ZONE 2

Zone 2 Description

Zone 2 includes portions of San Joaquin, Contra Costa, Alameda and Calaveras counties and the Sacramento-San Joaquin River Delta, covering approximately 998,340 acres with approximately 544,667 acres that are considered irrigated lands. The four major drainages in Zone 2 are the San Joaquin River, Stanislaus River, Calaveras River, and Mokelumne River. Many complex hydrologic systems are influenced by seasonal precipitation. Water management systems are designed to convey water from field to field for irrigation purposes, and complexities increase with the pumping of Delta water for agriculture, and to provide drinking water to southern California. The manipulated re-direction of fresh water supply, and pumping of Delta water south can create an influx of saline water to the northwest portion of Zone 2 that otherwise might not take place. Water flows fluctuate due to natural conditions as well, depending on tidal influences, snow melt, rainfall, and agricultural irrigation. Generally, water flow is heaviest in the winter months.

Many Zone 2 growers utilize an intricate system of conveyance canals for purposes of returning tail water back to upstream farms. This system allows the growers to transport and reuse runoff or tail water in upgradient areas. As a result, this sometimes affects the direction of flow in these water channels, compounding the difficulty in determining the source(s) of contaminants.

Over 100 different types of crops are grown in Zone 2. Predominant crops include asparagus, tomatoes, stone fruits, wine grapes, and irrigated pasture. The type of crops grown in any given area within Zone 2 varies greatly depending on soil type, hydrology, and farming history.

Pesticide Use information for Zone 2 is summarized in Appendix B. The Appendix lists the primary crops by acreage that were grown in 2005 sorted by county. The Appendix also references a selection of the types and quantity of pesticides that are recorded as being used for these crops (Department of Pesticide Regulation for 2005).

Monitoring Data

Table Z2-1 lists the monitoring locations, general analytical categories, and the periods of time at each location for which sample data were generated for this 2007 Review. The monitoring locations for Zone 2, indicated by site number, are shown on Figure Z2-1.

Table Z2-1
Summary of Monitoring Date Ranges

Site No.	Monitoring Site	Physical Parameters	Toxicity	Pesticides	Metals	Bacteria
1	8 Mile and Rio Blanco Rds.	7/3/03 - 9/25/03	7/3/03 - 9/25/03	None	None	None
2	Bear Creek at Alpine Rd	1/27/05 - 8/10/05	4/12/05 - 8/10/05	1/27/05 - 7/27/05	6/15/05 - 7/27/05	None
3	Bear Creek at Harney Ln.	6/15/05 - 7/27/05	6/15/05 - 7/27/05	6/15/05 - 7/27/05	6/15/05 - 7/27/05	None
4	Beaver Slough at Blossom Rd.	4/3/03 - 6/12/03	4/3/03 - 6/12/03	None	None	None

REVISED DRAFT

Site No.	Monitoring Site	Physical Parameters	Toxicity	Pesticides	Metals	Bacteria
5	Calaveras River @ Belota Intake	8/24/04 - 9/23/04	8/24/04 - 9/23/04	*8/24/04 - 9/23/04	None	8/24/04 - 9/23/04
6	Calaveras River at Clements Rd.	6/15/05 - 7/27/05	6/15/05 - 7/27/05	6/15/05 - 7/27/05	6/15/05 - 7/27/05	None
7	Calaveras River at Pezzi Rd	1/27/05 - 8/10/05	1/27/05 - 8/10/05	1/27/05 - 7/27/05	6/15/05 - 7/27/05	None
8	Delta Drain- Terminous Tract off Glascock Rd	2/16/15 - 4/27/06	2/16/15 - 4/27/06	*2/16/05 - 3/15/05	None	2/16/05 - 3/15/05
9	Delta Drain- Terminous Tract off Guard Rd	2/16/05 - 4/27/06	2/16/05 - 4/27/06	*2/16/05 - 3/15/05	None	2/16/05 - 3/15/05
10	Drain 11 @ Walthal Slough (Top of Bank)	None	None	9/2/04 - 12/22/05	None	None
11	Drain 12 @ French Camp Rd Headwall/Southside of RR	None	None	9/2/04 - 12/22/05	None	None
12	Drain 14 @ Lone Tree Ck (Top of Bank)	None	None	9/2/04 - 12/22/05	None	None
13	Drain at Bowman Rd.	4/1/03 - 9/4/03	4/1/03 - 9/1/03	None	None	None
14	Drain at Wing Levee Road	3/26/03 - 9/25/03	3/26/03 - 9/25/03	None	None	None
15	Drain to Brack Dr at Woodbridge Rd	None	8/28/04	8/28/2004	None	None
16	Drain to Grant Line Canal off Wing Levee Rd.	3/26/06 - 9/25/03	7/21/04 - 2/15/05	7/21/04 - 2/16/05	7/21/04 - 2/16/05	None
17	Drain to North Canal along Bonetti Drive	8/28/04 - 4/12/05	8/28/04 - 4/12/05	8/28/04 - 4/12/05	None	None
18	Drain to North Canal at South Bonetti Rd.	7/21/04 - 2/16/05	7/21/04 - 9/14/04	7/21/04 - 2/16/05	7/21/04 - 2/16/05	None
19	Drain to Pixley Slough at Davis Rd	8/28/04	8/28/04	8/28/2004	None	None
20	Drain to San Joaquin River off South Manthey Rd.	7/21/04 - 2/16/05	7/21/04 - 8/31/04	7/21/04 - 2/16/05	7/21/04 - 2/16/05	None
21	Duck Creek at Highway 4	8/24/04 - 9/29/06	8/24/04 - 9/29/06	*8/24/04 - 9/19/06	None	8/24/04 - 9/19/06
22	French Camp Slough @ Airport Way	2/16/05 - 9/19/06	2/16/05 - 9/19/06	*2/16/05 - 9/19/06	5/16/06 - 9/19/06	2/16/05 - 9/19/06
23	Grant Line Canal @ Clifton Court Rd	2/16/05 - 9/19/06	2/16/05 - 9/19/06	*2/16/05 - 9/19/06	5/16/06 - 9/19/06	2/16/05 - 9/19/06
24	Grant Line Canal near Calpack Rd	2/16/05 - 9/19/06	2/16/05 - 9/19/06	*2/16/05 - 9/19/06	5/16/06 - 9/19/06	2/16/05 - 9/19/06
25	Kellogg Creek @ Hwy 4	2/16/05 - 4/27/06	2/16/05 - 4/27/06	*2/16/05 - 3/15/06	None	2/16/05 - 3/15/06
26	Kellogg Creek along Hoffman Ln	9/20/05 - 9/19/06	9/20/05 - 9/19/06	*9/20/05 - 9/19/06	5/16/06 - 9/19/06	9/20/05 - 9/19/06
27	Little John Creek at Newcastle Rd.	4/1/03 - 9/5/03	4/1/03 - 9/5/03	None	None	None
28	Littlejohns Creek @ Jacktone Rd	8/24/04 - 9/19/06	8/24/04 - 9/19/06	*8/24/04 - 9/19/06	5/16/06 - 9/19/06	8/24/04 - 9/19/06
29	Lone Tree Creek @ Brennan Rd	9/20/05 - 4/27/06	9/20/05 - 4/27/06	*9/20/05 - 3/15/06	None	9/20/05 - 3/15/06
30	Lone Tree Creek @ Jacktone Rd	8/24/04 - 9/19/06	8/24/04 - 9/19/06	*8/24/04 - 9/19/06	5/16/06 - 9/19/06	8/24/04 - 9/19/06
31	Lone Tree Creek at Newcastle Rd.	3/26/03 - 9/23/03	3/26/03 - 9/23/03	None	None	None
32	Marsh Creek @ Balfour Ave	2/16/05 - 4/27/06	2/16/05 - 4/27/06	*2/16/05 - 3/15/06	None	2/16/05 - 3/15/06
33	Marsh Creek @ Concord Ave	9/20/05 - 9/19/06	9/20/05 - 6/20/06	*9/20/05 - 6/20/06	5/16/06 - 6/20/06	9/20/05 - 6/20/06
34	Marsh Creek @ Marsh Creek Rd	3/15/2006	None	None	None	None
35	Mid Roberts Island Drain at Woodsbro Road	7/14/04 - 8/10/05	7/14/04 - 8/10/05	7/14/05 - 7/28/05	5/16/06 - 9/19/06	None
36	Mokelumne River @ Bruella Rd	8/24/04 - 9/19/06	8/24/04 - 9/19/06	*8/24/04 - 9/19/06	5/16/06 - 9/19/06	8/24/04 - 3/15/06
37	Mokelumne River @ Fish Hatchery	9/20/05	9/20/05	*9/20/2005	None	9/20/05
38	Mormon Slough at Jack Tone Road	5/16/06 - 9/19/06	5/16/06 - 9/19/06	*5/16/06 - 9/19/06	None	5/16/06 - 9/19/06
39	Mormon Slough on Jack Tone Rd	7/14/04 - 9/8/04	7/14/04 - 9/8/04	7/14/04 - 9/8/04	7/14/04 - 9/8/04	None
40	Paddy Creek at Jack Tone Rd.	6/15/05 - 7/27/05	6/15/05 - 7/27/05	6/15/05 - 7/27/05	6/15/05 - 7/27/05	None
41	Pixley Slough at Eightmile Rd	7/14/04 - 8/10/05	7/14/04 - 8/10/05	7/14/04 - 7/28/05	7/14/04 - 7/28/05	None
42	Pixley Slough at Ham Ln	6/16/05 - 7/28/05	6/16/05 - 7/28/05	6/16/05 - 7/28/05	6/16/05 - 7/28/05	None
43	Potato Slough @ Hwy 12	8/24/04 - 4/27/06	8/24/04 - 3/15/06	*8/24/04 - 3/15/06	None	8/24/04 - 3/15/06
44	Return Irrigation Drain at MCD Rd.	4/3/03 - 9/25/03	4/3/03 - 9/25/03	None	None	None
45	Roberts Island Drain along House Road	5/16/06 - 9/19/06	5/16/06 - 9/19/06	*5/16/06 - 9/19/06	None	5/16/06 - 9/19/06
46	Roberts Island Drain at Holt Road	5/16/06 - 9/19/06	5/16/06 - 9/19/06	*5/16/06 - 9/19/06	None	5/16/06 - 9/19/06
47	Sand Creek at Highway 4 Bypass	5/16/06 - 9/19/06	5/16/06 - 9/19/06	*5/16/06 - 9/19/06	None	5/16/06 - 9/19/06
48	SJR Source Water to Canal at Holt and Nueger Roads	4/1/03 - 9/25/03	4/1/03 - 9/25/03	None	None	None
49	Sweet Lateral	6/23/04 - 1/22/06	None	6/23/04 - 1/22/06	None	None
50	Terminous Tract Drain @ Hwy 12	2/16/05 - 9/19/06	2/16/05 - 9/19/06	*2/16/05 - 9/19/06	5/16/06 - 9/19/06	2/16/05 - 9/19/06

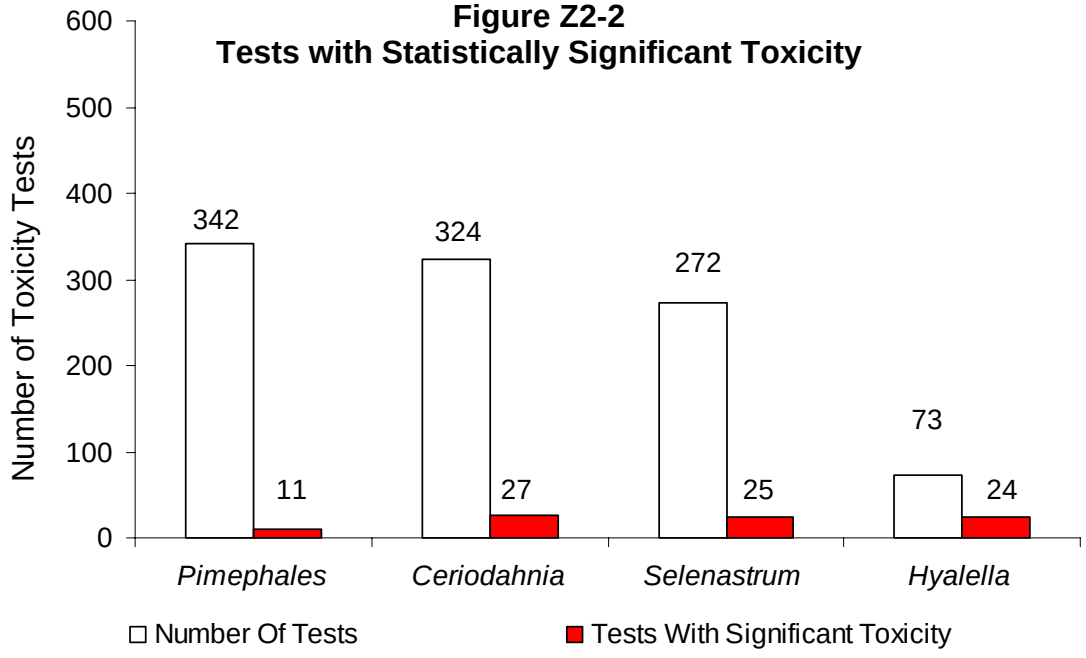
Site No.	Monitoring Site	Physical Parameters	Toxicity	Pesticides	Metals	Bacteria
51	Tom Paine Slough at El Rancho Rd.	7/24/03 - 9/25/03	7/24/03 - 9/25/03	None	None	None
52	Tom Paine Slough at Paradise Rd.	8/27/04	8/27/04	8/27/04	None	None
53	Unnamed Canal at Howard Road	6/16/05 - 8/10/05	6/16/05 - 8/10/05	6/16/05 - 7/28/05	6/16/05 - 7/28/05	None
54	Unnamed canal at west end of Woodbridge Rd	7/14/04 - 9/8/04	7/14/04 - 9/8/04	7/14/04 - 9/8/04	7/14/04 - 9/8/04	None
55	Unnamed Drain to Lone Tree Creek at Jack	6/20/06 - 9/19/06	6/20/06 – 9/19/06	*6/20/06 - 9/19/06	None	6/20/06 - 9/19/06
56	Unnamed Slough at Wildwood Rd	8/28/2004	8/28/2004	8/28/2004	None	None
57	Unnamed Slough at Woodsbro Rd. and Burns cutoff Levee	4/1/03 - 9/25/03	4/1/03 - 9/25/03	None	None	None
58	Upstream Kellogg Creek @ Hoffman Ln	3/15/2006	None	None	None	None

*Except for chlorpyrifos and diazinon, there are no data available for pesticides before 2006 irrigation season.

AQUATIC AND SEDIMENT TOXICITY. Water column and/or sediment toxicity testing data were collected from 52 locations within Zone 2 between March 2003 and September 2006. The toxicity tests included the water column species *Pimephales promelas* (fathead minnow), *Ceriodaphnia dubia* (water flea), *Selenastrum capricornutum* (green algae), and the sediment test species *Hyalella azteca* (a bottom-dwelling amphipod).

Figure Z2-2 shows the number of tests with significant toxicity as compared to the number of tests conducted on the four test species. The results from a cumulative 1,011 toxicity tests from 52 locations are summarized in this 2007 Review. Of these tests, 87 (8.6%) resulted in significant toxicity to the test species exhibited by the ambient sample, when compared to the laboratory control.

Figure Z2-2
Tests with Statistically Significant Toxicity



The percentage of toxic events compared to the number of tests for each species are: fathead minnow at 3%, water flea at 8%, algae at 9%, and *Hyalella* at 33%.

Seventeen percent of the different monitoring sites exhibited toxicity to fathead minnow at least one time, 28.8% of the sites exhibited toxicity to water flea, 23% of the sites exhibited algae toxicity, and sediment toxicity occurred in 23% of the monitoring sites in Zone 2.

Table Z2-2, Summary of Toxicity Test Frequency, provides details regarding the number of tests and those that resulted in toxicity for each species and site where toxicity testing occurred.

Table Z2-2
Summary of Toxicity Test Frequency

Site Number	Monitoring Site		*Ceriodaphnia dubia*	*Hyalella azteca*	*Pimephales promelas*	*Selenastrum*	Totals
1	8 Mile and Rio Blanco Rds.	Number of Tests	4	0	4	0	8
		Toxic Events	0	0	0	0	0
2	Bear Creek at Alpine Rd	Number of Tests	4	2	4	4	14
		Toxic Events	1	0	0	0	1
3	Bear Creek at Harney Ln.	Number of Tests	4	0	4	4	12
		Toxic Events	0	0	0	0	0
4	Beaver Slough at Blossom Rd.	Number of Tests	3	0	3	0	6
		Toxic Events	0	0	0	0	0
5	Calaveras River @ Belota Intake	Number of Tests	2	0	2	2	6
		Toxic Events	0	0	0	0	0
6	Calaveras River at Clements Rd.	Number of Tests	4	0	4	4	12
		Toxic Events	0	0	0	0	0
7	Calaveras River at Pezzi Rd	Number of Tests	8	1	8	8	25
		Toxic Events	1	1	0	3	5
8	Delta Drain- Terminous Tract off Glascock Rd	Number of Tests	9	4	10	8	31
		Toxic Events	0	2	1	0	3
9	Delta Drain- Terminous Tract off Guard Rd	Number of Tests	7	3	8	8	26
		Toxic Events	0	1	0	1	2
13	Drain at Bowman Rd.	Number of Tests	5	0	4	0	9
		Toxic Events	0	0	0	0	0
14	Drain at Wing Levee Road	Number of Tests	8	0	8	0	16
		Toxic Events	0	0	0	0	0
15	Drain to Brack Dr at Woodbridge Rd	Number of Tests	0	1	0	0	1
		Toxic Events	0	0	0	0	0
16	Drain to Grant Line Canal off Wing Levee Rd.	Number of Tests	8	1	8	8	25
		Toxic Events	2	1	0	0	3
17	Drain to North Canal along Bonetti Drive	Number of Tests	0	2	0	0	2

Site Number	Monitoring Site		*Ceriodaphnia dubia*	*Hyalella azteca*	*Pimephales promelas*	*Selenastrum*	Totals
		Toxic Events	0	0	0	0	0
18	Drain to North Canal at South Bonetti Rd.	Number of Tests	5	0	5	5	15
		Toxic Events	0	0	0	0	0
19	Drain to Pixley Slough at Davis Rd	Number of Tests	0	1	0	0	1
		Toxic Events	0	0	0	0	0
20	Drain to San Joaquin River off South Manthey Rd.	Number of Tests	4	0	4	4	12
		Toxic Events	0	0	0	0	0
21	Duck Creek at Highway 4	Number of Tests	7	2	7	7	23
		Toxic Events	1	0	0	0	1
22	French Camp Slough @ Airport Way	Number of Tests	12	5	14	14	45
		Toxic Events	1	1	0	1	3
23	Grant Line Canal @ Clifton Court Rd	Number of Tests	11	3	14	13	41
		Toxic Events	0	2	0	0	2
24	Grant Line Canal near Calpack Rd	Number of Tests	15	5	14	15	49
		Toxic Events	3	4	0	1	8
25	Kellogg Creek @ Hwy 4	Number of Tests	8	3	10	12	33
		Toxic Events	1	2	2	1	6
26	Kellogg Creek along Hoffman Ln	Number of Tests	8	1	8	8	25
		Toxic Events	1	0	0	0	1
27	Little John Creek at Newcastle Rd.	Number of Tests	7	0	6	0	13
		Toxic Events	1	0	0	0	1
28	Littlejohns Creek @ Jacktone Rd	Number of Tests	14	6	17	16	53
		Toxic Events	0	0	1	2	3
29	Lone Tree Creek @ Bernnan Rd	Number of Tests	3	1	4	4	12
		Toxic Events	1	0	1	3	5
30	Lone Tree Creek @ Jacktone Rd	Number of Tests	14	5	17	17	53
		Toxic Events	0	2	1	2	5
31	Lone Tree Creek at Newcastle Rd.	Number of Tests	7	0	8	0	15
		Toxic Events	1	0	0	0	1
32	Marsh Creek @ Balfour Ave	Number of Tests	10	4	9	9	32
		Toxic Events	2	4	0	0	6
33	Marsh Creek @ Concord Ave	Number of Tests	5	1	5	5	16
		Toxic Events	0	0	1	0	1
35	Mid Roberts Island Drain at Woodsbro Road	Number of Tests	2	1	2	2	7
		Toxic Events	0	0	0	0	0
36	Mokelumne River @ Bruella Rd	Number of Tests	18	5	16	15	54
		Toxic Events	5	0	0	3	8
37	Mokelumne River @ Fish Hatchery	Number of Tests	1	0	1	1	3

Site Number	Monitoring Site		*Ceriodaphnia dubia*	*Hyalella azteca*	*Pimephales promelas*	*Selenastrum*	Totals
		Toxic Events	0	0	0	0	0
38	Mormon Slough at Jack Tone Road	Number of Tests	4	0	5	5	14
		Toxic Events	0	0	0	0	0
39	Mormon Slough on Jack Tone Rd	Number of Tests	5	0	5	5	15
		Toxic Events	0	0	0	5	5
40	Paddy Creek at Jack Tone Rd.	Number of Tests	4	0	4	4	12
		Toxic Events	0	0	0	0	0
41	Pixley Slough at Eightmile Rd	Number of Tests	9	2	9	9	29
		Toxic Events	0	0	0	1	1
42	Pixley Slough at Ham Ln	Number of Tests	4	0	4	4	12
		Toxic Events	0	0	0	0	0
43	Potato Slough @ Hwy 12	Number of Tests	12	1	11	10	34
		Toxic Events	3	0	0	0	3
44	Return Irrigation Drain at MCD Rd.	Number of Tests	8	0	8	0	16
		Toxic Events	0	0	0	0	0
45	Roberts Island Drain along House Road	Number of Tests	4	1	5	5	15
		Toxic Events	0	0	0	0	0
46	Roberts Island Drain at Holt Road	Number of Tests	4	2	5	5	16
		Toxic Events	0	2	0	0	2
47	Sand Creek at Highway 4 Bypass	Number of Tests	7	2	6	5	20
		Toxic Events	3	2	1	0	6
48	SJR Source Water to Canal at Holt and Nueger Roads	Number of Tests	8	0	8	0	16
		Toxic Events	0	0	2	0	2
50	Terminous Tract Drain @ Hwy 12	Number of Tests	12	4	15	14	45
		Toxic Events	0	0	1	2	3
51	Tom Paine Slough at El Rancho Rd.	Number of Tests	5	0	7	0	12
		Toxic Events	0	0	0	0	0
52	Tom Paine Slough at Paradise Rd.	Number of Tests	0	1	0	0	1
		Toxic Events	0	0	0	0	0
53	Unnamed Canal at Howard Road	Number of Tests	4	1	4	4	13
		Toxic Events	0	0	0	0	0
54	Unnamed canal at west end of Woodbridge Rd	Number of Tests	5	0	5	5	15
		Toxic Events	0	0	0	0	0
55	Unnamed Drain to Lone Tree Creek at Jack	Number of Tests	3	1	4	4	12
		Toxic Events	0	0	0	0	0
56	Unnamed Slough at Wildwood Rd	Number of Tests	0	1	0	0	1
		Toxic Events	0	0	0	0	0
57	Unnamed Slough at Woodsbro Rd. and Burns cutoff Levee	Number of Tests	9	0	9	0	18

Site Number	Monitoring Site		*Ceriodaphnia dubia*	*Hyalella azteca*	*Pimephales promelas*	*Selenastrum*	Totals
		Toxic Events	0	0	0	0	0
	Total Number of Tests		324	73	342	272	1011
	Total Toxic Events		27	24	11	25	87

Figures Z2-3, Minnow Toxicity, Z2-4 Water Flea Toxicity, Z2-5 Algae Toxicity, and Z2-6 *Hyalella* in Sediment, identify the approximate location of all water column and sediment toxicity tests.

When toxicity was found at sufficiently high levels, laboratory procedures were initiated to identify the cause of the toxicity in most cases. Toxicity Identification Evaluation (TIE) procedures are laboratory procedures designed for this purpose. In combination with land use information, a TIE can provide valuable guidance regarding source identification.

Not all TIEs resulted in an identification of the likely cause of toxicity. Others were effective in identifying a general class of compound that was the apparent toxicant. The general class of toxicants that caused toxicity in Zone 2 were identified by the laboratory as non-polar organics, metabolically activated organic compounds, or organophosphate pesticides, depending on the type of information obtained from TIE results. A narrower class of toxicants can be identified from more specific TIE results. Organophosphate pesticides are non-polar, metabolically activated compounds. Two specific toxicants–ammonia and chlorpyrifos (an organophosphate pesticide)–were also identified.

Examples of toxicant identification evaluated in Zone 2 are as follows:

- Monitoring site at Lone Tree Creek at Bernnan Road resulted in 0% survival for the fathead minnow and water fleas on the sample collected 27 February 2006. The TIE procedures identified ammonia was the cause of toxicity. An additional clue that could lead to source identification of the toxicant was the measured result of the pathogen indicator, *E.coli,* at greater than 1600 MPN/100ml.

- Sand Creek at Highway 4 Bypass had low survival of water flea (16%) for samples collected on 16 May 2006. This coincided with detection of chlorpyrifos at 0.089 ug/L, which is a concentration that could account for the measured toxicity. Also detected were concentrations of DDT (0.054 ug/L) and dieldrin (0.076 ug/L), which are banned pesticides. Pesticide use reports did not document any chlorpyrifos or organochlorine use upstream of the site.

- The monitoring site Bear Creek at Alpine Road had one toxicity test that resulted in 0% survival to water flea on 27 July 2005. Chlorpyrifos was detected at 0.214 ug/L. Studies available in the literature have shown that 50% or greater mortality to *Ceriodaphnia* occurs when chlorpyrifos

exceeds concentrations in the range of 0.07 to 0.12 ug/L, which suggests that chlorpyrifos was the cause of toxicity for this sampling event.

Approved TIE procedures for sediment do not exist, and experimental techniques are still under development. However, some pesticides data were generated for samples collected through the ILP program. As part of a large study of sediment samples collected from agriculturally affected channels, University of California research has concluded that much of the observed sediment toxicity throughout Central Valley can be explained by the measured concentrations of just five relatively hydrophobic insecticides: biphenthrin, permethrin, esfenvalerate, lambda-cyhalothrin, and chlorpyrifos.

PESTICIDES. Of the 58 monitoring locations in Zone 2, 46 were tested at least once for pesticides between July 2004 and September 2006. The number and identity of pesticides analyzed in any given sample varied, based on the monitoring plans and the "phase" of sampling.

Of the 46 sites tested for pesticides in Zone 2, 28 yielded samples with pesticide concentrations greater than a water quality trigger on at least one occasion. The total number of pesticide results exceeding these triggers at a given location ranged from zero to 42. Table Z2-9, Summary of Number of Pesticide Monitoring Results Above Trigger Levels, provides this information and Figure Z2-7, Pesticide Exceedances, identifies the site and quantifies the number of pesticides detected above trigger limits

There were no detections at any monitoring site for the following constituents: aldicarb, methiocarb, methamidophos, molinate, phorate, phosmet, cyfluthrin (total), and paraquat dichloride during any of the monitoring events.

The pesticides most frequently exceeding trigger levels (with six or greater detections over trigger levels), included chlorpyrifos, diazinon, DDE, disulfoton, malathion, simazine, methyl parathion, and diuron. Table Z2-3, Summary of Pesticide Detections, details this information.

Table Z2-3 Summary of Pesticide Detections

Pesticide	Narrative Objective ug/L	Numeric Objective ug/L	Number of Tests	No. Samples Greater Than Trigger Levels	Avg. Concentration ug/L	Min. Concentration ug/L	Max. Concentration ug/L
Chlorpyrifos		0.015	347	51	0.050	0.016	0.214
Diazinon		0.10	341	34	0.368	0.117	1.180
DDE(p,p')		0.00059	218	18	0.044	0.002	0.480
Disulfoton	0.05	None	212	16	0.172	0.051	0.418
Malathion		ND	212	11	0.107	0.033	0.560
Simazine	10	4.0	205	9	18.3	4.160	41.00
Methyl Parathion	0.08	ND	212	7	0.049	0.016	0.188
Diuron	14.0	None	165	6	87.2	15.000	160.000

The chlorpyrifos water quality trigger of 0.015 ug/L was exceeded in 51 of 347 tests in Zone 2. Twelve of these were found at Pixley Slough at Eightmile Road with an average concentration of 0.038 ug/L, and ranging between 0.016 ug/L and 0.115 ug/L. These pesticide results coincided with dormant spraying during the 2005 storm season. The Pixley Slough passes through some of the City of Lodi's urban areas. There was no recorded water column toxicity on these same sample dates.

The diazinon water quality trigger is 0.10 ug/L, a level that was exceeded 34 times. Diazinon detections greater than the trigger ranged from 0.117 ug/L to 1.18 ug/L. One third of the detections over trigger levels also occurred at Pixley Slough at Eightmile Road, coinciding with dormant spraying during the 2005 storm season.

The legacy pesticide DDT is no longer registered or legally applied to crops, but it and its degradates DDE and DDD, continue to be found in Zone 2. The Basin Plan limitation for these banned pesticides established that any detection of these constituents in the receiving water is an exceedance of the water quality objective. One third of the detections in Zone 2 for DDT and its breakdown products DDE and DDD were found at the Drain to Grant Line Canal off Wing Levee Road.

Measurements for disulfoton were compared to 0.05 ug/L, which is an interpretation of the narrative Basin Plan objective for toxicity, and is the level considered protective of aquatic life, established by the California Department of Fish & Game. Disulfoton results were 16 times higher than the trigger, and ranged in concentrations from 0.051 ug/L to 0.418 ug/L, with an average of 0.172 ug/L.

Eleven of the 16 disulfoton measurements occurred at Drain to Grant Line Canal off Wing Levee Road between the periods July 2004 and February 2005. The detections ranged in concentrations from 0.062 ug/L to 0.418 ug/L, averaging 0.203 ug/L. Four occurred at Pixley Slough at Eightmile Road, and ranged in concentrations from 0.051 ug/L to 0.130 ug/L, averaging 0.095 ug/L. The remaining one occurred at Drain to North Canal at South Bonetti Road.

Dieldrin is a persistent organochlorine pesticide, and is no longer legally applied in California. The Sacramento San Joaquin Basin Plan regards any detection of dieldrin as an exceedance of the water quality objective. Results from four monitoring sites included the presence of dieldrin between the dates of August 2004 and June 2006. These ranged in concentration from 0.008 ug/L to 0.110 ug/L.

Diuron is a broad-spectrum herbicide commonly used for weed control and was detected 32 times, ranging in concentration from 0.0035 ug/L to 160.0 ug/L. The results were compared to the water quality trigger of 14.0 ug/L, which is the USEPA IRIS reference dose for drinking water. All six detections observed

above the trigger were encountered at drainages to Lone Tree Creek. These detections coincided with the 2005 storm season. The Lone Tree Creek subwatershed includes a diverse crop pattern including grains, hay, pasture, deciduous fruit/nut, vineyard, field crops, feedlot/dairy, and rice, with little urban influence.

Table Z2-4, Summary of Sites with Multiple Pesticide Detections over Trigger Levels, identifies five monitoring sites, out of the 33 tested, for which more than ten pesticide results measurements exceeded trigger levels during the monitoring period.

Table Z2-4
Summary of Sites with Multiple Pesticide Detections over Trigger Levels

Site Number	Monitoring Site	Chlorpyrifos	Diazinon	Other	Total No. Above Trigger Levels	No. of Unique Pesticide Exceedances
2	Bear Creek at Alpine Rd	1	5	4	10	6
16	Drain to Grant Line Canal off Wing Levee Rd.	1	2	26	29	8
20	Drain to San Joaquin River off South Manthey Rd.	7	8	4	19	6
41	Pixley Slough at Eightmile Rd	12	14	16	42	6
47	Sand Creek at Highway 4 Bypass	2	1	10	13	9

As discussed in the section on Zone 2 Water and Sediment toxicity, the Bear Creek at Alpine Road monitoring site had one toxicity test on 27 July 2005 for which the concentration of chlorpyrifos was sufficient to account for the complete mortality in water flea. The Bear Creek site had ten different pesticide measurements greater than water quality triggers for the period January 2005 through July 2005, although there were no additional tests with significant toxicity, other than 27 July 2005.

Pesticide monitoring results at the Drain to Grant Line Canal off Wing Levee Road had 29 detected pesticide results above water quality triggers between July 2004 and February 2005. During that same period, two water flea toxicity tests and one sediment toxicity test resulted in significant mortality, although the specific causes of toxicity were not identified.

Pesticide monitoring at the Drain to San Joaquin River off South Manthey Road resulted in 19 pesticide measurements above water quality triggers between July 2004 and February 2005. Toxicity testing did not occur at this site between September 2004 and February 2005.

Pesticide monitoring results at Pixley Slough at Eightmile Road showed 42 pesticide detections between August 2004 and June 2005 that exceeded water quality triggers. Toxicity test results identified only a single toxic event to algae during this same period.

Table Z2- 5, Summary of Less than 10 Pesticide Detections Over Trigger Levels, identifies 28 monitoring sites, out of the 33, for which less than ten pesticide

results measurements exceeded trigger levels from July 2004 through October 2006.

Table Z2-5
Summary of Less than 10 Pesticide Detections over Trigger Levels

Site Number	Monitoring Site	Chlorpyrifos	Diazinon	Other	Total No. Above Trigger levels	No. of Unique Pesticides
7	Calaveras River at Pezzi Rd	0	2	3	5	3
11	Drain 12 @ French Camp Rd Headwall/Southside of RR	0	0	5	5	2
12	Drain 14 @ Lone Tree Ck (Top of Bank)	0	1	7	8	4
15	Drain to Brack Dr at Woodbridge Rd	0	0	4	4	4
17	Drain to North Canal along Bonetti Drive	0	0	4	4	4
18	Drain to North Canal at South Bonetti Rd.	3	1	5	9	7
19	Drain to Pixley Slough at Davis Rd	0	0	2	2	2
21	Duck Creek at Highway 4	2	0	0	2	1
22	French Camp Slough @ Airport Way	4	0	2	6	3
23	Grant Line Canal @ Clifton Court Rd	1	0	3	4	4
24	Grant Line Canal near Calpack Rd	4	0	2	6	3
25	Kellogg Creek @ Hwy 4	1	0	1	2	2
26	Kellogg Creek along Hoffman Ln	0	0	3	3	3
28	Littlejohns Creek @ Jacktone Rd	2	0	0	2	1
29	Lone Tree Creek @ Bernnan Rd	1	0	0	1	1
30	Lone Tree Creek @ Jacktone Rd	2	0	2	4	3
32	Marsh Creek @ Balfour Ave	1	0	1	2	2
33	Marsh Creek @ Concord Ave	0	0	2	2	2
35	Mid Roberts Island Drain at Woodsbro Road	0	0	1	1	1
38	Mormon Slough at Jack Tone Road	1	0	0	1	1
39	Mormon Slough on Jack Tone Rd	3	0	3	6	2
42	Pixley Slough at Ham Ln	1	0	0	1	1
45	Roberts Island Drain along House Road	0	0	2	2	2
46	Roberts Island Drain at Holt Road	0	0	3	3	2
49	Sweet Lateral	0	0	2	2	1
52	Tom Paine Slough at Paradise Rd.	0	0	2	2	2
55	Unnamed Drain to Lone Tree Creek at Jack	2	0	1	3	2
56	Unnamed Slough at Wildwood Rd	0	0	4	4	4

Effective 1 January 1991, the Regional Board prohibited the discharge of irrigation return flows containing the pesticides carbofuran, malathion, thiobencarb, molinate, and methyl parathion, unless the discharger is following Board approved management practices. Water Board approved management practices are associated with the use of these pesticides on rice fields represented by the California Rice Commission in the Sacramento and San Joaquin River Basins. Discharges from any other irrigated lands are prohibited in Zone 2. No rice field applications of carbofuran (no longer a rice pesticide), malathion, or methyl parathion took place in Zone 2 from 2004-2006. However, carbofuran, malathion, thiobencarb and methyl parathion were detected in Zone 2 in multiple instances throughout the monitoring period. Thiobencarb detections did not exceed the 1.5 ug/L performance goal established by the Water Board for rice fields or the 1.0 ug/L secondary MCL.

Table Z2-6, Summary of Tests & Detections of Pesticides under Basin Plan Prohibition, summarizes the number of tests and all prohibited pesticide detections in Zone 2 for the period between July 2004 and September 2006. The location and number of detected pesticides with prohibitions are shown on Figure Z2-8, Detections of Pesticides under a Basin Plan Prohibition of Discharge.

Table Z2-6
Summary of Detections of Pesticides under Basin Plan Prohibition

Site Number	Monitoring Site	Data	Carbofuran	Malathion	Methyl Parathion	Molinate	Thiobencarb	Total
2	Bear Creek at Alpine Rd	Number of tests	4	13	13	13	13	56
		Number of Detections	0	1	1	0	1	3
3	Bear Creek at Harney Ln.	Number of tests	4	4	4	4	4	20
		Number of Detections	0	0	0	0	0	0
6	Calaveras River at Clements Rd.	Number of tests	4	4	4	4	4	20
		Number of Detections	0	0	0	0	0	0
7	Calaveras River at Pezzi Rd	Number of tests	4	19	19	8	8	58
		Number of Detections	0	0	2	0	0	2
10	Drain 11 @ Walsal Slough (Top of Bank)	Number of tests	0	6	6	11	7	30
		Number of Detections	0	0	0	0	0	0
11	Drain 12 @ French Camp Rd Headwall/Southside of RR	Number of tests	0	5	5	9	7	26
		Number of Detections	0	0	0	0	0	0
12	Drain 14 @ Lone Tree Ck (Top of Bank)	Number of tests	0	6	6	12	8	32
		Number of Detections	0	1	0	0	0	1
16	Drain to Grant Line Canal off Wing Levee Rd.	Number of tests	4	12	12	6	6	40
		Number of Detections	1	0	0	0	0	1
18	Drain to North Canal at South Bonetti Rd.	Number of tests	4	12	12	6	6	40
		Number of Detections	1	0	1	0	0	2
20	Drain to San Joaquin River off South Manthey Rd.	Number of tests	5	13	13	7	7	45
		Number of Detections	1	0	0	0	0	1
21	Duck Creek at Highway 4	Number of tests	5	5	5	5	5	25
		Number of Detections	0	0	0	0	0	0
22	French Camp Slough @ Airport Way	Number of tests	5	5	5	5	5	25
		Number of Detections	0	0	0	0	0	0
23	Grant Line Canal @ Clifton Court Rd	Number of tests	5	5	5	5	5	25
		Number of Detections	0	0	0	0	0	0
24	Grant Line Canal near Calpack Rd	Number of tests	5	5	5	5	5	25

Site Number	Monitoring Site	Data	Carbofuran	Malathion	Methyl Parathion	Molinate	Thiobencarb	Total
		Number of Detections	0	0	0	0	0	0
26	Kellogg Creek along Hoffman Ln	Number of tests	5	5	5	5	5	25
		Number of Detections	0	0	0	0	0	0
28	Littlejohns Creek @ Jacktone Rd	Number of tests	5	5	5	5	5	25
		Number of Detections	0	0	0	0	0	0
30	Lone Tree Creek @ Jacktone Rd	Number of tests	5	5	5	5	5	25
		Number of Detections	0	0	0	0	0	0
33	Marsh Creek @ Concord Ave	Number of tests	2	2	2	2	2	10
		Number of Detections	0	0	0	0	0	0
35	Mid Roberts Island Drain at Woodsbro Road	Number of tests	2	2	2	2	2	10
		Number of Detections	0	0	0	0	0	0
36	Mokelumne River @ Bruella Rd	Number of tests	5	5	5	5	5	25
		Number of Detections	0	0	0	0	0	0
38	Mormon Slough at Jack Tone Road	Number of tests	5	5	5	5	5	25
		Number of Detections	0	0	0	0	0	0
39	Mormon Slough on Jack Tone Rd	Number of tests	5	5	5	5	5	25
		Number of Detections	0	0	3	0	1	4
40	Paddy Creek at Jack Tone Rd.	Number of tests	4	4	4	4	4	20
		Number of Detections	0	0	0	0	0	0
41	Pixley Slough at Eightmile Rd	Number of tests	9	23	23	23	23	101
		Number of Detections	0	9	0	0	1	10
42	Pixley Slough at Ham Ln	Number of tests	4	4	4	4	4	20
		Number of Detections	0	0	0	0	0	0
45	Roberts Island Drain along House Road	Number of tests	5	5	5	5	5	25
		Number of Detections	0	0	0	0	0	0
46	Roberts Island Drain at Holt Road	Number of tests	5	5	5	5	5	25
		Number of Detections	0	0	0	0	0	0
47	Sand Creek at Highway 4 Bypass	Number of tests	5	5	5	5	5	25
		Number of Detections	0	0	0	0	0	0
50	Terminous Tract Drain @ Hwy 12	Number of tests	5	5	5	5	5	25
		Number of Detections	0	0	0	0	0	0
53	Unnamed Canal at Howard Road	Number of tests	4	4	4	4	4	20
		Number of Detections	0	0	0	0	0	0
54	Unnamed canal at west end of Woodbridge Rd	Number of tests	5	5	5	5	5	25
		Number of Detections	0	0	0	0	0	0
55	Unnamed Drain to Lone Tree Creek at Jack	Number of tests	4	4	4	4	4	20

Site Number	Monitoring Site	Data	Carbofuran	Malathion	Methyl Parathion	Molinate	Thiobencarb	Total
		Number of Detections	0	0	0	0	1	1
	Total Number of tests		133	212	212	198	188	943
	Total Number of Detections		3	11	7	0	4	25

As previously noted, carbofuran, malathion and methyl parathion were not applied to rice fields during the monitoring period; therefore, the detections presented in Table Z2-6 are associated with non-rice fields. Molinate was not detected during the monitoring period. The four thiobencarb detections were less than the performance goal of 1.5 ug/L and secondary MCL of 1.0 ug/L and would represent a violation only if associated with non-rice field applications.

The sample site at Pixley Slough at Eightmile Road had the greatest frequency of these pesticide detections, accounting for 10 (40%) out of the 25 detections found in the region. Nine out of 10 of these detections were malathion and the other was thiobencarb.

Thiobencarb is typically applied only to rice, while carbofuran is not. Malathion and methyl-parathion are applied to rice or non-rice crops. Detections of thiobencarb occurred in four out of the 188 tests conducted and were all less than the rice performance goal (1.5 ug/L) and the secondary MCL (1.0 ug/L). Detectable amounts ranged from 0.035 ug/L to 0.498 ug/L, all of which are lower than the concentration allowed under the Rice Pesticide Program (Resolution No. R5-2007-0018).

Eleven detections of malathion occurred during storm season of 2005, and ranged in concentration from 0.033 ug/L to 0.56 ug/L. Nine of these detections occurred at Pixely Slough at Eightmile Road, while single detections were observed at sample points Bear Creek at Alpine Road and Drain 14 at Lone Tree Creek. Sources of these detections have not been determined, but are under evaluation.

Detections of carbofuran occurred in three out of 133 tests ranging in concentrations from 0.015 ug/L to 0.104 ug/L. A single detection was found at the following sample points: Drain to Grant Line Canal off Wing Levee Road, Drain to North Canal at South Bonetti Road, and Drain to San Joaquin River off South Manthey Road. Sources of these detections have not been determined and are under evaluation.

Detections of methyl-parathion occurred in seven out of the 212 tests conducted. Three detections were observed at Mormon Slough on Jacktone Road, two at Calaveras River at Pezzi Road, and one each at Bear Creek at Alpine Road and Drain to North Canal at South Bonetti Road.

METALS. Metals analyzed in Zone 2 include: arsenic, boron, cadmium, copper, lead, nickel, selenium, and zinc. The lowest water quality triggers for some metals vary depending on the water hardness ($CaCO_3$) at the time of sample collection. Eleven of the 23 sites sampled did not have any results for metals that were detected above trigger levels, although concentrations below trigger levels were often detected. The metals that were detected above trigger levels, are summarized in Table Z2-7, Metal Detections Above Trigger Levels.

Table Z2-7
Metal Detections Above Trigger Levels

Site Number	Monitoring Site	Data	Arsenic	Boron	Cadmium	Copper	Lead	Nickel	Selenium	Zinc	Total
2	Bear Creek at Alpine Rd	Number of Tests	4	4	4	4	4	4	4	4	32
		Number of Exceedances	0	0	0	0	0	0	0	0	0
3	Bear Creek at Harney Ln.	Number of Tests	4	4	4	4	4	4	4	4	32
		Number of Exceedances	0	0	0	0	0	0	0	0	0
6	Calaveras River at Clements Rd.	Number of Tests	4	4	4	4	4	4	4	4	32
		Number of Exceedances	0	0	0	0	0	0	0	0	0
7	Calaveras River at Pezzi Rd	Number of Tests	4	4	4	4	4	4	4	4	32
		Number of Exceedances	0	0	0	0	0	0	0	0	0
16	Drain to Grant Line Canal off Wing Levee Rd.	Number of Tests	12	13	12	12	12	12	12	12	97
		Number of Exceedances	0	0	0	0	0	0	0	0	0
18	Drain to North Canal at South Bonetti Rd.	Number of Tests	12	13	12	12	12	12	12	12	97
		Number of Exceedances	6	7	0	0	0	0	0	0	13
20	Drain to San Joaquin River off South Manthey Rd.	Number of Tests	12	12	12	12	12	12	12	12	96
		Number of Exceedances	1	0	0	0	1	0	0	0	2
22	French Camp Slough @ Airport Way	Number of Tests	5	5	5	5	5	5	5	5	40
		Number of Exceedances	0	0	0	4	2	0	0	0	6
23	Grant Line Canal @ Clifton Court Rd	Number of Tests	5	5	5	5	5	5	5	5	40
		Number of Exceedances	2	0	0	3	3	1	0	0	9
24	Grant Line Canal near Calpack Rd	Number of Tests	5	5	5	5	5	5	5	5	40
		Number of Exceedances	2	0	0	0	0	0	0	0	2
26	Kellogg Creek along Hoffman Ln	Number of Tests	5	5	5	5	5	5	5	5	40
		Number of Exceedances	0	0	0	0	0	0	0	0	0
28	Littlejohns Creek @ Jacktone Rd	Number of Tests	5	5	5	5	5	5	5	5	40
		Number of Exceedances	0	0	0	1	0	0	0	0	1
30	Lone Tree Creek @ Jacktone Rd	Number of Tests	5	5	5	5	5	5	5	5	40
		Number of Exceedances	0	0	0	1	0	0	0	0	1
33	Marsh Creek @ Concord Ave	Number of Tests	2	2	2	2	2	2	2	2	16
		Number of Exceedances	0	2	0	1	0	0	0	0	3

Site Number	Monitoring Site	Data	Arsenic	Boron	Cadmium	Copper	Lead	Nickel	Selenium	Zinc	Total
35	Mid Roberts Island Drain at Woodsbro Road	Number of Tests	2	2	2	2	2	2	2	2	16
		Number of Exceedances	0	0	0	0	0	0	0	0	0
36	Mokelumne River @ Bruella Rd	Number of Tests	5	5	5	5	5	5	5	5	40
		Number of Exceedances	0	0	0	0	0	0	0	0	0
39	Mormon Slough on Jack Tone Rd	Number of Tests	5	6	5	5	5	5	5	5	41
		Number of Exceedances	0	0	0	0	0	0	0	0	0
40	Paddy Creek at Jack Tone Rd.	Number of Tests	4	4	4	4	4	4	4	4	32
		Number of Exceedances	0	0	0	0	0	0	0	0	0
41	Pixley Slough at Eightmile Rd	Number of Tests	23	23	23	23	23	23	23	23	184
		Number of Exceedances	0	0	0	8	20	0	0	4	32
42	Pixley Slough at Ham Ln	Number of Tests	4	4	4	4	4	4	4	4	32
		Number of Exceedances	0	0	0	0	3	0	0	0	3
50	Terminous Tract Drain @ Hwy 12	Number of Tests	5	5	5	5	5	5	5	5	40
		Number of Exceedances	1	0	0	0	0	0	0	0	1
53	Unnamed Canal at Howard Road	Number of Tests	4	4	4	4	4	4	4	4	32
		Number of Exceedances	0	0	0	0	0	0	0	0	0
54	Unnamed canal at west end of Woodbridge Rd	Number of Tests	5	5	5	5	5	5	5	5	40
		Number of Exceedances	5	0	0	0	0	0	0	0	5
	Total Number of Tests		141	144	141	141	141	141	141	141	1131
	Total Number of Exceedances		17	9	0	18	29	1	0	4	78

There were 1,131 total test results for metals conducted in Zone 2. Of these results, 78 or 7% exceeded limits. There were 144 samples analyzed for boron during the monitoring period, and 141 samples analyzed for each of the other metals. There were no detections for either cadmium or selenium observed above trigger levels in any of the samples.

The metal that exceeded trigger levels most frequently was lead, with 37% of the detections above trigger levels. Following lead, the percentages of samples exceeding trigger levels for other metals were: copper (23%), arsenic (22%), boron (12%), zinc (5%), and nickel (1%). The sources of these metals concentrations are not identified.

Agricultural applications of copper, in the form of copper hydroxide or copper sulfate, are common in nut and stone fruit orchards, grape crops, tomato, rice, alfalfa, and onion fields to control mildew/fungi. These types of commodities are widespread in the French Camp Slough, Lone Tree Creek, Littlejohns Creek, Pixley Slough and Grant Line Canal areas. Copper detections above trigger levels may be in part the result of agricultural copper applications, as well as other sources.

Pixley Slough at Eightmile Road, which had the highest number of pesticide detections over trigger levels, also had more metals detections above trigger levels (lead, copper, zinc) than any other site. Toxicity tests results identified a single toxicity test result with significant toxicity.

PATHOGENS. *E.coli* is an indicator pathogen, and results are compared to the USEPA Recommended Criteria of 235 MPN/100 mL in Zone 2. It is not yet clear what sources contribute to the *E.coli* in program samples. A special study is currently being conducted by UC Davis in order to help identify possible sources. The study is scheduled for completion this year.

Monitoring took place at 23 sites throughout Zone 2, varying from one to 16 tests per site. A total of 98 out of 195 tests showed levels above the 235 MPN/100 mL. It is worth noting that 39% of these 98 tests were at or above 1600 MPN/100 mL.

The water bodies with the least number *E.coli* above the trigger level were tested for at least a year or more. These include the following sites: Delta Drain-Terminous Tract off Guard Road, Kellogg Creek along Hoffman Lane, Littlejohns Creek @ Jacktone Road, and Mokelumne River @ Bruella Road. Table Z2-8, Summary of *E. coli* Test Results, provides information about the number of tests collected at each monitoring site and the number that exceeded the USEPA Recommended criteria of 235 MPN/100ml.

Table Z2-8
Summary of *E.coli* Test Results

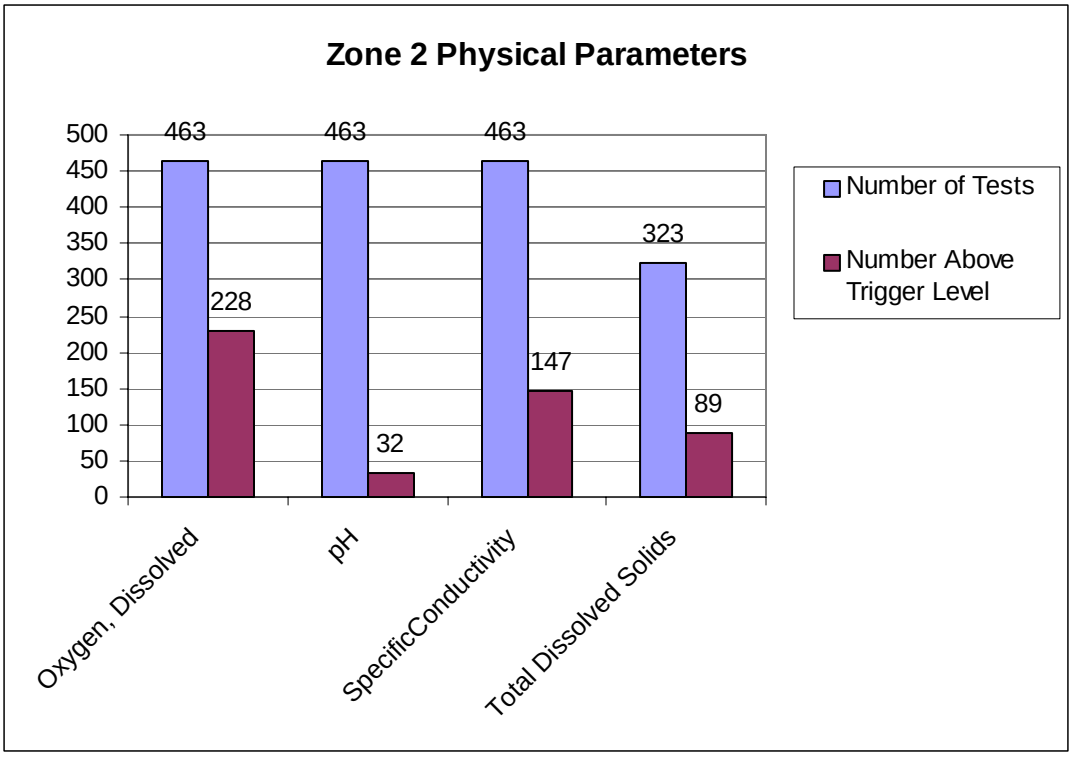
Site No.	Monitoring Site ID	Total No. of Tests	No. of Tests Less than 235 MPN/100 ml	No. of Tests Greater than 235 MPN/100 ml
5	Calaveras River @ Belota Intake	2	2	0
8	Delta Drain- Terminous Tract off Glascock Rd	9	5	4
9	Delta Drain- Terminous Tract off Guard Rd	8	6	2
21	Duck Creek at Highway 4	7	5	2
22	French Camp Slough @ Airport Way	14	3	11
23	Grant Line Canal @ Clifton Court Rd	14	3	11
24	Grant Line Canal near Calpack Rd	14	4	10
25	Kellogg Creek @ Hwy 4	9	4	5
26	Kellogg Creek along Hoffman Ln	8	5	3
28	Littlejohns Creek @ Jacktone Rd	16	11	5
29	Lone Tree Creek @ Bernnan Rd	3	0	3
30	Lone Tree Creek @ Jacktone Rd	16	2	14
32	Marsh Creek @ Balfour Ave	9	1	8
33	Marsh Creek @ Concord Ave	5	1	4
36	Mokelumne River @ Bruella Rd	11	11	0
37	Mokelumne River @ Fish Hatchery	1	1	0

38	Mormon Slough at Jack Tone Road	5	5	0
43	Potato Slough @ Hwy 12	11	11	0
45	Roberts Island Drain along House Road	5	1	4
46	Roberts Island Drain at Holt Road	5	4	1
47	Sand Creek at Highway 4 Bypass	5	0	5
50	Terminous Tract Drain @ Hwy 12	14	9	5
55	Unnamed Drain to Lone Tree Creek at Jack	4	3	1
	Totals	195	97	98

Monitoring results from four sites had 10 or more results above 235 MPN/100 mL for the pathogen indicator. These sites were Lone Tree Creek at Jacktone Road, Grant Line Canal at Clifton Court, Grant Line Canal at Calpack Road, and French Camp Slough at Airport Way.

PHYSICAL PARAMETERS. Physical parameters discussed here include dissolved oxygen (DO), pH, electrical conductivity (EC), and total dissolved solids (TDS). Participants conducted an average of 31 tests across all physical parameters at 54 monitoring points. With the exception of TDS, testing occurred 463 times for each physical parameter. TDS testing occurred 323 times. Figure Z2-9, Zone 2 Physical Parameters summarizes this monitoring.

Figure Z2-9



Interpretation of DO and pH results is difficult because these parameters can change over short time frames due to variables such as ambient temperature, photosynthesis, flow/turbulence, and atmospheric conditions. Consequently,

additional study and investigation is necessary to determine the cause and severity of the measurement outside water quality triggers.

Total dissolved solids (TDS) is a measurement of mineral salts dissolved in water. Identifying elevated TDS sources within Zone 2 is currently under evaluation and an EC/TDS study is currently under development.

Data Gaps

Baseline water quality conditions cannot be evaluated in Zone 2 sub-areas of the western Delta area, such as the Delta islands and tracts, due to lack of availability of monitoring data for this program.

Many sample points represent a large section of agricultural land, which cannot provide accurate information regarding waste concentrations from the upper reaches of the subwatersheds.

The effort to identify monitoring sites that are representative of agriculture is a challenge in Zone 2. For example, urban development has encroached near sample sites Marsh Creek at Balfour and Kellogg Creek at Highway 4. Consequently, these monitoring sites were moved from their original position to avoid urban influence. The Sand Creek at Highway 4 site is also being investigated for urban influence. Data obtained thus far are inconclusive because the origin of a drainage to Sand Creek from a nearby culvert is unknown at this time.

Zone 2 Summary

Some observations are made regarding water quality data collected in Zone 2, as follows:

The greatest percentage (33%) of toxicity events to the number of tests in Zone 2 occurs to the species *Hyalella azteca*, which serves as an indicator of sediment toxicity. Twelve of the 52 monitoring sites (23%) exhibited sediment toxicity at one time or another. In general, monitoring sites west of the San Joaquin River had the greatest toxicity to *Hyalella* located mostly in the lower reaches of the sub-watersheds.

Pimephales promelas (fathead minnow) had the least toxic frequency (3%) as a percentage to the number of tests in the Zone, although 17% of the individual monitoring sites in Zone 2 exhibited fathead minnow toxicity at one time or another. Observed minnow toxicity is mostly limited to the drains in the Delta with the exception of the Lone Tree Creek, Marsh Creek, and Sand Creek sub-watershed monitoring points.

Toxicity to *Ceriodaphnia dubia* (water flea) and *Selenastrum capricornutum* (algae) were almost equal at 8% and 9% comparing the number of toxic events vs. the number of tests. Twenty-three percent (15 out of 52) of the monitoring sites indicated toxicity to both species at least one time.

The incidence of pesticides observed above the trigger level varies from constituent to constituent. The most common pesticides ranked in order as observed above the water quality triggers are: chlorpyrifos, diazinon, disulfoton, DDE, malathion, DDT, simazine, methyl parathion, dieldrin, and diuron.

The sample site No. 41 at Pixley Slough at Eightmile Road had the greatest frequency of prohibited pesticide detections, accounting for 10 (40%) out of the 25 detections found in the region. Nine out of 10 detections were malathion. Pixley Slough at Eightmile Road also had more detections above trigger levels for lead, copper and zinc than any other Zone 2 monitoring site.

Site No. 20 (Drain to San Joaquin River off South Manthey Road) experienced frequent chlorpyrifos and diazinon exceedances (7 and 8 times, respectively). All results were from the 2005 storm season. Detected concentrations of chlorpyrifos ranged from 0.018 ug/L to 0.072 ug/L, and detected concentrations of diazinon ranged from 0.226 ug/L to 0.728 ug/L. No toxicity samples were collected at the time the pesticide exceedances were observed.

Site No. 47 (Sand Creek at Highway 4 Bypass) experienced toxicity to water flea, fathead minnow and sediment toxicity a total of six times, with four of these results at 0% survival. The TIE tests conducted found that organophosphates were the source of toxicity to water flea and fathead minnow, suggesting that chlorpyrifos may have been the cause. Although two exceedances of chlorpyrifos were observed, it is notable that PURs have not documented any chlorpyrifos use in this subwatershed.

The frequency of salinity, in excess of water quality triggers measured as electrical conductivity, predominates in the Delta drain areas and in areas where receiving waters receive Delta water. Four of the 54 monitoring sites where specific conductance was tested exhibited 36% of all the occurrences above the trigger level. These monitoring points: Terminous Tract off Guard Road, Grant Line Canal near Calpack Road, Drain to Grant Line Canal off Wing Levee Road, and Drain to North Canal at South Bonetti Road occupy Delta drain areas.

Management plans are under development for Zone 2 to address water quality issues such as toxicity and pesticides, and future monitoring data reviews will attempt to evaluate the effectiveness of the Management Plans.

The tables below, Z2-9 through Z2-11 summarize the number of data results that were greater than water quality triggers.

REVISED DRAFT

Table Z2-9
Summary of Pesticide Monitoring Results Above Trigger Levels

Site Number	Monitoring Site	Azinphos methyl	Bifenthrin	Carbaryl	Carbofuran	Chlorpyrifos	Cyhalothrin, lambda, total	Cypermethrin, total	DDD(p,p')	DDE(p,p')	DDT(p,p')	Diazinon	Dieldrin	Dimethoate	Disulfoton	Diuron	Endrin	Esfenvalerate/Fenvalerate, total	Linuron	Malathion	Methomyl	Methyl Parathion	Permethrin, total	Permethrin-1	Permethrin-2	Simazine	Total
1	8 Mile and Rio Blanco Rds.																										0
2	Bear Creek at Alpine Rd	1				1						5		1						1		1					10
3	Bear Creek at Harney Ln.																										0
4	Beaver Slough at Blossom Rd.																										0
5	Calaveras River @ Belota Intake																										0
6	Calaveras River at Clements Rd.																										0
7	Calaveras River at Pezzi Rd	1										2										2					5
8	Delta Drain-Terminous Tract off Glascock Rd																										0
9	Delta Drain-Terminous Tract off Guard Rd																										0
10	Drain 11 @ Walsal Slough (Top of Bank)																										0
11	Drain 12 @ French Camp Rd Headwall/Southside of RR															1										4	5
12	Drain 14 @ Lone Tree Ck (Top of Bank)											1				3				1						3	8
13	Drain at Bowman Rd.																										0
14	Drain at Wing Levee Road																										0
15	Drain to Brack Dr at Woodbridge Rd								1	1	1		1														4
16	Drain to Grant Line Canal off Wing Levee Rd.				1	1			1	9	2	2	2		11												29
17	Drain to North Canal along Bonetti Drive								1	1	1							1									4
18	Drain to North Canal at South Bonetti Rd.				1	3						1			1							1		1	1		9
19	Drain to Pixley Slough at Davis Rd									1	1																2
20	Drain to San Joaquin River off South Manthey Rd.				1	7				1		8												1	1		19
21	Duck Creek at Highway 4					2																					2
22	French Camp Slough @ Airport Way	1				4	1																				6
23	Grant Line Canal @ Clifton Court Rd					1				1				1				1									4
24	Grant Line Canal near Calpack Rd					4				1									1								6
25	Kellogg Creek @ Hwy 4					1																	1				2
26	Kellogg Creek along Hoffman Ln									1	1						1										3

Site Number	Monitoring Site	Azinphos methyl	Bifenthrin	Carbaryl	Carbofuran	Chlorpyrifos	Cyhalothrin, lambda, total	Cypermethrin, total	DDD(p,p')	DDE(p,p')	DDT(p,p')	Diazinon	Dieldrin	Dimethoate	Disulfoton	Diuron	Endrin	Esfenvalerate/Fenvalerate, total	Linuron	Malathion	Methomyl	Methyl Parathion	Permethrin, total	Permethrin-1	Permethrin-2	Simazine	Total
27	Little John Creek at Newcastle Rd.																										0
28	Littlejohns Creek @ Jacktone Rd					2																					2
29	Lone Tree Creek @ Bernnan Rd					1																					1
30	Lone Tree Creek @ Jacktone Rd					2	1	1																			4
31	Lone Tree Creek at Newcastle Rd.																										0
32	Marsh Creek @ Balfour Ave					1																	1				2
33	Marsh Creek @ Concord Ave									1	1																2
34	Marsh Creek @ Marsh Creek Rd																										0
35	Mid Roberts Island Drain at Woodsbro Road													1													1
36	Mokelumne River @ Bruella Rd																										0
37	Mokelumne River @ Fish Hatchery																										0
38	Mormon Slough at Jack Tone Road					1																					1
39	Mormon Slough on Jack Tone Rd					3																3					6
40	Paddy Creek at Jack Tone Rd.																										0
41	Pixley Slough at Eightmile Rd			1		12						14			4					9						2	42
42	Pixley Slough at Ham Ln					1																					1
43	Potato Slough @ Hwy 12																										0
44	Return Irrigation Drain at MCD Rd.																										0
45	Roberts Island Drain along House Road						1			1																	2
46	Roberts Island Drain at Holt Road						2			1																	3
47	Sand Creek at Highway 4 Bypass		1			2	1			2	2	1	2				1				1						13
48	SJR Source Water to Canal at Holt and Nueger Roads																										0
49	Sweet Lateral															2											2
50	Terminous Tract Drain @ Hwy 12																										0
51	Tom Paine Slough at El Rancho Rd.																										0
52	Tom Paine Slough at Paradise Rd.									1	1																2
53	Unnamed Canal at Howard Road																										0
54	Unnamed canal at west end of Woodbridge Rd																										0

Site Number	Monitoring Site	Azinphos methyl	Bifenthrin	Carbaryl	Carbofuran	Chlorpyrifos	Cyhalothrin, lambda, total	Cypermethrin, total	DDD(p,p')	DDE(p,p')	DDT(p,p')	Diazinon	Dieldrin	Dimethoate	Disulfoton	Diuron	Endrin	Esfenvalerate/Fenvalerate, total	Linuron	Malathion	Methomyl	Methyl Parathion	Permethrin, total	Permethrin-1	Permethrin-2	Simazine	Total
55	Unnamed Drain to Lone Tree Creek at Jack					2				1																	3
56	Unnamed Slough at Wildwood Rd								1	1	1		1														4
57	Unnamed Slough at Woodsbro Rd. and Burns cutoff Levee																										0
58	Upstream Kellogg Creek @ Hoffman Ln																										0
	Grand Total	3	1	1	3	51	6	1	4	24	11	34	6	3	16	6	2	2	1	11	1	7	2	2	2	9	209

Table Z2-10
Summary of Metals, Toxicity and Other Parameters with Monitoring Results Above Trigger Levels

Site Number	Monitoring Site	E. coli	Total Dissolved Solids	Oxygen, Dissolved	pH	SpecificConductivity	Zinc,Total	Arsenic,Total	Boron,Total	Copper,Total	Lead,Total	Nickel,Total	Ceriodaphnia dubia	Pimephales promelas	Selenastrum capricornutum	Hyalella azteca	Total
		General Parameters					Metals						Toxicity				
1	8 Mile and Rio Blanco Rds.			3		1											4
2	Bear Creek at Alpine Rd			4									1				5
3	Bear Creek at Harney Ln.			3	2												5
4	Beaver Slough at Blossom Rd.			1													1
5	Calaveras River @ Belota Intake																0
6	Calaveras River at Clements Rd.			2													2
7	Calaveras River at Pezzi Rd			2	2								1		3	1	9
8	Delta Drain- Terminous Tract off Glascock Rd	4	4	8		4								1		2	23
9	Delta Drain- Terminous Tract off Guard Rd	2	7	7		10									1	1	28
10	Drain 11 @ Walsal Slough (Top of Bank)																0
11	Drain 12 @ French Camp Rd Headwall/Southside of RR																0
12	Drain 14 @ Lone Tree Ck (Top of Bank)																0
13	Drain at Bowman Rd.			3		4											7

REVISED DRAFT

Site Number	Monitoring Site	E. coli	Total Dissolved Solids	Oxygen, Dissolved	pH	SpecificConductivity	Zinc,Total	Arsenic,Total	Boron,Total	Copper,Total	Lead,Total	Nickel,Total	Ceriodaphnia dubia	Pimephales promelas	Selenastrum capricornutum	Hyalella azteca	Total
		General Parameters					Metals						Toxicity				
14	Drain at Wing Levee Road			5		6											11
15	Drain to Brack Dr at Woodbridge Rd																0
16	Drain to Grant Line Canal off Wing Levee Rd.		12	11		14							2			1	40
17	Drain to North Canal along Bonetti Drive			1													1
18	Drain to North Canal at South Bonetti Rd.		12	11		13		6	7								49
19	Drain to Pixley Slough at Davis Rd			1													1
20	Drain to San Joaquin River off South Manthey Rd.		6	8		8		1			1						24
21	Duck Creek at Highway 4	2		3	2								1				8
22	French Camp Slough @ Airport Way	11		6	1					4	2		1		1	1	27
23	Grant Line Canal @ Clifton Court Rd	11	5	11	4	5		2		3	3	1				2	47
24	Grant Line Canal near Calpack Rd	10	10	15		16		2					3		1	4	61
25	Kellogg Creek @ Hwy 4	5	5	3	1	8							1	2	1	2	28
26	Kellogg Creek along Hoffman Ln	3	2	3	1	3							1				13
27	Little John Creek at Newcastle Rd.			2	1	1							1				5
28	Littlejohns Creek @ Jacktone Rd	5		6	2					1				1	2		17
29	Lone Tree Creek @ Bernnan Rd	3	1	2		1							1	1	3		12
30	Lone Tree Creek @ Jacktone Rd	14		11	2					1				1	2	2	33
31	Lone Tree Creek at Newcastle Rd.			5	1								1				7
32	Marsh Creek @ Balfour Ave	8	5	3	1	7							2			4	30
33	Marsh Creek @ Concord Ave	4	2		2	3			2	1				1			15
34	Marsh Creek @ Marsh Creek Rd																0
35	Mid Roberts Island Drain at Woodsbro Road		2	3	1	2											8
36	Mokelumne River @ Bruella Rd			4	2								5		3		14
37	Mokelumne River @ Fish Hatchery			1													1
38	Mormon Slough at Jack Tone Road			3													3
39	Mormon Slough on Jack Tone Rd				1										5		6
40	Paddy Creek at Jack Tone Rd.			4													4
41	Pixley Slough at Eightmile Rd			11			4			8	20				1		44

Site Number	Monitoring Site	E. coli	Total Dissolved Solids	Oxygen, Dissolved	pH	SpecificConductivity	Zinc,Total	Arsenic,Total	Boron,Total	Copper,Total	Lead,Total	Nickel,Total	Ceriodaphnia dubia	Pimephales promelas	Selenastrum capricornutum	Hyalella azteca	Total
		General Parameters					Metals						Toxicity				
42	Pixley Slough at Ham Ln			1							3						4
43	Potato Slough @ Hwy 12			1	1	1							3				6
44	Return Irrigation Drain at MCD Rd.			3	1	5											9
45	Roberts Island Drain along House Road	4	4	5	3	2											18
46	Roberts Island Drain at Holt Road	1	1	5		3										2	12
47	Sand Creek at Highway 4 Bypass	5	4	7		6							3	1		2	28
48	SJR Source Water to Canal at Holt and Nueger Roads			7										2			9
49	Sweet Lateral			4	1												5
50	Terminous Tract Drain @ Hwy 12	5	5	10		7		1						1	2		31
51	Tom Paine Slough at El Rancho Rd.			4		4											8
52	Tom Paine Slough at Paradise Rd.																0
53	Unnamed Canal at Howard Road			2													2
54	Unnamed canal at west end of Woodbridge Rd		2	4		3		5									14
55	Unnamed Drain to Lone Tree Creek at Jack	1		2													3
56	Unnamed Slough at Wildwood Rd																0
57	Unnamed Slough at Woodsbro Rd. and Burns cutoff Levee			7		9											16
58	Upstream Kellogg Creek @ Hoffman Ln					1											1
	Total	98	89	228	32	147	4	17	9	18	29	1	27	11	25	24	759