
Central Valley Regional Water Quality Control Board

14 August 2015

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MANAGEMENT PLAN FOR WATER FLEA TOXICITY IN CACHE CREEK

Thank you for your 18 December 2013 request to approve completion of the *Ceriodaphnia dubia* (water flea) Toxicity Management Plan for Cache Creek in the Yolo Subwatershed of the Sacramento Valley Water Quality Coalition (Coalition). The request is based upon the Coalition's finding that agricultural sources did not contribute to the observed exceedances and that the water quality objectives for toxicity have been met.

Under the Waste Discharge Requirements for Growers within the Sacramento River Watershed Order R5-2014-0030 (WDR), Management Plans can be completed if an approved source study shows that irrigated agriculture is not causing or contributing to the water quality problem or if improved management practices have resolved the water quality problem. At least three years of compliance with no exceedances during the times of year when previous exceedances occurred must be demonstrated before a management plan can be petitioned for completion (WDR Attachment B, Appendix MRP-1, Section III).

Based on staff's evaluation in the attached memorandum, agricultural sources of pesticides cannot be ruled out as potential causes of the water column toxicity observed in 2007, 2008, and 2011. However, three years of compliance with no exceedances demonstrates that management practices protective of water quality are effective in the drainage. Twelve samples collected from 2012 through 2014 were free of water flea toxicity, with samples collected during the irrigation season when the previous exceedances occurred. The lack of exceedances since August 2011 provides evidence that the water quality problem has been resolved. Therefore, the management plan for *Ceriodaphnia dubia* is considered complete and the request is approved.

If you have any questions or comments regarding this approval letter, please contact Lynn Coster at (530) 224-2437, or by email at Lynn.Coster@waterboards.ca.gov.

Original Signed By

Pamela C. Creedon
Executive Officer

Enclosure: Staff review of the request to complete management plan for water flea toxicity in
Cache Creek

cc: Bruce Houdesheldt, Northern California Water Association
Claus Suverkropp, Larry Walker Associates

Central Valley Regional Water Quality Control Board

TO: Susan Fregien
Senior Environmental Scientist
Irrigated Lands Regulatory Program

FROM: Lynn Coster
Environmental Scientist
MONITORING AND IMPLEMENTATION UNIT
IRRIGATED LANDS REGULATORY PROGRAM

DATE: 6 July 2015

SUBJECT: MANAGEMENT PLAN FOR WATER FLEA TOXICITY IN CACHE CREEK

The Sacramento Valley Water Quality Coalition (Coalition) is required to implement management plans for constituents that exceed water quality objectives at the same site more than once in a three-year period (Order R5-2014-0030). On 18 December 2013 the Coalition submitted a request to approve completion of the *Ceriodaphnia dubia* (water flea) toxicity management plan for Cache Creek in the Yolo Subwatershed. The request is based upon the contention that Cache Creek has met the water quality objectives for toxicity, and agricultural sources do not contribute to the observed exceedances.

Based on the requirements in Order R5-2014-0030 (Attachment B, Appendix MRP-1), management plans can be completed in one of two ways: irrigated agriculture is demonstrated not to be causing or contributing to the water quality problem, or the improved management practices have resolved the water quality problem and the water quality data show at least three years of compliance. The Central Valley Water Board staff reviewed the Coalition's request.

Staff evaluation of evidence presented to support the request:

a) Monitoring data. The management plan in Cache Creek was triggered by exceedances in August 2007 and July 2008 when significant toxicity to water flea was observed (Figure 1). Toxicity was observed again in August 2011. No toxicity to water flea has been observed since August 2011.

There have been no exceedances of monitored pesticides and metals in the subwatershed, and monitored pesticides were not detected in toxic samples, although pesticides are occasionally detected in the water column. Monitoring for pyrethroids in the water column commenced in 2012, however pesticide detections were not associated with toxicity. For example, esfenvalerate (June) and chlorpyrifos (April, June and August) were detected in samples in 2012; chlorpyrifos (April), bifenthrin (August) and λ -cyhalothrin (August) were detected in 2013. All results were below the reporting limit and samples were not toxic.

b) Potential sources. The 2011 Source Evaluation Report (SER) assessed land uses, pesticide applications, timing of irrigation, precipitation, chemistry and toxicity results, results of Toxicity Identification Evaluations (TIEs), chemical and toxicity characteristics, and non-agricultural sources. The TIE results were determined to be inconclusive as toxicity was not

persistent during the TIE analysis or in the follow-up samples. No pesticides or other chemicals were detected in the initial sample at concentrations expected to cause toxicity to *Ceriodaphnia dubia*. The conclusion of the SER was that specific causes and sources could not be definitively identified for the toxicity exceedances in Cache Creek, and that agricultural pesticides were not likely to have caused or contributed to the observed toxicity.

Staff evaluated Pesticide Use Reporting (PUR) data in Cache Creek at Capay Diversion Dam drainage for one month prior to each of the observed water flea toxicity exceedances in 2007, 2008, and 2011 (Tables 1-3). The PUR data showed the use of pyrethroids and organophosphate pesticides, potential candidate compounds that could have caused toxicity to water flea:

- **PUR data one month prior to 8/22/2007 (5% survival):** esfenvalerate, permethrin, chlorpyrifos, malathion (Table 1, Figure 2a).
- **PUR data one month prior to 7/16/2008 (15% survival):** malathion (Table 2, Figure 2b).
- **PUR data one month prior to 8/16/2011 (5% survival):** bifenthrin, carbaryl, chlorpyrifos, malathion (California Pesticide Information Portal (CalPIP) data for township range sections (COMTRS) in the Cache Creek at Capay Diversion Dam drainage; Table 3, Figure 2c).

Staff did not agree with the SER evaluation that agricultural pesticides were unlikely to have caused or contributed to the toxicity based on the fact that toxicity was not persistent during the TIE analysis or in subsequent samples. Toxicity present and then lost could be caused by non-polar compounds that degrade, are volatilized, or sorbed to particles in the sample or to container walls. For example, malathion and abamectin degrade quickly and therefore could cause or contribute to toxicity in tests initiated soon after application, but could go undetected in samples or in subsequent toxicity tests.

Finally, it is possible that a mixture of various compounds (below detection limit or not analyzed for) could cause toxicity in initial tests, and when one or more compounds degrade, volatilize or get adsorbed, subsequent tests indicate loss of toxicity. Chlorpyrifos and malathion are considered to have additive toxicity and together may have the potential for cumulative toxicity risk. Malathion degrades quickly, and therefore subsequent tests may not show persistent toxicity. In addition, there was no monitoring for pyrethroids in the water column prior to 2012 when the toxicity to water flea was observed, although PUR data shows the use of pyrethroids at the time of the exceedances in 2007 and 2011. Based on the lack of toxicity in the sediment sample collected with the 2007 sample, the SER determined that pyrethroid pesticides were unlikely to have had a significant potential to cause or contribute to the toxicity. It is possible, however, that pyrethroids in the water column may have had a cumulative toxic effect on *Ceriodaphnia dubia*.

- c) Third-party outreach and management practice implementation. The Coalition informed growers about exceedances, but there was no targeted outreach to growers to promote pesticide-specific management practices because the cause of the exceedances was not identified. Management practices were not surveyed nor were additional practices recommended in the subwatershed. In the 2011 SER, SVWQC included an extensive description of relevant irrigation and pesticide management practices that were in use in the Cache Creek drainage to prevent runoff of pesticides during irrigation season and to prevent soil and sediment movement during storm events.

Staff recommendation:

While the source of toxicity could not be determined, the evidence presented does not rule out an agricultural contribution to the observed water column toxicity to water flea. However, evaluation of monitoring data shows three years of compliance with no toxicity exceedances since August 2011, which demonstrates that the water quality objective is being met. Growers were informed of the exceedances, and management practices continue to be implemented. As demonstrated through monitoring results, common pesticide application and runoff management practices have been sufficient to prevent toxicity in the drainage.

Assessment monitoring will continue at monitoring site Willow Slough Bypass at Pole Line, which is representative of the Cache Creek drainage. Monitoring for *Ceriodaphnia dubia* toxicity in the water column is required, with monitoring scheduled during the irrigation season when the initial exceedances occurred. Pesticide monitoring for chlorpyrifos and malathion in the water column and for bifenthrin, chlorpyrifos, esfenvalerate, and permethrin in sediment (when sediment toxicity is observed) is included in the 2015 Monitoring Plan for the Willow Slough site. Discharges from irrigated lands to surface water and the effectiveness of management practices will continue to be evaluated for the drainage based on monitoring results from the representative site and data collected from Farm Evaluation Surveys. For the above reasons, staff supports the request to approve completion of the *Ceriodaphnia dubia* Toxicity Management Plan for Cache Creek.

Figures and Tables

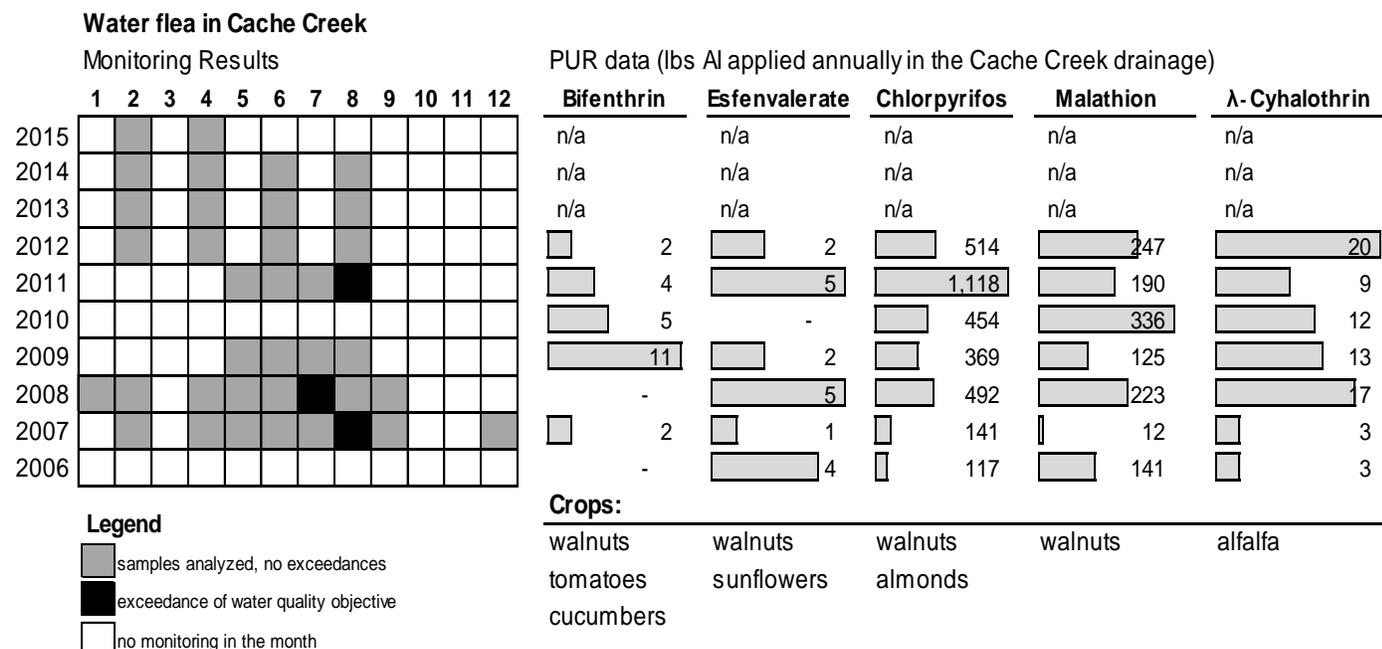


Figure 1. Monitoring results for toxicity to water flea in Cache Creek and Pesticide Use Report (PUR) summary for four pesticides commonly used in the drainage. Results of monitoring are shown by year (rows) and month (columns). Each cell represents one month, and the cell fill indicates if monitoring took place and if results were in compliance with the water quality objectives. PUR data (pounds of active ingredient (AI) applied) are shown for each year; crops with applications prior to the observed exceedances are indicated.

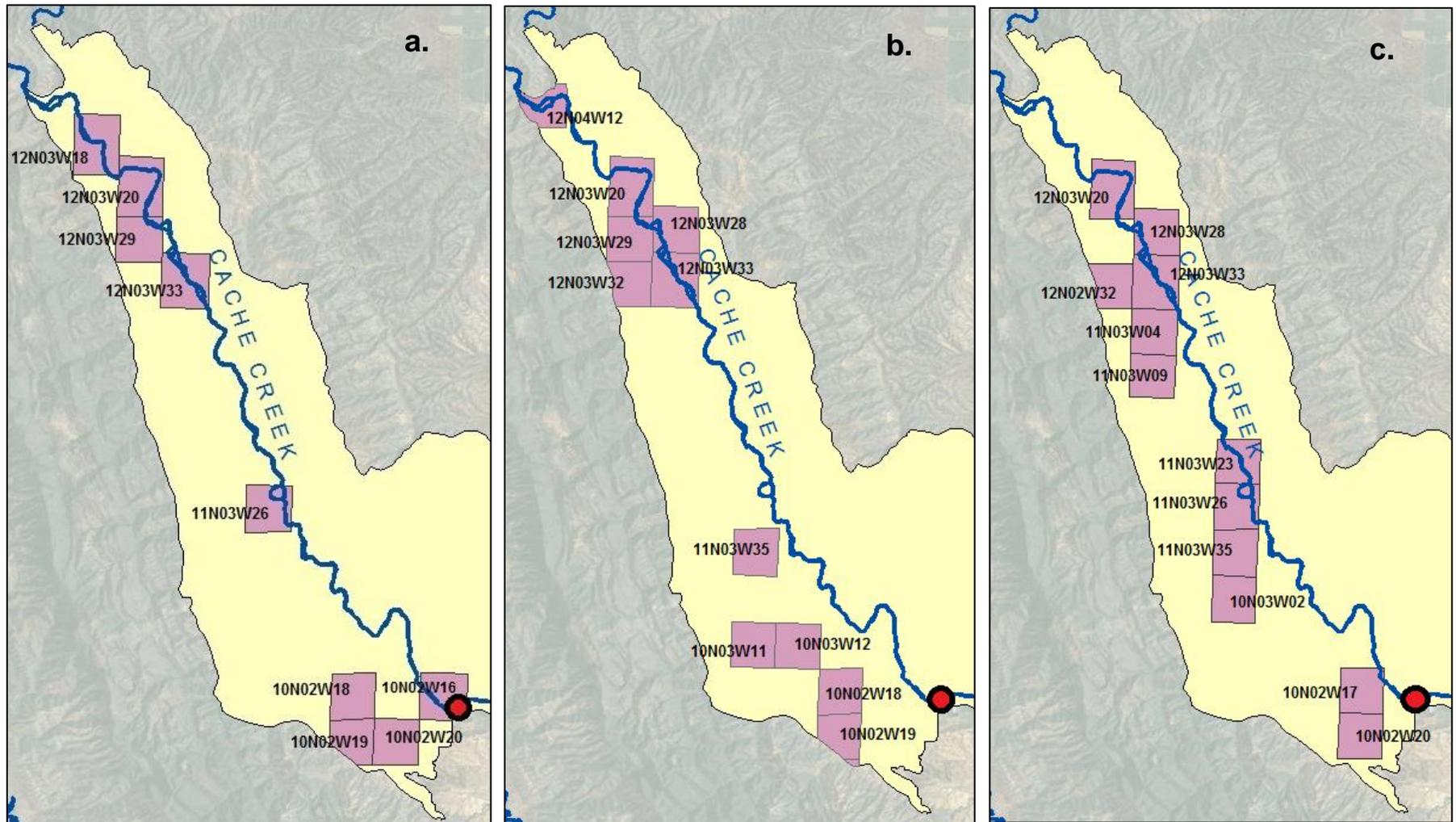


Figure 2. Location of pesticide use associated with periods of water column toxicity to water flea in Cache Creek at Capay Diversion Dam drainage (CalPIP data retrieved for one month preceding the observed toxicity, details are listed in related tables): **a.** Event 023 on 22 August 2007 (Table 1), **b.** Event 031 on 16 July 2008 (Table 2), and **c.** Event 066 on 16 August 2011 (Table 3).

Table 1. Pesticide use (CalPIP data) in Cache Creek at Capay Diversion Dam drainage one month preceding the observed water column toxicity to water flea: Event 023 (22 August 2007).

Commodity	Date	Active Ingredient	Application Method	lbs AI applied	Acres treated	COMTRS
GRAPES, WINE	7/25/2007	TRIFLUMIZOLE	G	0.5	2	10N02W19
WALNUT	7/26/2007	GLYPHOSATE, ISOPROPYLAMINE SALT	G	5.0	4	12N03W20
WALNUT	7/31/2007	DIPHACINONE	G	0.001	5	12N03W18
ALMOND	8/3/2007	GLYPHOSATE, ISOPROPYLAMINE SALT	G	4.5	8.5	10N02W19
WALNUT	8/3/2007	GLYPHOSATE, ISOPROPYLAMINE SALT	G	2.0	4	10N02W18
WALNUT	8/3/2007	MALATHION	G	1.0	4	12N03W20
WALNUT	8/3/2007	SPINOSAD	G	0.002	12	12N03W29
VEGETABLES	8/6/2007	BACILLUS SOLUBLES	G	2.7	11	11N03W26
WALNUT	8/7/2007	MALATHION	G	10.8	30	12N03W20
POME FRUITS	8/7/2007	SPINOSAD	G	0.1	2	12N03W29
CUCUMBER	8/8/2007	PERMETHRIN	A	0.9	4.5	10N02W20
CUCUMBER	8/8/2007	DINOTEFURAN	A	0.7	4.5	10N02W20
SUNFLOWER	8/8/2007	ESFENVALERATE	A	0.5	10	10N02W20
CUCUMBER	8/8/2007	ABAMECTIN	A	0.04	4.5	10N02W20
WALNUT	8/15/2007	CHLORPYRIFOS	G	29.9	46	12N03W33
WALNUT	8/17/2007	GLYPHOSATE, POTASSIUM SALT	G	16.6	8	10N02W16
SUNFLOWER	8/18/2007	ESFENVALERATE	A	0.5	10	10N02W20
VEGETABLES	8/20/2007	BACILLUS THURINGIENSIS	G	0.4	4	12N03W29
VEGETABLES	8/20/2007	PYRETHRINS	G	0.04	4	12N03W29
WALNUT	8/20/2007	SPINOSAD	G	0.001	8	10N02W20
POME FRUITS	8/21/2007	SPINOSAD	G	0.1	2	12N03W29

Table 2. Pesticide use (CalPIP data) in Cache Creek at Capay Diversion Dam drainage one month preceding the observed water column toxicity to water flea: Event 031 (16 July 2008).

Commodity	Date	Active Ingredient	Application Method	lbs AI applied	Acres treated	COMTRS
UNCULTIVATED AG	6/16/2008	BROMOXYNIL OCTANOATE	G	0.7	2	10N03W12
UNCULTIVATED AG	6/16/2008	BROMOXYNIL HEPTANOATE	G	0.7	2	10N03W12
SUNFLOWER	6/16/2008	IMAZAMOX, AMMONIUM SALT	G	0.1	3	10N03W11
WALNUT	6/17/2008	ALUMINUM PHOSPHIDE	A	0.2	10	10N02W18
VEGETABLES	6/18/2008	BACILLUS THURINGIENSIS	G	0.2	2	12N03W29
WALNUT	6/20/2008	GLYPHOSATE, ISOPROPYLAMINE SALT	G	10.0	3	12N03W20
CITRUS	6/20/2008	POTASH SOAP	A	0.1	1	12N04W12
WALNUT	6/24/2008	KAOLIN	A	807.5	17	12N03W20
WALNUT	6/25/2008	KAOLIN	A	1453.5	34	12N03W33
WALNUT	6/25/2008	KAOLIN	A	726.8	17	12N03W20
WALNUT	6/25/2008	KAOLIN	A	342.0	8	12N03W33
VEGETABLES	6/25/2008	BACILLUS THURINGIENSIS	G	0.3	3	12N03W29
APPLE	6/26/2008	CODLING MOTH GRANULOSIS VIRUS	G	0.0003	2	12N03W28
WALNUT	6/27/2008	ALUMINUM PHOSPHIDE	A	0.1	10	10N02W18
VEGETABLES	7/1/2008	BACILLUS THURINGIENSIS	G	0.2	2	12N03W29
ALMOND	7/3/2008	SULFUR	G	320.0	20	11N03W35
ALMOND	7/3/2008	SULFUR	G	240.0	15	11N03W35
VEGETABLES	7/7/2008	BACILLUS THURINGIENSIS	G	0.5	5	12N03W32
VEGETABLES	7/11/2008	BACILLUS THURINGIENSIS	G	0.3	3	12N03W32
WALNUT	7/11/2008	ALUMINUM PHOSPHIDE	G	0.2	10	10N02W18
WALNUT	7/15/2008	GLYPHOSATE, ISOPROPYLAMINE SALT	G	4.5	9	10N02W18
WALNUT	7/15/2008	MALATHION	G	2.0	4	12N03W20
WALNUT	7/15/2008	MALATHION	G	2.0	4	12N03W20
WALNUT	7/15/2008	OXYFLUORFEN	G	1.2	9	10N02W18
WALNUT	7/16/2008	MALATHION	G	30.7	32	12N03W33
WALNUT	7/16/2008	MALATHION	G	30.7	34	12N03W33
WALNUT	7/16/2008	MALATHION	G	15.4	12	12N03W33
ALMOND	7/16/2008	GLYPHOSATE, ISOPROPYLAMINE SALT	G	8.5	17	10N02W19
ALMOND	7/16/2008	OXYFLUORFEN	G	1.9	17	10N02W19

Table 3. Pesticide use (CalPIP data) in Cache Creek at Capay Diversion Dam drainage one month preceding the observed water column toxicity to water flea: Event 066 (16 August 2011).

Commodity	Date	Active Ingredient	Application Method	lbs AI applied	Acres treated	COMTRS
WALNUT	7/16/2011	GLYPHOSATE, ISOPROPYLAMINE SALT	G	0.001	0.5	12N03W20
WALNUT	7/16/2011	GLYPHOSATE, ISOPROPYLAMINE SALT	G	0.001	0.4	12N03W20
WALNUT	7/16/2011	OXYFLUORFEN	G	0.001	0.5	12N03W20
WALNUT	7/16/2011	GLYPHOSATE, ISOPROPYLAMINE SALT	G	0.001	0.6	12N03W20
WALNUT	7/16/2011	OXYFLUORFEN	G	0.001	0.4	12N03W20
WALNUT	7/16/2011	OXYFLUORFEN	G	0.0004	0.6	12N03W20
WALNUT	7/18/2011	GLYPHOSATE, ISOPROPYLAMINE SALT	G	0.005	3.3	12N03W20
WALNUT	7/18/2011	OXYFLUORFEN	G	0.003	3.3	12N03W20
ALMOND	7/21/2011	GLYPHOSATE, ISOPROPYLAMINE SALT	G	94.9	47.5	10N02W20
ALFALFA	7/23/2011	CLETHODIM	G	15.5	93.0	11N03W35
ALFALFA	7/28/2011	CLETHODIM	G	13.3	80.0	10N03W02
VEGETABLES	7/29/2011	KAOLIN	G	14.3	3.0	12N03W28
ALMOND	7/30/2011	CHLORPYRIFOS	G	175.7	87.0	10N02W20
ALMOND	7/30/2011	HEXYTHIAZOX	G	11.1	87.0	10N02W20
ALMOND	7/30/2011	CHLORANTRANILIPROLE	G	1.1	13.2	11N03W26
ALMOND	7/30/2011	CHLORANTRANILIPROLE	G	1.9	21.2	11N03W35
ALMOND	7/30/2011	CHLORANTRANILIPROLE	G	1.2	14.0	11N03W35
CUCUMBER	7/31/2011	BIFENTHRIN	G	1.5	15.0	10N02W20
CUCUMBER	7/31/2011	CYAZOFAMID	G	1.1	15.0	10N02W20
ALMOND	8/2/2011	GLUFOSINATE-AMMONIUM	G	55.8	47.5	10N02W20
OLIVE	8/2/2011	GLYPHOSATE, ISOPROPYLAMINE SALT	G	5.8	11.5	10N02W20
OLIVE	8/2/2011	CARFENTRAZONE-ETHYL	G	0.2	11.5	10N02W20
TOMATOES	8/3/2011	PYRACLOSTROBIN	A	4.0	25.0	10N02W20
TOMATOES	8/3/2011	BIFENTHRIN	A	2.0	25.0	10N02W20
TOMATOES	8/3/2011	ABAMECTIN	A	0.2	25.0	10N02W20
ALMOND	8/3/2011	HEXYTHIAZOX	G	1.7	13.2	11N03W26
ALMOND	8/3/2011	HEXYTHIAZOX	G	2.7	21.2	11N03W35
ALMOND	8/3/2011	HEXYTHIAZOX	G	1.8	14.0	11N03W35
WALNUT	8/3/2011	MALATHION	G	6.0	17.0	12N03W20
WALNUT	8/5/2011	GLYPHOSATE, POTASSIUM SALT	G	13.8	45.0	12N03W33
OLIVE	8/6/2011	CARFENTRAZONE-ETHYL	G	0.2	15.7	10N02W17
OLIVE	8/6/2011	CARBARYL	G	158.2	40.0	12N03W32
WALNUT	8/8/2011	HEXYTHIAZOX	G	11.1	86.8	10N02W17
OLIVE	8/9/2011	GLYPHOSATE, ISOPROPYLAMINE SALT	G	7.8	15.7	10N02W17
WALNUT	8/10/2011	HEXYTHIAZOX	G	4.9	38.0	10N02W17
WALNUT	8/10/2011	GLYPHOSATE, ISOPROPYLAMINE SALT	G	6.0	4.0	12N03W20
WALNUT	8/14/2011	GLYPHOSATE, POTASSIUM SALT	G	69.0	80.0	11N03W23
WALNUT	8/15/2011	SPINETORAM	G	3.7	45.0	12N03W33
WALNUT	8/16/2011	GLUFOSINATE-AMMONIUM	G	40.8	34.7	10N02W17