007	Lone Tree Creek	Outreach to Walnut growers in the Lone Tree Creek site subwatershed, exceedances and relevant BMPs presented, alternative materials (to chlorpyrifos) and BMPs for the upcoming irrigation season discussed among growers.	Pesticides (chlorpyrifos and other OP)	Terry Prichard
May 18, 2007	Littlejohns Creek	Outreach to Walnut growers in Littlejohns Creek site subwatershed, exceedances and relevant BMPs presented, alternative materials (to chlorpyrifos) and BMPs for the upcoming irrigation season discussed among growers.	Pesticides (chlorpyrifos and other OP)	Terry Prichard
June 12, 2007	San Joaquin County	Outreach to Lodi Chamber of Commerce Leadership Lodi Class regarding the Coalition and the Irrigated Lands Program.	All exceedances	John Meek
June 18, 2007	Terminous Tract Drain	Grower Meeting - Terminous Tract Drain, to discuss all exceedances including malathion hit in the site subwatershed and BMPs.	Malathion (and all other exceedances)	John Meek, MLJ-LLC
July 24, 2007	Grant Line Canal	Meet with landowner/operators, Pesticide Control Advisors of other operators, and UC Extension water and alfalfa specialists regarding the Grant Line Canal site subwatershed. Reviewed Management Practice options for material used, applications and buffer zones when controlling worm and aphids.	OP Pesticides	John Meek, MLJ-LLC
August 8, 2007	San Joaquin County	Attended irrigation workshop by UC Extension gave presentation regarding the Irrigated Lands Program and the Coalition to growers.	All exceedances	John Meek
August 24, 2007	Mokelumne River	Met with producer and landowner regarding irrigation runoff, set up date to inspect site (Mokelumne River).	Sediment runoff	John Meek
August 30, 2007	All	California Alfalfa & Forage Assn. conference call with John Meek regarding pesticide application and runoff practices.	Chlorpyrifos	John Meek
September 25, 2007	San Joaquin County	Meet with landowners, PCA's and Languard representatives to discuss OP pesticide concerns and viability of Landguard.	OP Pesticides	John Meek, MLJ-LLC
October 9, 2007	Contra Costa County	Coalition outreach to growers in the Contra Costa County held in Knightsen. Presentations included general Coalition information, monitoring results and program objectives, description of management plans, and information on management practices to decrease runoff of irrigation water, pesticides and sediment.	All exceedances (OP and pyrethroid pesticide BMPs)	John Meek, Mike Wackman, MLJ-LLC, CURES, UC Extension

Management Practice Outreach and Education				
Date	**County or Site Subwatershed**	**Details**	**Constituents Addressed**	**Who**
October 16, 2007	San Joaquin	Coalition outreach to growers in the San Joaquin County held in Tracy. Presentations included general Coalition information, monitoring results and program objectives, description of management plans, and information on management practices to decrease runoff of irrigation water, pesticides and sediment.	All exceedances (OP and pyrethroid pesticide BMPs)	John Meek, Mike Wackman, MLJ-LLC, CURES, UC Extension
October 23, 2007	San Joaquin County	Coalition outreach to growers in the San Joaquin County held in east Stockton. Presentations included general Coalition information, monitoring results and program objectives, description of management plans, and information on management practices to decrease runoff of irrigation water, pesticides and sediment.	All exceedances (OP and pyrethroid pesticide BMPs)	John Meek, Mike Wackman, MLJ-LLC, CURES, UC Extension
October 30, 2007	San Joaquin County	Coalition outreach to growers in the San Joaquin County held in central Stockton and Lodi. Presentations included general Coalition information, monitoring results and program objectives, description of management plans, and information on management practices to decrease runoff of irrigation water, pesticides and sediment.	All exceedances (OP and pyrethroid pesticide BMPs)	John Meek, Mike Wackman, MLJ-LLC, CURES, UC Extension

Table 21. SJCDWQC management practice tracking and implementation relevant to the irrigation season 2007.

Management Practice Tracking and Implementation				
Date	**County or Site Subwatershed**	**Details**	**Constituents Addressed**	**Who**
May 1, 2007	Grant Line Canal	Ferguson Farms converts to alternative pesticides to chlorpyrifos (and also uses an additional buffer) which has resulted in no pesticide exceedances yet this year. Communicated change to Coalition in May but will use alternative material when needed year round.	Chlorpyrifos	Ferguson Farms
May 17, 2007	All	BMP Survey was included in mailing that went out to all growers in the Coalition region.	NA	John Meek
September 25, 2007	Mokelumne River	Meeting with Don Lucchessi, his landlord Jim Moffatt, Chris Jimmersen, Mike Johnson and John Meek regarding sediment runoff in Mokelumne River. Landowner has applied for an EQIP grant though NRCS to install a tailwater return system.	Sediment runoff	John Meek, MLJ-LLC

Management Practice Tracking and Implementation				
Date	**County or Site Subwatershed**	**Details**	**Constituents Addressed**	**Who**
December 31, 2007	All	BMP surveys compiled and summarized.	NA	John Meek, MLJ-LLC

Table 22. SJCDWQC collaborations and special studies to address water quality issues during the irrigation season 2007.

Collaborations and Special Studies				
Date	**County or Site Subwatershed**	**Details**	**Constituents Addressed**	**Who**
July 24, 2007	San Joaquin County	Test studies to determine most effective alternative material to chlorpyrifos - results provided to growers.	OP Pesticides	UC Ag Extension
September 12, 2007	Marsh Creek	Special monitoring for pesticides and toxicity as a result of fish kill in Marsh Creek.	Acrolein	MLJ-LLC, John Meek
October 19, 2007	Mormon Slough	Meeting with grower regarding complaint of wastewater discharge. Operation and drainage of facility investigated and results reported to CVRWQCB.	General discharge	John Meek
August 8-9, 2007	All	Working with Dow Agro Sciences on chlorpyrifos issues.	Chlorpyrifos	John Meek, MLJ-LLC

I. DUCK CREEK

Management Plan Constituents

Priority A

- Chlorpyrifos

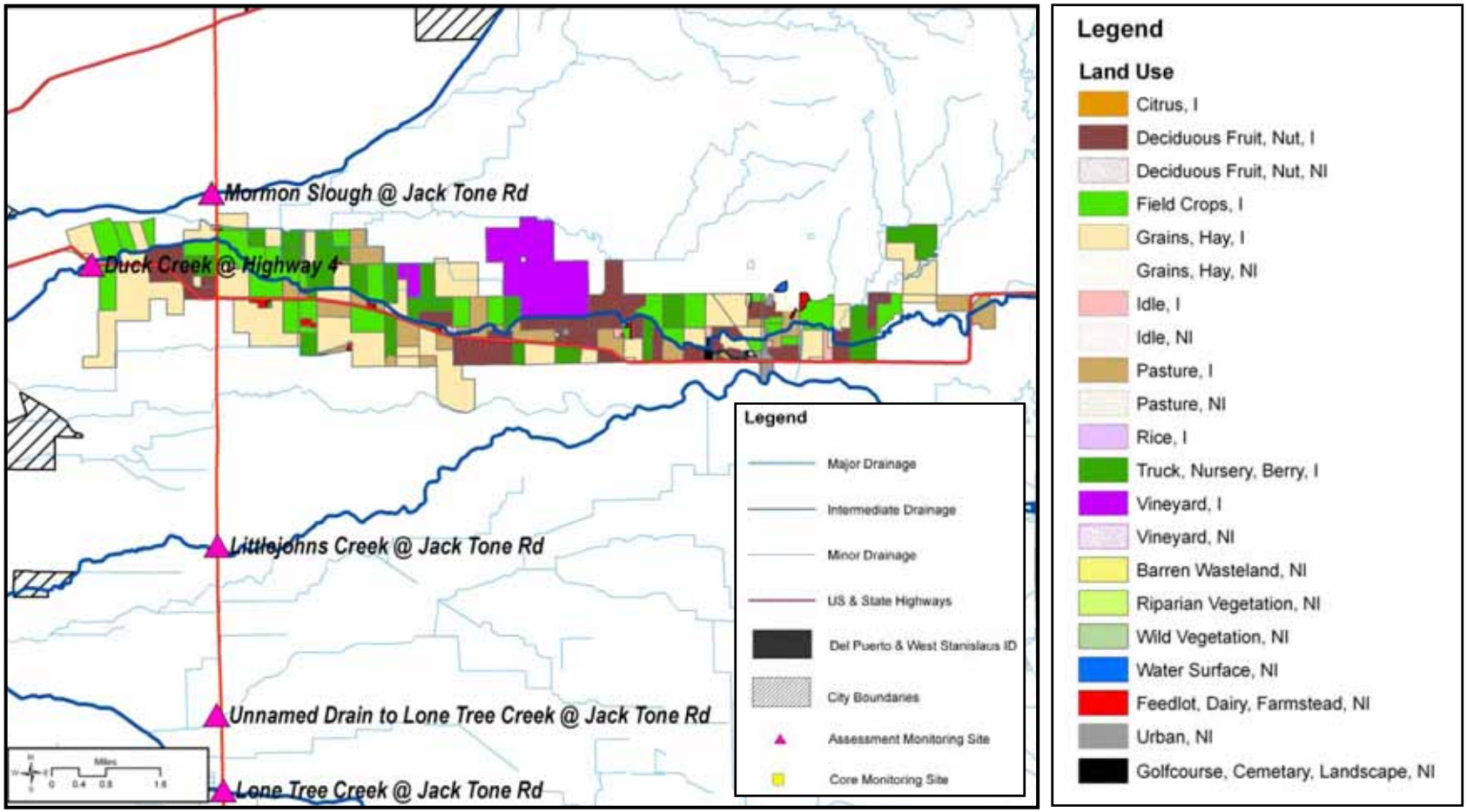
Priority E

- Dissolved Oxygen
- pH
- Color
- *E. coli*

Description of Duck Creek Site Subwatershed

Duck Creek @ Highway 4 (10,777 irrigated acres) is located just to the east of the city of Stockton. Duck Creek drains a section of southern San Joaquin County between Stockton and the Lone Tree Creek site subwatershed. During the summer, flow is typically low in the creek. The creek channel was dredged over several months early in the 2007 irrigation season. The predominant land uses for irrigated agriculture are field crops and irrigated pasture. There is also a relatively large amount of deciduous orchards in the site subwatershed, and truck farm/nursery and berry crops are also grown. Figure I-1 shows the land use within this site subwatershed area.

Figure I-1. Site subwatershed map of land use for sample site at Duck Creek @ Hwy 4.



Subwatershed Monitoring History

Monitoring occurred at the Duck Creek @ Hwy 4 monitoring site during the irrigation season of 2004 and the storm and irrigation seasons of 2006 and 2007 (Table I-1). Samples were collected from this site for field parameters and the analysis of water chemistry and toxicity (Table I-2). Two irrigation seasons were monitored in 2004 for all field and physical parameters (including bacteria), chlorpyrifos, diazinon, four pyrethroids, and water column toxicity to all three species. Sediment was collected only once in 2004. This location was removed from the monitoring program in 2005 and the Coalition restarted sampling at Duck Creek @ Hwy 4 during the irrigation season of 2006. Management plan monitoring for the Coalition was initiated during June of 2007 and included additional sampling at Duck Creek @ Hwy 4 in September for chlorpyrifos. Specific information on the analyses conducted across each of the monitoring seasons is provided below (Table I-2). Exceedances of field and physical parameters, *E. coli*, pesticides and water column toxicity have occurred at this site. A summary and discussion of these exceedances are provided in the next section (Table I-3).

The Duck Creek is not considered impaired in the current Basin Plan, however Walker Slough, the most immediate downstream waterbody, is listed as impaired for pathogens due to urban runoff/storm sewers and recreational and tourism activities.

Duck Creek @ Hwy 4 will be an Assessment Monitoring location under the new MRPP and will be monitored with the first rotation of sites from October 2008 to December 2010. The Coalition will also continue to conduct management plan monitoring at this site. Management plan monitoring is described in better detail later in this document.

Table I-1. Duck Creek @ Highway 4 sampling events per season and year. An irrigation season sampling event encompasses normal monitoring and any associated resampling, management plan monitoring, and sediment sampling. A storm event encompasses normal monitoring and any associated resampling.

	2004	2005		2006		2007	
	Irrigation	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Sampling Events	2	None	None	None	5	2	6

Table I-2. Duck Creek @ Highway 4. Number of analyses run per constituent in each sampling season (only environmental samples and field analyses listed).

Constituent	2004	2006	2007	
	Irrigation	Irrigation	Storm	Irrigation
Field and Physical Parameters				
pH	2	5	3	8
Electrical Conductivity	2	5	3	8
Dissolved Oxygen	2	4	3	8
Total Dissolved Solids	2	5	2	6
Turbidity	2	5	2	6
E. coli	2	5	2	6
Color	2	5	2	6
Total Organic Carbon	2	5	2	6
Biological Oxygen Demand		1	2	2
Carbamates				
Aldicarb		5	2	6
Carbaryl		5	2	6
Carbofuran		5	2	6
Methiocarb		5	2	6
Methomyl		5	2	6
Oxamyl		5	2	6
Organochlorines				
DDD		5	2	6
DDE		5	2	6
DDT		5	2	6
Dicofol		5	2	6
Dieldrin		5	2	6
Endrin		5	2	6
Methoxychlor		5	2	6
Organophosphates				
Azinphos methyl		5	2	6
Chlorpyrifos	2	5	2	7
Diazinon	2	5	2	6
Dimethoate		5	2	6
Disulfoton		5	2	6
Malathion		5	2	6
Methamidophos		5	2	6
Methidathion		5	2	6
Parathion, Methyl		5	2	6
Phorate		5	2	6
Phosmet		5	2	6
Pyrethroids				
Bifenthrin		5	2	6
Cypermethrin	2	5	2	6
Cyhalothrin, lambda	2	5	2	6
Permethrin	2	5	2	6
Cyfluthrin		5	2	6
Esfenvalerate/ Fenvalerate	2	5	2	6
Triazines				

Constituent	2004	2006	2007	
	Irrigation	Irrigation	Storm	Irrigation
Atrazine		5	2	6
Cyanazine		5	2	6
Diuron		5	2	6
Glyphosate		5	2	6
Linuron		5	2	6
Molinate		5	2	6
Paraquat dichloride		5	2	6
Simazine		5	2	6
Thiobencarb		5	2	6
Toxicity				
Ceriodaphnia dubia	2	6	2	6
Pimephales promelas	2	5	2	6
Selenastrum capricornutum	2	5	3	6
Hyalella azteca	2	1	1	1

Exceedance History

Water quality results from sampling during the irrigation season of 2007 included four exceedances of dissolved oxygen (DO), one pH, one *E. coli*, and three of chlorpyrifos. Sampling prior to the 2007 irrigation season resulted in four DO exceedances, one pH exceedance, two *E. coli* exceedances, and one instance of water column toxicity to *Ceriodaphnia*. All exceedances are listed in Table I-3 by season and date and are based on WQTLs listed in the overall introduction of the SJCDWQC Management Plan. The priority level (A-E) assigned to each constituent is listed in the bottom row of Table I-3 for those analytes with two or more exceedances within the last three years.

Table I-3. All exceedances experienced in samples collected from the Duck Creek @ Hwy 4 Coalition monitoring site between August 2004 and September 2007.

Station Name	Season	Sample Date	Oxygen, Dissolved, mg/L	pH, none	Color, color units	E. coli, MPN/100 mL	Chlorpyrifos, µg/L	Diazinon, µg/L	Ceriodaphnia dubia, Survival (%)	Selenastrum capricornutum, Total Cell Count
Duck Creek @ Hwy 4	Irrigation	24/Aug/2004			100					
Duck Creek @ Hwy 4	Irrigation	23/Sep/2004			300					
Duck Creek @ Hwy 4	Irrigation	16/May/2006	5.6		45	2400	0.029			
Duck Creek @ Hwy 4	Irrigation	20/Jun/2006	4.5		320	330				
Duck Creek @ Hwy 4	Irrigation	18/Jul/2006	5.5		90					
Duck Creek @ Hwy 4	Irrigation	15/Aug/2006		6.43	35					
Duck Creek @ Hwy 4	Irrigation	19/Sep/2006			34		0.15		0	
Duck Creek @ Hwy 4	Irrigation	10/Apr/2007			30	290				
Duck Creek @ Hwy 4	Irrigation	22/May/2007			30					
Duck Creek @ Hwy 4	Irrigation	12/Jun/2007		8.66	80					
Duck Creek @ Hwy 4	Irrigation	10/Jul/2007	6.67		50		0.024			
Duck Creek @ Hwy 4	Irrigation	07/Aug/2007			25					
Duck Creek @ Hwy 4	Irrigation	09/Aug/2007	6.54							
Duck Creek @ Hwy 4	Irrigation	04/Sep/2007	6.99		25		0.025			
Duck Creek @ Hwy 4	Irrigation	25/Sep/2007	5.83				0.029			
Duck Creek @ Hwy 4	Storm	11/Feb/2007			250	820				
Duck Creek @ Hwy 4	Storm	28/Feb/2007			380	2400		0.11		793000
Duck Creek @ Hwy 4	Storm	06/Mar/2007	5.8							
		Constituent Priority	**E**	**E**	**E**	**E**	**A**			

2007 Management Plan Monitoring Results

In 2007, Management Plan monitoring was implemented at the Duck Creek @ Hwy 4 monitoring site for chlorpyrifos. Table I-4 provides monitoring results for chlorpyrifos from all sampling events during the 2007 irrigation season including management plan monitoring (MPM). The chlorpyrifos WQTL was exceeded in July and in September including the MPM sample collected on September 25, 2007. Samples collected in April, May, June and August had no detectable amounts of chlorpyrifos.

Table I-4. Duck Creek @ Hwy 4 Normal monitoring (NM) and Management Plan monitoring (MPM) results for chlorpyrifos from the 2007 irrigation season. Exceedance values are in bold.

Monitoring Type	NM	NM	NM	NM	NM	NM	MPM
Date	4/10/07	5/22/07	6/12/07	7/10/07	8/07/07	9/04/07	9/25/07
Chlorpyrifos (µg/L)	<0.00259	<0.00259	<0.00259	**0.024**	<0.003	**0.025**	**0.029**

Load Calculations

Loads have been calculated for the chlorpyrifos exceedances based on the following formula (Table I-5):

Load = Discharge (cfs) X 28.317L X Concentration (milligram/L X 1000 or µg/L).

The load values calculated and presented for pesticides or other constituents in this report represent instantaneous loads only. These values should not be used to extrapolate loading over any period of time (e.g. weekly, monthly, seasonal or annual). The primary purpose for reporting instantaneous loads is to provide the Regional Water Board with a context for the concentrations of various constituents at the time that samples were collected.

Table I-5. Chlorpyrifos loads calculated from concentration and discharge measured on each exceedance date for the Duck Creek @ Hwy 4 monitoring site.

Exceedance Date	Discharge (cfs)	Concentration (µg/L)	Load (µg/sec)
5/16/2006	6.34	0.029	**5.21**
9/19/2006	6.02	0.15	**25.57**
7/10/2007	14.43	0.024	**9.81**
9/4/2007	no flow	0.025	**NA**
9/25/2007	2.16	0.029	**1.77**

Source Identification

Priority A Constituents

Chlorpyrifos

Chlorpyrifos is the only priority A constituent included in a Management Plan within the Duck Creek @ Hwy 4 site subwatershed. Five exceedances of the WQTL of 0.015 µg/L occurred in samples collected between 2004 and 2006 in the months May, July and September (Table I-3). To determine the source(s) of chlorpyrifos, the Coalition uses Pesticide Use Reports (PURs) to examine the amount and timing of pesticide applications and the types of crops to which the active ingredients are applied relative to exceedance dates. Township, range and section (TRS) are identified that have applied chlorpyrifos within one month of the exceedance date. Within the Duck Creek @ Hwy 4 site subwatershed chlorpyrifos has been applied 85 times in 2006 and 129 times in 2007 (Table I-6). In both years, May appears to be the peak application month with 2,462 pounds applied in 2006 and 1,211 pounds applied in 2007 (Table I-6, Figure I-2). Chlorpyrifos use has decreased from 2006 to 2007 with less than half the number of applications and pounds applied in 2007 as compared to 2006 (Table I-6). The average application rate of chlorpyrifos for the Duck Creek subwatershed from 2004-2007 is 1.23 lbs AI/acre (Table I-7). The highest application rates are associated with walnut orchards.

Table I-6. Number of chlorpyrifos applications, total pounds applied, and total acres treated by month for 2006 and 2007 in the Duck Creek @ Hwy 4 site subwatershed.

Month	Number of Chlorpyrifos Applications	Pounds Applied	Acres Treated
March, 2006	1	18.6	40
April, 2006	2	38.5	50
May, 2006	28	2462.3	1696
June, 2006	12	1342.1	876.5
July, 2006	18	1943.0	1534
August, 2006	20	1170.8	1015
September, 2006	3	127.2	268
October, 2006	1	114.1	57
March, 2007	11	603.4	537
April, 2007	9	362.3	548
May, 2007	12	1211.3	803
June, 2007	2	156.8	78
July, 2007	7	429.5	572
August, 2007	3	70.2	80
2006 Total	85	7216.6	5536.5
2007 Total	44	2833.5	2618.0
TOTAL	**129**	**10050.1**	**8154.5**

Figure I-2. Pounds of chlorpyrifos added to TRS within the Duck Creek @ Hwy 4 site subwatershed by month for 2006 and 2007. Asterisk (*) denotes months in which chlorpyrifos exceedances were detected at the site.

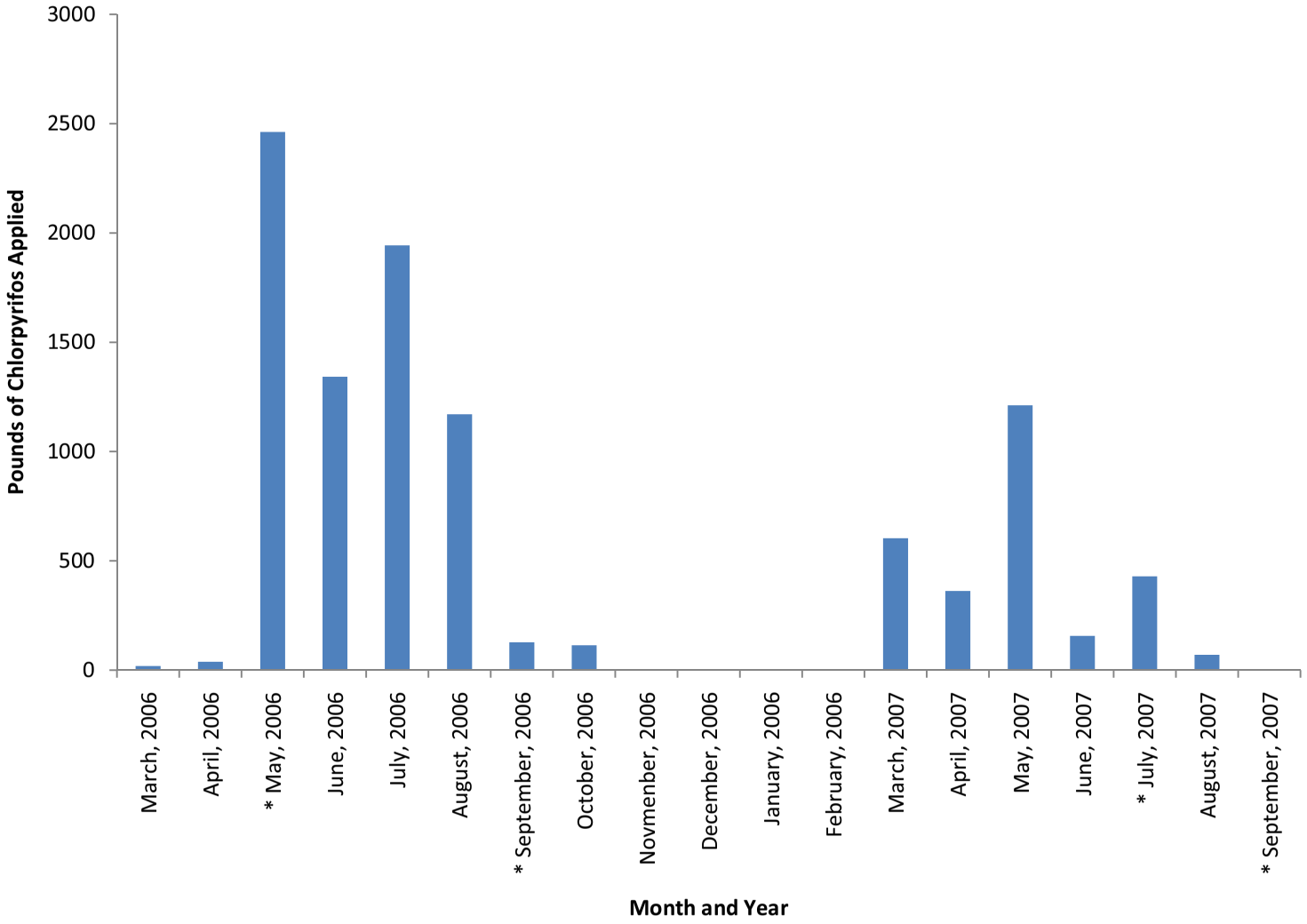


Table I-7. Average pound active ingredient (AI) per acre for chlorpyrifos based on PUR data from 2004-2007 within the Duck Creek @ Hwy 4 subwatershed.

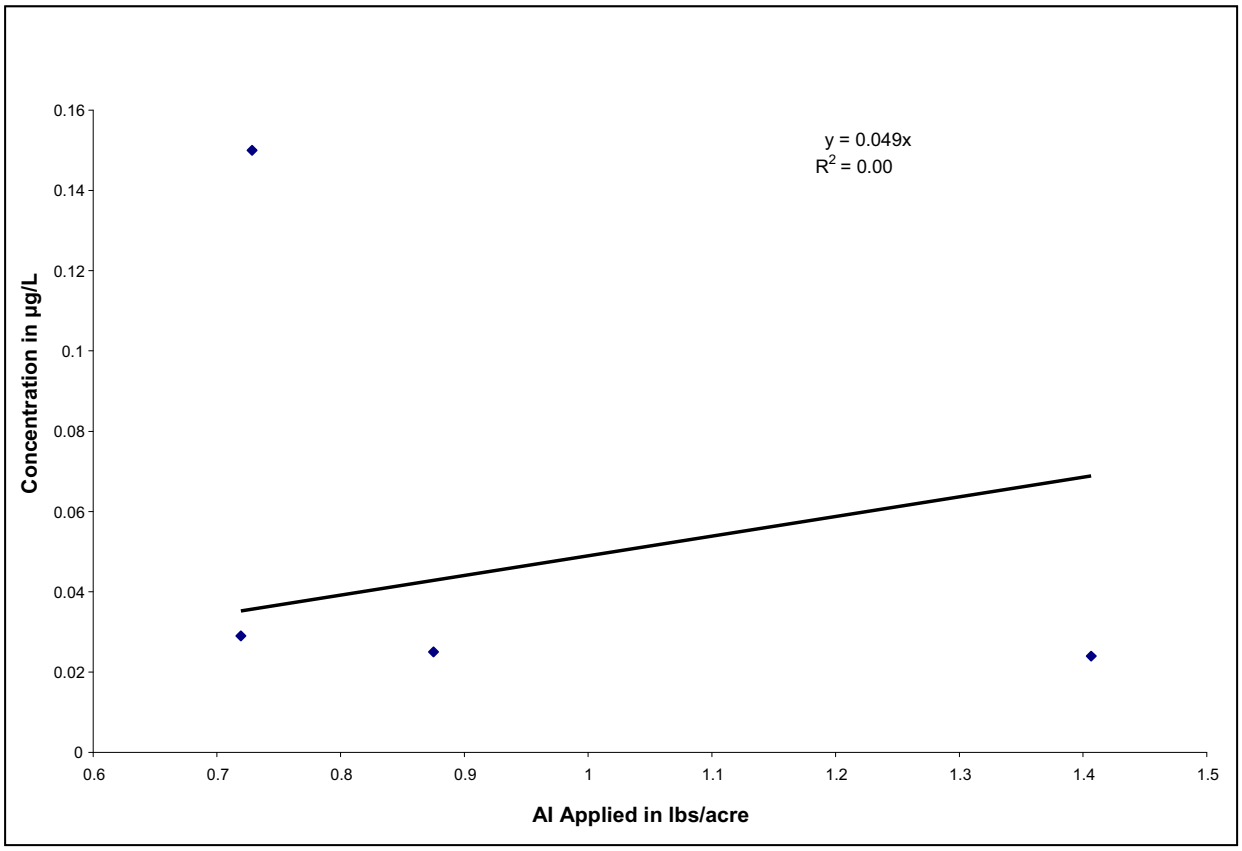
Chemical name	Commodity	Product name	Average Lbs AI/Acre
CHLORPYRIFOS	ALFALFA	LOCK-ON INSECTICIDE	0.50
		LORSBAN 4E-HF	0.50
		LORSBAN-4E	0.48
	APPLE	LORSBAN 4E-HF	0.62
		LORSBAN-4E	1.84
	CORN (FORAGE - FODDER)	GOVERN 4E INSECTICIDE	1.01
		LORSBAN 15G GRANULAR INSECTICIDE	1.33
		NUFOS 15G	1.22
	N-OUTDR CONTAINER/FLD GRWN PLANTS	ESTATE INSECTICIDE	0.81
	ONION (DRY, SPANISH, WHITE, YELLOW, RED, ETC.)	LORSBAN 15G GRANULAR INSECTICIDE	1.01
	WALNUT	DURSBAN 4E-N	2.00
		GOVERN 4E INSECTICIDE	1.39
		LORSBAN 4E INSECTICIDE	1.61
		LORSBAN 4E-HF	1.68
		LORSBAN-4E	1.29
		NUFOS 4E	2.03
Average pounds applied chlorpyrifos per acre (2004-2007)			**1.23**

The Coalition developed hypotheses to guide the search for sources within the watershed. If the amount of chlorpyrifos (either concentration or load) detected in the sample water was positively associated with amount of chlorpyrifos, then the exceedance would most likely be a result of accumulated runoff from numerous parcels. Alternatively, if there was no relationship between the amount applied across the watershed and the amount found in the water, the exceedance would be a result of one or a few parcels with poorly managed discharge. In order to develop an outreach strategy based on PUR data and the above hypothesis, the Coalition must assume that all applications have been reported and that each application has been reported accurately. The outreach strategy of the Coalition varies depending on which hypothesis is correct. The hypotheses are not mutually exclusive as some parcels could always contribute to exceedances, although the magnitude of the exceedance would be determined by the amount of product applied.

Consequently, the Coalition performed an analysis of chlorpyrifos applications within the last four weeks and concentrations and loads of chlorpyrifos in the water (all detections). A linear regression analysis was performed to establish the relationship between application in pounds per acre for those acres on which applications were made (not averaged across the entire watershed) and concentration and load (Figure I-3). To associate PUR data (pounds AI per acre) with a single exceedance, the pounds AI was summed and divided by the summed acreage. The small sample size precluded a rigorous statistical treatment but sample sizes are sufficiently

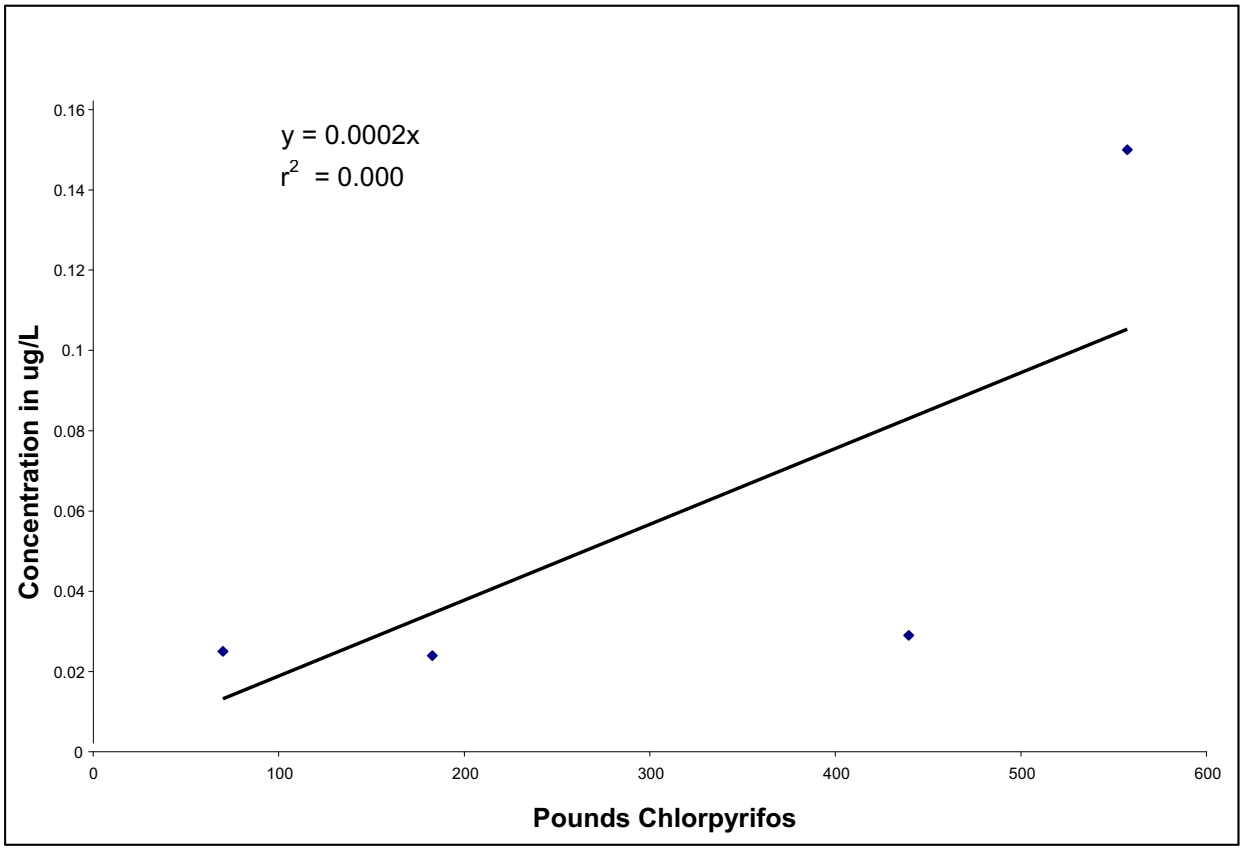
large to allow the two hypotheses to be distinguished. The intercept for all analyses was set at zero as there should be no chlorpyrifos in the water if there are no applications. However, this assumes that applications more than four weeks prior to sampling would not contribute chlorpyrifos to the water body. For purposes of this analysis, it is assumed that applications prior to four weeks before sampling would not contribute substantially to loads measured four weeks later.

Figure I-3. Chlorpyrifos concentrations and application rates for Duck Creek @ Hwy 4.



The regression of concentration on pounds AI per acre was not significant indicating that none of the variation in concentration was accounted for by the application rate (Figure I-3). There was no significant regression of chlorpyrifos concentration on pounds of active ingredient applied (Figure I-4). There was a single exceedance with a large positive residual in September 2006. This exceedance was the result of 12 applications to a variety of crops; alfalfa (8 applications), walnuts (3 applications) and outdoor container plants (1 application). The application method was aerial for all of the alfalfa applications and ground for the four remaining applications.

Figure I-4. Chlorpyrifos concentrations and pounds applied for Duck Creek @ Hwy 4.



To determine if there were specific parcels associated with exceedances on a continuing basis, the Coalition examined the sections (TRS) associated with each exceedance (Tables I-8, I-9, and Figures I-5, I-6). There were 16 sections associated with exceedances; each section had 1 or 2 applications in the month prior to sampling (Table I-8). Generally, these applications were associated with different parcels within the section. Sections were associated with 1 to 3 exceedances, and no sections were associated with all exceedances. Other exceedances were associated with walnuts and alfalfa with aerial applications, but there were far fewer applications and far less product applied, and as a result the concentration of chlorpyrifos in the water was far less.

Table I-8. All TRS that had more than one application associated with an exceedance for chlorpyrifos in 2006 and 2007. Table shows which exceedance the application was associated with and number of applications associated with an exceedance for a given TRS.

TRS*	Date of associated exceedance				
	5/16/06	9/19/06	7/10/07	9/4/07	9/25/07
IN7E11		2			
IN8E15		2			
IN8E8		1	1		
IN9E17	2	2	1		
IN9E18	1	2		1	
IN9E19	1		1		

*Bolded TRS are members of the Coalition

Table I-9. TRS with chlorpyrifos applications in month prior to each exceedance date. Includes pounds applied and acres treated.

TRS	5/16/06			9/19/06			7/10/07			9/4/07		
	Application Date	Pounds applied	Acres treated	Application Date	Pounds applied	Acres treated	Application Date	Pounds applied	Acres treated	Application Date	Pounds applied	Acres treated
1N8E4	5/4/06	24.16	52									
1N9E19	5/9/06	31.59	17				6/23/07	80.04	40			
1N8E2	5/10/06	65.04	140									
1N7E1	5/10/06	27.88	60									
1N8E11	5/10/06 5/10/06	34.38 70.62	74 152									
1N9E17	5/10/06 5/12/06	33.45 13.94	18 8	8/22/06 8/30/06	33.45 29.73	18 16	6/20/17	76.76	38			
1N7E3	5/16/06	80.01	40									
1N9E18	5/16/06	58.50	50	8/22/06 8/25/06	30.04 28.54	60 57				8/21/07	30.04	60
1N7E11				8/19/06 9/6/06	193.40 70.24	97 154						
1N8E7				8/24/06	20.03	40						
1N8E15				8/24/06 8/30/06	33.05 35.05	60 70						
1N7E12				8/28/06	180.09	90						
1N8E10				8/30/06	40.06	80						
1N9E11				9/13/06	3.92	8						
1N8E8				9/13/06	53.08	106	7/10/07	26.04	52			
1N8E14										8/8/07	20.2	10

*Bolded TRS are members of the Coalition.

Figure I-5. Duck Creek @ Hwy 4 TRS' that have had applications co-occurring with an exceedance.

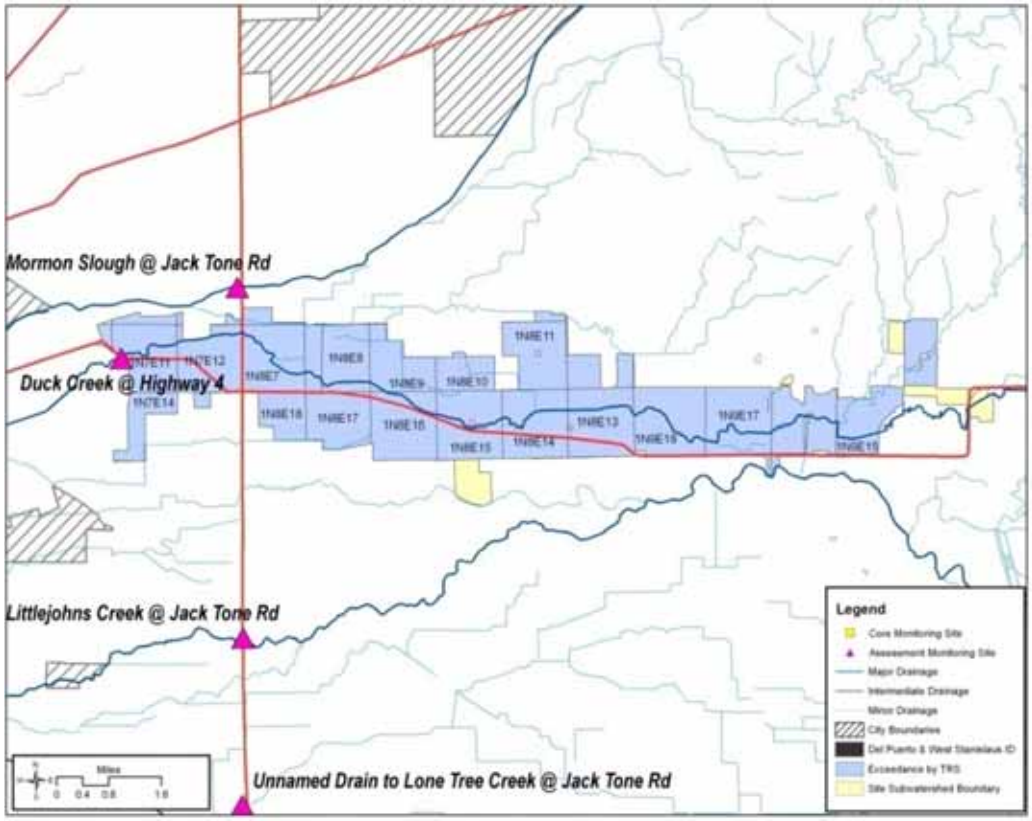
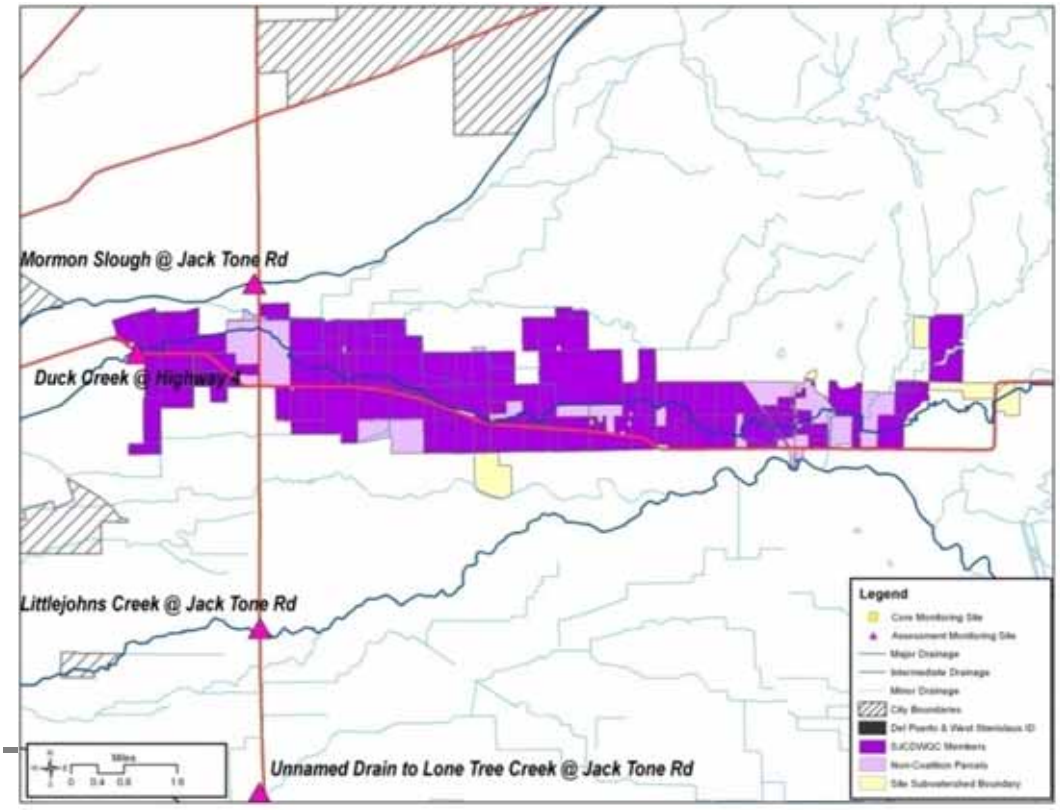


Figure I-6. Duck Creek @ Hwy 4 APN numbers within sections that have had applications co-occurring with an exceedance.



The analyses conducted by the Coalition suggest that management of chlorpyrifos in this watershed should focus on providing information on a watershed wide basis to growers to review their operation to determine if irrigation return flows are managed properly. Alfalfa and walnut growers should be targeted for outreach especially prior to the irrigation season. Aerial applications could have contributed to the exceedances primarily from drift and the TRS' with exceedances are located adjacent to the creek further suggesting that drift could play a role in generating the exceedances. Outreach to aerial applicators should take place.

Analysis of the management practices surveys for this watershed indicates that a small portion of parcels claim there is no discharge from their property. Fourteen percent of the parcels for which surveys were filled out claim no runoff (8% of member acreage within the Lone Tree Creek subwatershed for which surveys were filled out). Fifty-two percent of parcels (50% of member acreage) discharge directly to a waterway (local drainage system or directly to the waterway). Twenty-one percent of parcels (24% of member acreage) use recirculation (tail water return system), 3% of parcels (2% of member acreage) use micro/drip irrigation, 14% of parcels (16% of member acreage) utilize sediment settling ditches and 4% of parcels (9% of member acreage) utilize holding basins to reduce runoff. A large number of growers use grass waterways or vegetated filter strips (63% of parcels, 57% of member acreage) suggesting that there is a mix of management practice intensity in the watershed. Although there is a large amount of acreage that discharges directly into a local drainage system or waterway, a majority of member acreage utilizes one or more management practices to reduce discharge. Outreach could focus on management practices that improve irrigation efficiency and keep water on the field rather than allowing discharge to surface waters including micro/drip irrigation systems, recirculation/tail water return systems and hold basins. As there are no sections that appear to be associated with more applications or more exceedances (Table I-8), there appears to be no need for focused outreach on one or two sections. The lack of a relationship between pounds AI per acre and concentration with the one large residual value (Figure I-4) suggests that the greatest problems may not be a result of high application rates or specific parcels, but rather the method used to apply. The Coalition has been engaged in targeted outreach in the Duck Creek watershed through the Proposition 50 activities.

Priority E Constituents

E. coli

The Coalition performed a pilot study to understand the sources of *E. coli* being detected at Coalition monitoring sites. Samples were not collected from the Duck Creek site, however results of the study may be representative of the Coalition region. Molecular markers were used to distinguish human, bovine, and avian sources. Human, bovine, and avian molecular markers were found in samples collected for this study, indicating active inputs from all three species. Results from the study also indicated that there was no relationship between the amount of coliform bacteria in the system and the presence of human or bovine bacteria. Because this study was performed at a single time of the year with a limited set of potential hosts, further study may be initiated to more fully understand bacterial contamination in the Coalition region. Until such time as the study is completed, the Coalition will not actively manage for *E. coli*. Once a better understanding of the *E. coli* dynamics is obtained, the Coalition will re-evaluate management options.

DO

The amount of dissolved oxygen in surface waters is a function of the processes of algal (and additional aquatic vegetation) photosynthesis and respiration, water temperature, turbulent flow, and biological oxygen demand (BOD), the respiration that accompanies degradation of organic carbon. In an attempt to understand dissolved oxygen dynamics, the Coalition sampled for BOD during the September 2006, February, April and July 2007 monitoring events. Only one sample, collected in February 2007 from Duck Creek @ Hwy 4, contained a measurable amount, 9 mg/L, of BOD (Table I-10). The conclusion of the study was that BOD was important in establishing DO levels, although many sites had no BOD. An elevated positive correlation between BOD and TOC suggested that TOC could be used as a surrogate for BOD and consequently, the Coalition used TOC in an analysis to determine the potential effect of organic carbon/BOD on DO for the samples in the site subwatershed. The residuals of temperature – DO regression were used in a second regression with TOC. The residuals were used to remove the effect of temperature. As expected, there was a statistically significant negative relationship between DO and temperature. Although the relationship between residual DO and TOC was negative, the regression was not significant indicating that DO dynamics are not a function of TOC. The lack of BOD confirms this finding. At some time in the future, the Coalition may be able to undertake a larger study to more fully understand the dissolved oxygen dynamics in the watershed. At this point, it is unclear what can be managed to eliminate low DO and the Coalition will not attempt to provide outreach to growers in an attempt to manage DO.

Table I-10. Duck Creek @ Hwy 4 BOD, pH and dissolved oxygen results.

Station Name	Sample Date	pH	Oxygen, Dissolved	BOD, mg/L
Duck Creek @ Hwy 4	19/Sep/2006	6.87	NA	ND
Duck Creek @ Hwy 4	11/Feb/2007	7.32	8.03	9
Duck Creek @ Hwy 4	28/Feb/2007	6.76	10.48	ND
Duck Creek @ Hwy 4	10/Apr/2007	7.42	9.66	ND
Duck Creek @ Hwy 4	10/Jul/2007	7.26	6.67	ND

NA – dissolved oxygen meter malfunction.

pH

Understanding pH dynamics in the system is as difficult as understanding DO dynamics. The Coalition used monitoring data to conduct a simple analysis in an attempt to associate pH with manageable constituents. A multiple regression was performed using DO and TOC as the predictor variables and pH as the response variable. The regression model was not significant ($F = 1.55$, $p = 0.29$, $df = 2, 6$) indicating that pH is not a function of either dissolved oxygen or organic carbon. These results suggest that photosynthetic activity is not a driving factor in pH and DO dynamics and it is not known what determines pH variation in Duck Creek. As with DO, the Coalition will not actively manage for pH at this time. If future studies are conducted that allow the Coalition to understand pH dynamics, the Coalition will re-evaluate the management options.

Upstream Monitoring

As outlined in the introduction, upstream sampling may be implemented to facilitate source identification for discharges of chlorpyrifos. The 2008 schedule for upstream Management Plan Monitoring is provided in Table I-11 and the upstream sampling location is provided in Table I-12 and Figure I-7. Monitoring at the upstream site, Duck Creek @ Drais Rd, will provide information on the contribution from either the upper or lower site subwatershed to the load of chlorpyrifos measured at the Highway 4 site. The Coalition is not currently conducting Management Plan monitoring during the storm seasons.

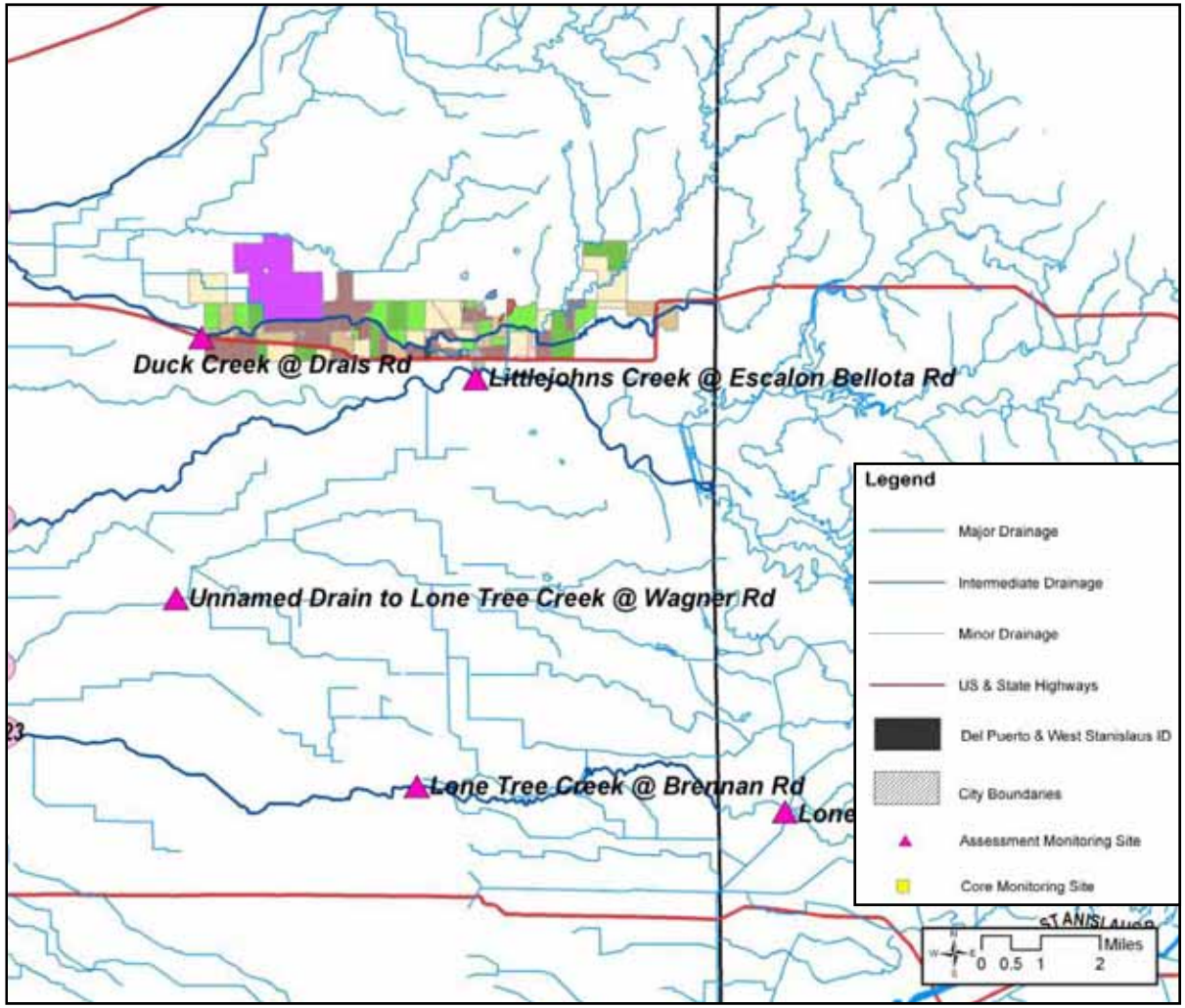
Table I-11. 2008 Management Plan sampling schedule. U = upstream sampling.

Sample Site	Month	Type	Chlorpyrifos
Duck Creek @ Drais Rd	July	U	**x**
Duck Creek @ Drais Rd	May	U	**x**
Duck Creek @ Drais Rd	September	U	**x**

Table I-12. Coordinates of the Duck Creek sampling locations.

Station Name	Station Code	Target Latitude	Target Longitude
Duck Creek @ Highway 4	531XDCAHF	37.9491	-121.1810
Duck Creek @ Drais Rd	531XDCADR	37.9348	-121.0841

Figure I-7. Site subwatershed map of land use for upstream Management Plan monitoring site at Duck Creek @ Drais Rd.



Outreach

The Coalition outreach includes grower meetings and mailing/distribution of information. The Coalition conducts three types of meetings: general grower meetings on a county level, grower group meetings (groups may be specified by crop, chemical use or seasonal practices) and individual contacts.

General grower meetings were held for San Joaquin County growers in October 2007 and May 2008. All outreach that has occurred in the 2007 irrigation season is documented in the Summary of Coalition Outreach Activities section of the Management Plan. The Coalition anticipates conducting grower meetings in the various Coalition counties prior to the irrigation season to address irrigation water quality concerns and management practices, and again between October and December focusing on dormant spray practices and presenting Coalition data from the previous year of monitoring.

Grower group meetings will be conducted between October 2008 and April 2009 targeting alfalfa and walnut growers. The grower group meetings will focus on management practices for these crops that can reduce spray drift of aerial applications and management practices for chlorpyrifos use. The Coalition has conducted a management practice study in the Duck Creek subwatershed as part of the Proposition 50 grant to assess the mobilization of chlorpyrifos in furrow irrigation water applied to corn planted with chlorpyrifos pellets. The results are still being analyzed and will be used to educate farmers about the mobilization of chlorpyrifos and management practices that will be effective in reducing irrigation discharge of chlorpyrifos.

In October 2008, a publication of Best Management Practices information, developed by the Center for Urban/Rural Environmental Stewardship (CURES), will go out to all members with 15 or more acres enrolled in the program. The handbooks were originally designed for the Westside Coalition and contain information on farming practices such as sediment basins, polyacrylamide (PAM), enzyme treatments, tail water return systems, vegetative ditches, irrigation scheduling and others (Attachment I, example of Westside handbook). These documents are summaries of technical reports developed by the California Water Institute, Ducks Unlimited, California Department of Pesticide Regulation and others.

Evaluation

The Duck Creek site subwatershed is one of the rotating Assessment Monitoring locations within the SJCDWQC French Camp Slough @ Airport Way Zone. This site subwatershed will first be monitored between 2008 and 2010, and in addition Management Plan monitoring will continue as outlined in Table I-11. This subwatershed is one of the three priority site subwatersheds within the SJCDWQC and therefore the Coalition is focusing its resources on identifying the sources of agricultural discharge within this subwatershed that could lead to water quality impairments, extending outreach to individual Coalition members and setting evaluation goals. Members will be contacted individually based on their proximity to the

waterway, number of applications co-occurring with WQTL exceedances and amount of acres farmed.

The Coalition sent general management practice surveys to members in May 2007. This survey was intended to collect baseline information from growers to understand current management practices conducted and implemented within the Coalition region. The Coalition plans to build upon the baseline survey results by conducting individual contacts with growers and fill out more detailed checklists that can be used to gain specific parcel information in regards to agricultural discharge and management practices currently implemented. At that time the Coalition will offer resources (i.e. management practice handbooks, information to obtain NRCS funds) to the grower to aid them in implementing additional management practices. The Coalition will return in a year to interview the grower again and determine if any additional management practices were performed. Parcel specific information will remain confidential between the member and the Coalition and used to evaluate effectiveness of management practices at a subwatershed level.

The Coalition's strategy for the Duck Creek subwatershed was to first conduct a grower group meeting this summer (May, 2008) and speak with individual growers who attended the meeting about current irrigation and dormant spray practices. The Coalition verbally obtained valuable information about specific parcel practices within this area and was able to discuss with growers management practices that could potentially reduce runoff of chlorpyrifos on an individual grower level. The Coalition realizes the importance of keeping track internally of specific practices and therefore is developing a series of checklists to use during conversations/interviews with growers through individual contacts or at grower group meetings. Information will be kept confidential between the Coalition and member and used at the site subwatershed level to evaluate management practice effectiveness. The Coalition is developing these checklists with the aid of UC Davis Extension and will include categories such as organophosphate pesticide management and additional checklists on a broader level for overall irrigation and dormant season management. The details of the checklists are still being developed but the goal is to have a documentation tool to allow the Coalition to keep track of specific management practices as they pertain to water quality impairments within that particular subwatershed.

The Coalition is also conducting "tail-gate" meetings with large growers within the entire Coalition region to discuss overall management practices. Large growers are selected by Coalition representatives based on number of acres that they manage and availability to meet with Coalition representatives, regardless of current monitoring locations or specific water quality information. For example, a large grower may be contacted within a subwatershed that the Coalition has not yet sampled for water quality. This method will allow the Coalition to speak with specific growers about current Coalition wide water quality impairments, discuss current management practices and also inform the owner/grower of additional management practices that can be used to reduce/eliminate agricultural discharge. The Coalition will also present CURES booklets on management practices and resources for obtaining management

practice implementation funds (such as NRCS funds). By focusing on large growers, any updates to management practices as a result of these meetings will affect large areas within the Coalition region impacting overall Coalition area water quality.

The Coalition and UC Davis Extension will use the checklists while contacting specific growers within the Duck Creek @ Hwy 4 subwatershed during the 2008/2009 winter season. The results of the checklists will be entered into a database that will be used internally by the Coalition. After the first round of contacts using the checklists, the checklist format and information will be evaluated based on the amount of information obtained that can be used to track and assess management practices within the Duck Creek @ Hwy 4 subwatershed. If this method is deemed effective, the Coalition will continue to use the checklists with future individual contacts across other site subwatersheds.

In addition, the Coalition will continue to conduct grower meetings by county during the winter of 2008/2009 to inform all members of current water quality impairments and Coalition activities. The Coalition will record the number of attendees at the meeting to evaluate the effectiveness of these outreach meetings.

II. LONE TREE CREEK @ JACK TONE RD

Management Plan Constituents

Priority A

- Chlorpyrifos

Priority C

- Copper
- Diuron

Priority D

- *Hyalella azteca* sediment toxicity
- *Selenastrum capricornutum* water column toxicity
- *Pimephales promelas* water column toxicity

Priority E

- Ammonia
- Cadmium
- Dissolved Oxygen
- *E. coli*
- pH

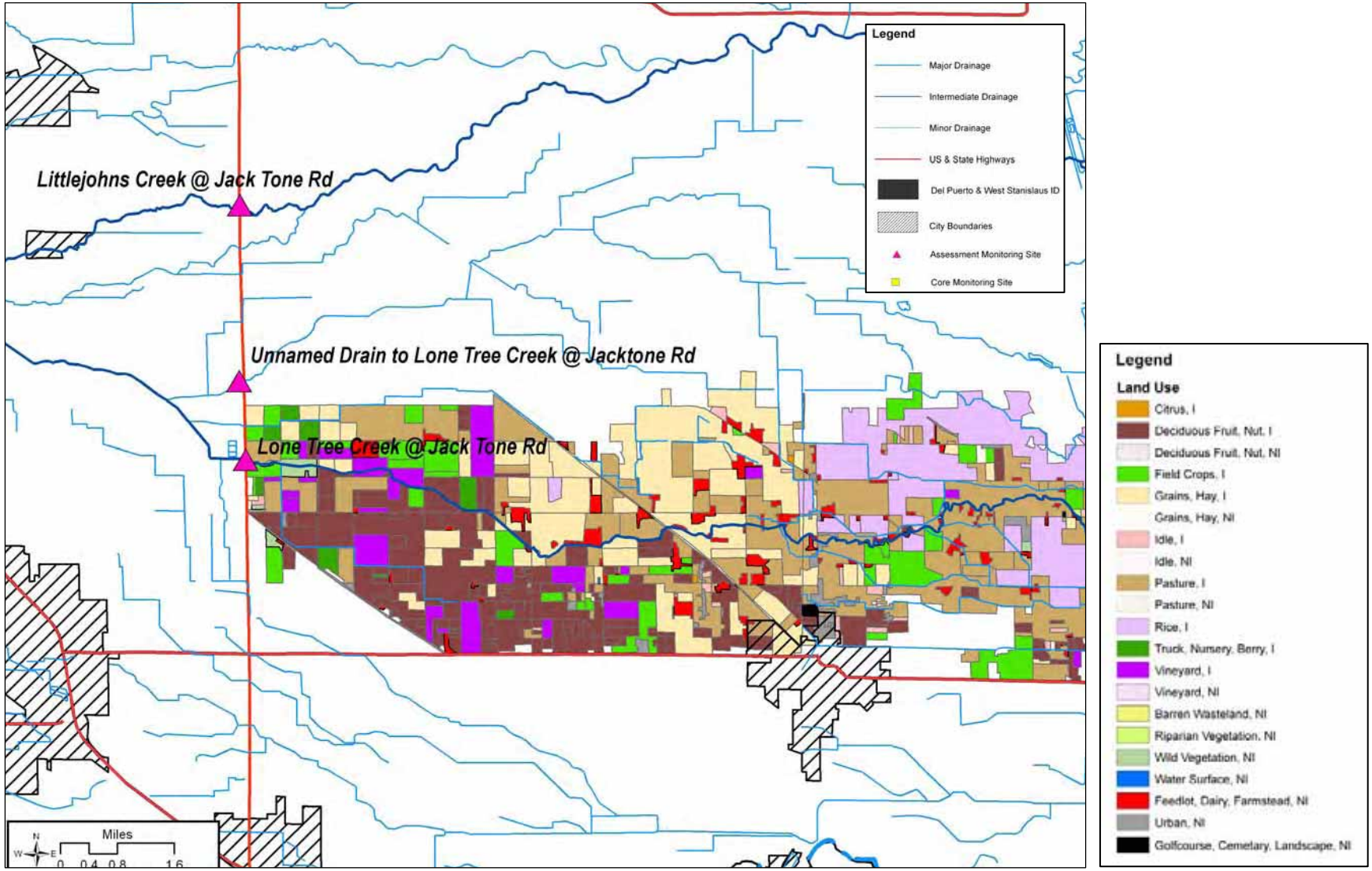
Description of Lone Tree Creek Site Subwatershed

Lone Tree Creek is a 20-mile long modified natural channel originating south of Woodward Reservoir. This ephemeral stream carries natural runoff for the Farmington flood control basin during periods of high flow and is composed of mostly hardpan clay. During the irrigation season Lone Tree Creek carries agricultural supply and return flows to its confluence with Littlejohns Creek.

Lone Tree Creek @ Jack Tone Road is upstream from the French Camp Slough @ Airport Way site and contains 22,359 irrigated acres. This site drains a large portion of the southern SJCDWQC region and joins with Littlejohns Creek downstream eventually forming French Camp Slough which flows through urban areas before emptying into the Delta. The main agricultural land use upstream consists of deciduous orchards, field crops, irrigated pastures and dairies. Figure II-1 shows the land use within this site subwatershed area.

Lone Tree Creek @ Brennan Rd, upstream from the Lone Tree Creek @ Jack Tone Road site, drains primarily rice and pasture and contains 7,370 irrigated acres. This site was sampled at the end of the irrigation season in 2005 and the storm season of 2006 as an upstream site to Lone Tree Creek @ Jack Tone Rd to try to narrow down toxicity and pesticide exceedance sources (prior to the development of the SJCDWQC Management Plan). Refer to Figure II-14 under Management Plan Monitoring for a map of the Lone Tree Creek @ Brennan Rd site subwatershed.

Figure II-1. Site subwatershed map of land use for the Lone Tree Creek @ Jack Tone Rd sample site. The highlighted points mark current sampling sites.



Subwatershed Monitoring History

The Lone Tree site subwatershed was one of the original monitoring locations established by the Coalition in 2004. The original monitoring location, Lone Tree Creek @ Jack Tone Rd has been monitored since 2004 (Table II-1). Samples were collected from this site for field parameters and the analysis of water chemistry and toxicity. Two months were monitored in the 2004 irrigation season for all field and physical parameters (including bacteria), two organophosphates, four pyrethroids, water column toxicity to all three species, and sediment toxicity. Lone Tree Creek @ Brennan Rd was added as an upstream site in 2005 and has been monitored occasionally (Tables II-2 and II-4). Management Plan monitoring for the Coalition was initiated during June of 2007 and included additional sampling at Lone Tree Creek @ Jack Tone Road in July and August for chlorpyrifos. Specific information on the analyses conducted across each of the monitoring seasons is provided below (Tables II-3 and II-4). Exceedances of field and physical parameters, *E. coli*, pesticides, metals, and water column and sediment toxicity have occurred at this site. A summary and discussion of these exceedances is provided in the next section (Table II-5).

The Lone Tree Creek site subwatershed is one of the rotating Assessment Monitoring locations within the SJCDWQC French Camp Slough @ Airport Way Zone. This subwatershed will not be rotated into the SJCDWQC monitoring program until 2015 (see SJCDWQC MRPP submitted on August 25, 2008 for details). However the Coalition will continue to monitor for Management Plan constituents as outlined in this document.

Table II-1. Lone Tree Creek @ Jack Tone Rd sampling events per season and year. An irrigation season sampling event encompasses normal monitoring and associated resampling, management plan monitoring, and sediment sampling. A storm event encompasses normal monitoring and any associated resampling.

	2004	2005		2006		2007	
	Irrigation	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Sampling Events	2	2	5	2	5	2	6

Table II-2. Lone Tree Creek @ Brennan Rd sampling events per season and year. An irrigation season encompasses normal monitoring and associated resampling, management plan monitoring, and sediment sampling. A storm event encompasses normal monitoring and any associated resampling.

	2004	2005		2006		2007	
	Irrigation	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Sampling Events	None	None	1	2	None	None	None

Table II-3. Lone Tree Creek @ Jack Tone Rd. Number of analyses performed per constituent in each sampling season (only environmental samples listed).

Constituent	2004	2005		2006		2007	
	Irrigation	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Field and Physical Parameters							
pH	2	3	5	4	5	3	9
Electrical Conductivity	2	3	5	4	5	3	9
Dissolved Oxygen	2	3	4	3	4	3	9
Total Dissolved Solids	2	2	5	2	5	2	6
Turbidity	2	2	5	2	5	2	7
E. coli	2	2	5	2	6	2	7
Color	2	2	5	2	5	2	7
Total Organic Carbon	2	2	5	2	7	2	6
Biological Oxygen Demand					2	2	2
Carbamates							
Aldicarb					5	2	6
Carbaryl					5	2	6
Carbofuran					5	2	6
Methiocarb					5	2	6
Methomyl					5	2	6
Oxamyl					5	2	6
Organochlorines							
DDD					5	2	6
DDE					5	2	6
DDT					5	2	6
Dicofol					5	2	6
Dieldrin					5	2	6
Endrin					5	2	6
Methoxychlor					5	2	6
Organophosphates							
Azinphos methyl					5	2	6
Chlorpyrifos	2	2	5	2	5	2	8
Diazinon	2	2	5	2	5	2	6
Dimethoate					5	2	6
Disulfoton					5	2	6
Malathion					5	2	6
Methamidophos					5	2	6
Methidathion					5	2	6
Parathion, Methyl					5	2	6
Phorate					5	2	6
Phosmet					5	2	6
Pyrethroids							
Bifenthrin			1	2	5	2	6
Cypermethrin	2	2	5	2	5	2	6
Cyhalothrin, lambda	2	2	5	2	5	2	6
Permethrin	2	2	5	2	5	2	6
Cyfluthrin			1	2	5	2	6
Esfenvalerate/ Fenvalerate	2	2	5	2	5	2	6
Triazines							

Constituent	2004	2005		2006		2007	
	Irrigation	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Atrazine					5	2	6
Cyanazine					5	2	6
Diuron					5	2	6
Glyphosate					5	2	6
Linuron					5	2	6
Molinate					5	2	6
Paraquat dichloride					5	2	6
Simazine					5	2	6
Thiobencarb					5	2	6
Metals							
Arsenic					6	2	6
Boron					6	2	6
Cadmium					6	2	6
Copper					6	2	6
Lead					6	2	6
Nickel					6	2	6
Selenium					6	2	2
Zinc					6	2	6
Nutrients							
Nitrate as NO3					6	2	6
Nitrite as Nitrogen					6	2	6
Ammonia					6	2	6
Hardness					6	2	6
Total Phosphorus					6	2	6
Orthophosphate					6	2	6
TKN					6	2	6
Toxicity							
Ceriodaphnia dubia	2	2	5	2	5	3	7
Pimephales promelas	2	3	5	2	5	3	7
Selenastrum capricornutum	2	3	5	3	5	4	7
Hyalella azteca	2		3	1	1	1	1

Table II-4. Lone Tree Creek @ Brennan Rd. Number of analyses performed per constituent in each sampling season (only environmental samples listed).

Constituent	2005	2006
	Irrigation	Storm
Field and Physical Parameters		
pH	1	5
Electrical Conductivity	1	5
Dissolved Oxygen	1	4
Total Dissolved Solids	1	2
Turbidity	1	2
E. coli	1	2
Color	1	2
Total Organic Carbon	1	2
Organophosphates		
Chlorpyrifos	1	2
Diazinon	1	2
Pyrethroids		
Bifenthrin	1	2
Cypermethrin	1	2
Cyhalothrin, lambda	1	2
Permethrin	1	2
Cyfluthrin	1	2
Esfenvalerate/ Fenvalerate	1	2
Toxicity		
Ceriodaphnia dubia	1	3
Pimephales promelas	1	3
Selenastrum capricornutum	1	3
Hyalella azteca		1

Exceedance History

During monitoring at the Lone Tree Creek sites, exceedances of numerous field, physical, bacteriological, and organic parameters have occurred including 14 dissolved oxygen (DO), 2 pH, 1 total dissolved solids (TDS) and 23 *E. coli* exceedances (Table II-5). Six exceedances of the chlorpyrifos WQTL occurred in the Lone Tree Creek subwatershed. Several other pesticides experienced exceedances; one each for cypermethrin, DDT, DDE, simazine and diazinon; and twice each for thiobencarb and diuron (Table II-6). The analysis of metals was initiated during the 2006 irrigation season. Since that time, one exceedance of the WQTL for lead, three exceedances for cadmium and six exceedances of the WQTL for copper have occurred. Samples taken from sites within the Lone Tree Creek subwatershed have also experienced water column toxicity to *Ceriodaphnia* once, *Pimephales* twice and to *Selenastrum* six times. Sediment samples were toxic to *Hyalella* twice.

Lone Tree Creek is currently listed under the Central Valley Basin Plan 303d list of impaired water bodies for ammonia, biochemical (biological) oxygen demand, and specific conductivity. The potential source of the stressors/pollutants is indicated as dairies. Lone Tree Creek has experienced one specific conductivity exceedance and three ammonia exceedances over the past three years of Coalition sampling. The exceedances were attributed to discharges from dairies.

Using the priority flow chart outlined in the Management Plan introduction, priorities were assigned to the constituents experiencing more than one exceedance. Based on the exceedances at the Lone Tree Creek sites, the constituents receiving the highest priorities were chlorpyrifos (A), copper (C) and diuron (C).

Table II-5. Field, bacteria, inorganic and legacy pesticide exceedances (low priority) experienced in samples collected from the previous and current Lone Tree Creek monitoring site between August 2004 and September 2007.

Station Name	Season	Sample Date	Oxygen, Dissolved, mg/L	pH, none	Specific Conductivity, µS/cm	Color, color units	Dissolved Solids, mg/L	Ammonia as N, mg/L	E. coli, MPN/100 mL	DDE(p,p')[1], µg/L	DDT(p,p')[1], µg/L
Lone Tree Creek @ Brennan Rd	Irrigation	20/Sep/2005	5.1			150			1600		
Lone Tree Creek @ Brennan Rd	Storm	27/Feb/2006			1370	1000	730		1600		
Lone Tree Creek @ Brennan Rd	Storm	15/Mar/2006				500			1600		
Lone Tree Creek @ Brennan Rd	Storm	24/Mar/2006	3.3								
Lone Tree Creek @ Jack Tone Rd	Irrigation	24/Aug/2004	6.3			50			500		
Lone Tree Creek @ Jack Tone Rd	Irrigation	23/Sep/2004				50					
Lone Tree Creek @ Jack Tone Rd	Irrigation	17/May/2005				50			900		
Lone Tree Creek @ Jack Tone Rd	Irrigation	21/Jun/2005				75			500		
Lone Tree Creek @ Jack Tone Rd	Irrigation	19/Jul/2005	6.1			60			900		
Lone Tree Creek @ Jack Tone Rd	Irrigation	16/Aug/2005	6.9			75			500		
Lone Tree Creek @ Jack Tone Rd	Irrigation	20/Sep/2005	4.5			80			1600		
Lone Tree Creek @ Jack Tone Rd	Irrigation	16/May/2006	6.7			55			2400		
Lone Tree Creek @ Jack Tone Rd	Irrigation	20/Jun/2006	4.7			85			2400		
Lone Tree Creek @ Jack Tone Rd	Irrigation	18/Jul/2006	5.6			35			770		
Lone Tree Creek @ Jack Tone Rd	Irrigation	15/Aug/2006	6.62			65			920		
Lone Tree Creek @ Jack Tone Rd	Irrigation	19/Sep/2006				56					
Lone Tree Creek @ Jack Tone Rd	Irrigation	10/Apr/2007				65					
Lone Tree Creek @ Jack Tone Rd	Irrigation	22/May/2007				40			730		
Lone Tree Creek @ Jack Tone Rd	Irrigation	12/Jun/2007				56			580		
Lone Tree Creek @ Jack Tone Rd	Irrigation	10/Jul/2007				75		2.5	2400		
Lone Tree Creek @ Jack Tone Rd	Irrigation	07/Aug/2007				55			1400	0.058	0.031
Lone Tree Creek @ Jack Tone Rd	Irrigation	04/Sep/2007				40					
Lone Tree Creek @ Jack Tone Rd	Storm	16/Feb/2005	6			800			1600		
Lone Tree Creek @ Jack Tone Rd	Storm	21/Mar/2005		8.58		150			900		
Lone Tree Creek @ Jack Tone Rd	Storm	27/Feb/2006		9		300			900		
Lone Tree Creek @ Jack Tone Rd	Storm	15/Mar/2006	6.3			750			1600		
Lone Tree Creek @ Jack Tone Rd	Storm	24/Mar/2006	6.7								
Lone Tree Creek @ Jack Tone Rd	Storm	27/Apr/2006									
Lone Tree Creek @ Jack Tone Rd	Storm	11/Feb/2007	5.54			400		2.8	2400		
Lone Tree Creek @ Jack Tone Rd	Storm	28/Feb/2007				380		2.1	2400		
Constituent Priority			**E**	**E**		**E**		**E**	**E**		

[1]Montitoring for this analyte was not initiated until May of 2006.

Table II-6. Metals, pesticides and toxicity (high priority) exceedances experienced in samples collected from the previous and current Jack Tone Creek monitoring site between August 2004 and September 2007.

Station Name	Season	Sample Date	Cadmium, µg/L	Copper[1,2], µg/L	Lead[1,2], µg/L	Chlorpyrifos, µg/L	Cypermethrin, total, µg/L	Diazinon, µg/L	Diuron[1], µg/L	Simazine[1], µg/L	Thiobencarb[1], µg/L	Ceriodaphnia dubia, Survival (%)	Hyalella azteca, Survival (%)	Pimephales promelas, Survival (%)	Selenastrum capricornutum, Total Cell Count
Lone Tree Creek @ Brennan Rd	Irrigation	20/Sep/2005													
Lone Tree Creek @ Brennan Rd	Storm	27/Feb/2006				0.018						0		0	1286750
Lone Tree Creek @ Brennan Rd	Storm	15/Mar/2006													680250
Lone Tree Creek @ Brennan Rd	Storm	24/Mar/2006													1234500
Lone Tree Creek @ Jack Tone Rd	Irrigation	24/Aug/2004													
Lone Tree Creek @ Jack Tone Rd	Irrigation	23/Sep/2004													
Lone Tree Creek @ Jack Tone Rd	Irrigation	17/May/2005											93.8		
Lone Tree Creek @ Jack Tone Rd	Irrigation	21/Jun/2005													
Lone Tree Creek @ Jack Tone Rd	Irrigation	19/Jul/2005				0.036	0.03								
Lone Tree Creek @ Jack Tone Rd	Irrigation	16/Aug/2005				0.019									
Lone Tree Creek @ Jack Tone Rd	Irrigation	20/Sep/2005													
Lone Tree Creek @ Jack Tone Rd	Irrigation	16/May/2006													
Lone Tree Creek @ Jack Tone Rd	Irrigation	20/Jun/2006													
Lone Tree Creek @ Jack Tone Rd	Irrigation	18/Jul/2006				0.019									
Lone Tree Creek @ Jack Tone Rd	Irrigation	15/Aug/2006		8.9 (6.4)											
Lone Tree Creek @ Jack Tone Rd	Irrigation	19/Sep/2006													
Lone Tree Creek @ Jack Tone Rd	Irrigation	10/Apr/2007													
Lone Tree Creek @ Jack Tone Rd	Irrigation	22/May/2007									0.5				
Lone Tree Creek @ Jack Tone Rd	Irrigation	12/Jun/2007									0.12				
Lone Tree Creek @ Jack Tone Rd	Irrigation	10/Jul/2007		12 (5.3)		0.035									
Lone Tree Creek @ Jack Tone Rd	Irrigation	07/Aug/2007	0.06	4.6 (4.1)											
Lone Tree Creek @ Jack Tone Rd	Irrigation	04/Sep/2007		3.5 (3.1)											
Lone Tree Creek @ Jack Tone Rd	Storm	16/Feb/2005												0	1380000
Lone Tree Creek @ Jack Tone Rd	Storm	21/Mar/2005													
Lone Tree Creek @ Jack Tone Rd	Storm	27/Feb/2006													
Lone Tree Creek @ Jack Tone Rd	Storm	15/Mar/2006													753750
Lone Tree Creek @ Jack Tone Rd	Storm	24/Mar/2006													
Lone Tree Creek @ Jack Tone Rd	Storm	27/Apr/2006											80		
Lone Tree Creek @ Jack Tone Rd	Storm	11/Feb/2007	0.1	21 (12.4)	3.8 (3.6)	0.052		0.14	12						
Lone Tree Creek @ Jack Tone Rd	Storm	28/Feb/2007	0.1	19 (13.9)					4.3	4.1					353000
Constituent Priority			**E**	**C**		**A**			**C**		**NP**		**D**	**D**	**D**

[1]Montitoring for this analyte was not initiated until May of 2006.
[2]Water quality trigger for each sample is based on hardness and is shown in parenthesis.

NP – Not Prioritized; thiobencarb is used only by rice and therefore all exceedances are turned over to the Rice Coalition.

2007 Management Plan Monitoring Results

In 2007, Management Plan monitoring was implemented at Lone Tree Creek @ Jack Tone Road for chlorpyrifos (Table II-7). During the irrigation season of 2007 the Coalition did not conduct Management Plan monitoring for copper since only one prior exceedance occurred during the irrigation season. All *Selenastrum* and diuron exceedances occurred during the storm season. Table II-8 provides monitoring results for chlorpyrifos from all sampling events during the 2007 irrigation season.

Table II-7. Management Plan monitoring schedule for chlorpyrifos at the Lone Tree Creek @ Jack Tone Rd sample site. "X" indicates the site, month and analyte sampled.

Sample Site	Sample Month	Chlorpyrifos
Lone Tree Creek @ Jack Tone Rd	July	**x**
Lone Tree Creek @ Jack Tone Rd	August	**x**

Table II-8. Lone Tree Creek @ Jack Tone Rd. Normal monitoring (NM) and Management Plan monitoring (MPM) results for chlorpyrifos from the 2007 irrigation season. Exceedance values are in bold.

Constituent	NM	NM	NM	NM	MPM	NM	MPM	NM
	4/10/07	5/22/07	6/12/07	7/10/07	7/30/07	8/07/07	8/28/07	9/04/07
Chlorpyrifos (ug/L)	<0.00259	<0.00259	0.011	**0.035**	0.01	<0.003	<0.003	<0.003

Load Calculations

Loads were calculated for the chlorpyrifos, copper, and diuron detections based on the following formula (Table II-9):

Load = Discharge (cfs) X 28.317L/ft^3 X Concentration (milligram/L X 1000 or µg/L).

The load values presented for constituents in this report represent instantaneous loads only. These values should not be used to extrapolate loading over any period of time (e.g. weekly, monthly, seasonal or annual). The primary purpose for reporting instantaneous loads is to provide a normalization of the concentrations by flow for various constituents at the time the samples were collected.

Table II-9. Instantaneous load calculations for chlorpyrifos, copper and diuron (sorted by site, analyte and date).

Station	Analyte	Sample Date	Discharge cfs	Concentration µg/L	Loading Rate µg/sec
Lone Tree Creek @ Brennan Rd	Chlorpyrifos	27/Feb/2006	No flow	0.018	0
Lone Tree Creek @ Jack Tone Rd	Chlorpyrifos	16/Feb/2005	0.63	0.014	0.25
Lone Tree Creek @ Jack Tone Rd	Chlorpyrifos	16/Aug/2005	25.85	0.019	13.91
Lone Tree Creek @ Jack Tone Rd	Chlorpyrifos	27/Feb/2006	0.34	0.014	0.13

Station	Analyte	Sample Date	Discharge cfs	Concentration µg/L	Loading Rate µg/sec
Lone Tree Creek @ Jack Tone Rd	Chlorpyrifos	15/Mar/2006	27.84	0.013	10.25
Lone Tree Creek @ Jack Tone Rd	Chlorpyrifos	11/Feb/2007	26.7	0.052	39.32
Lone Tree Creek @ Jack Tone Rd	Chlorpyrifos	12/Jun/2007	39.21	0.011	12.21
Lone Tree Creek @ Jack Tone Rd	Chlorpyrifos	10/Jul/2007	35.9	0.035	35.58
Lone Tree Creek @ Jack Tone Rd	Chlorpyrifos	30/Jul/2007	26.77	0.01	7.58
Lone Tree Creek @ Jack Tone Rd	Copper	16/May/2006	13.95	3.6	1422.08
Lone Tree Creek @ Jack Tone Rd	Copper	15/Aug/2006	49.49	8.9	12472.53
Lone Tree Creek @ Jack Tone Rd	Copper	11/Feb/2007	26.7	21	15877.34
Lone Tree Creek @ Jack Tone Rd	Copper	28/Feb/2007	7.85	19	4223.48
Lone Tree Creek @ Jack Tone Rd	Copper	10/Apr/2007	24.9	3.4	2397.32
Lone Tree Creek @ Jack Tone Rd	Copper	12/Jun/2007	39.21	5.1	5662.58
Lone Tree Creek @ Jack Tone Rd	Copper	10/Jul/2007	35.9	12	12198.96
Lone Tree Creek @ Jack Tone Rd	Copper	07/Aug/2007	19.43	4.6	2530.92
Lone Tree Creek @ Jack Tone Rd	Diuron	11/Feb/2007	26.7	12	9072.77
Lone Tree Creek @ Jack Tone Rd	Diuron	28/Feb/2007	7.85	4.3	955.84
Lone Tree Creek @ Jack Tone Rd	Diuron	10/Apr/2007	24.9	0.23	162.17

Source Identification

Priority A Constituents

Chlorpyrifos

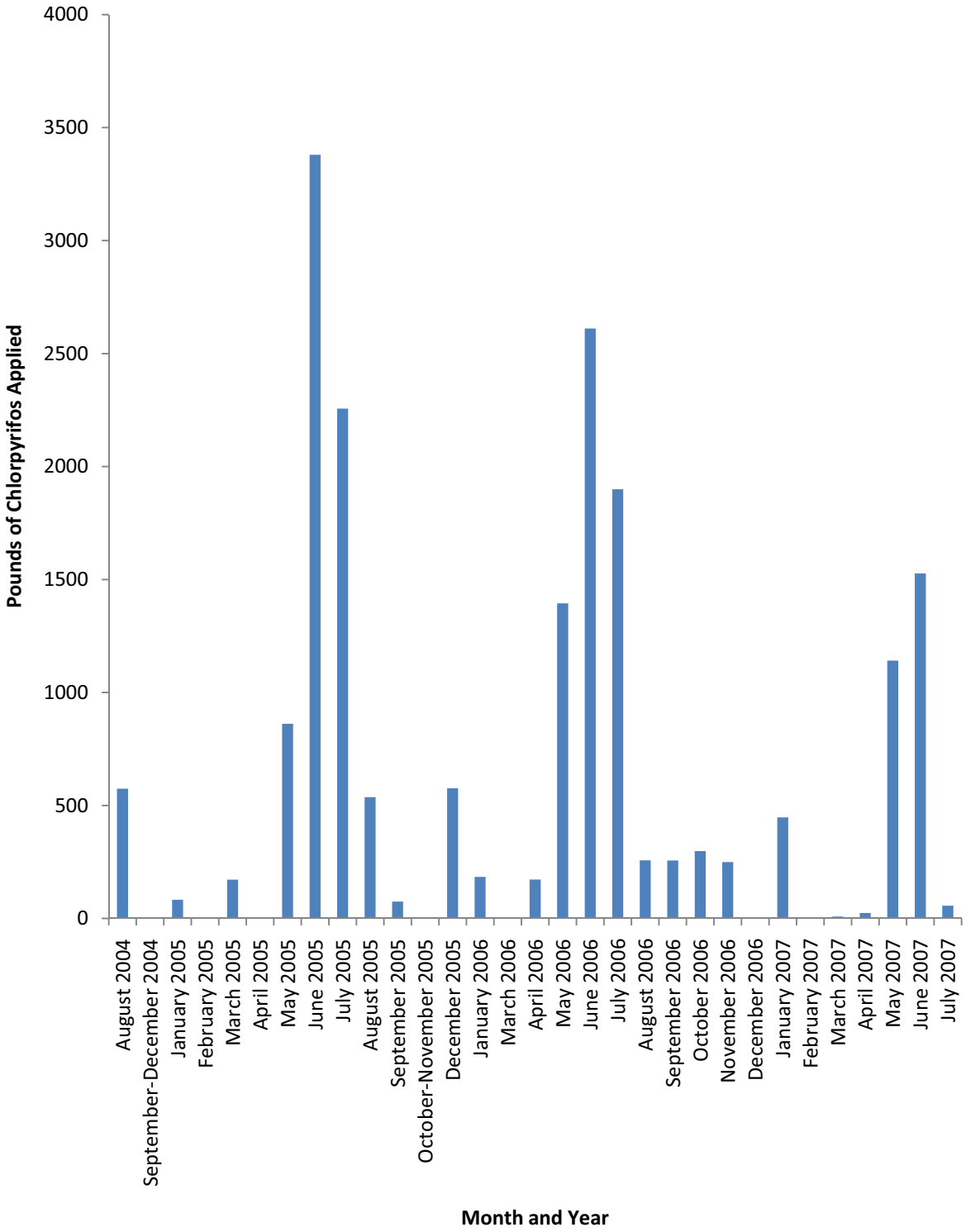
Applications of chlorpyrifos are made in as many as 10 months of the year in this watershed with the peak of applications in June of each year (Table II-10, Figure II-2). Large numbers of applications occur in May and into July. Exceedances occurred in the months of February (2), July (3), and August (1). Only one of the exceedances was associated with toxicity to *Ceriodaphnia* (February 2006 at Lone Tree Creek @ Brennan Rd) (Table II-6). There were only four applications of chlorpyrifos during the dormant season of 2006. Exceedances in July and August followed the largest amount of chlorpyrifos applied during each year (Figure II-2).

Table II-10. Number of chlorpyrifos applications, total pounds applied, and total acres treated by month for August 2004 through July 2007 in the Lone Tree Creek @ Jack Tone Rd site subwatershed. If a month is not included in the table, no applications were made.

Month	Number of Chlorpyrifos Applications	Pounds AI Applied	Acres Treated
August 2004	9	574.23	530
January 2005	1	82.56	44
March 2005	6	171.71	282
May 2005	18	861.2	508
June 2005	33	3379.7	1554.6
July 2005	51	2256.3	1717
August 2005	10	536.43	298
September 2005	3	74.37	248
December 2005	5	575.6	288.4
January 2006	4	183.8	98
March 2006	4	4.68	188
April 2006	2	172.3	127
May 2006	13	1394.6	800
June 2006	35	2611.1	1894.1
July 2006	35	1899.6	1382
August 2006	7	256.7	138
September 2006	4	256.5	253
October 2006	3	297.6	152.4
November 2006	2	249	134
January 2007	5	447.3	240
March 2007	1	8.08	40
April 2007	2	24.24	110
May 2007	24	1140.9	922

Month	Number of Chlorpyrifos Applications	Pounds AI Applied	Acres Treated
June 2007	22	1526.8	1205
July 2007	2	56.03	62
2004 Total	9	574.23	530
2005 Total	127	7937.87	4940
2006 Total	109	7325.88	5166.5
2007 Total	56	3203.35	2579
TOTAL	**301**	**19041.33**	**13215.5**

Figure II-2. Pounds of chlorpyrifos applied within the Lone Tree Creek @ Jack Tone Rd site subwatershed by month for 2004 through 2007.



The Coalition uses a combination of monitoring data and evaluation of PUR data to identify possible sources. The Coalition developed hypotheses to guide the search for sources within the watershed. If the amount of chlorpyrifos (either concentration or load) detected in the sample water was positively associated with amount of chlorpyrifos, then the exceedance would most likely be a result of accumulated runoff from numerous parcels. Alternatively, if there was no relationship between the amount applied across the watershed and the amount found in the water, the exceedance would be a result of one or a few parcels with poorly managed discharge. In order to develop an outreach strategy based on PUR data and the above hypothesis, the Coalition must assume that all applications have been reported and that each application has been reported accurately. The outreach strategy of the Coalition varies depending on which hypothesis is correct. The hypotheses are not mutually exclusive as some parcels could always contribute to exceedances, although the magnitude of the exceedance would be determined by the amount of product applied.

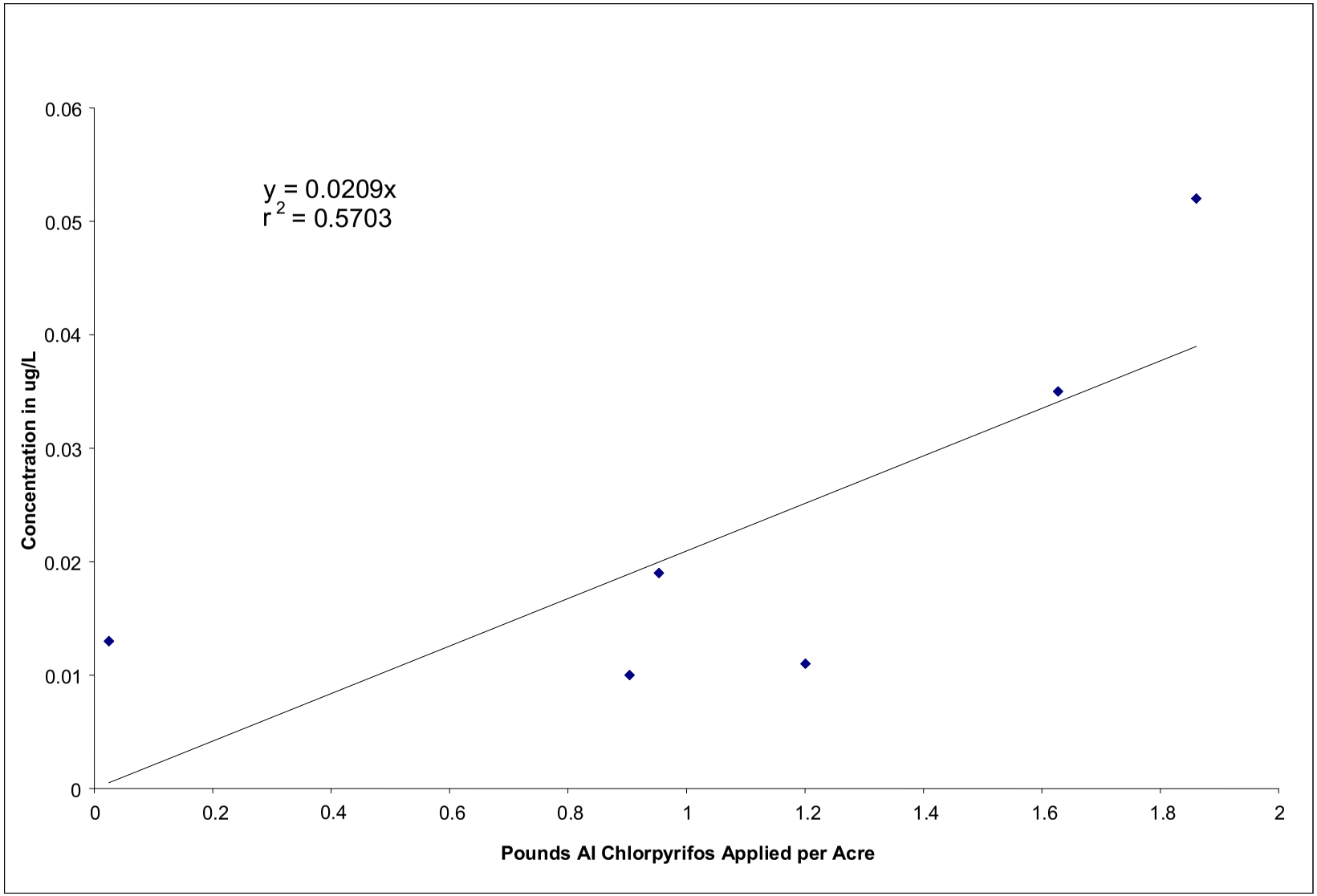
Consequently, the Coalition performed an analysis of chlorpyrifos applications within the last four weeks and concentrations and loads of chlorpyrifos in the water (all detections). A linear regression analysis was performed to establish the relationship between application in pounds per acre for those acres on which applications were made (not averaged across the entire watershed) and concentration and load. To associate PUR data (pounds AI per acre) with a single exceedance, the pounds AI was summed and divided by the summed acreage. The small sample size precluded a rigorous statistical treatment but sample sizes are sufficiently large to allow the two hypotheses to be distinguished. The intercept for all analyses was set at zero as there should be no chlorpyrifos in the water if there are no applications. However, this assumes that applications more than four weeks prior to sampling would not contribute chlorpyrifos to the water body. For purposes of this analysis, it is assumed that applications prior to four weeks before sampling would not contribute substantially to loads measured four weeks later.

The regression of concentration on pounds applied (AI) per acre indicated a significant positive relationship with 57% of the variation in concentration accounted for by the application rate (Figure II-3). In this situation the active ingredient is chlorpyrifos. Maximum application rates are set by the label and vary by crop. The average application rate of chlorpyrifos for the Lone Tree Creek subwatershed from 2004-2007 is 1.44 lbs AI/acre (Table II-11). The highest application rates are associated with almond and walnut orchard sprays and wine grapes.

Table II-11. Average pound active ingredient (AI) per acre for chlorpyrifos based on PUR data from 2004-2007 within the Lone Tree Creek @ Jack Tone Rd subwatershed.

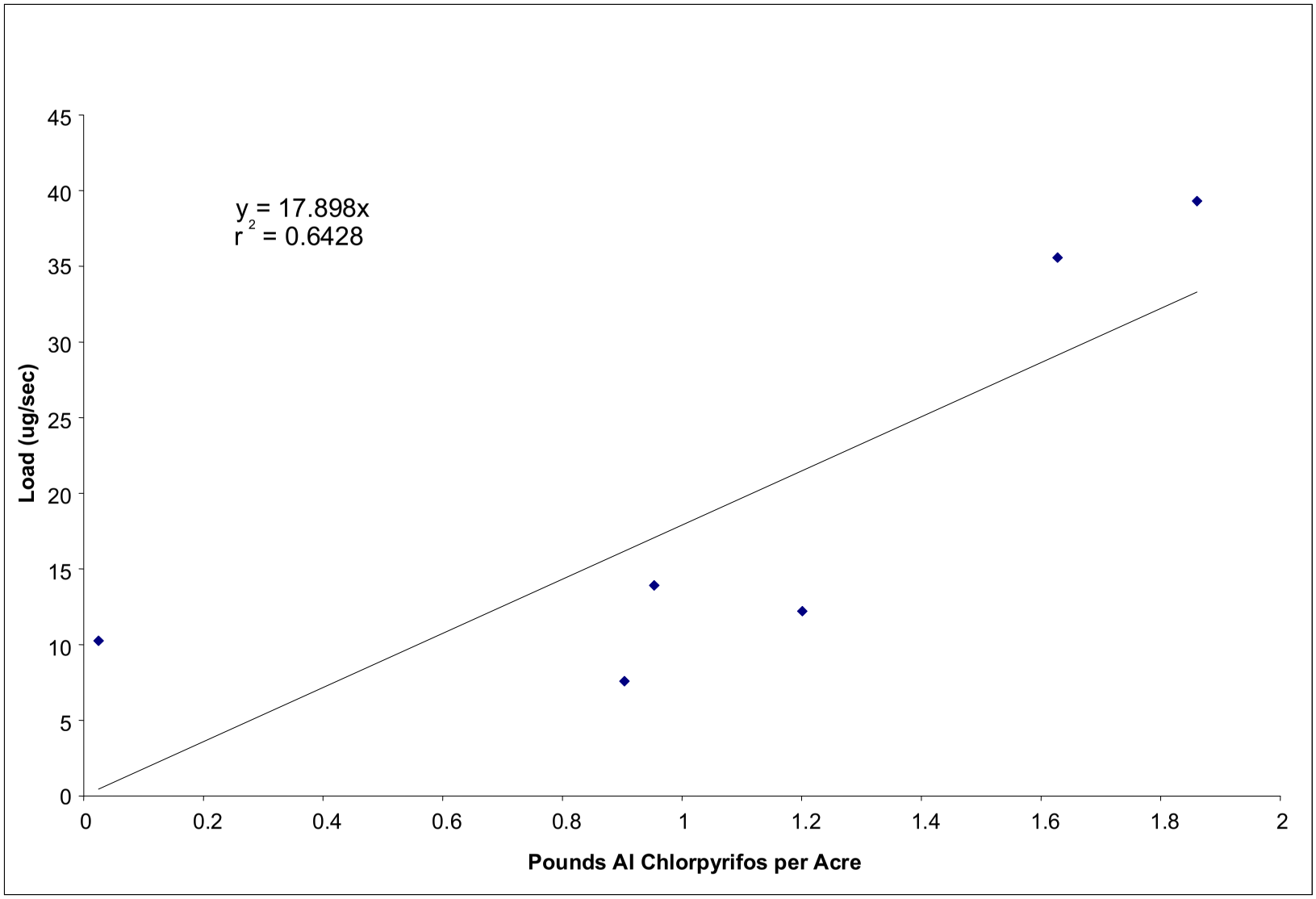
CHEMICAL NAME	Commodity	PRODUCT NAME	Average lbs AI/acre
CHLORPYRIFOS	CORN (FORAGE - FODDER)	LORSBAN 4E-HF	1.00
	WALNUT (ENGLISH WALNUT, PERSIAN WALNUT)	LORSBAN 4E-HF	1.99
	ALFALFA (FORAGE - FODDER) (ALFALFA HAY)	LOCK-ON INSECTICIDE	0.50
		LORSBAN 4E-HF	0.66
	ALMOND	CHLORPYRIFOS 4E AG	1.89
		GOVERN 4E INSECTICIDE	1.89
		LORSBAN 4E INSECTICIDE	1.92
		LORSBAN 4E-HF	0.92
		LORSBAN-4E	1.75
		WARHAWK	0.21
	CORN (FORAGE - FODDER)	LORSBAN 15G GRANULAR INSECTICIDE	1.25
		LORSBAN 4E-HF	0.47
		NUFOS 15G	1.5
	CORN FOR/FOD	LORSBAN 15G GRANULAR INSECTICIDE	1.24
		LORSBAN 4E-HF	0.83
		NUFOS 15G	1.50
	GRAPES, WINE	LORSBAN 4E-HF	2.04
		LORSBAN-4E	1.86
	WALNUT	LORSBAN 4E-HF	1.99
		LORSBAN-4E	1.86
		NUFOS 4E	2.03
	WALNUT (ENGLISH WALNUT, PERSIAN WALNUT)	CHLORPYRIFOS 4E AG	2.02
		GOVERN 4E INSECTICIDE	2.02
		LORSBAN 4E INSECTICIDE	1.60
		LORSBAN 4E-HF	1.91
		LORSBAN 50W INSECTICIDE IN WATER SOLUBLE PACKETS	0.06
		LORSBAN-4E	1.96
Average pounds applied chlorpyrifos per acre (2004-2007)			**1.44**

Figure II-3. Chlorpyrifos concentrations and application rates for the Lone Tree Creek @ Jack Tone Rd.



The slope of the regression line indicates that for each pound AI per acre that is not applied the concentration would decrease by 0.021 µg/L, more than the amount of the WQTL (0.015 µg/L). Based on the regression equation in Figure II-3, the maximum concentration that might be expected in the water would be approximately 0.040 µg/L. However, the maximum concentration at this site was 0.052 µg/L, approximately 30% greater than expected based on the regression line. This event was associated with a February sample collected after four applications to almonds in January. The elevated concentration suggests that the exceedance is not associated with spray drift but rather storm water runoff containing chlorpyrifos. The point with the lowest concentration relative to the line (the greatest negative residual) was associated with 36 applications to corn, almonds, and walnuts in June of 2005. These results suggest that the number of applications is not critical, while the average pounds applied per acre is important in determining the concentration of chlorpyrifos in the water. Similar results were found when load of chlorpyrifos was associated with pounds AI applied per acre (Figure II-4) and this relationship was stronger, as measured by the coefficient of determination (r^2), than the relationship between concentration and application rate. Dormant season applications result in the largest exceedances relative to the general trend. It also appears that exceedances are not associated with only one or two locations, but rather an accumulation of applications across the watershed. However, particular applications may be associated with exceedances over time.

Figure II-4. Instantaneous loads of chlorpyrifos associated with application rates based on detections of chlorpyrifos in the Lone Tree Creek @ Jack Tone Rd subwatershed.



To determine if there were specific parcels associated with exceedances on a continuing basis, the Coalition examined the sections (TRS) associated with each exceedance (Table II-12, Figures II-5, II-6). There were 28 sections associated with exceedances, each section had between 1 and 5 applications in the month prior to sampling. Generally, these applications were associated with different parcels within the section. Sections were associated with 1 – 4 applications, and only one section (1S8E35) was associated with all exceedances. This section had applications to almonds and walnuts in January, March, and June through early August. The application method was specified as aerial for some of the almond applications, ground for the walnut applications, and unspecified for one almond and one walnut application.

Table II-12. TRS with chlorpyrifos applications in month prior to each exceedance date. Includes pounds applied and acres treated. No chlorpyrifos applications were reported one month prior to the 02/27/06 exceedance.

TRS*	7/19/2005			8/16/2005			7/18/2006			2/11/2007			7/10/2007		
	Application Date	Pounds Applied	Acres Treated	Application Date	Pounds Applied	Acres Treated	Application Date	Pounds Applied	Acres Treated	Application Date	Pounds Applied	Acres Treated	Application Date	Pounds Applied	Acres Treated
1S8E13	7/7/05	66.9	36				7/17/06	66.9	36						
1S8E14				7/25/05	72.77	73									
1S8E15				7/21/05	46.46	25									
1S8E17	6/30/05 6/30/05 6/30/05	37.5 105 1500	25 70 100												
1S8E18				7/28/05	22.53	45									
1S8E20							7/1/06 7/1/06	120 150	80 100						
1S8E22	6/30/05	75	50	7/20/05 7/23/05 7/23/05	0.9969 0.2692 0.9646	20 9 25									
1S8E23				7/20/05 7/20/05	0.2492 1.495	5 30	6/24/06	192	160				6/11/07	187.2	156
1S8E24	7/15/05	195.6	163				6/22/06 6/22/06 6/26/06	26.4 44.4 24	22 37 40				6/11/07	24	20
1S8E25	7/4/05 7/4/05	48 69.6	40 58				6/26/06 6/26/06 7/15/06	48 69.6 8	40 58 4						
1S8E26				7/20/05	0.3987	8									
1S8E27				7/20/05 7/20/05	0.2492 0.4984	5 10									
1S8E28				8/12/05	37.16	20									
1S8E29	7/5/05	24.16	13	7/22/05	26.23	13	7/7/06	24.16	13				6/29/07	26.44	13
1S8E30										1/13/07 1/16/07	82.55 48.78	44 26			
1S8E31	6/30/05 7/19/05	18.58 22.3	10 12	7/19/05	22.3	12									
1S8E33				8/9/05 8/9/05	19.94 39.87	9 17	7/8/06	19.94	9						
1S8E34	7/16/05	8	8	7/16/05 7/25/05	8 35.88	8 18									
1S8E35	7/11/05 7/13/05 7/18/05 7/19/05	33.45 171.5 35.88 35.88	18 86 18 18	7/18/05 7/19/05 8/8/05	35.88 35.88 17.94	18 18 9	6/22/06 7/13/06 7/14/06	8.97 33.45 39.87	4.5 18 20	1/26/07	92.92	50	6/30/07	171.47	86
1S8E36										1/25/07	111.5	60			
1S9E15				7/29/05 7/29/05	0.4985 0.7476	10 15									

TRS*	7/19/2005			8/16/2005			7/18/2006			2/11/2007			7/10/2007		
	Application Date	Pounds Applied	Acres Treated	Application Date	Pounds Applied	Acres Treated	Application Date	Pounds Applied	Acres Treated	Application Date	Pounds Applied	Acres Treated	Application Date	Pounds Applied	Acres Treated
1S9E18							6/30/06	36.45	27						
1S9E21				7/27/05 7/27/05	0.7975 1.595	20 40	6/20/06	78	65						
1S9E22	6/21/05	18	15												
1S9E25													6/11/07	20.4	17
1S9E26	6/27/05 7/2/05	49.2 48	41 40				6/25/06	48	40				6/11/07 6/29/07	42 55.2	35 46
1S9E30	7/14/05	39.87	40				7/15/06 7/15/06 7/15/06	0.7476 3.05 3.48	24 98 112						
1S9E32	7/13/05 7/14/05	76.76 37.17	77 20												
1S9E33							6/30/06 6/30/06	24.3 35.1	18 26						
1S9E34	6/28/05 7/8/05 7/8/05	144 63.18 81.76	120 34 44				6/27/06 6/30/06 7/12/06 7/12/06 7/13/06	19.94 151.2 63.18 81.76 27.87	10 126 34 44 15				6/11/07	151.2	126
1S9E35	6/22/05 6/23/05 7/7/05	36 19.94 26.02	20 6 14				7/12/06 7/14/06	26.02 39.87	14 20						
1S9E36							6/24/06	24	20						
2S8E2	7/18/05	39.87	20	7/27/05 7/27/20	39.87 40	20 20	6/22/06 7/6/06 7/11/06 7/16/06 7/18/06	3.98 11.15 15.04 19.94 79.75	10 6 12 20 40						
2S8E3	7/17/05	15	15	7/17/05	15	15	7/13/06	91.24	40						
2S9E1	7/2/05	40.8	34	8/3/05 8/3/05	3.991 59.81	30 30	6/19/06	84	70				6/16/07	48	40
2S9E2	7/7/05 7/7/05 7/12/05	33.45 35.31 232.3	18 19 125				7/18/06 7/18/06	33.45 230.4	18 124	1/16/2007	111.5	60			
2S9E5	7/6/05 7/13/05	66.9 120.02	36 60	7/20/05	40	20	7/12/06 7/15/06 7/18/06	66.9 11.5 120	36 60 60						
2S9E6	7/5/05 7/5/05 7/8/05 7/9/05 7/11/05	18.58 46.46 9.29 139.4 79.75	20 50 5 75 40	8/12/05	87.73	44	7/13/06	137.5	74						

*Bolded TRS are members of the Coalition.

Figure II-5. Lone Tree Creek @ Jack Tone Rd TRS' that have had applications co-occurring with a chlorpyrifos exceedance.

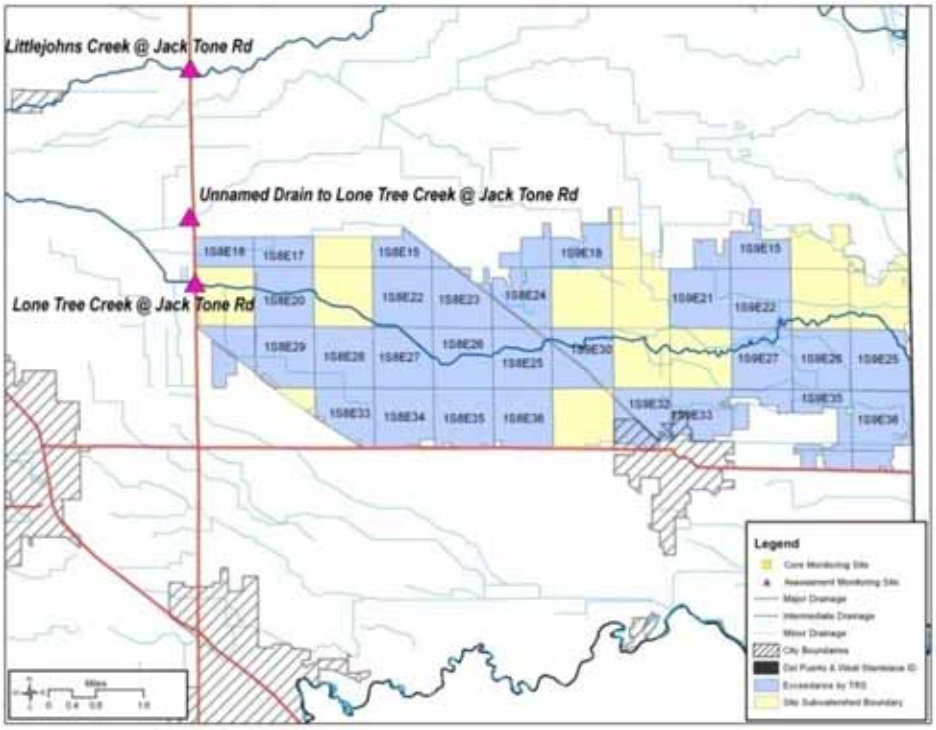
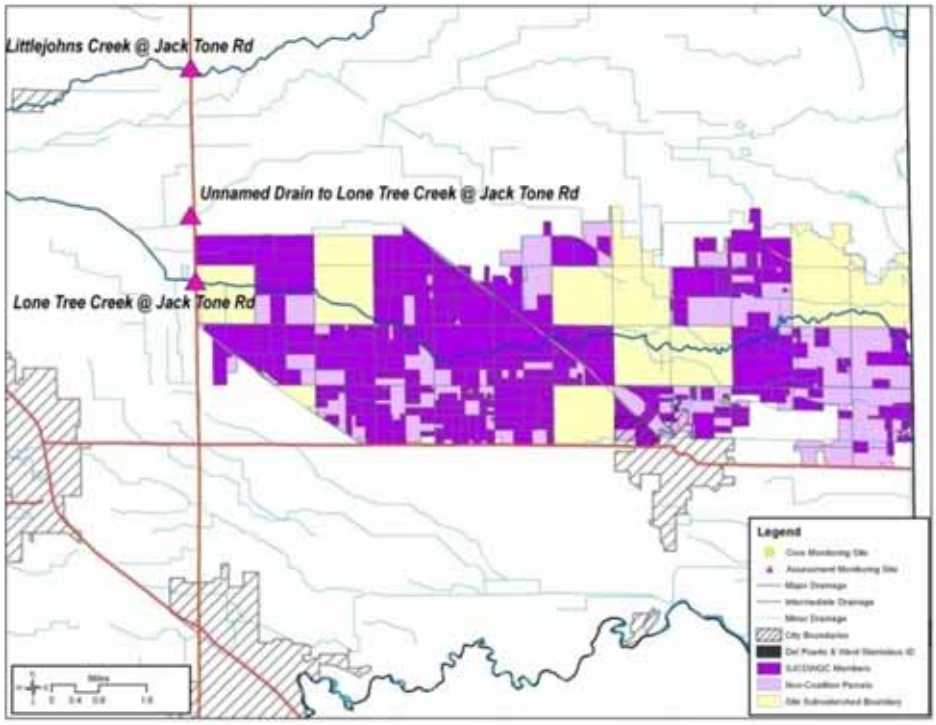


Figure II-6. Lone Tree Creek @ Jack Tone Rd member APNs relative to TRS with applications co-occurring with chlorpyrifos exceedances.



The analyses conducted by the Coalition suggest that management of chlorpyrifos in this watershed should focus on providing information on a watershed wide basis to encourage growers to review their operation to determine if irrigation return flows and storm water discharges are managed properly. Almond and walnut growers should be targeted for outreach especially prior to the dormant spray season. Low concentrations of chlorpyrifos in the water samples during the summer could be the result of drift as well as irrigation return flows carrying product to the creek. It is unknown how many of the orchards are on drip or microspray but these irrigation practices could lower runoff and reduce the amount of chlorpyrifos reaching the creek.

Analysis of the management practices surveys for this watershed indicates that less than a quarter of members claim there is no discharge from their property. Twenty-two percent of the parcels for which surveys were filled out claim no runoff (20% of member acreage within the Lone Tree Creek subwatershed for which surveys were filled out). Thirty-seven percent of parcels (41% of member acreage) discharge directly to a waterway (local drainage system or directly to the waterway). Twenty-six percent of parcels (31% of member acreage) use recirculation (tail water return system), 1% of parcels (1% of member acreage) use micro/drip irrigation, 5% of parcels (4% of member acreage) utilize sediment settling ditches and 16% of parcels (14% of member acreage) utilize holding basins to reduce runoff. A large number of growers use grass waterways or vegetated filter strips (46% of parcels, 44% of member acreage) suggesting that there is a mix of management practice intensity in the watershed. Although there is a large amount of acreage that discharges directly into a local drainage system or waterway, a majority of member acreage utilizes one or more management practices to reduce discharge. Outreach could focus on management practices that improve irrigation efficiency and retain water on the field rather than allowing discharge to surface waters including micro/drip irrigation systems, recirculation/tail water return systems and hold basins. There are several sections that could be targeted for intensified outreach including 1S8E35 and the remaining 15 sections that are associated with two or more exceedances. This targeted outreach represents a significant effort as each section may contain numerous parcels. The Coalition has been engaged in targeted outreach in the Lone Tree Creek watershed through the Proposition 50 activities.

Priority C Constituents

Copper

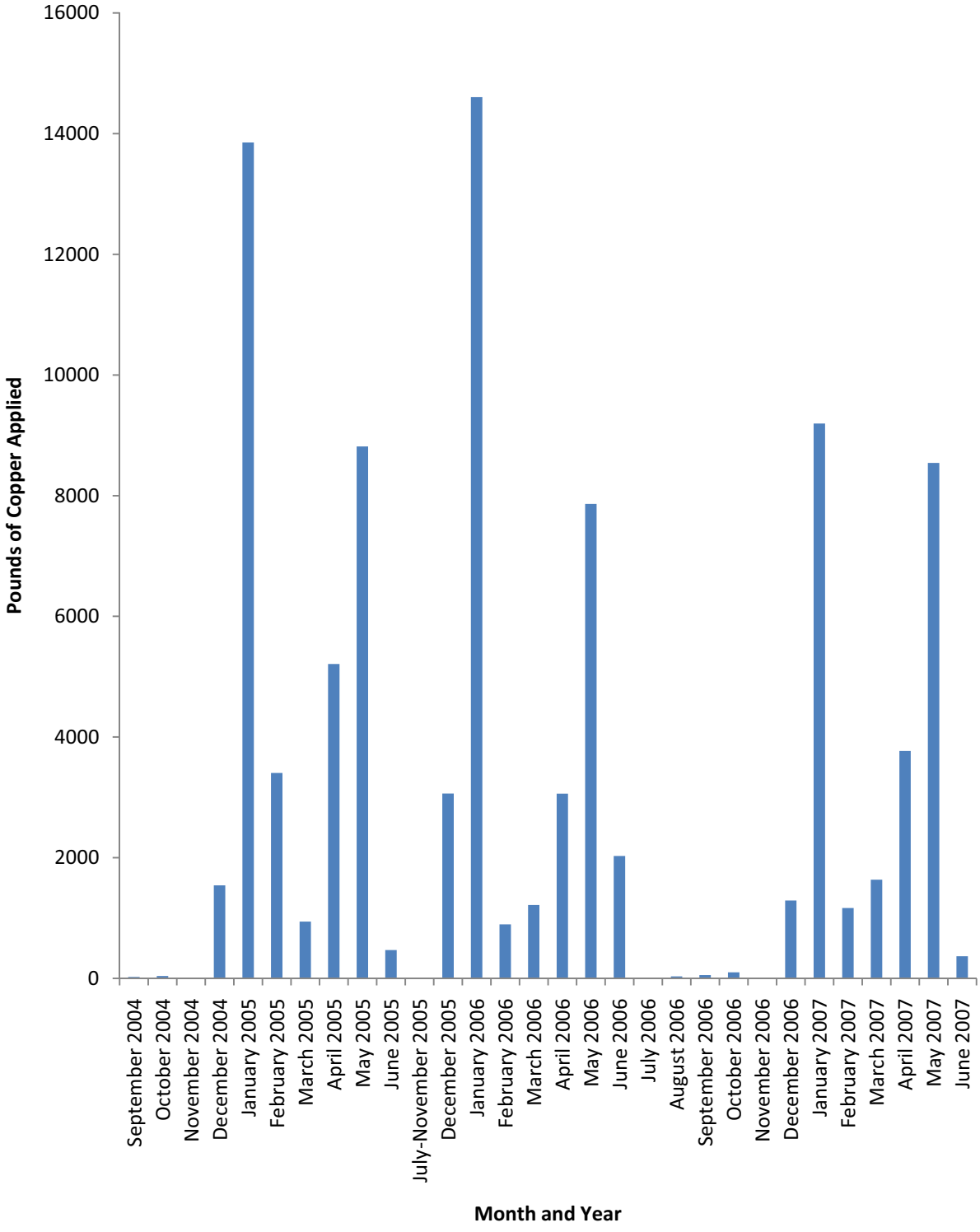
Copper is one of the most heavily applied constituents in the Coalition region. Copper is applied in every month except July and November. There are fewer applications from the summer through the fall, with the bulk of the applications occurring in the winter and spring (Table II-13, Figure II-7). The greatest number of pounds AI were applied in January with the second greatest month of application being May (Figure II-7). The large number of applications is spread across the entire site subwatershed with applications in almost every section (Figures II-8, II-9). Within each of the sections, almost every parcel received at least one application.

Table II-13. Number of copper applications, total pounds applied, and total acres treated by month for August 2004 through July 2007 in the Lone Tree Creek @ Jack Tone Rd site subwatershed. If a month is not included in the table, no applications were made.

Month	Number of Copper Applications	Pounds Applied	Acres Treated
September 2004	1	24.6	16
October 2004	1	39.3	16
December 2004	14	1541.2	350.25
January 2005	58	13854	2612.3
February 2005	47	3403.8	1352.5
March 2005	17	940.7	459
April 2005	40	5211.3	1361.6
May 2005	29	8815.5	1051
June 2005	2	469.7	105
December 2005	19	3062.6	612.5
January 2006	83	14606	3122
February 2006	28	895.5	608.5
March 2006	30	1216.2	1006.5
April 2006	29	3062.1	1166.6
May 2006	22	7863.4	1062.5
June 2006	6	2029.5	205
August 2006	1	32.28	9
September 2006	1	53.9	35
October 2006	2	100.1	65
December 2006	19	1290.5	282.5
January 2007	56	9196.5	2229
February 2007	21	1165.6	640
March 2007	11	1634.9	401
April 2007	31	3768.9	921
May 2007	15	8541.7	869
June 2007	1	366.3	37

Month	Number of Copper Applications	Pounds Applied	Acres Treated
2004 Total	16	1605.1	382.25
2005 Total	212	35757.6	7553.9
2006 Total	221	31149.48	7562.6
2007 Total	135	24673.9	5097
Total	**584**	**93186.08**	**20595.75**

Figure II-7. Pounds of copper applied within the Lone Tree Creek @ Jack Tone Rd site subwatershed by month for 2004 through 2007.



To determine if there were specific parcels associated with exceedances on a continuing basis, the Coalition examined the sections (TRS) associated with each exceedance (Table II-14 and II-15). There were 44 sections associated with exceedances. Exceedances were associated with applications in 11 to 29 sections, and each section had between 1 and 6 applications in the months prior to sampling. Two sections (1S8E33, 1S9E13) were associated with all exceedances. Section 1S8E33 had applications to almonds, walnuts, nectarines, and peaches in December, January, February, April, May and August. The application method was specified as ground. Section 1S9E13 had applications to almonds in February, and rice in May and June. The application method was specified as aerial for rice and not specified for almonds. Overall, applications were made to almonds, walnuts, cherries, alfalfa, grapes, tomatoes, apricots, nectarines, peaches, plums, and rice. By far, the largest number of applications was made on almonds during the winter dormant season.

Table II-14. TRS with copper applications in three months prior to each exceedance date. Includes pounds applied and acres treated. No copper applications were reported for the three month time period prior to the 9/4/07 exceedance.

TRS*	8/15/2006			2/11/2007			2/28/2007			7/10/2007			8/7/2007		
	Application Date	Pounds Applied	Acres Treated	Application Date	Pounds Applied	Acres Treated	Application Date	Pounds Applied	Acres Treated	Application Date	Pounds Applied	Acres Treated	Application Date	Pounds Applied	Acres Treated
1S8E13				1/10/07	188.7	36	1/10/07	188.7	36						
1S8E15										4/21/07	114.7	100			
1S8E20										4/20/07 4/20/07 4/21/07 4/22/07 4/22/07	96.84 338.9 96.84 116.2 145.26	20 70 20 24 30			
1S8E21										4/20/07	385	50			
1S8E22										4/21/07	122.8	107			
1S8E25				1/24/07	129.1	40	1/24/07	129.1	40						
1S8E26				2/1/07	121.1	40	2/1/07	121.1	40	4/20/07	49.36	38			
1S8E27				1/31/07 2/17/07 2/20/07 2/20/07 2/20/07	45.19 26.9 18.48 60.6 92.4	14 35 12 39 60	1/31/07	45.19	14						
1S8E28				12/5/06 12/5/06 12/28/06 1/3/07 1/3/07 2/2/07	30.45 54.14 83.93 32.28 67.78 32.28	9 15 26 10 21 10	12/5/06 12/5/06 12/28/06 1/3/07 1/3/07 2/2/07 2/17/07 2/20/07	30.45 54.14 83.93 32.28 67.78 32.28 15.4 123.2	9 15 26 10 21 10 10 80						
1S8E29				1/17/07 1/17/07	103.3 159.2	24 27	1/17/07 1/17/07	103.3 159.2	24 27	4/19/07	41.96	13	5/22/06	79.82	13
1S8E30				1/10/07 1/13/07 1/16/07	32.28 142 83.93	10 44 26	1/10/07 1/13/07 1/16/07	32.28 142 83.93	10 44 26	4/14/07	419.6	130			
1S8E31				1/9/07 1/15/07 1/17/07 1/24/07	251.7 112.9 206.6 246.4	78 36 64 46	1/9/07 1/15/07 1/17/07 1/24/07	251.7 112.9 206.6 246.4	78 36 64 46						
1S8E32				1/11/07 1/22/07	167.8 161.4	52 48	1/11/07 1/22/07	167.8 161.4	52 48	4/14/07	36.59	30			

TRS*	8/15/2006			2/11/2007			2/28/2007			7/10/2007			8/7/2007		
	Application Date	Pounds Applied	Acres Treated	Application Date	Pounds Applied	Acres Treated	Application Date	Pounds Applied	Acres Treated	Application Date	Pounds Applied	Acres Treated	Application Date	Pounds Applied	Acres Treated
1S8E33	5/21/06 8/4/06	32.28 32.28	9 9	12/13/06 12/13/06 1/17/07 1/18/07	12.21 121.1 129.1 4.035	8 22 40 15	12/13/06 12/13/06 1/17/07 1/18/07 2/17/07 2/20/07	12.21 121.1 129.1 40.35 110.88 67.76	8 22 40 15 72 44	4/13/07 5/11/07	69.3 27.72	9 9	4/13/07	69.3	9
1S8E34				1/3/07 1/17/07 2/1/07	61.33 64.56 246.1	19 15 76	1/3/07 1/17/07 2/1/07	61.33 64.56 246.1	19 15 76						
1S8E35				12/29/06 1/5/07 1/26/07 2/6/07 2/6/07	94.38 86.08 308 30.8 46.2	18 20 50 5 7	12/29/06 1/5/07 1/26/07 2/6/07 2/6/07	94.38 86.08 308 30.8 46.2	18 20 50 5 7	4/10/07 4/10/07 4/10/07 4/13/07 4/18/07	24.56 69.3 184.8 123.2 24.56	4 9 30 20 4			
1S8E36				1/25/07	369.6	60	1/25/07 2/19/07	369.6 8.07	60 20						
1S9E13	5/27/06 6/5/06	435.6 306.9	44 31	2/3/07	24.21	7	2/3/07	24.21	7	5/16/07	524.7	53	5/16/07	524.7	53
1S9E14	5/24/06 5/26/06	1584 366.3	160 37							5/8/07 5/14/07 5/18/07	455.4 1584 891	46 160 90	5/8/07 5/14/07 5/18/07	455.4 1584 891	46 160 90
1S9E15	5/24/06	196.48	40							4/10/07 5/18/07 6/1/07	308 1059.3 366.3	40 107 37	5/18/07 6/1/07	1059.3 366.3	107 37
1S9E16	5/25/06 6/3/06	534.6 178.2	54 18							5/12/07	534.6	54	5/12/07	534.6	54
1S9E17	5/23/06	336.6	34							5/10/07	336.6	34	5/10/07	336.6	34
1S9E18				1/11/07 1/15/07	371.22 219.5	115 68	1/11/07 1/15/07	371.22 219.5	115 68						
1S9E20							2/20/07	13.32	33						
1S9E21	6/3/06	673.2	68												
1S9E22	5/18/06 5/23/06 5/27/06	693 277.2 450.4	70 28 45.5							5/8/07 5/14/07 5/17/07	891 277.2 455.4	90 28 46	5/8/07 5/14/07 5/17/07	891 277.2 455.4	90 28 46
1S9E23	6/5/06	227.2	23												
1S9E24	5/25/06 5/27/06	495 316.8	50 32							5/10/07 5/17/07 5/26/07	297 554.4 495	30 56 50	5/10/07 5/17/07 5/26/07	297 554.4 495	30 56 50
1S9E25	5/20/06 5/20/06 6/5/06 6/5/06	168.3 277.2 118.8 524.7	16 28 12 53							5/16/07	158.4	16	5/16/07	158.4	16

TRS*	8/15/2006			2/11/2007			2/28/2007			7/10/2007			8/7/2007		
	Application Date	Pounds Applied	Acres Treated	Application Date	Pounds Applied	Acres Treated	Application Date	Pounds Applied	Acres Treated	Application Date	Pounds Applied	Acres Treated	Application Date	Pounds Applied	Acres Treated
1S9E30				1/10/07	8.07	3	1/10/07	8.07	3						
1S9E31				1/4/07 1/4/07 1/12/07 1/22/07 2/2/07 2/6/07	10.76 43.04 60.41 122.6 56.49 46.2	4 16 15 38 17 7	1/4/07 1/4/07 1/12/07 1/22/07 2/2/07 2/6/07	10.76 43.04 60.41 122.6 56.49 46.2	4 16 15 38 17 7	4/19/07	9.684	3			
1S9E32				1/10/07	125.8	24	1/10/07	125.8	24						
1S9E33				1/4/07	375.4	78	1/4/07	375.4	78						
1S9E34				1/5/07 1/5/07 1/12/07 1/13/07 1/20/07	81.81 736.3 61.4 77 115.1	17 153 10 10 40	1/5/07 1/5/07 1/12/07 1/13/07 1/20/07	81.81 736.3 61.4 77 115.1	17 153 10 10 40	4/18/07	61.6	10			
1S9E35				1/10/07 1/10/07 1/10/07	73.41 125.8 169.5	14 24 50	1/10/07 1/10/07 1/10/07	73.41 125.8 169.5	14 24 50						
1S9E36	5/27/06	712.8	71												
2S8E1				12/29/06 1/6/07 1/23/07 1/30/07	96.94 64.56 92.4 24.56	30 30 20 8	12/29/06 1/6/07 1/23/07 1/30/07 2/28/07	96.94 64.56 92.4 24.56 3.85	30 30 20 8 20	4/14/07	147.1	19			
2S8E2				12/23/06 1/17/07 1/26/07	15.38 387.4 112.9	3 90 35	12/23/06 1/17/07 1/26/07 2/28/07	15.38 387.4 112.9 11.55	3 90 35 29	4/10/07 4/13/07	123.2 123.2	20 20			
2S8E3				1/19/07	29.05	9	1/19/07	29.05	9	4/10/07 4/13/07 4/14/07	17.07 26.84 17.07	14 22 14			
2S8E4				1/18/07 1/18/07 1/26/07	8.07 32.28 73.68	3 10 20	1/18/07 1/18/07 1/26/07	8.07 32.28 73.68	3 10 20	4/10/07	46.35	38			
2S9E1				12/20/06 12/20/06 1/9/07 1/18/07	3.146 4.195 859.9 49.28	0.75 1 164 8	12/20/06 12/20/06 1/9/07 1/18/07	3.146 4.195 859.9 49.28	0.75 1 164 8						
2S9E2				12/14/06 12/14/06 1/8/07 1/8/07 1/16/07 1/23/07	38.5 38.5 99.63 650.2 193.6 277.2	3 4.25 19 124 60 60	12/14/06 12/14/06 1/8/07 1/8/07 1/16/07 1/23/07	38.5 38.5 99.63 650.2 193.6 277.2	3 4.25 19 124 60 60	4/14/07 4/19/07	188.6 83.93	24 26			

TRS*	8/15/2006			2/11/2007			2/28/2007			7/10/2007			8/7/2007		
	Application Date	Pounds Applied	Acres Treated	Application Date	Pounds Applied	Acres Treated	Application Date	Pounds Applied	Acres Treated	Application Date	Pounds Applied	Acres Treated	Application Date	Pounds Applied	Acres Treated
2S9E5				12/18/06 12/30/06 2/5/07	51.65 31.46 10.44	16 6 17	12/18/06 12/30/06 2/5/07	51.65 31.46 10.44	16 6 17						
2S9E6	5/18/06	38.5	5	12/30/06 12/31/06 1/17/07	388 216.1 274.4	74 44 85	12/30/06 12/31/06 1/17/07	388 216.1 274.4	74 44 85	4/10/07 4/12/07	16.14 142	5 44			

*Bolded TRS are members of the Coalition

Table II-15. All TRS that had more than one application associated with an exceedance for copper in 2006 and 2007. Table shows which exceedance the application was associated with and number of applications associated with an exceedance for a given TRS.

TRS*	Date of associated exceedance			
	8/15/2006	2/11/2007	2/28/2007	7/10/2007
1S8E13		1	1	
1S8E15				1
1S8E20				5
1S8E21				1
1S8E22				1
1S8E25		1	1	
1S8E26		1	1	1
1S8E27		1	5	1
1S8E28		6	8	
1S8E29	1	2	2	1
1S8E30		3	3	1
1S8E31		4	4	
1S8E32		2	2	1
1S8E33	2	4	6	2
1S8E34		3	3	
1S8E35		5	5	5
1S8E36		1	2	
1S9E13	2	1	1	1
1S9E14	2			3
1S9E15	1			3
1S9E16	2			1
1S9E17	1			1
1S9E18		2	2	
1S9E20			1	
1S9E21	1			
1S9E22	3			3
1S9E23	1			
1S9E24	2			3
1S9E25	4			1
1S9E30		1	1	
1S9E31		6	6	1
1S9E32		1	1	
1S9E33		1	1	
1S9E34		5	5	1
1S9E35		3	3	
1S9E36	1			

TRS*	Date of associated exceedance			
	8/15/2006	2/11/2007	2/28/2007	7/10/2007
2S8E1		4	5	1
2S8E2		3	4	2
2S8E3		1	1	3
2S8E4		3	3	1
2S9E1		7	7	
2S9E2		6	6	2
2S9E5		3	3	
2S9E6	1	3	3	2

*Bolded TRS are members of the Coalition

Figure II-8. Lone Tree Creek @ Jack Tone Rd TRS that have had applications co-occurring with a copper exceedance.

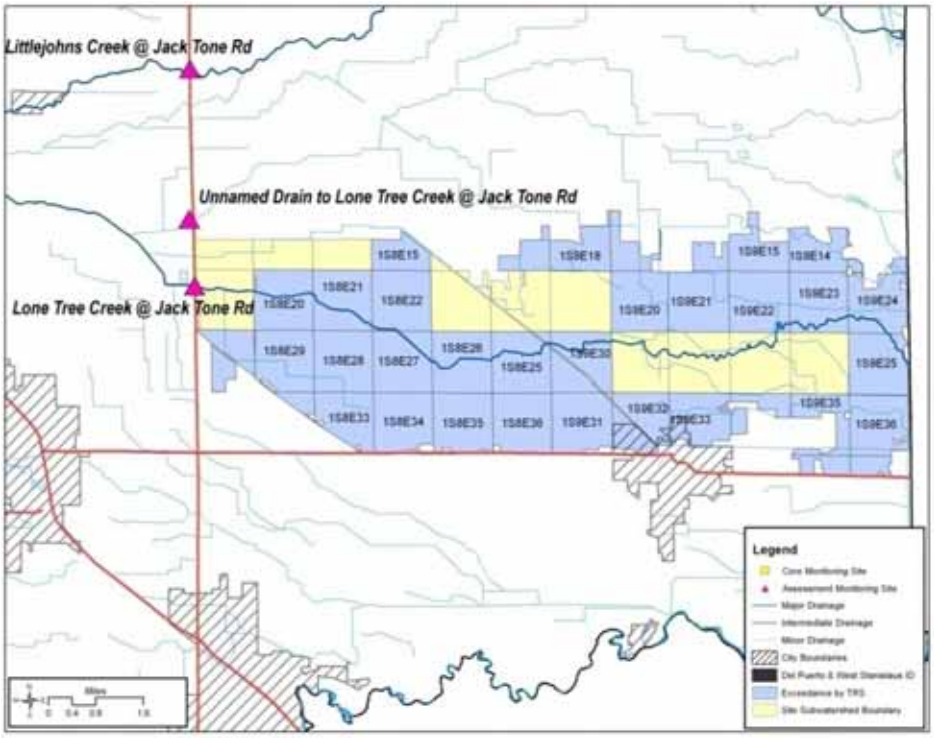
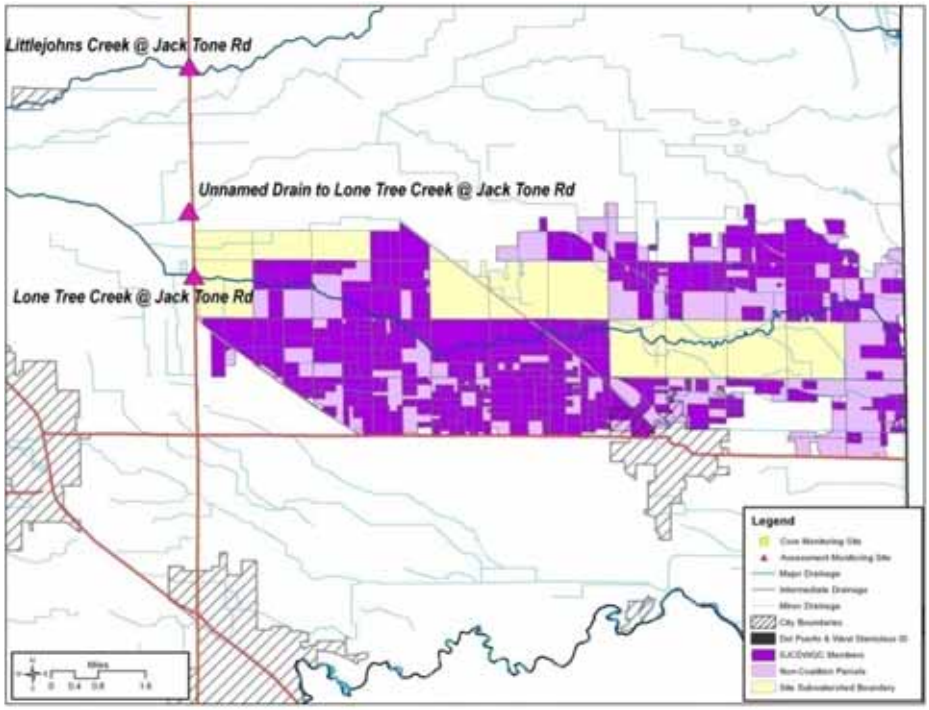


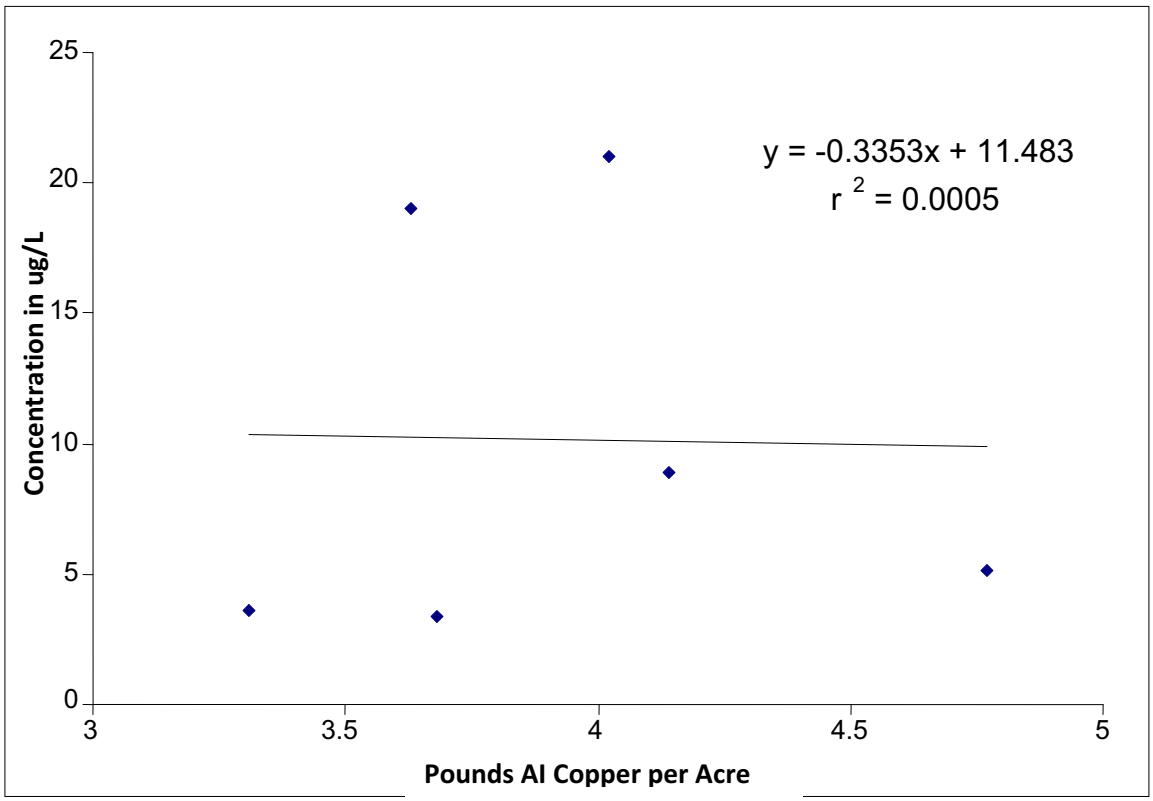
Figure II-9. Lone Tree Creek @ Jack Tone Rd member APNs relative to TRS with applications co-occurring with chlorpyrifos exceedances.



Similar to the analysis performed for chlorpyrifos, a linear regression analysis was performed to establish the relationship between application in pounds per acre for those acres on which applications were made (not averaged across the entire watershed) and concentration and load. To associate PUR data (pounds AI per acre) with a single exceedance, the pounds AI was summed and divided by the summed acreage. Four products with copper as the active ingredient were included in the analysis. The small sample size precluded a rigorous statistical treatment but sample sizes are sufficiently large to allow the two hypotheses to be distinguished. The intercept was not set to zero as there could be natural copper in the system that would serve as a baseline value. Unlike the chlorpyrifos analysis, copper applications were included in the analysis if they occurred within six months of the detection. Copper does not degrade and could remain in place until moved to a surface water body. It is unclear if the six month window is sufficient, but summing applications from a longer window dilutes out the effects of recent applications. Statistically, using longer than six months for applications also makes the points in the regression analysis non-independent as the same applications contribute to the average pounds AI per acre for several detections. For the analysis reported below, some interdependence was allowed for data points that were temporally close because the same application in the previous few months could contribute to both detections.

The regression of concentration and pounds applied (AI) per acre indicated no relationship with only .05% of the variation in concentration accounted for by the application rate (Figure II-10). Based on the method used to analyze the data, the average amount of copper applied per acre does not predict the concentration in the water and therefore it is unlikely that the detections of copper in Lone Tree Creek are a function of accumulated applications across the site subwatershed. There may be several parcels that contribute a disproportionate amount of copper to the creek, however because there are numerous parcels associated with each detection of copper (see below), isolating sources will be difficult.

Figure II-10. Copper loads and application rates for the Lone Tree Creek @ Jack Tone Rd.



The analyses conducted by the Coalition suggest that management of copper in this watershed should focus on providing information on a watershed wide basis to growers to encourage the retention of water and sediment on the fields, especially during the dormant season. Copper is measured as total copper and it is unknown which fraction represents the majority of the detectable copper. The Coalition will begin measuring total and dissolved metals this upcoming monitoring season and should be able to more accurately assess which management practices would be effective for copper. Copper is found naturally in soils in the region and consequently, managing copper will take a great deal of effort as only very small amounts of copper applied to crops can move to surface waters without causing an exceedance. Almond and walnut growers should be targeted for outreach especially prior to the dormant spray season. Analysis of the management practices surveys for this watershed indicate that a large number of growers (37% of parcels, 41% of member acreage) discharge directly to a waterway (local drainage system or directly to the waterway), and only a small number utilize retention ponds/holding basin (16% of parcels, 14% of member acreage) suggesting that outreach could focus on management practices that keep water on the field rather than allowing discharge to surface waters. The exceedances are associated with a large number of sections and parcels indicating that it will be difficult to target individual parcels/growers and make a large difference in copper concentrations in Lone Tree Creek.

Diuron

Diuron is a soluble herbicide applied throughout the year. Applications have occurred in every month of the year except August, September, and October, although the majority of the applications occur in the period between November and February. The largest amount AI was applied in December with the second greatest month of application being January (Table II-16, Figure II-11). The large number of applications is spread across the entire site subwatershed with applications in almost every section (Figures II-12 and II-13).

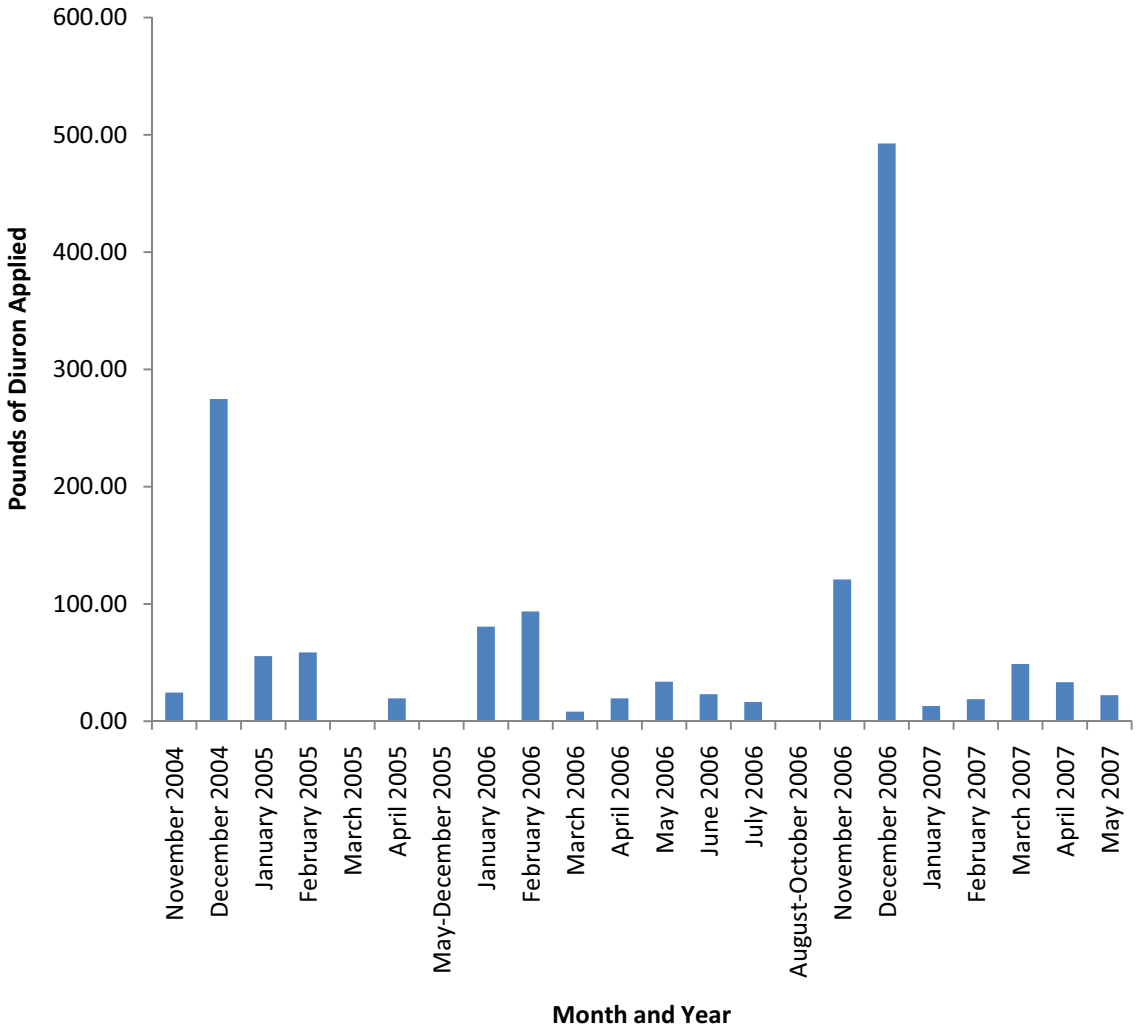
The two exceedances occurred in February 2007, and all applications associated with the two exceedances occurred prior to the first exceedance on February 11. No applications were reported in the period between the first exceedance and the second exceedance on February 28. Consequently the applications for both exceedances are identical and it was not possible to perform a linear regression analysis similar to those performed for copper and chlorpyrifos.

Table II-16. Number of diuron applications, total pounds applied, and total acres treated by month for August 2004 through July 2007 in the Lone Tree Creek @ Jack Tone Rd site subwatershed. If a month is not included in the table, no applications were made.

Month	Number of Diuron Applications	Pounds Applied	Acres Treated
November 2004	2	24.38	39.1
December 2004	9	274.7	286.3
January 2005	5	55.49	124
February 2005	4	58.66	93
April 2005	1	19.55	7
January 2006	4	80.66	151
February 2006	7	93.64	95.5
March 2006	1	8.21	8.33
April 2006	1	19.55	47
May 2006	2	33.63	40.4
June 2006	2	23.07	47.5
July 2006	1	16.42	16.67
November 2006	3	120.85	124
December 2006	8	492.66	337
January 2007	1	12.99	13
February 2007	2	18.77	19
March 2007	3	48.79	99
April 2007	1	33.24	17
May 2007	3	22.2	24
2004 Total	11	299.08	325.4
2005 Total	10	133.7	224
2006 Total	29	888.69	867.4

Month	Number of Diuron Applications	Pounds Applied	Acres Treated
2007 Total	10	135.99	172
TOTAL	**60**	**1457.46**	**1588.8**

Figure II-11. Pounds of diuron applied within the Lone Tree Creek @ Jack Tone Rd site subwatershed by month for 2004 through 2007.



To determine if there were specific parcels associated with the two exceedances the Coalition identified the sections associated with each exceedance (Table II-17, II-18, and Figures II-12, II-13). Only seven sections were associated with exceedances and only three applications in three sections were made within the month prior to sampling. Applications were made to alfalfa two months prior to sampling in four sections. Applications made in the month prior to sampling were made to grapes (1S8E21) and walnuts (1S8E35 and 2S8E2). The application method was not specified but other applications to grapes and walnuts were made by ground. Only one section, 1S8E21, is located directly adjacent to Lone Tree Creek and is the more likely source of the exceedances. At this location, only 12.9 lbs AI was applied to 13 acres suggesting that the high solubility of diuron (K_{oc} = 480) facilitates movement of the product off site to the creek.

Table II-17. All TRS that had more than one application associated with an exceedance for diuron in 2006 and 2007. Table shows which exceedance the application was associated with and number of applications associated with an exceedance for a given TRS.

TRS	Date of associated exceedances	
	2/11/2007	2/28/2007
1S8E21	1	
1S8E35	1	1
2S8E2	1	1

*Bolded TRS are members of the Coalition

Table II-18. TRS with diuron applications one month prior to each exceedance date. Includes pounds applied and acres treated.

TRS*	2/11/2007			2/28/2007		
	Application Date	Pounds Applied	Acres Treated	Application Date	Pounds Applied	Acres Treated
1S8E21	1/18/07	12.99	13			
1S8E35	2/3/07	5.866	6	2/3/07	5.866	6
2S8E2	2/5/07	12.91	13	2/5/07	12.91	13

*Bolded TRS are members of the Coalition

Figure II-12. Lone Tree Creek TRS' that have had applications co-occurring with a diuron exceedance.

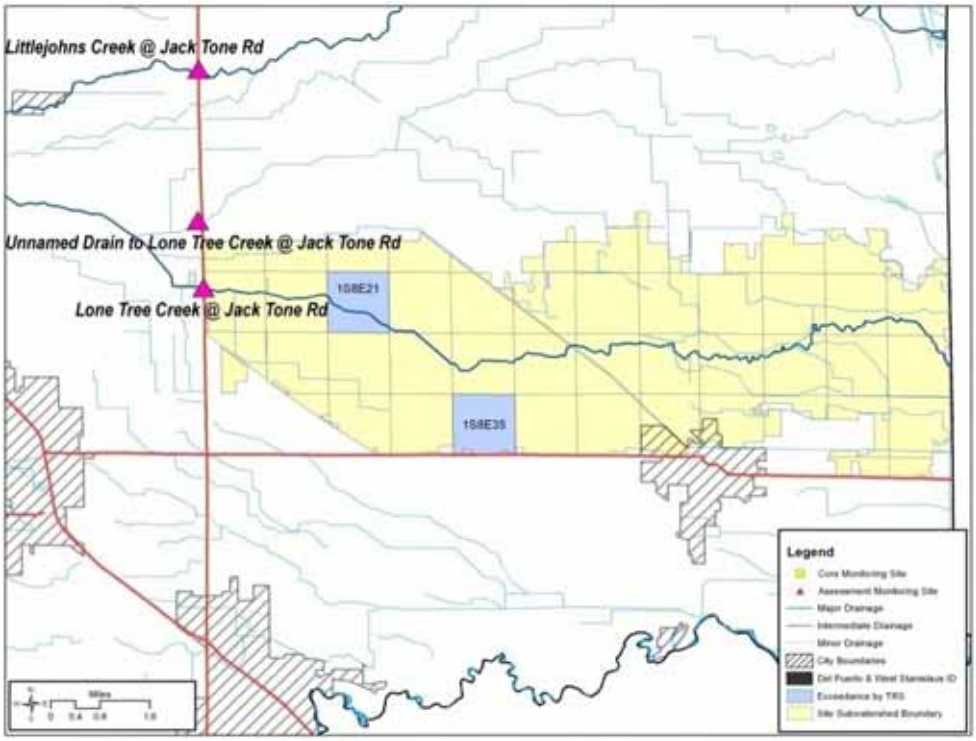
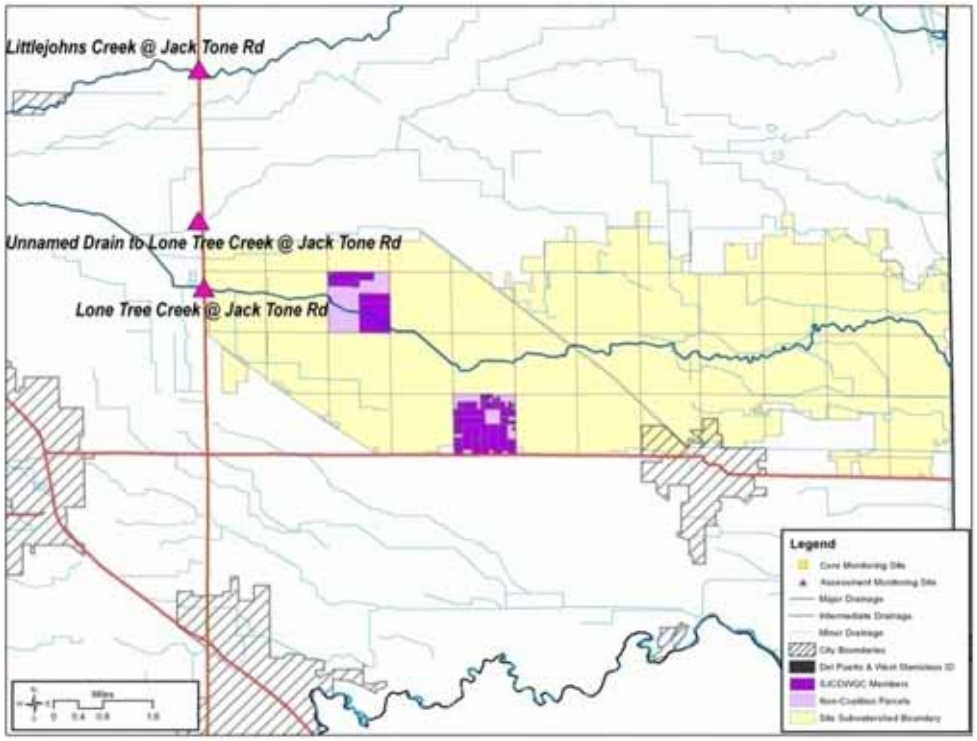


Figure II-13. Lone Tree Creek member APNs relative to TRS with applications co-occurring with diuron exceedances.



Although not a formal statistical analysis, the few applications and the proximity to Lone Tree Creek suggest that the exceedances were a result of an application to grapes on January 18 approximately three weeks prior to the first exceedance and six weeks prior to the second exceedance. The analyses conducted by the Coalition suggest that management of diuron in this watershed should focus on targeting specific growers in the two sections with applications to encourage the retention of water on the fields. Further outreach should be targeted to alfalfa, grape, and walnut growers especially prior to the dormant spray season. As with chlorpyrifos and copper outreach, diuron outreach could focus on management practices that keep water on the field rather than allowing discharge to surface waters. The few growers involved in the exceedances should facilitate contacts although the extremely high solubility of the product will make its management difficult.

Priority D Constituents

Selenastrum Toxicity

Selenastrum toxicity and diuron and copper management are closely tied as the *Selenastrum* toxicity events occurring in February 2005, March 2006, and February 2007 at Lone Tree Creek @ Jack Tone Road and in February and March 2006 at Lone Tree Creek @ Brennan Road all had diuron and copper applications in the preceding months. There were nine applications in the month prior to the February 16, 2005 exceedance, eight applications in the month prior to the March 15, 2006 exceedance, and three applications in the month prior to the February 28, 2007 exceedance. The last *Selenastrum* exceedance co-occurred with the diuron exceedance discussed above (Table II-6). Several other soluble herbicides were also applied including simazine, sethoxydim, diglycolamine salt, oryzalin, norflurazon, MCPA dimethylamine salt, and napropamide. All have K_{oc} values less than 1000 indicating that they would be soluble and move off-site. These chemicals were applied in almost every section in the site subwatershed making outreach on an individual grower basis difficult.

The Coalition's strategy for eliminating *Selenastrum* toxicity will involve focusing on copper and diuron. If these two constituents can be prevented from entering storm water during the winter rainy season, the Coalition believes that *Selenastrum* toxicity can also be reduced or eliminated. If the Coalition finds that diuron and copper exceedances are eliminated and *Selenastrum* toxicity persists, additional herbicides will be targeted for outreach and management.

Thiobencarb

Thiobencarb is a rice herbicide and is not under the management of the Coalition. Although the Coalition continues to monitor for thiobencarb, all exceedances are reported to the CVRWQCB and the Rice Coalition, and the Rice Coalition addresses the management of the chemical. The Coalition will not provide any active management of thiobencarb.

Hyalella azteca sediment toxicity

Toxicity to *Hyalella* from sediment occurred in May 2005 and April 2006 (Table II-6). The dynamics of sediment transport in Lone Tree Creek are not understood, and consequently it is unknown from where the toxic sediment originated or when specifically it was deposited. Generally, the toxicity occurred in the spring sample after winter rains mobilized sediment from fields upstream. No toxicity occurred in the late summer samples or after the 2007 winter season which had very little rainfall and presumably low flows that would mobilize less sediment. In the spring of 2009, the Coalition will initiate chemical analysis of sediments if those sediments prove to be toxic. If a chemical is identified from the sediment, it will be possible to use the PUR information to identify potential sources. Until that time, Coalition outreach will focus on the entire watershed and provide information on management practices

that prevent the movement of sediment off-site. The Coalition is expecting to receive funds from the Proposition 84 grant that was recently awarded to the Central Valley, and anticipate the construction of sediment retention basins within the Coalition region.

Pimephales promelas toxicity

Toxicity to the fathead minnow larvae has occurred in 2005 and 2006 (Table II-6). In both instances as reported in the applicable Semi-Annual Monitoring Report, analysis of the monitoring data suggested that ammonia was the cause of the toxicity. Elevated levels of ammonia accompanied by elevated levels of *E. coli* indicate that a discharge from a dairy upstream was the source of the toxicity. The Coalition will not institute any additional outreach for *Pimephales* toxicity.

Priority E Constituents

DO

The amount of dissolved oxygen in surface waters is a function of the processes of algal (and additional aquatic vegetation) photosynthesis and respiration, water temperature, turbulent flow, and biological oxygen demand (BOD), the respiration that accompanies degradation of organic carbon. In an attempt to understand dissolved oxygen dynamics, the Coalition sampled for BOD during the September 2006, February, April and July 2007 monitoring events. Three of the five samples collected at Lone Tree Creek @ Jack Tone Rd contained measurable amounts of BOD (Table II-19). The conclusion of the BOD study was that BOD was important in establishing DO levels, although many sites had no BOD. Because BOD was present at a somewhat elevated level for the one sample with DO below the WQTL of 7.0 mg/L, it is possible that BOD contributed to the low DO in the sample. BOD measurements were made only for one exceedance, and it is not possible to determine if BOD was a contributor to the other exceedances. An elevated positive correlation between BOD and TOC suggested that TOC could be used as a surrogate for BOD and consequently, the Coalition used TOC in an analysis to determine the potential effect of organic carbon/BOD on DO for the samples in the site subwatershed. DO was regressed on water temperature and discharge and the residual variation, the variation in DO unexplained by water temperature or discharge, was regressed on TOC to account for the effects of organic carbon/BOD. The regression of temperature and discharge was significant ($F = 4.306$, $p = 0.039$, $df = 2,12$) although the regression coefficients had the wrong sign compared to expectations (DO = 4.708 - .0655*discharge + 0.2287*temperature). The regression coefficient for discharge was negative indicating that the greater the flow, the lower the DO, and the regression coefficient for temperature was positive indicating that the lower temperature, the lower the measured DO. The signs of the regression coefficients suggest that other factors are driving DO and that discharge and temperature are playing a minor role. The residuals and TOC were used in a regression analysis to determine if the residual variation could be explained by organic carbon. The regression was not significant ($F = 1.77$, $p = 0.21$, $df = 1, 13$) indicating that TOC was not a significant predictor of the residual variation, meaning DO dynamics were not controlled by organic carbon. These results indicate

that BOD and TOC are not well correlated in this watershed, and it is likely that photosynthetic rate is the primary factor influencing DO. At some time in the future, the Coalition may be able to undertake a larger study to more fully understand the dissolved oxygen dynamics in the watershed. At this point, it is unclear what can be managed to eliminate low DO and the Coalition will not attempt to provide outreach to growers in an attempt to manage DO.

Table II-19. Lone Tree Creek @ Jack Tone Rd. BOD, pH and dissolved oxygen results for September 2006-February 2007 sampling events.

Station Name	Sample Date	pH	Oxygen, Dissolved	BOD, mg/L
Lone Tree Creek @ Jack Tone Rd	19/Sep/2006	7.11	NA	ND
Lone Tree Creek @ Jack Tone Rd	11/Feb/2007	7.42	5.54	21
Lone Tree Creek @ Jack Tone Rd	28/Feb/2007	7.49	8.9	17
Lone Tree Creek @ Jack Tone Rd	10/Apr/2007	7.1	8.05	ND
Lone Tree Creek @ Jack Tone Rd	10/Jul/2007	7.31	7.45	6

E. coli

The Coalition performed a pilot study to understand the sources of E. coli in the site subwatershed. Molecular markers were used to distinguish human, bovine, and avian sources. Upstream sampling was conducted and the results indicated that there was no relationship between the amount of coliform bacteria in the system and the presence of human or bovine bacteria. Human, bovine, and avian molecular markers were found in the watershed indicating active inputs from all three species (Table II-20). Because this study was performed at a single time of the year with a limited set of potential hosts, a further study may be initiated to more fully understand bacterial contamination in the watershed. Until such time as the study is completed, the Coalition will not actively manage for *E. coli*. Once a better understanding of the *E. coli* dynamics is obtained, the Coalition will re-evaluate management options.

Table II-20. Results of *Bacteroides* analysis. The baseline site, Lone Tree Creek @ Jack Tone Rd, was sampled three times daily for three consecutive days, and each upstream site, Lone Tree Creek @ Brennan, Lone Tree Creek @ Steingol Rd and Lone Tree Creek @ Henry Rd, were sampled only once. A + indicates the DNA was detected but at too low of a concentration to estimate a percentage.

Station Name	Sample Date	Sample Time	Sample Type	% Human	% Bovine	% Chicken
Lone Tree Creek @ Jack Tone Rd	8/16/2006	11:40	Grab	100	0.097656	+
Lone Tree Creek @ Jack Tone Rd	8/16/2006	16:40	Grab	50	0	+
Lone Tree Creek @ Jack Tone Rd	8/16/2006	21:50	Grab	50	0.048828	+
Lone Tree Creek @ Jack Tone Rd	8/17/2006	10:50	Grab	50	0	25
Lone Tree Creek @ Jack Tone Rd	8/17/2006	14:50	Grab	25	0	25
Lone Tree Creek @ Jack Tone Rd	8/17/2006	19:30	Grab	25	0	50
Lone Tree Creek @ Jack Tone Rd	8/18/2006	9:30	Grab	+	0	+
Lone Tree Creek @ Jack Tone Rd	8/18/2006	14:30	Grab	100	0.097656	+
Lone Tree Creek @ Jack Tone Rd	8/18/2006	19:30	Grab	50	0	25

Station Name	Sample Date	Sample Time	Sample Type	% Human	% Bovine	% Chicken
Lone Tree Creek @ Brennan Rd	8/31/2006	12:30	Grab	100	0.390625	+
Lone Tree Creek @ Steingol Rd	8/31/2006	12:50	Grab	100	0.097656	+
Lone Tree Creek @ Henry Rd	8/31/2006	13:30	Grab	12.5	0.097656	0

pH

Understanding pH dynamics in the system is as difficult as understanding DO dynamics. The Coalition used monitoring data to conduct a simple analysis in an attempt to associate pH with manageable constituents. A multiple regression was performed using DO and TOC as the predictor variables and pH as the response variable. The regression model was highly significant ($F = 7.545$, $p = 0.0039$, $df = 2,19$) and the regression coefficients for both predictor variables were positive ($pH = 6.376 + 0.13*DO + 0.0056*TOC$) indicating that pH is increased as both organic carbon and DO increase. These results further suggest that photosynthetic activity is a driving factor in pH and DO dynamics. Lone Tree Creek is a small water body and the most probably source of the photosynthesis is benthic algae, although this remains to be confirmed. As with DO, the Coalition will not actively manage for pH at this time. If future studies are conducted that allow the Coalition to understand pH dynamics, the Coalition will re-evaluate the management options.

Ammonia

As discussed in the SAMRs, ammonia exceedances have been associated with toxicity to *Pimephales* and have been attributed to discharges from dairies in the site subwatershed. The Coalition will not implement management practices to manage ammonia.

Cadmium

Cadmium is a heavy metal that is not applied by agriculture except as a by-product of fertilizer applications. Cadmium may be a minor constituent of some phosphate-based fertilizers and may be found in manure and biosolids. The Coalition will provide information about nutrient/manure management to growers in an attempt to reduce cadmium inputs to surface waters. However, at this time, the Coalition will not focus on cadmium as a high priority constituent.

Upstream Monitoring

As outlined in the introduction, upstream sampling may be implemented to facilitate source identification for discharges of chlorpyrifos, copper, and diuron. The 2008 schedule for upstream Management Plan Monitoring is provided in Table II-21 and the upstream sampling locations are provided in Table II-22 and Figures II-14, II-15. These locations were based on a review of PUR data indicating likely upstream sources. The upstream monitoring sites were selected to divide the watershed into smaller areas which will allow an analysis of the contribution of each portion of the watershed to the load measured at the Jack Tone Road site. Lone Tree Creek @ Valley Home Rd location was selected as an upstream of agriculture location to assess the contribution of total metals from the Sierra Nevada foothills. Only metal samples will be collected from this location. Diuron and *Selenastrum* were not monitored at upstream locations because the exceedances occurring during the storm season. The Coalition is not currently conducting management plan monitoring during the storm season.

Table II-21. 2008 Management Plan sampling schedule. U = upstream sampling.

Station Name	Month	Type	Chlorpyrifos	Metals
Lone Tree Creek @ Valley Home Rd	May	U		**x**
Lone Tree Creek @ Valley Home Rd	June	U		**x**
Lone Tree Creek @ Valley Home Rd	July	U		**x**
Lone Tree Creek @ Brennan Rd	July	U	**x**	**x**
Lone Tree Creek @ Valley Home Rd	August	U		**x**
Lone Tree Creek @ Brennan Rd	August	U	**x**	**x**
Lone Tree Creek @ Valley Home Rd	September	U		**x**
Lone Tree Creek @ Brennan Rd	September	U		**x**

Table II-22. Three Lone Tree Creek sites in the SJCDWQC region that have been used for coalition sampling.

Station Name	Station Code	Target Lat	Target Long
Lone Tree Creek @ Jack Tone Rd*	531XLTCJR	37.8376	-121.144
Lone Tree Creek @ Brennan Rd*[u]	535XLTABR	37.82552	-121.016
Lone Tree Creek @ Valley Home Rd[u]	535LTCVHR	37.82023	-120.902

*Original SJCDWQC sampling site
[u]Upstream sites

Figure II-14. Site subwatershed map of land use for upstream Management Plan monitoring site at Lone Tree Creek @ Brennan Rd.

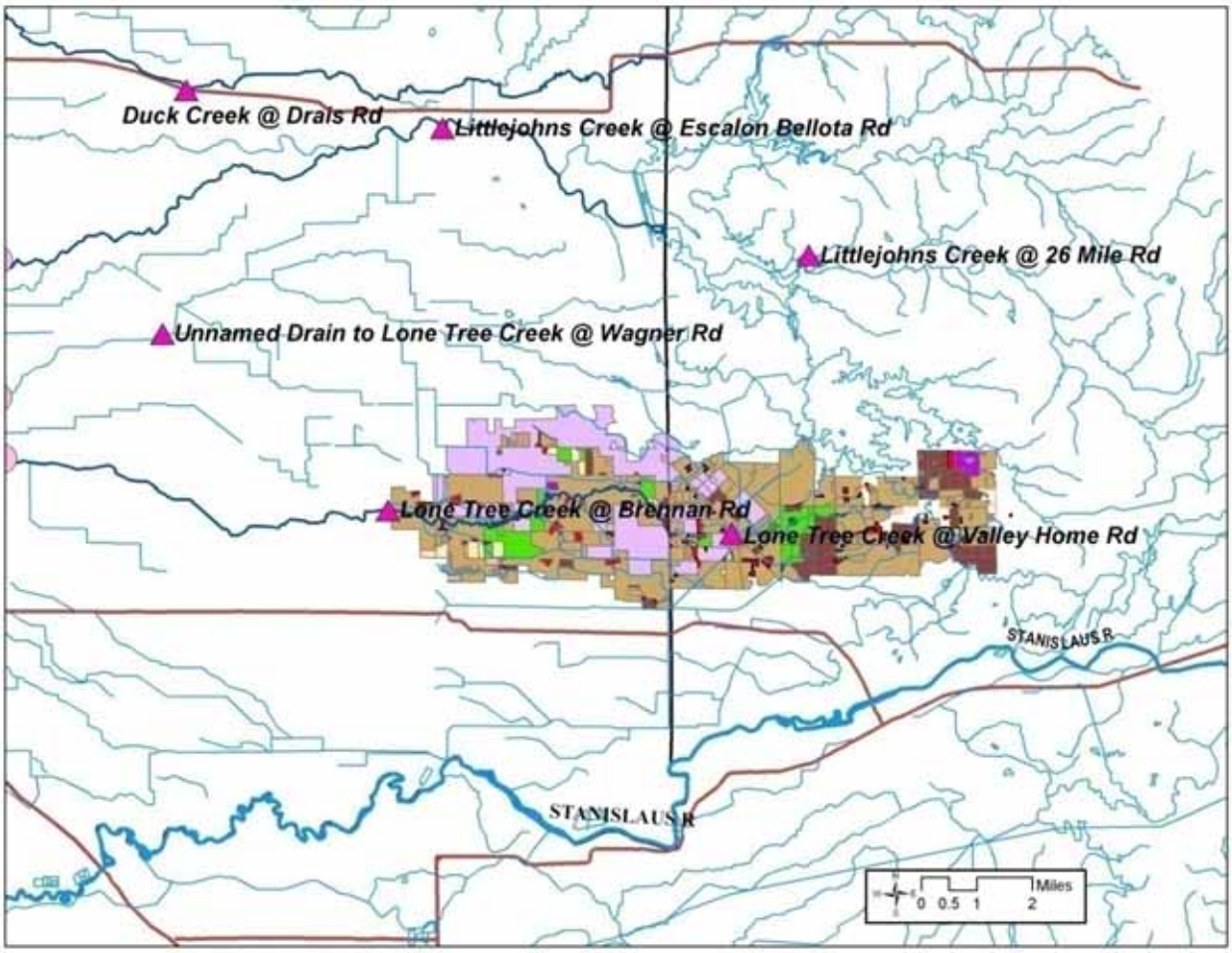
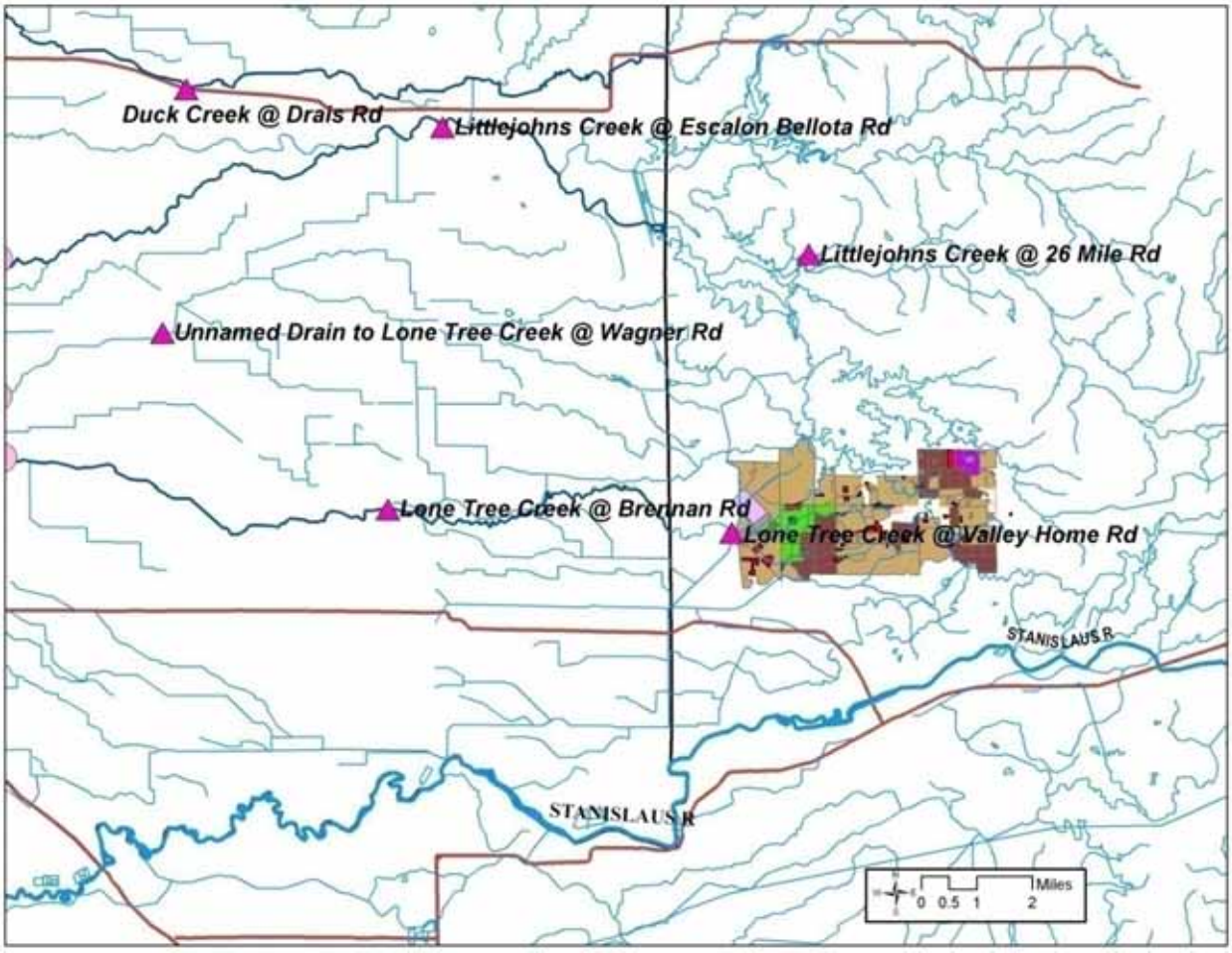


Figure II-15. Site subwatershed map of land use for upstream Management Plan monitoring site at Lone Tree Creek @ Valley Home Rd.



Outreach

The Coalition outreach includes grower meetings and mailing/distribution of information. The Coalition conducts three types of meetings: general grower meetings on a county level, grower group meetings (groups may be specified by crop, chemical use or seasonal practices) and individual contacts. All outreach conducted in the 2007 is documented in the Summary of Coalition Outreach Activities section of the Management Plan.

General grower meetings were held for Stockton County growers in October 2007 and May 2008. The Coalition anticipates conducting grower meetings in the various Coalition counties prior to the irrigation season to address irrigation water quality concerns and management practices and again between October and December focusing on dormant spray practices and presenting Coalition data from the previous year of monitoring.

Grower group meeting were held for growers in the Lone Tree Creek subwatershed and focused on walnut, vineyard and corn growers (Table II-23). Water quality exceedances of chlorpyrifos, copper, and herbicides within the Lone Tree Creek subwatershed were discussed and crop specific management practices were presented. Discussions with growers after the meeting allowed Coalition representatives to gain additional information about local application practices and will use this information to focus future outreach.

Grower group meetings will be conducted between October 2008 and April 2009. The grower group meetings will focus on management practices that can reduce spray drift of aerial applications and management practices for chlorpyrifos use. In October 2008, a publication of Best Management Practices information, developed by the Center for Urban/Rural Environmental Stewardship (CURES), will go out to all members with 15 or more acres enrolled in the program. The handbooks were originally designed for the Westside Coalition and contain information on farming practices such as sediment basins, polyacrylamide (PAM), enzyme treatments, tail water return systems, vegetative ditches, irrigation scheduling and others (Attachment I, example of Westside handbook). These documents are summaries of technical reports developed by the California Water Institute, Ducks Unlimited, California Department of Pesticide Regulation and others.

Table II-23. Grower group meetings conducted in the Lone Tree Creek site subwatershed.

Location	Date	Description	Who
Lone Tree Creek subwatershed	May 16, 2007	Outreach to Walnut growers in the Lone Tree Creek subwatershed (including Unnamed Drain to Lone Tree Creek), exceedances and relevant MPs presented, alternative materials and MPs for the upcoming irrigation season discussed among growers.	Terry Prichard

Location	Date	Description	Who
Lone Tree Creek subwatershed	July 15, 2008	Corn, alfafa and tomato growers meeting to discuss water management strategies in regards to organophosphates.	Mike Wackman, Terry Prichard, CURES
Lone Tree Creek subwatershed	July 16, 2008	Tree and vine growers meeting to discuss water management strategies in regards to organophosphates and pyrethroids focusing on management of codling moth and vine mealeybug outbreaks.	Mike Wackman, Terry Prichard, CURES

Evaluation

The Lone Tree Creek site subwatershed is one of the rotating Assessment Monitoring locations within the SJCDWQC French Camp Slough @ Airport Way Zone. This subwatershed will not be rotated into the SJCDWQC monitoring program until 2015. However the Coalition will continue to monitor for Management Plan constituents as outlined in Table II-21. This subwatershed is one of the thee priority subwatersheds within the SJCDWQC and therefore the Coalition is focusing its resources on identifying the sources of agricultural discharge within this subwatershed that could lead to water quality impairments, extending outreach to individual Coalition members and setting evaluation goals. Members will be contacted individually based on their proximity to the waterway, number of applications co-occurring with WQTL exceedances and amount of acres farmed.

The Coalition sent general management practice surveys to members in May 2007. This survey was intended to collect baseline information from growers to understand current management practices conducted and implemented within the Coalition region. The Coalition plans to build upon the baseline survey results by conducting individual contacts with growers and fill out more detailed checklists that can be used to gain specific parcel information in regards to agricultural discharge and management practices currently implemented. At that time the Coalition will offer resources (i.e. management practice handbooks, information to obtain NRCS funds) to the grower to aid them in performing additional management practices. The Coalition will return in a year to interview the grower again and determine if any additional management practices were performed. Parcel specific information will remain confidential between the member and the Coalition and used to evaluate effectiveness of management practices at a subwatershed level.

The Coalition's strategy for the Lone Tree Creek subwatershed was to first conduct a grower group meeting this summer (June 15 and 16, 2008) and speak with individual growers who attended the meeting about current irrigation and dormant spray practices (Table II-23). The Coalition verbally obtained valuable information about specific parcel practices within this area and was able to discuss with growers management practices that could potentially reduce runoff of chlorpyrifos on an individual grower level. The Coalition realizes the importance of

keeping track internally of specific practices and therefore is developing a series of checklists to use during conversations/interviews with growers through individual contacts or at grower group meetings. The Coalition is developing these checklists with the aid of UC Davis Extension and will be developed by categories such as nutrient management, organophosphate management, herbicide management, copper management and additional checklists on a broader level for overall irrigation and dormant season management. The details of the checklists are still being developed but the goal is to have a documentation tool to allow the Coalition to keep track of specific management practices as they pertain to water quality impairments within that particular subwatershed.

The Coalition is also conducting "tail-gate" meetings with large growers within the entire Coalition region to discuss overall management practices. Large growers are selected by Coalition representatives based on number of acres that they manage and availability to meet with Coalition representatives, regardless of current monitoring locations or specific water quality information. For example, a large grower may be contacted within a subwatershed that the Coalition has not yet sampled for water quality. This method will allow the Coalition to speak with specific growers about current Coalition wide water quality impairments, discuss current management practices and also inform the owner/grower of additional management practices that can be used to reduce/eliminate agricultural discharge. The Coalition will also present CURES booklets on management practices and resources for obtaining management practice implementation funds (such as NRCS funds). By focusing on large growers, any updates to management practices as a result of these meetings will affect large areas within the Coalition region impacting overall Coalition area water quality.

The Coalition and UC Davis Extension will use the checklists while contacting specific growers within the Duck Creek @ Hwy 4 subwatershed (also a high priority subwatershed) during the 2008/2009 winter season. The results of the checklists will be entered into a database that will be used internally by the Coalition. After the first round of contacts using the checklists, the checklist format and information will be evaluated based on the amount of information obtained that can be used to track and assess management practices within the Duck Creek @ Hwy 4 subwatershed. If this method is deemed effective, the Coalition will continue to use the checklists with future individual contacts within the Lone Tree Creek subwatershed. Contacts within the Lone Tree Creek subwatershed are anticipated to occur prior to the irrigation season of 2009.

In addition, the Coalition will continue to conduct grower meetings by county during the winter of 2008/2009 to inform all members of current water quality impairments and Coalition activities. The Coalition will record the number of attendees at the meeting to evaluate the effectiveness of these outreach meetings.

III. UNNAMED DRAIN TO LONE TREE CREEK @ JACK TONE RD

Management Plan Constituents

Priority A

- Chlorpyrifos

Priority C

- Diuron

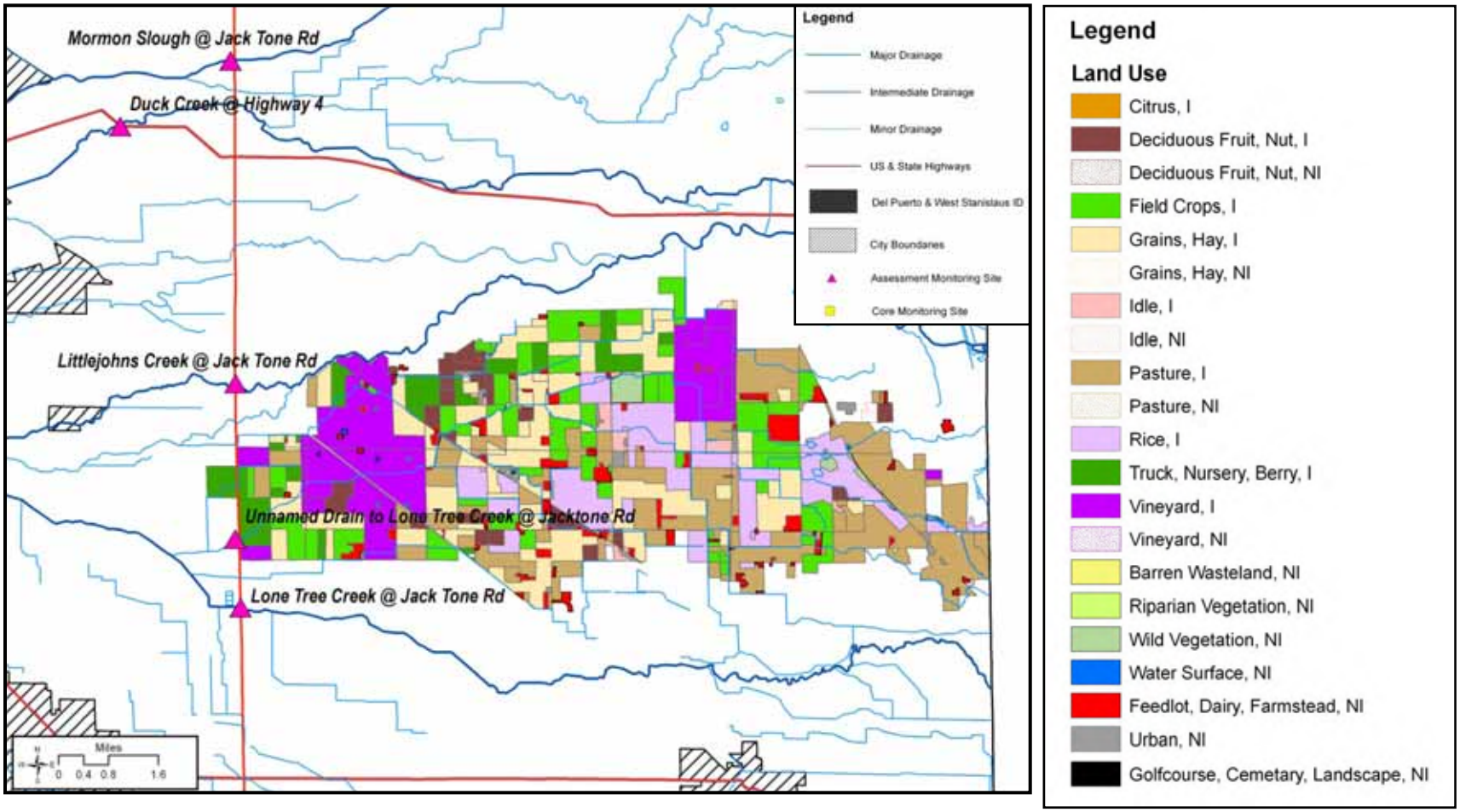
Priority E

- Dissolved Oxygen
- *Selenastrum capricornutum* water column toxicity
- Specific Conductivity
- Color
- Total Dissolved Solids
- *E. coli*

Description of Unnamed Drain to Lone Tree Creek @ Jack Tone Rd site subwatershed

Unnamed Drain to Lone Tree Creek @ Jack Tone Road (23,051 irrigated acres) site subwatershed is located to the north of the Lone Tree Creek site subwatershed and south of Littlejohns Creek. The drain forms in the eastern portion of San Joaquin County and flows west eventually joining with Lone Tree Creek just west of Jack Tone Road. Unlike most of the SJCDWQC area, rice is a major crop in the site subwatershed. Agriculture in the site subwatershed also consists of deciduous orchards, field crops and grains. Figure III-1 provides the land use within this site subwatershed area.

Figure III-1. Site subwatershed map of land use for the Unnamed Drain to Lone Tree Creek @ Jack Tone Rd sample site. The highlighted points mark current sampling sites.



Subwatershed Monitoring History

Monitoring was initiated at Unnamed Drain to Lone Tree Creek during the irrigation season of 2006 and continued through the irrigation season of 2007 (Table III-1). Samples were collected from this site for field parameters and the analysis of water chemistry and toxicity. Specific information on the analysis conducted across each of the monitoring seasons is provided below (Table III-2). Exceedances of field and physical parameters, *E. coli*, pesticides, and water column and sediment toxicity have occurred at this site. A summary and discussion of these exceedances is provided in the next section (Tables III-3 and III-4).

The Unnamed Drain to Lone Tree Creek is not considered impaired in the current Basin Plan, however the Lone Tree Creek is listed as impaired for ammonia, biological oxygen demand and electrical conductivity. The potential source is listed as dairies.

Unnamed Drain to Lone Tree Creek @ Jack Tone Rd will be an Assessment Monitoring location under the new MRPP and the first monitoring rotation will occur in 2017-2018. Until that time, the Coalition will continue to conduct management plan monitoring for at this site. Management Plan monitoring at this site is described in better detail later in this document.

Table III-1. Unnamed Drain to Lone Tree Creek @ Jack Tone Rd sampling events per season and year. An irrigation season sampling event encompasses normal monitoring and associated resampling, management plan monitoring, and sediment sampling. A storm event encompasses normal monitoring and any associated resampling.

	2004	2005		2006		2007	
	Irrigation	Storm	Irrigation	Storm	Irrigation	Storm	Irrigation
Events Sampled	NA	NA	NA	NA	4	2	6
Events Not Sampled	NA	NA	NA	NA	1 (site dry)	0	0
Total	NA	NA	NA	NA	5	2	6

Table III-2. Unnamed Drain to Lone Tree Creek @ Jack Tone Rd. Number of analyses run per constituent in each sampling season (only environmental samples listed).

Constituent	2006	2007	
	Irrigation	Storm	Irrigation
Field and Physical Parameters			
pH	4	4	9
Electrical Conductivity	4	4	9
Dissolved Oxygen	3	4	9
Total Dissolved Solids	4	2	6
Turbidity	4	2	6
E. coli	4	2	6
Color	4	2	6
Total Organic Carbon	4	2	6
Biological Oxygen Demand	1	2	2
Carbamates			

Constituent	2006	2007	
	Irrigation	Storm	Irrigation
Aldicarb	4	2	6
Carbaryl	4	2	6
Carbofuran	4	2	6
Methiocarb	4	2	6
Methomyl	4	2	6
Oxamyl	4	2	6
Organochlorines			
DDD	4	2	6
DDE	4	2	6
DDT	4	2	6
Dicofol	4	2	6
Dieldrin	4	2	6
Endrin	4	2	6
Methoxychlor	4	2	6
Organophosphates			
Azinphos methyl	4	2	6
Chlorpyrifos	4	2	8
Diazinon	4	2	6
Dimethoate	4	2	6
Disulfoton	4	2	6
Malathion	4	2	6
Methamidophos	4	2	6
Methidathion	4	2	6
Parathion, Methyl	4	2	6
Phorate	4	2	6
Phosmet	4	2	6
Pyrethroids			
Bifenthrin	4	2	6
Cypermethrin	4	2	6
Cyhalothrin, lambda	4	2	6
Permethrin	4	2	6
Cyfluthrin	4	2	6
Esfenvalerate/ Fenvalerate	4	2	6
Triazines			
Atrazine	4	2	6
Cyanazine	4	2	6
Diuron	4	2	6
Glyphosate	4	2	6
Linuron	4	2	6
Molinate	4	2	6
Paraquat dichloride	4	2	6
Simazine	4	2	6
Thiobencarb	4	2	6
Toxicity			
Ceriodaphnia dubia	4	3	6
Pimephales promelas	4	2	6
Selenastrum capricornutum	4	4	6

Constituent	2006	2007	
	Irrigation	Storm	Irrigation
Hyalella azteca	1	1	2

Exceedance History

During Coalition monitoring, exceedances of water quality trigger limits for field and physical parameters, *E. coli,* pesticides, and water column and sediment toxicity have occurred at this site. During the irrigation season of 2007, exceedances included chlorpyrifos (2), thiobencarb (1), color (5), total dissolved solids (TDS) (1), *E. coli* (2), and specific conductance (EC) (1). One sediment sample tested toxic to *Hyalella azteca*. Samples collected over the entire three years of monitoring at the Unnamed Drain to Lone Tree Creek sample site resulted in two exceedances of DO, three of EC, 11 of color, one of TDS, five of *E. coli*, one of DDE, five of chlorpyrifos, two of diuron, one of methidathion, one of simazine and two of thiobencarb. Toxicity has occurred once to *Ceriodaphnia dubia* and four times to *Selenastrum capricornutum*. Sediment toxicity to *Hyalella azteca* occurred once. All exceedances are listed in Tables III-3 and III-4 by season and date and are based on water quality trigger limits (WQTL) listed in the introduction of the SJCDWQC Management Plan. The priority level (A-E) assigned to each constituent is listed in the bottom row of Tables III-3 and III-4 for those analytes with two or more exceedances over the last three years.

Table III-3. Field, bacteria, inorganic and legacy pesticides (low priority) experienced in samples collected from the Unnamed Drain to Lone Tree Creek @ Jack Tone Rd monitoring site between April 2006 and September 2007.

Station Name	Season	Sample Date	Oxygen, Dissolved, mg/L	Specific Conductivity, µS/cm	Color, color units	Dissolved Solids, mg/L	E. coli, MPN/100 mL	DDE(p,p')[1], µg/L
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	Irrigation	20/Jun/2006	4.8		85			0.004
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	Irrigation	18/Jul/2006	6		70		2400	
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	Irrigation	15/Aug/2006			45			
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	Irrigation	19/Sep/2006			85			
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	Irrigation	10/Apr/2007			85			
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	Irrigation	22/May/2007		905		620		
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	Irrigation	12/Jun/2007			60			
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	Irrigation	10/Jul/2007			100		2400	
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	Irrigation	07/Aug/2007			100		250	
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	Irrigation	04/Sep/2007			30			
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	Storm	11/Feb/2007			800		2400	
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	Storm	21/Feb/2007						
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	Storm	28/Feb/2007			350		2400	
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	Storm	06/Mar/2007		841				
Constituent Priority			**E**	**E**	**E**	**E**	**E**	

[1]Montitoring for this analyte was not initiated until May of 2006.

Table III-4. Metals, pesticides and toxicity exceedances (high priority) experienced in samples collected at Unnamed Drain near Lone Tree Creek @ Jack Tone Rd monitoring site between April 2006 and September 2007.

Station Name	Season	Sample Date	Chlorpyrifos, µg/L	Diuron[1], µg/L	Methidathion[1], µg/L	Simazine[1], µg/L	Thiobencarb[1], µg/L	Ceriodaphnia dubia, Survival (%)	Hyalella azteca, Survival (%)	Selenastrum capricornutum, Total Cell Count
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	Irrigation	20/Jun/2006					0.12			
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	Irrigation	18/Jul/2006	0.031							
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	Irrigation	19/Sep/2006	0.045							
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	Irrigation	12/Jun/2007					0.57			
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	Irrigation	10/Jul/2007	0.034							
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	Irrigation	09/Aug/2007							57	
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	Irrigation	25/Sep/2007	0.017							
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	Storm	11/Feb/2007	0.048	19	1.1	7		0		475000
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	Storm	21/Feb/2007								926000
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	Storm	28/Feb/2007		29						55300
Unnamed Drain to Lone Tree Creek @ Jack Tone Rd	Storm	07/Mar/2007								504000
Constituent Priority			**A**	**C**			**NP**			**C**

[1]Montitoring for this analyte was not initiated until May of 2006.
NP – not prioritized; thiobencarb is a pesticide applied only to rice and is therefore reported to the Regional Board and the Rice Coalition to manage.

2007 Management Plan Monitoring Results

In 2007, Management Plan monitoring was implemented at the Unnamed Drain to Lone Tree Creek @ Jack Tone Rd monitoring site for chlorpyrifos. Additional monitoring occurred during the months in which exceedances of priority constituents or toxicity were detected during the previous year. This additional monitoring was designed to increase the temporal coverage of monitoring during the months when exceedances had occurred in the past, in particular as they co-occurred with applications of relevant pesticides in the site subwatershed. Management Plan monitoring (MPM) occurred for chlorpyrifos in July and September. Table III-5 includes monitoring results for chlorpyrifos from all sampling events during the 2007 irrigation season. Chlorpyrifos was detected in samples collected in July and September. The normal monitoring sample in July contained 0.034 µg/L of chlorpyrifos and the Management Plan sample collected later that month showed a detection of 0.014 µg/L. In September, the normal monitoring sample did not contain chlorpyrifos above the detection limit however the MPM sample (collected two weeks later) contained 0.017 µg/L. There were no other detections of chlorpyrifos at this site in 2007.

Table III-5. Unnamed Drain to Lone Tree Creek @ Jack Tone Rd. Normal monitoring (NM) and Management Plan monitoring (MPM) results to chlorpyrifos from the 2007 irrigation season. Exceedance values are in bold.

	NM	NM	NM	NM	MPM	NM	NM	MPM
	4/10/07	5/22/07	6/12/07	7/10/07	7/30/07	8/07/07	9/04/07	9/25/07
Chlorpyrifos (ug/L)	<0.00259	<0.00259	<0.00259	**0.034**	0.014	<0.003	<0.003	**0.017**

Load Calculations

Loads have been calculated for all chlorpyrifos detections in the site subwatershed based on the following formula (Table III-6):

Load = Discharge (cfs) X 28.317L/ft^3 X Concentration (milligram/L X 1000 or µg/L).

The load values for constituents in this report represent instantaneous loads only. These values should not be used to extrapolate loading over any period of time (e.g. weekly, monthly, seasonal or annual). The primary purpose for reporting instantaneous loads is to provide a normalization of the concentrations by flow for various constituents at the time the samples were collected.

Table III-6. Instantaneous load calculations for chlorpyrifos and diuron (sorted by analyte and date).

Analyte	Sample Date	Discharge cfs	Concentration µg/L	Loading Rate µg/sec
Chlorpyrifos	18/Jul/2006	40.64	0.031	35.67
Chlorpyrifos	15/Aug/2006	17.86	0.011	5.56
Chlorpyrifos	19/Sep/2006	10.41	0.045	13.27
Chlorpyrifos	11/Feb/2007	27.09	0.048	36.82
Chlorpyrifos	10/Jul/2007	21.51	0.034	20.71
Chlorpyrifos	30/Jul/2007	32.45	0.014	12.86
Chlorpyrifos	25/Sep/2007	15.92	0.017	7.66
Diuron	11/Feb/2007	27.09	19	14575.04
Diuron	28/Feb/2007	7.49	29	6150.74
Diuron	10/Apr/2007	3.56	1.6	161.29
Diuron	22/May/2007	No flow	1.5	0.00

*field duplicate

Source Identification

Priority A Constituents

Chlorpyrifos

The WQTL for chlorpyrifos (0.015 µg/L) was exceeded at this site during the months of February (2007), July (2006, 2007) and September (2006, 2007) (Table III-4). To identify potential sources of chlorpyrifos, the Coalition uses Pesticide Use Reports (PURs) to examine the amount and timing of pesticide applications and the types of crops to which the active ingredients are applied relative to exceedance dates. Township, range and section (TRS) in which chlorpyrifos was applied within one month of the exceedance date are identified. In the years 2004-2006, July and August appear to be the peak application months with a total of 672 pounds of product applied in these two months in 2005, and 341 pounds applied in these two months in 2006, which for both years accounts for over 90% of the total pounds applied in the entire year (Table III-7, Figure III-2). The average application rate of chlorpyrifos for the Unnamed Drain to Lone Tree Creek subwatershed from 2004-2007 is 1.36 lbs AI/acre. The lowest application rates are associated with alfalfa (Table III-8).

Table III-7. Number of applications, pounds applied and acres treated for each month and year of application in the Unnamed Drain to Lone Tree Creek @ Jack Tone Rd site subwatershed.

Month	Number of Chlorpyrifos	Pounds Product Applied	Acres Treated
March 2006	1	50	25
April 2006	6	168.4	382
May 2006	28	2168	1297.3
June 2006	25	2515.2	1747.5
July 2006	15	1037.5	673.5
August 2006	6	340.6	290
September 2006	6	294.1	295
November 2006	1	185.8	100
March 2007	5	172.4	209
April 2007	6	303.8	325
May 2007	23	2208.2	1558
June 2007	11	741.1	637
July 2007	2	71.5	57
August 2007	1	80	37
2006 Total	88	6760	4810
2007 Total	48	3577	2823
TOTAL	**136**	**10337**	**7633**

Figure III-2. Pounds of chlorpyrifos added to TRS within the Unnamed Drain to Lone Tree Creek site subwatershed by month for 2005-2007. Asterisk (*) denotes months in which chlorpyrifos exceedances were detected at the site.

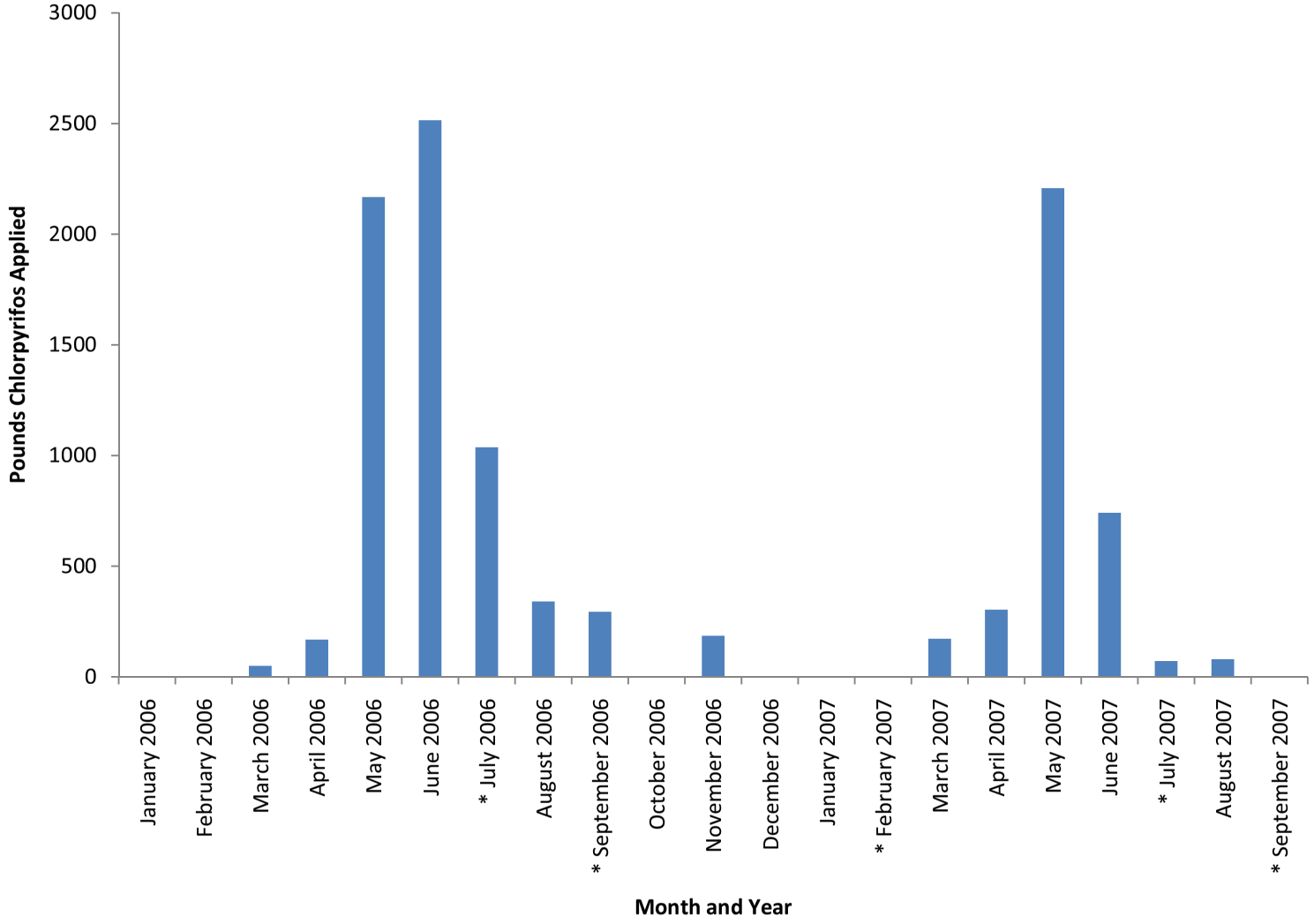


Table III-8. Average pound active ingredient (AI) per acre for chlorpyrifos based on PUR data from 2006-2007 within the Unnamed Drain to Lone Tree Creek @ Jack Tone Rd subwatershed.

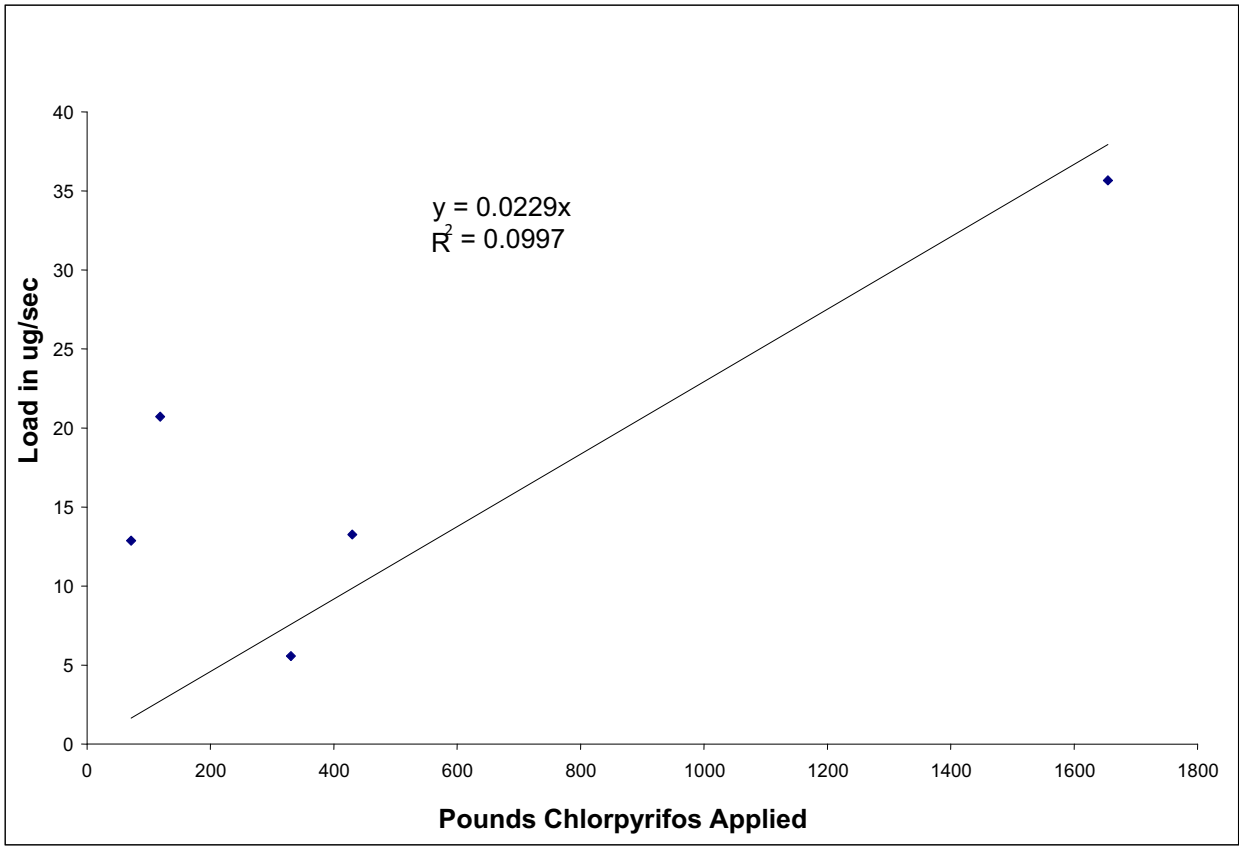
Chemical name	Commodity	Product name	Average Lbs AI/Acre
CHLORPYRIFOS	ALFALFA	LOCK-ON INSECTICIDE	0.45
		LORSBAN 4E-HF	0.495
		LORSBAN-4E	0.46
	ALMOND	LORSBAN 4E-HF	1.99
		LORSBAN-4E	1.88
		WARHAWK	0.21
	APPLE	LORSBAN-4E	1.93
	CORN (FORAGE - FODDER)	CHLORPYRIFOS 4E AG	1.01
		LORSBAN 15G GRANULAR INSECTICIDE	1.325
		LORSBAN 4E-HF	0.835
		LORSBAN-4E	0.93
		NUFOS 15G	2.035
		NUFOS 4E	0.69
	GRAPES, WINE	LORSBAN 4E-HF	1.99
		LORSBAN-4E	1.86
	WALNUT	GOVERN 4E INSECTICIDE	1.87
		LORSBAN 4E INSECTICIDE	2.01
		LORSBAN 4E-HF	2.03
		LORSBAN-4E	1.88
Overall Average application rate of chlorpyrifos			**1.36**

The Coalition uses a combination of monitoring data and evaluation of PUR data to identify possible sources. The Coalition developed hypotheses to guide the search for sources within the watershed. If the amount of chlorpyrifos (either concentration or load) detected in the sample water was positively associated with amount of chlorpyrifos, then the exceedance would most likely be a result of accumulated runoff from numerous parcels. Alternatively, if there was no relationship between the amount applied across the watershed and the amount found in the water, the exceedance would be a result of one or a few parcels with poorly managed discharge. The outreach strategy of the Coalition varies depending on which hypothesis is correct. The hypotheses are not mutually exclusive as some parcels could always contribute to exceedances, although the magnitude of the exceedance would be determined by the amount of product applied.

Consequently, the Coalition performed an analysis of chlorpyrifos applications within the last four weeks and concentrations and loads of chlorpyrifos in the water (all detections). A linear regression analysis was performed to establish the relationship between application in pounds per acre for those acres on which applications were made (not averaged across the entire watershed) and concentration and load. To associate PUR data (pounds AI per acre) with a single exceedance, the pounds AI was summed and divided by the summed acreage. The small sample size precluded a rigorous statistical treatment but sample sizes are sufficiently large to allow the two hypotheses to be distinguished. The intercept for all analyses was set at zero as there should be no chlorpyrifos in the water if there are no applications. However, this assumes that applications more than four weeks prior to sampling would not contribute chlorpyrifos to the water body. For purposes of this analysis, it is assumed that applications prior to four weeks before sampling would not contribute substantially to loads measured four weeks later.

The regression of concentration on pounds AI applied per acre indicated a positive but nonsignificant relationship (not shown). The relationship between load and pounds AI applied was slightly better with 13% of the variation in load explained by applications, but the relationship was also nonsignificant (not shown). The relationship between total pounds applied and load was positive with 10% of the variation in load accounted for by the variation in total pounds AI applied (Figure III-3). However, the regression analysis suffers from the large variance of pounds AI applied per acre and the single point at the right side of the figure anchors the regression line. The largest residual occurs for a sample collected on July 10, 2007. In the month prior to the sampling event, only two applications were made, one to corn and one to walnuts. The application method was not included in the 2007 PUR data and it is possible that at least one of the applications was aerial since past application on those TRS for corn and walnuts were done using both methods. The second positive residual was for a sample collected on July 18, 2006 to walnuts (10 applications), corn (10 applications), and almonds (2 applications). It is possible that the aerial application in both years resulted in overspray and drift into Unnamed Drain to Lone Tree Creek.

Figure III-3. Chlorpyrifos concentrations and pounds applied for Unnamed Drain to Lone Tree Creek @ Jack Tone Rd.



To determine if there were specific parcels associated with exceedances on a continuing basis, the Coalition examined the sections (TRS) associated with each exceedance (Tables III-9 and III-10). There were 27 sections associated with exceedances, each section had between one and three applications in the month prior to sampling. Each section was associated with from 1 to 3 exceedances, and section 1S8E23 was associated with all exceedances. This is a section located in the southern portion of the watershed a considerable distance from Unnamed Drain and it is unknown if the TRS actually has drainage to surface waters (Figures III-4, III-5). Coalition members own a majority of the land in the watershed.

Table III-9. All TRS that had more than one application associated with an exceedance for chlorpyrifos in 2006 and 2007. Table shows which exceedance the application was associated with and number of applications associated with an exceedance for a given TRS.

TRS	Date of associated exceedance		
	7/10/2007	7/18/2006	9/19/2006
1N8E32			2
IN9E19	1		1
1S7E12		3	1
1S8E1			2
1S8E23	1	1	1
1S8E24	1	3	
1S8E3		2	
1S9E12		1	1

*Bolded TRS are members of the Coalition

Table III-10. TRS with chlorpyrifos applications in month prior to each exceedance date. Includes pounds applied and acres treated.

TRS	7/18/2006			9/19/2006			7/10/2007		
	Application Date	Pounds Applied	Pounds Applied	Application Date	Acres Treated	Pounds Applied	Application Date	Pounds Applied	Acres Treated
1N8E26	7/1/2006	9.97	5						
1N8E27	3/24/2006	50.02	25						
1N8E32				8/21/2006 8/21/2006	10.3 24.8	66 66			
1N8E34	7/1/2006	48.32	26						
1N8E35	7/1/2006	31.9	16						
1N8E36							6/27/2007	38.64	38
1N9E19	7/16/2006	69.78	35				6/23/2007	80.04	40
1N9E35	7/7/2006	70.7	70						
1S7E12	7/8/2006 7/10/2006 7/10/2006	80.8 80.8 80.8	40 40 40	8/24/2006	26.26	13			
1S8E1				9/7/2006 9/7/2006	10 49.8	10 50			
1S8E10	4/1/2006	31.4	111						
1S8E11	4/1/2006	32.18	65						
1S8E13	7/17/2006	66.9	36						
1S8E2	4/6/2006	29.91	60						
1S8E23	6/24/2006	192	160	9/13/2006	149.54	150	6/11/2007	187.2	156
1S8E24	6/22/2006 6/26/2006 6/26/2006	26.4 44.4 24	22 37 20				6/11/2007	24	20
1S8E3	6/22/2006 7/13/2006	78 89.72	65 90						
1S8E6	7/11/2006	196.99	106						
1S8E8				8/31/2006	119.63	60			
1S8E9	7/16/2006	39.88	20						
1S9E10	7/18/2006	103.68	52						
1S9E12	6/27/2006	121.5	90	9/11/2006	34.89	35			
1S9E18	6/30/2006	36.45	27						
1S9E21	6/20/2006	78	65						
1S9E7	6/30/2006	83.7	62						

1S9E9				9/15/2006	39.88	40				

*Bolded TRS are members of the Coalition

Figure III-4. Unnamed Drain to Lone Tree Creek TRS' that have had applications co-occurring with a chlorpyrifos exceedance.

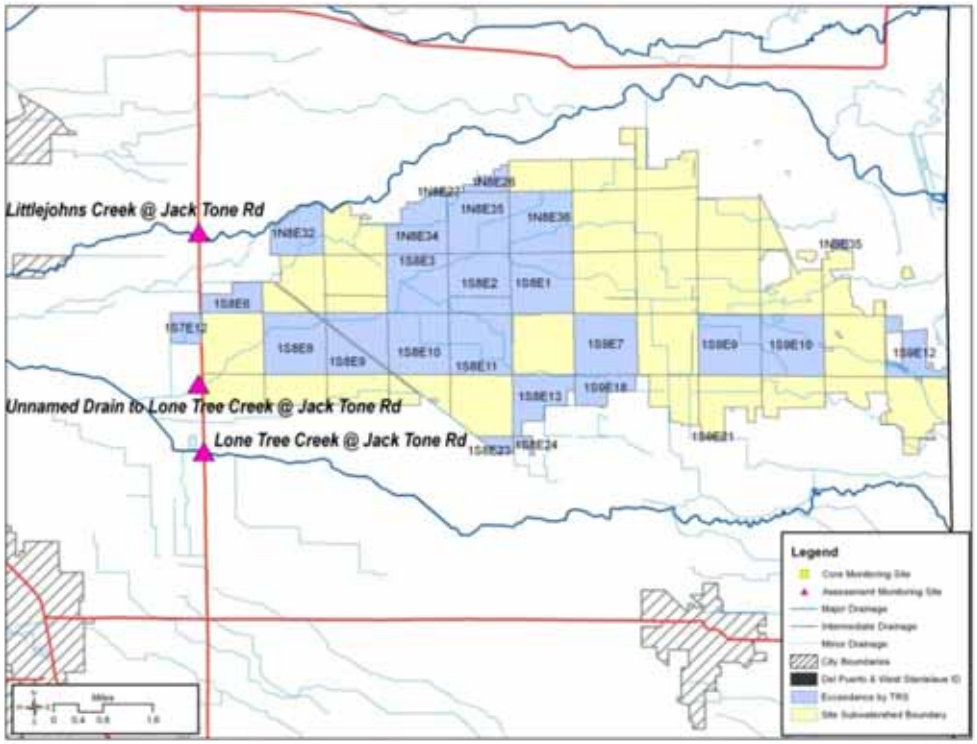
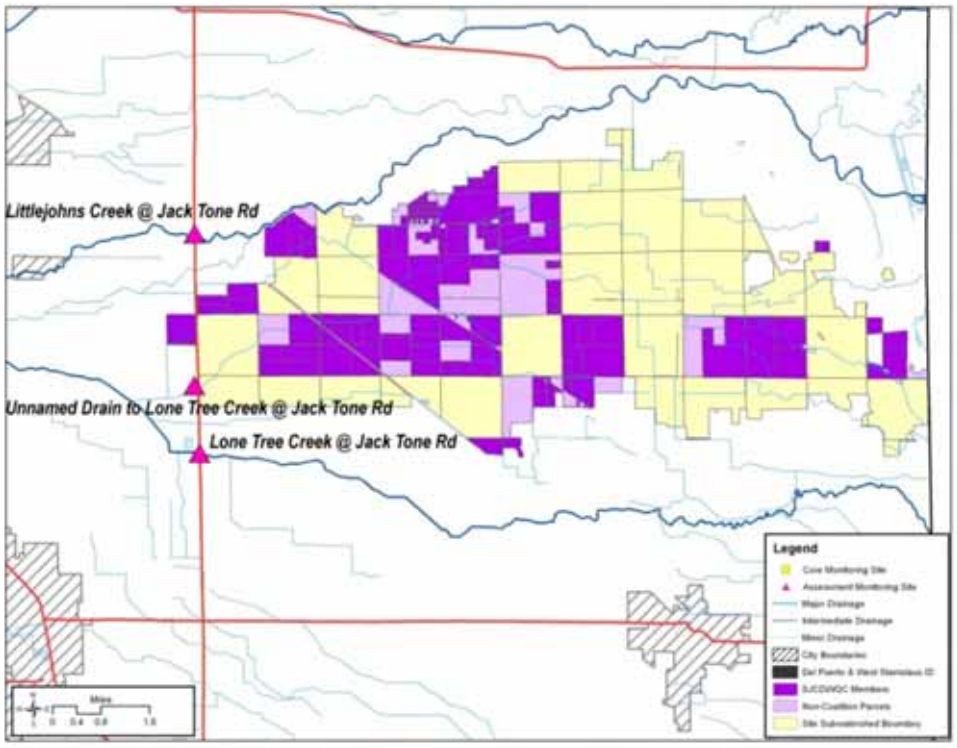


Figure III-5. Unnamed Drain to Lone Tree Creek member APNs relative to TRS with applications co-occurring with chlorpyrifos exceedances.



The analyses conducted by the Coalition suggest that management of chlorpyrifos in this watershed should focus on providing information on a watershed wide basis to encourage growers to review their operation to determine if irrigation return flows and storm water discharges are managed properly. Corn and walnut growers should be targeted for outreach especially prior to the mid-summer irrigation season. Elevated concentrations of chlorpyrifos in the water samples during the summer could be the result of drift as well as irrigation return flows carrying product to the creek. It is unknown how many of the orchards are on drip or microspray but these irrigation practices could lower runoff and reduce the amount of chlorpyrifos reaching the creek.

Analysis of the management practices surveys for this watershed indicates that 15% of the parcels for which surveys were filled out claim no runoff (15% of member acreage within the Unnamed Drain to Lone Tree Creek subwatershed for which surveys were filled out). Forty-two percent of parcels (42% of member acreage) discharge directly to a waterway (local drainage system or directly to the waterway). Thirty-five percent of parcels (39% of member acreage) use recirculation (tail water return system), 1% of parcels (1% of member acreage) use micro/drip irrigation, 5% of parcels (3% of member acreage) utilize sediment settling ditches and 16% of parcels (16% of member acreage) utilize holding basins to reduce runoff. A large number of growers use grass waterways or vegetated filter strips (49% of parcels, 47% of member acreage) suggesting that there is a mix of management practice intensity in the watershed. Although there is a large amount of acreage that discharges directly into a local drainage system or waterway, a majority of member acreage utilizes one or more management practices to reduce discharge. The results of the analysis suggest that outreach should focus on identifying those individuals who may not efficiently manage their applications or tail water. There are several sections that could be targeted for intensified outreach including 1S8E23 and 1N9E19 that are associated with two or more exceedances. This targeted outreach represents a significant effort as each section may contain numerous parcels.

Priority C constituents

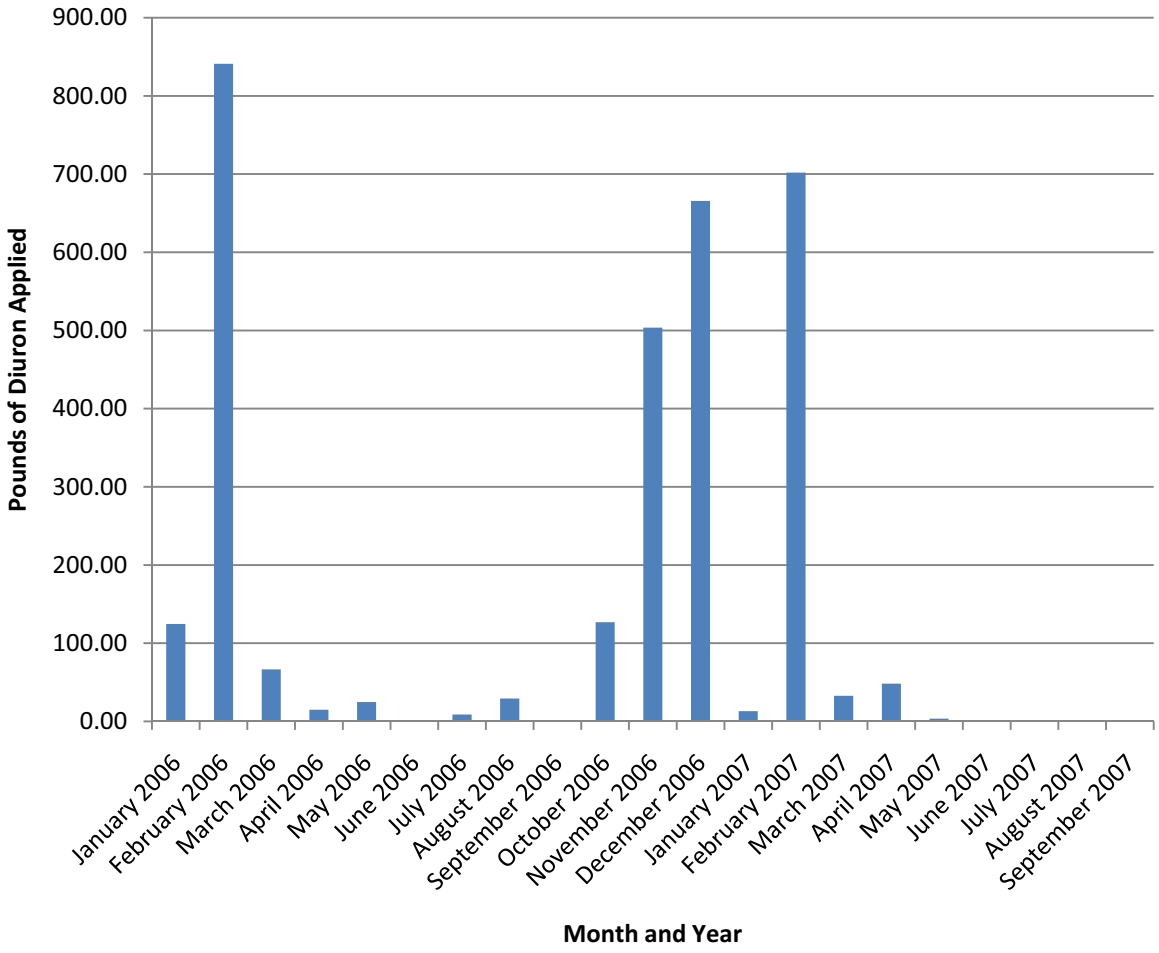
Diuron

Diuron is a soluble herbicide applied throughout the year. Unlike other watersheds in the Coalition region where diuron applications are targeted to winter and spring months, applications of diuron have occurred in the Unnamed Drain to Lone Tree Creek site subwatershed in every month except June and September. There are fewer applications from the summer through the fall, with the bulk of the applications occurring in the winter and spring (Table III-11, Figure III-6). The greatest number of pounds AI was applied in February with the second greatest month of application being December (Figure III-6). Applications occurred over five sections, all of which are found near the sampling location (Figures III-7, III-8).

Table III-11. Number of diuron applications, total pounds applied, and total acres treated by month for January 2006 through September 2007 in the Unnamed Drain to Lone Tree Creek @ Jack Tone Rd site subwatershed. If a month is not included in the table, no applications were made.

Month	Number of Diuron Applications	Pounds Applied	Acres Treated
January 2006	5	124.56	140.00
February 2006	20	841.14	1197.43
March 2006	1	66.49	80.00
April 2006	1	15.04	9.40
May 2006	2	24.81	46.00
July 2006	1	8.85	20.00
August 2006	1	29.24	15.00
October 2006	6	126.78	171.30
November 2006	8	503.64	212.90
December 2006	11	665.79	462.00
January 2007	1	13.06	33.00
February 2007	10	701.93	1380.00
March 2007	2	32.67	20.00
April 2007	2	48.39	77.00
May 2007	1	3.43	5.00
2006 Total	56	2406.33	2354.03
2007 Total	16	799.48	1515.00
Total	**72**	**3205.81**	**3869.03**

Figure III-6.Pounds of diuron applied within the Unnamed Drain to Lone Tree Creek @ Jack Tone Rd site subwatershed by month for 2006 through 2007.



Two exceedances were detected; February 11, 2007 and February 28, 2007. Eleven applications were made between January 11, 2007 and February 6, 2007, and no applications were made between February 6 and February 28, 2007. Consequently, no regression analysis could be performed to establish a relationship between concentration of diuron in the water and application rates. Applications were made to one parcel of walnuts and 10 parcels of grapes. The application method is not specified.

Because only 11 applications were made prior to both exceedances, all TRS' were associated with both exceedances (Table III-12 and III-13). Each section had 2 applications in the month prior to sampling except for section 1N9E19 which had only one application. A map showing the location of the TRS and APN numbers are shown in Figures III-7 and III-8.

Table III-12. All TRS that had more than one application associated with an exceedance for diuron in 2007. Table shows which exceedance the application was associated with and number of applications associated with an exceedance for a given TRS.

TRS*	Date of Associated Exceedance	
	2/11/2007	2/28/2007
1N8E32	2	2
1N9E19	1	
1S8E4	2	2
1S8E5	2	2
1S8E8	2	2
1S8E9	2	2

*Bolded TRS are members of the Coalition

Table III-13. TRS with diuron applications one month prior to each exceedance date. Includes pounds applied and acres treated.

TRS*	2/11/2007			2/28/2007		
	Application Date	Pounds Applied	Acres Treated	Application Date	Pounds Applied	Acres Treated
1N8E32	2/6/2007	1.50	1	2/6/2007	1.50	1
	2/6/2007	34.91	73	2/6/2007	34.91	73
1N9E19	1/11/2007	13.06	33			
1S8E4	2/4/2007	180.98	361	2/4/2007	180.98	361
	2/6/2007	3.01	2	2/6/2007	3.01	2
1S8E5	2/4/2007	163.94	327	2/4/2007	163.94	327
	2/6/2007	4.51	3	2/6/2007	4.51	3
1S8E8	2/5/2007	70.30	148	2/5/2007	70.30	148
	2/6/2007	4.51	3	2/6/2007	4.51	3
1S8E9	2/6/2007	7.52	5	2/6/2007	7.52	5
	2/6/2007	230.74	457	2/6/2007	230.74	457

*Bolded TRS are members of the Coalition

Figure III-7. TRS that have had applications co-occurring with a diuron exceedance.

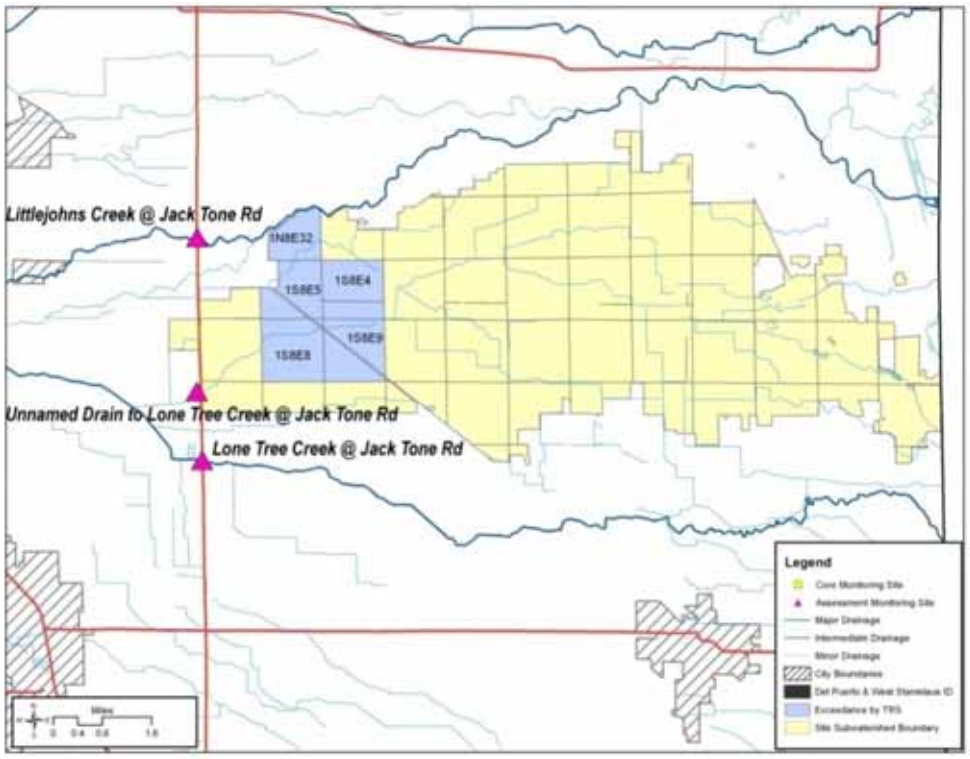
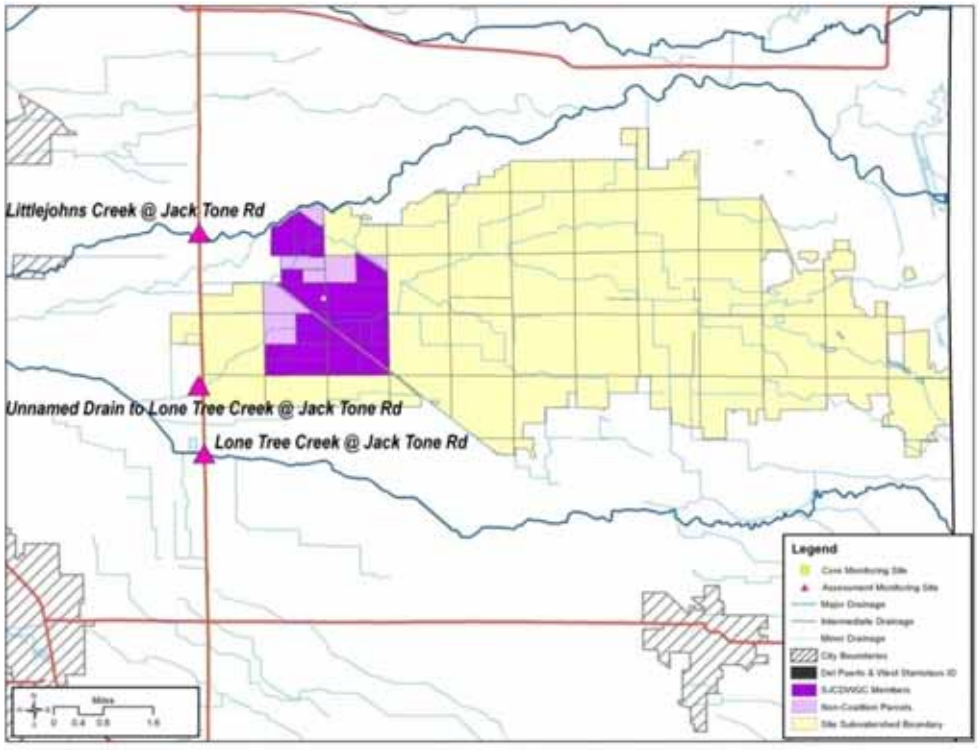


Figure III-8. Member APNs relative to TRS with applications co-occurring with diuron exceedances.



The analyses conducted by the Coalition suggest that management of diuron in this watershed should focus on providing information to the small number of growers whose applications in January and February 2007 were associated with the exceedances. Throughout the watershed, walnut and grape growers should be targeted for some outreach as both exceedances involved walnuts and grapes.