

**A Summary of the 2005 TMDL Monitoring for Selected
Pesticides in the Sacramento-San Joaquin Delta, California**

March - May 2005

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Introduction

This report describes the results of pesticide monitoring at seven locations in California's Sacramento-San Joaquin Delta during March, April and May 2004. Monitoring was conducted by staff of the Aquatic Ecosystems Analysis Laboratory (AEAL) of the John Muir Institute of the Environment, University of California, Davis, as authorized under Contract No. 02-210-150 from the Central Valley Regional Water Quality Control Board (CVRWQCB).

Objective

The primary objective of this project was to monitor seven sites in the Sacramento-San Joaquin River Delta during the 2005 spring irrigation season to characterize the sources of diazinon, chlorpyrifos and other pesticides that can cause surface water contamination and toxic conditions to aquatic life. The results of this study will be used to support the development of diazinon and chlorpyrifos Total Maximum Daily Loads (TMDL) for the Sacramento-San Joaquin Delta.

Monitoring Overview

Three sites ([Figure 1](#), [Table 1](#)) were monitored once per week from 2 March to 6 April 2005 for a total of six times each. Four sites were monitored once per week from 2 March to 25 May 2005 for a total of thirteen times each.

The measured field parameters included pH, water temperature and electrical conductivity (EC). Stream discharge was measured at two sites (the Calaveras River at Ijams Road and Ulatis Creek at Brown Road) using standard USGS methods (Nolan 2001) and a Swiffer Model 2100 current meter. Discharge estimates at one site (French Camp Slough at Airport Way) were obtained from the California Department of Water Resources (CDWR).

Water samples were delivered to the California Department of Food and Agriculture (CDFA) laboratory in Sacramento, California for chemical analysis using gas

chromatography-mass spectrometry (GCMS). The CDFA laboratory analyzed each water sample for 12 chemical compounds ([Table 2](#)). The project quality assurance objectives are provided in [Table 3](#). The detection frequencies, concentrations and calculated daily loading rates for diazinon and chlorpyrifos are presented in [Table 4](#). The detection frequencies and concentrations of the other 10 compounds are listed in [Appendix A](#).

Details of the monitoring plan can be found in Appendix 1b of the Quality Assurance Project Plan (QAPP): *Sacramento, Delta and San Joaquin River Basins Organophosphorus Pesticides TMDL Monitoring Quality Assurance Project Plan* (Calanchini, 2005).

Figure 1. The seven sampling sites in the Sacramento-San Joaquin Delta monitored for pesticides during the 2005 spring irrigation season.

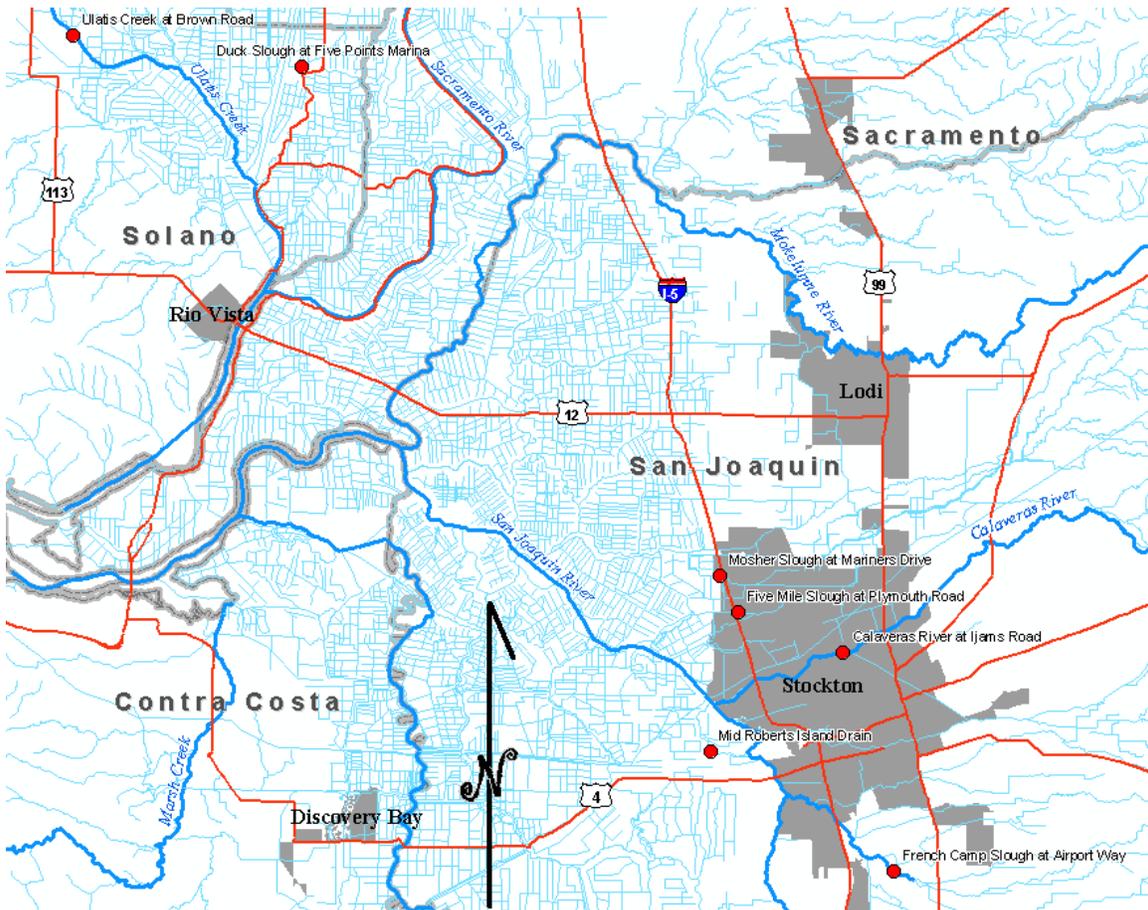


Table 1. Sampling sites, locations, collection method and sampling dates

Site #	Site Name	Latitude	Longitude	Sample Collection Method	Sampling Dates
Delt02	Mosher Slough at Mariners Drive	38.0327	-121.3639	Grab from bank	2 March through 6 April 2005
Delt03	Five Mile Slough at Plymouth Road	38.0139	-121.3514	Grab from bank	2 March through 6 April 2005
Delt04	Calaveras River at Ijams Road	37.9938	-121.2825	Grab from bank	2 March through 6 April 2005
Delt05	Mid Roberts Island Drain	37.9417	-121.3683	Grab from bank	2 March through 25 May 2005
Delt06	French Camp Slough at Airport Way	37.9119	-121.2902	Grab from bank	2 March through 25 May 2005
Delt10	Ulatis Creek at Brown Road	38.3069	-121.7938	Grab from bank	2 March through 25 May 2005
Delt11	Duck Slough at Five Points Marina	38.2931	-121.6435	Grab from bank	3 March through 25 May 2005

Sample Collection Methods

All samples were collected by harnessing a 1-liter amber glass bottle to a pole sampler and dipping the bottle into the stream as close to the center of the channel as possible. Detailed procedures for sample collection and handling are listed in Appendix 3b of the QAPP (Calanchini, 2005).

Discharge Methods

At the Calaveras River and Ulatis Creek discharge was measured using a Swiffer Model 2100 current meter while wading. All measurements were made using standard USGS current-meter methods (Nolan, et al. 2001). Discharge estimates for French Camp Slough at Airport Way were provided courtesy of John Tingle of the California Department of Water Resources (CDWR) from the CDWR gage located on site. No discharge measurements were made at any of the other sites due to tidal influences and site logistics.

Loading Rate Calculations

Daily loading rates of diazinon and chlorpyrifos were calculated by multiplying the stream discharge at the time of sample collection by the measured concentrations of each pesticide by the number of seconds (86,400) in one day. Loading rates were only calculated when the pesticide concentration was above the limit of detection and a

discharge estimate was available. The loading rate was assumed to be zero for all samples where pesticide concentrations were below the limit of detection.

Laboratory Sample Preparation and Analysis Methods

Upon arrival at the CDFA laboratory, samples were weighed and recorded. Each sample was spiked with 500 μ L of surrogate spiking solution composed of 0.25 μ g/mL chlorpyrifos methyl. Matrix spikes were spiked with 500 μ L of appropriate spiking solution. Approximately 500ml of the sample was emptied into a 2-liter size separatory funnel. The sample bottle was weighed and recorded and approximately 10-15g of granular sodium chloride added. The sample was gently shaken to dissolve salt. The following steps, listed in parentheses, were then repeated three times in succession: (60ml of methylene chloride were added and the sample was mixed thoroughly for three minutes. After mixing the sample was allowed to settle until the lower methylene chloride layer was completely separated from the above water layer. The organic fraction was filtered through a bed of granular anhydrous sodium sulfate (approx. 20g) into a 250ml round bottom flask). The round bottom flask was then placed on a Rotavapor evaporator and the resultant sample evaporated to 5-7 ml at 40° C. The contents of the round bottom flask were then transferred to a 15ml collection tube. The round bottom flask was rinsed with 5ml of methylene chloride and the rinse was added to the collection tube. The 15ml collection tube was placed on the N-Evaporator with the water temperature set at 40° C and the sample was evaporated until just reaching dryness. The sample was removed from the evaporator and added to a test tube containing 0.5ml of methylene chloride and 5.0 μ L of 5.0 μ g/mL internal standard solution. The contents of the test tube were then mixed with a vortex and transferred into an autosampler vial. The vial was capped and stored in a -5° C freezer until ready for analysis.

Samples were analyzed with an Agilent Model 5973 GC-MSD using a HP-5MS or equivalent GC column. Analysis was performed in the selective ion-monitoring mode.

Twelve compounds were analyzed for each sample ([Table 2](#)). The limits of quantitation (LOQ) for diazinon and chlorpyrifos were 0.020 and 0.010 parts per billion (ppb), respectively. The detection limits (LOD) were 0.007 and 0.004 ppb for diazinon and chlorpyrifos, respectively ([Table 2](#)). The lab reported estimated values when the

values were below the LOQ but above the LOD. To ensure the accuracy and precision of the sample analysis, lab spikes, blanks, and a surrogate standard (chlorpyrifos methyl) were used. If the recovery of a spike sample was out of the control range, the water sample was re-analyzed.

Table 2. CDFA Laboratory limits of detection and practical quantitation limits for select pesticides

Compound	Limit of Detection (LOD in µg/L)	Limit of Quantitation (LOQ in µg/L)
Azinphos methyl	0.007	0.050
Bifenthrin	0.007	0.050
Carbaryl	0.007	0.020
Chlorpyrifos	0.004	0.010
Cyanazine	0.007	0.050
Dacthal (DCPA)	0.007	0.050
Diazinon	0.007	0.020
EPTC (Eptam)	0.020	0.050
Methidathion	0.010	0.030
Metolachlor	0.007	0.020
Propargite	0.150	0.500
Simazine	0.005	0.200

Quality Assurance Objectives

Sampling during the 2005 irrigation season was conducted under the requirements of the Sacramento, Delta and San Joaquin River Basins Organophosphorus Pesticides TMDL Monitoring Quality Assurance Project Plan (QAPP) (Calanchini, 2005).

Sampling precision and variability were measured through the use of field duplicates and matrix spike duplicates. The Quality Assurance Objective (QAO) for precision was a relative percent difference (RPD) of $\pm 25\%$ between duplicate samples and their corresponding environmental samples and between matrix spike samples and their corresponding matrix spike duplicates ([Table 3](#)).

Accuracy was measured by determining the percent recovery of known concentrations of analytes spiked into environmental samples or reagent water before extraction. The QAO for accuracy in laboratory analytical measurements was a 70% - 130% recovery rate of chlorpyrifos and a 70% - 140% recovery rate for diazinon in

matrix spikes and matrix spike duplicates, or control limits at ± 3 standard deviations based on actual lab data, and 80% - 125% in all surrogates ([Table 3](#)).

In accordance with the QAPP requirements, analytical results that fell outside of the acceptable level of recovery, as stated in the QAOs, were flagged. For the purpose of this report all results outside of the QAO recovery ranges were flagged as follows: BL = results should be viewed as biased low due to low surrogate recovery in sample. No samples had recoveries above the acceptable range.

Table 3. Field and Laboratory Quality Assurance Objectives (QAOs).

Field QC	Frequency/Number	Acceptance Limits	Results (met QAO/total)
Field Blanks	Approximately 5%	Less than Reporting Limit	3/3
Cooler Temperature	Measured by analyzing lab at time of delivery	$\leq 4^{\circ} \text{C}$	100%
Field Duplicate Pairs	3	RPD $\leq 25\%$	3/3 chlorpyrifos 3/3 diazinon
Laboratory QC	Frequency/Number	Acceptance Limits	
Method Blank (=Lab Blank)	1/batch	80-125%	
Instrument Blank	After any standards	All target analytes below reporting limit	12/13
Matrix Spike	Approximately 5%	70-130 % diazinon; 70-140% chlorpyrifos	100%
Lab. Control Sample (=Lab Control Spike)	1/Batch	80-125%	3/3 chlorpyrifos 3/3 diazinon
Surrogates	In all samples and QC	80-125%	11/13
Internal Standards	All samples and standards	50 – 200 %	98/105
			100%

Results

A total of 70 environmental samples ([Table 4](#)) and 9 quality control (QC) samples ([Table 5](#)) were collected and analyzed.

Environmental samples

Concentrations of diazinon and chlorpyrifos ranged from below detection to 0.220 parts per billion (ppb) of diazinon in Mosher Slough on 6 April and 0.098 parts per billion (ppb) of chlorpyrifos in Mid Roberts Island Drain on 9 March 2005 ([Table 4](#)).

The highest calculated daily loading rates for both diazinon (113.42 grams/day) and chlorpyrifos (85.83 grams/day) were in French Camp Slough on 23 March 2005 ([Table 4](#)).

Other pesticides detected in the environmental samples were Carbaryl, Dacthal (DCPA), Eptam (EPTC), Methidathion, Metolachlor and Simazine ([Appendix A](#)).

Three environmental samples, in which at least one pesticide was detected, had surrogate recoveries outside of the QAO acceptance limits – see footnotes in [Table 4](#) and [Appendix A](#).

Environmental Quality Control Samples

Sample quality control was measured through collection of sequential and split duplicates (n=3), field blanks (n=3), matrix spikes (n=3) and surrogate recovery. Duplicate samples provided a measure of analytical precision; field blanks were used to evaluate possible introduction of contaminants during sample collection, handling and transport to the lab; matrix spikes were used to evaluate the accuracy of extracting spiked chemicals from the sample matrix; surrogate recoveries provided a measure of analytical accuracy for individual samples.

The precision QAO for duplicate samples was a relative percent difference (RPD) of $\leq 25\%$ between the duplicate and corresponding environmental sample concentrations. All duplicate samples met the QAO for precision. RPDs between duplicate and environmental samples ranged from 8.70% - 15.38% ([Table 5](#)).

The QAO acceptance limit for field blanks was “less than the reporting limit”. All field blanks met the acceptance limits with no detections of any pesticides ([Table 5](#)).

The QAO acceptance limit for matrix spikes was a 70-140% recovery rate for chlorpyrifos and 70-130% recovery rate for diazinon. Each of the three matrix spikes met the QAO objective for recovery. Recoveries ranged from 90-97% for chlorpyrifos and 97-110% for diazinon ([Table 5](#)). The QAO for precision between matrix spike and matrix spike duplicate recoveries was an RPD of $\leq 25\%$. All matrix spike pairs met the QAO for precision with RPDs ranging from 0%-7.49%.

The QAO for surrogate recovery was 80-125%. Three primary samples from early March had low surrogate recoveries ranging from 72-79% ([Table 4](#)). A field blank from 2 March 2005, had a 71% surrogate recovery ([Table 5](#)).

Laboratory Quality Control Samples

Thirteen lab blanks and 13 lab control matrix spikes were analyzed with the environmental samples. The QAO acceptance limits for lab blanks and lab control matrix spikes were recoveries of 80-125% each for chlorpyrifos, diazinon and the surrogate (chlorpyrifos methyl). One lab blank and two lab control spikes had surrogate recoveries of less than 80% ([Appendices B](#) and [C](#)).

Surrogate recoveries in lab blanks ranged from 74-99% ([Appendix B](#)). Surrogate recoveries in lab control matrix spikes ranged from 80-106%, 86-110% and 77-110% for chlorpyrifos, diazinon and chlorpyrifos methyl, respectively ([Appendix C](#)).

Data Quality Assessment

Three primary samples had surrogate recoveries below the 80-125% quality assurance objective for accuracy. Those recoveries ranged from 72-79%. The method blanks and lab control spikes processed in the same batches as those samples met all of the quality assurance objectives. The three samples with low surrogate recovery are considered usable data with the results biased low.

A field blank from 2 March 2005 had a low surrogate recovery of 71%. Because there were no detections of any analytes in the field blank, and the surrogate recovery (71%) was close to the control limits, it seems likely that there was no contamination of the field blank and the results are considered usable.

One method blank and two lab control spikes (LCS) from batches of samples processed in mid-May had low surrogate recoveries ranging from 74-77%. There were no detections of any analytes in any of the method blanks. Because the surrogate recoveries in individual samples run with the method blank that had low recovery (74%) were within the QAO objectives, those samples are considered unbiased by the low method blank recovery.

The two LCS with low recoveries are considered usable data with their results biased low. The recoveries of diazinon and chlorpyrifos spiked into the two LCS were within the 80-125% objective for accuracy. The recoveries in all primary samples processed in the same batches as the LCSs with low recoveries met the quality assurance objective for accuracy. These data are all considered unbiased and usable.

Because all of the results were classified as usable, the data completeness for this project was 100%.

Table 4. Summary of environmental data collected on diazinon and chlorpyrifos concentrations and daily loading rates for sites in the Sacramento-San Joaquin River Delta, California. March - May 2005.

Stream flow is in cubic feet per second. J: the reported concentrations were below the quantitative limit and are considered estimates; NA: not available; ND: Not detected; g a.i./d: grams active ingredient per day; µg/L: micrograms per liter; BL: result should be viewed as biased low due to low surrogate recovery in sample.

Site number	Site name	Date (month/day/year)	Time (24 hr)	Stream flow (cfs)	Chlorpyrifos concentration (µg/L)	Chlorpyrifos daily loading rate (g a.i./d)	Diazinon concentration (µg/L)	Diazinon daily loading rate (g a.i./d)
Delt02	Mosher Slough at Mariners Drive	3/2/2005	11:50	NA	0.011	NA	0.051	NA
		3/9/2005	11:20	NA	0.014	NA	0.049	NA
		3/16/2005	12:30	NA	0.011	NA	0.024	NA
		3/23/2005	09:20	NA	0.043	NA	0.046	NA
		3/30/2005	12:40	NA	0.025	NA	0.049	NA
		4/6/2005	13:10	NA	0.016	NA	0.220	NA
Delt03	Five Mile Slough at Plymouth Road	3/2/2005	12:20	NA	(0.006 J)	NA	0.040	NA
		3/9/2005	11:30	NA	0.015	NA	0.027	NA
		3/16/2005	12:50	NA	0.020	NA	(0.016 J)	NA
		3/23/2005	09:40	NA	0.043	NA	0.044	NA
		3/30/2005	13:00	NA	0.018	NA	0.022	NA
		4/6/2005	13:30	NA	(0.009 J)	NA	(0.013 J)	NA
Delt04	Calaveras River at Ijams Road	3/2/2005	12:50	233.76	(0.007 J)	4.00	ND	NA
		3/9/2005	12:00	44.80	(0.010 J)	1.10	ND	NA
		3/16/2005	13:20	17.02	(0.006 J)	0.25	ND	NA
		3/23/2005	10:00	NA	(0.008 J)	NA	(0.012 J)	NA
		3/30/2005	13:30	1018.49	ND	NA	ND	NA
		4/6/2005	14:10	NA	ND	NA	ND	NA
Delt05	Mid Roberts Island Drain	3/2/2005	15:20	NA	(0.004 J)	NA	ND	NA
		3/9/2005	14:00 ¹	NA	BL (0.098)	NA	ND	NA
		3/16/2005	15:20	NA	0.069	NA	ND	NA
		3/23/2005	11:50	NA	0.056	NA	ND	NA

¹ Surrogate recovery (72%) was below the QAPP acceptance limits. Results should be viewed as biased low.

Table 4. Summary of environmental data collected on diazinon and chlorpyrifos concentrations and daily loading rates for sites in the Sacramento-San Joaquin River Delta, California. March - May 2005.

Stream flow is in cubic feet per second. J: the reported concentrations were below the quantitative limit and are considered estimates; NA: not available; ND: Not detected; g a.i./d: grams active ingredient per day; µg/L: micrograms per liter; BL: result should be viewed as biased low due to low surrogate recovery in sample.

Site number	Site name	Date (month/day/year)	Time (24 hr)	Stream flow (cfs)	Chlorpyrifos concentration (µg/L)	Chlorpyrifos daily loading rate (g a.i./d)	Diazinon concentration (µg/L)	Diazinon daily loading rate (g a.i./d)
Delt05	Mid Roberts Island Drain <i>continued</i>	3/30/2005	15:50	NA	0.027	NA	ND	NA
		4/6/2005	15:30	NA	0.022	NA	ND	NA
		4/13/2005	11:50	NA	0.017	NA	ND	NA
		4/20/2005	11:40	NA	0.013	NA	ND	NA
		4/27/2005	13:00	NA	0.078	NA	ND	NA
		5/4/2005	12:40	NA	0.013	NA	ND	NA
		5/11/2005	13:10	NA	(0.008 J)	NA	ND	NA
		5/18/2005	13:30	NA	0.011	NA	ND	NA
		5/25/2005	12:40	NA	(0.006 J)	NA	ND	NA
Delt06	French Camp Slough at Airport Way	3/2/2005	14:50	605.00	(0.007 J)	10.36	ND	NA
		3/9/2005	13:40	154.00	0.037	13.94	ND	NA
		3/16/2005	14:40	47.40	(0.007 J)	0.81	ND	NA
		3/23/2005	11:20	1253.00	0.028	85.83	0.037	113.42
		3/30/2005	15:20	1644.00	ND	NA	ND	NA
		4/6/2005	14:50	109.00	(0.008 J)	2.13	(0.011 J)	2.93
		4/13/2005	12:20	93.50	(0.006 J)	1.37	ND	NA
		4/20/2005	12:10	49.70	(0.006 J)	0.73	(0.011 J)	1.34
		4/27/2005	13:30	32.90	(0.008 J)	0.64	(0.009 J)	0.72
		5/4/2005	13:10	85.00	(0.009 J)	1.87	ND	NA
		5/11/2005	13:50	69.20	(0.007 J)	1.19	ND	NA
		5/18/2005	14:10	81.30	0.012	2.39	ND	NA
		5/25/2005	13:20	76.20	0.014	2.61	ND	NA
Delt10	Ulatis Creek at Brown Rd	3/2/2005	09:00 ²	658.31	BL (0.007 J)	11.27	BL (0.017 J)	27.38
		3/9/2005	09:00	95.84	(0.009 J)	2.11	ND	NA
		3/16/2005	09:30	56.29	(0.006 J)	0.83	(0.007 J)	0.96

² Surrogate recovery (79%) was below the QAPP acceptance limits. Results should be viewed as biased low.

Table 4. Summary of environmental data collected on diazinon and chlorpyrifos concentrations and daily loading rates for sites in the Sacramento-San Joaquin River Delta, California. March - May 2005.

Stream flow is in cubic feet per second. J: the reported concentrations were below the quantitative limit and are considered estimates; NA: not available; ND: Not detected; g a.i./d: grams active ingredient per day; µg/L: micrograms per liter; BL: result should be viewed as biased low due to low surrogate recovery in sample.

Site number	Site name	Date (month/day/year)	Time (24 hr)	Stream flow (cfs)	Chlorpyrifos concentration (µg/L)	Chlorpyrifos daily loading rate (g a.i./d)	Diazinon concentration (µg/L)	Diazinon daily loading rate (g a.i./d)
Delt10	Ulatis Creek at Brown Rd <i>continued</i>	3/23/2005	14:20	402.68	0.023	22.66	0.045	44.33
		3/30/2005	09:20	127.35	0.011	3.43	(0.007 J)	2.18
		4/6/2005	10:10	74.04	(0.008 J)	1.45	0.082	14.85
		4/13/2005	08:50	58.10	(0.006 J)	0.85	ND	NA
		4/20/2005	08:50	83.01	ND	NA	ND	NA
		4/27/2005	09:10	84.57	(0.004 J)	0.83	ND	NA
		5/4/2005	10:10	24.96	(0.006 J)	0.37	ND	NA
		5/11/2005	10:00	70.32	ND	NA	(0.010 J)	1.72
		5/18/2005	10:40	18.10	ND	NA	ND	NA
		5/25/2005	10:00	40.27	ND	NA	ND	NA
Delt11	Duck Slough at Five Points Marina	3/2/2005	10:50 ³	NA	ND	NA	ND	NA
		3/9/2005	15:30	NA	ND	NA	ND	NA
		3/16/2005	11:30	NA	(0.007 J)	NA	ND	NA
		3/23/2005	13:20	NA	0.011	NA	ND	NA
		3/30/2005	11:50	NA	(0.004 J)	NA	ND	NA
		4/6/2005	11:50	NA	ND	NA	ND	NA
		4/13/2005	10:10	NA	ND	NA	ND	NA
		4/20/2005	10:20	NA	ND	NA	ND	NA
		4/27/2005	11:20	NA	ND	NA	ND	NA
		5/4/2005	11:30	NA	ND	NA	ND	NA
		5/11/2005	12:00	NA	ND	NA	ND	NA
		5/18/2005	12:20	NA	ND	NA	ND	NA
		5/25/2005	11:30	NA	ND	NA	(0.008 J)	NA

³ Surrogate recovery (79%) was below the QAPP acceptance limits. Results should be viewed as biased low.

Table 5. Summary of diazinon and chlorpyrifos concentrations quality-control data for sites in the Sacramento-San Joaquin River Delta, California, March - May 2005.

NA: not applicable - cannot be calculated because of "less than" concentration; µg/L: micrograms per liter; J: the reported concentrations were below the quantitative limit and are considered estimates; <: less than; N/A: not available.

Site identification number	Site name	Date and time (month/day/year 24-hour time)	Chlorpyrifos (ug/L)	Relative percent difference (chlorpyrifos)*	Diazinon (ug/L)	Relative percent difference (diazinon)*	
DUPLICATES							
Delt04	Calaveras River at Ijams Road	3/16/2005 13:20	(0.006 J)	15.38%	<0.007	NA	
		3/16/2005 13:25	(0.007 J)		<0.007		
Delt10	Ulatis Creek at Brown Road	3/30/2005 09:20	0.011	8.70%	(0.007 J)	13.33%	
		3/30/2005 09:25	0.012		(0.008 J)		
Delt05	Mid Roberts Island Drain	5/18/2005 13:30	0.011	9.52%	<0.007	NA	
		5/18/2005 13:35	(0.010 J)		<0.007		
BLANKS							
Delt02	Mosher Slough at Mariners Drive	3/02/2005 11:55 ¹	<0.004		<0.007		
Delt05	Mid Roberts Island Drain	3/23/2005 11:55	<0.004		<0.007		
Delt11	Duck Slough at Five Points Marina	4/20/2005 10:25	<0.004		<0.007		
Site identification number	Site name	Date and time (month/day/year 24-hour time)	Chlorpyrifos (ug/L)	Percent recovery (chlorpyrifos)	Diazinon (ug/L)	Percent recovery (diazinon)	
SPIKES^{2,3}							
Delt03	Five-mile Slough at Plymouth Road	3/09/2005 11:30	0.015		0.027	110%	
		3/09/2005 11:30		90%			110%
		3/09/2005 11:30		0%			0%
Delt06	French Camp Slough at Airport Way	4/06/2005 14:50	(0.008 J)		(0.011 J)	97%	
		4/06/2005 14:50		90%			97%
		4/06/2005 14:50		7.49%			0%
Delt10	Ulatis Creek at Brown Road	5/04/2005 10:10	(0.006 J)		<0.007	104%	
		5/04/2005 10:10		93%			N/A
		5/04/2005 10:10 ⁴		N/A			N/A

¹Surrogate recovery (71%) was outside of QAPP acceptance limits of 80-125%.

²Spiked samples were injected with 0.05 ug/L of chlorpyrifos and 0.10 ug/L of diazinon.

³First sample in each pair is the environmental sample; second sample is the spike; third sample is the spike duplicate

⁴Sample extract was spilled. No additional sample was available for matrix spike duplicate.

*Relative percent difference between matrix spike (MS) and matrix spike duplicate (MSD) is listed in bold italics below MS & MSD recoveries

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Appendix A

Appendix A. Pesticide results (excluding diazinon and chlorpyrifos).

(Concentrations are in units of µg/L. NA: Not available; ND: Not detected; J: the reported concentrations were below the quantitative limit and are considered estimates; BL: result should be viewed as biased low due to low surrogate recovery in sample. Each sample was also analyzed for Azinphos methyl, Bifenthrin, Methidathion and Propargite which were not present at detectable levels).

Site	Date	Time	Carbaryl	Dacthal (DCPA)	Eptam (EPTC)	Methidathion	Metolachlor	Simazine
Mosher Slough at Mariners Drive	3/02/2005	11:50	0.048	(0.011 J)	ND	ND	(0.007 J)	(0.039 J)
Mosher Slough at Mariners Drive	3/09/2005	11:20	0.049	ND	ND	ND	ND	0.260
Mosher Slough at Mariners Drive	3/16/2005	12:30	(0.015 J)	ND	ND	ND	(0.007 J)	0.590
Mosher Slough at Mariners Drive	3/23/2005	09:20	0.230	ND	ND	ND	(0.019 J)	(0.071 J)
Mosher Slough at Mariners Drive	3/30/2005	12:40	0.087	ND	ND	ND	(0.012 J)	(0.190 J)
Mosher Slough at Mariners Drive	4/06/2005	13:10	0.094	ND	ND	ND	(0.013 J)	0.230
Five Mile Slough at Plymouth Road	3/02/2005	12:20	0.610	ND	ND	ND	ND	(0.046 J)
Five Mile Slough at Plymouth Road	3/09/2005	11:30	0.140	ND	ND	ND	ND	(0.140 J)
Five Mile Slough at Plymouth Road	3/16/2005	12:50	ND	ND	ND	ND	(0.009 J)	0.210
Five Mile Slough at Plymouth Road	3/23/2005	09:40	0.200	ND	ND	ND	(0.010 J)	(0.032 J)
Five Mile Slough at Plymouth Road	3/30/2005	13:00	0.110	ND	ND	ND	(0.010 J)	0.200
Five Mile Slough at Plymouth Road	4/06/2005	13:30	0.085	ND	ND	ND	(0.011 J)	(0.059 J)
Calaveras River at Ijams Road	3/02/2005	12:50	ND	ND	ND	0.056	ND	0.870
Calaveras River at Ijams Road	3/09/2005	12:00	ND	ND	ND	ND	ND	0.240
Calaveras River at Ijams Road	3/16/2005	13:20	ND	ND	ND	ND	ND	(0.170 J)
Calaveras River at Ijams Road	3/23/2005	10:00	(0.008 J)	ND	ND	ND	(0.011 J)	1.300
Calaveras River at Ijams Road	3/30/2005	13:30	ND	ND	ND	ND	ND	0.220
Calaveras River at Ijams Road	4/06/2005	14:10	ND	ND	ND	ND	ND	(0.190 J)
Mid Roberts Island Drain	3/02/2005	15:20	ND	ND	ND	ND	0.600	0.460
Mid Roberts Island Drain	3/09/2005	14:00 ¹	ND	ND	ND	ND	BL (0.072)	BL (0.062 J)
Mid Roberts Island Drain	3/16/2005	15:20	ND	ND	ND	ND	0.072	(0.041 J)
Mid Roberts Island Drain	3/23/2005	11:50	ND	ND	ND	ND	0.230	0.240
Mid Roberts Island Drain	3/30/2005	15:50	ND	ND	ND	ND	0.071	(0.048 J)
Mid Roberts Island Drain	4/06/2005	15:30	ND	ND	ND	ND	0.610	(0.034 J)

¹ Surrogate recovery (72%) was below the QAPP acceptance limits. Results should be viewed as biased low.

Appendix A. Pesticide results (excluding diazinon and chlorpyrifos).

(Concentrations are in units of µg/L. NA: Not available; ND: Not detected; J: the reported concentrations were below the quantitative limit and are considered estimates; BL: result should be viewed as biased low due to low surrogate recovery in sample. Each sample was also analyzed for Azinphos methyl, Bifenthrin, Methidathion and Propargite which were not present at detectable levels).

Site	Date	Time	Carbaryl	Dacthal (DCPA)	Eptam (EPTC)	Methidathion	Metolachlor	Simazine
Mid Roberts Island Drain	4/13/2005	11:50	ND	ND	ND	ND	0.069	(0.060 J)
Mid Roberts Island Drain	4/20/2005	11:40	ND	ND	ND	ND	0.064	(0.033 J)
Mid Roberts Island Drain	4/27/2005	13:00	ND	ND	(0.019 J)	ND	0.410	(0.140 J)
Mid Roberts Island Drain	5/04/2005	12:40	(0.008 J)	ND	0.740	ND	0.850	(0.120 J)
Mid Roberts Island Drain	5/11/2005	13:10	ND	ND	ND	ND	0.550	(0.054 J)
Mid Roberts Island Drain	5/18/2005	13:30	0.036	ND	0.210	ND	18.000	(0.036 J)
Mid Roberts Island Drain	5/25/2005	12:40	(0.016 J)	ND	(0.039 J)	ND	0.310	(0.021 J)
French Camp Slough at Airport Way	3/02/2005	14:50	ND	ND	ND	ND	ND	0.930
French Camp Slough at Airport Way	3/09/2005	13:40	ND	ND	ND	ND	ND	0.320
French Camp Slough at Airport Way	3/16/2005	14:40	ND	ND	ND	ND	ND	0.300
French Camp Slough at Airport Way	3/23/2005	11:20	ND	ND	ND	ND	(0.019 J)	0.300
French Camp Slough at Airport Way	3/30/2005	15:20	ND	ND	ND	ND	ND	0.470
French Camp Slough at Airport Way	4/06/2005	14:50	ND	ND	ND	ND	ND	0.260
French Camp Slough at Airport Way	4/13/2005	12:20	ND	ND	ND	ND	ND	0.390
French Camp Slough at Airport Way	4/20/2005	12:10	0.029	ND	ND	ND	(0.007 J)	(0.160 J)
French Camp Slough at Airport Way	4/27/2005	13:30	0.038	ND	ND	ND	0.021	(0.110 J)
French Camp Slough at Airport Way	5/04/2005	13:10	ND	ND	ND	ND	ND	(0.078 J)
French Camp Slough at Airport Way	5/11/2005	13:50	ND	ND	ND	ND	ND	(0.085 J)
French Camp Slough at Airport Way	5/18/2005	14:10	ND	ND	ND	ND	(0.009 J)	0.240
French Camp Slough at Airport Way	5/25/2005	13:20	(0.009 J)	ND	ND	0.050	0.023	(0.099 J)
Ulatis Creek at Brown Road	3/02/2005	09:00 ²	BL (0.016 J)	ND	ND	ND	BL (0.033)	BL (0.800)
Ulatis Creek at Brown Road	3/09/2005	09:00	ND	ND	ND	ND	(0.008 J)	(0.075 J)
Ulatis Creek at Brown Road	3/16/2005	09:30	ND	ND	ND	ND	ND	(0.032 J)
Ulatis Creek at Brown Road	3/23/2005	14:20	ND	ND	ND	ND	(0.014 J)	0.320

² Surrogate recovery (79%) was below the QAPP acceptance limits. Results should be viewed as biased low.

Appendix A. Pesticide results (excluding diazinon and chlorpyrifos).

(Concentrations are in units of µg/L. NA: Not available; ND: Not detected; J: the reported concentrations were below the quantitative limit and are considered estimates; BL: result should be viewed as biased low due to low surrogate recovery in sample. Each sample was also analyzed for Azinphos methyl, Bifenthrin, Methidathion and Propargite which were not present at detectable levels).

Site	Date	Time	Carbaryl	Dacthal (DCPA)	Eptam (EPTC)	Methidathion	Metolachlor	Simazine
Ulatis Creek at Brown Road	3/30/2005	09:20	ND	ND	ND	ND	(0.007 J)	(0.051 J)
Ulatis Creek at Brown Road	4/06/2005	10:10	ND	ND	ND	ND	ND	(0.072 J)
Ulatis Creek at Brown Road	4/13/2005	08:50	ND	ND	ND	ND	ND	(0.048 J)
Ulatis Creek at Brown Road	4/20/2005	08:50	ND	ND	ND	ND	(0.011 J)	(0.053 J)
Ulatis Creek at Brown Road	4/27/2005	09:10	ND	ND	ND	ND	ND	(0.049 J)
Ulatis Creek at Brown Road	5/04/2005	10:10	ND	ND	ND	ND	(0.013 J)	(0.030 J)
Ulatis Creek at Brown Road	5/11/2005	10:00	0.055	ND	ND	ND	1.200	(0.040 J)
Ulatis Creek at Brown Road	5/18/2005	10:40	ND	ND	ND	ND	1.200	(0.028 J)
Ulatis Creek at Brown Road	5/25/2005	10:00	ND	ND	ND	ND	3.500	(0.028 J)
Duck Slough at Five Points Marina	3/02/2005	10:50 ³	ND	ND	ND	ND	ND	BL (0.260)
Duck Slough at Five Points Marina	3/09/2005	15:30	ND	ND	ND	ND	ND	(0.170 J)
Duck Slough at Five Points Marina	3/16/2005	11:30	ND	ND	ND	ND	ND	(0.044 J)
Duck Slough at Five Points Marina	3/23/2005	13:20	ND	ND	ND	ND	(0.007 J)	(0.095 J)
Duck Slough at Five Points Marina	3/30/2005	11:50	ND	ND	ND	ND	ND	(0.140 J)
Duck Slough at Five Points Marina	4/06/2005	11:50	ND	ND	ND	ND	ND	(0.069 J)
Duck Slough at Five Points Marina	4/13/2005	10:10	ND	ND	ND	ND	ND	(0.053 J)
Duck Slough at Five Points Marina	4/20/2005	10:20	ND	ND	ND	ND	0.027	(0.015 J)
Duck Slough at Five Points Marina	4/27/2005	11:20	ND	ND	ND	ND	ND	(0.024 J)
Duck Slough at Five Points Marina	5/04/2005	11:30	ND	ND	ND	ND	ND	(0.024 J)
Duck Slough at Five Points Marina	5/11/2005	12:00	ND	ND	ND	ND	ND	(0.030 J)
Duck Slough at Five Points Marina	5/18/2005	12:20	ND	ND	ND	ND	ND	(0.035 J)
Duck Slough at Five Points Marina	5/25/2005	11:30	ND	ND	ND	ND	ND	(0.040 J)

³ Surrogate recovery (79%) was below the QAPP acceptance limits. Results should be viewed as biased low.

Appendix B. Lab blank data

(No pesticides were present at detectable levels. The pesticides include azinphos methyl, bifenthrin, carbaryl, chlorpyrifos, cyanazine, dacthal (DCPA), diazinon, EPTC (Eptam), methidathion, metolachlor, propargite and simazine)

Date Extracted	Chlorpyrifos Methyl (Surrogate) Recovery
3/03/2005	99%
3/10/2005	92%
3/22/2005	81%
3/29/2005	98%
4/05/2005	81%
4/12/2005	85%
4/19/2005	94%
4/21/2005	86%
4/28/2005	80%
5/05/2005	83%
5/13/2005	74%
5/20/2005	84%
6/01/2005	90%

Appendix C. Recovery rates in lab control matrix spikes

Date Extracted	Chlorpyrifos	Diazinon	Chlorpyrifos methyl (surrogate)
3/03/2005	100%	98%	110%
3/10/2005	104%	110%	102%
3/22/2005	88%	102%	93%
3/29/2005	98%	108%	97%
4/05/2005	100%	104%	94%
4/12/2005	94%	104%	86%
4/19/2005	102%	107%	101%
4/21/2005	91%	86%	91%
4/28/2005	95%	86%	95%
5/05/2005	106%	107%	102%
5/13/2005	83%	86%	77%
5/20/2005	87%	86%	77%
6/01/2005	80%	86%	104%