DELTA REGIONAL MONITORING PROGRAM

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Executive Summary

The Delta RMP conducts water sampling monthly with the primary goal of tracking and documenting the effectiveness of beneficial use protection and restoration efforts through comprehensive monitoring of water quality constituents and their effects in the Delta through the use of toxicity testing and analytical chemistry. This annual report summarizes the results of toxicity tests and water quality parameters conducted on samples collected from July 28, 2015 to July 13, 2016.

Toxicity tests were performed on samples collected monthly by USGS. Samples were initiated with *Pimephales promelas*, *Ceriodaphnia dubia*, and *Selenastrum capricornutum*, employing toxicity testing methods based on protocols developed by USEPA and UCD AHP SOPs. Low conductivity controls were included with each test batch to match the conductivity of the Mokelumne River at New Hope Road (544SAC002), which is consistently below 100 µS/cm, and PRT-style test protocols were used with this site with every test initiation.

In 2015, two samples met the TIE criterion of >50% reduction in endpoints: site 544SAC002 (Mokelumne River at New Hope Road) and site 544LSAC13 (San Joaquin River at Buckley Cove) in the *S. capricornutum* test initiated on July 29, 2015. Further investigations suggested that the toxicity observed in the initial screening test was likely due to glassware contamination.
In 2016, the San Joaquin River at Buckley Cove (544LSAC13) met the TIE trigger in the January 19, 2016 event, with *C. dubia* exhibiting 100% mortality within 24 h of test initiation. Through multiple follow-up tests, we were not able to recover the toxicity observed in the initial screening test, and we cannot determine the cause or source of that toxicity at this time.

During this period there were 30 instances of observed toxicity, observed in 18 tests. The San Joaquin River at Buckley Cove (544LSAC13) had the highest number of significantly reduced endpoints (10), with one *C. dubia* survival impairment, five *C. dubia* reproductive impairments, and four instances of reduced algal growth. The Sacramento River at Hood (510SACC3A) had one *C. dubia* survival impairment and seven instances of reduced *C. dubia* fecundity. The San Joaquin River at Vernalis (541JSC501) had one instance of Pathogen-Related Toxicity, one reduced *P. promelas* biomass endpoint, two instances of reduced algal growth and one instance of reduced *C. dubia* reproduction. Ulatis Creek at Brown Road (510SOL010/511ULCABR) had four instances of impairment, two each of reduced *C. dubia* reproduction and reduced algal growth. The Mokelumne River at New Hope Road had three instances of toxicity, two of which were Pathogen-Related Toxicity with *P. promelas* that was alleviated when initiated in the follow-up PRT style protocol toxicity test (which led to using PRT-style protocol for the remainder of the project period in initial screening tests), and one instance of reduced *C. dubia* reproduction. These instances of observed toxicity, other than those described above, did not meet applicable TIE triggers and therefore we are unable to determine the cause or source of toxicity at this time.

Between the time this report was originally submitted and its most recent revision, changes to *C. dubia* test termination protocols were made, which affected the survival and reproduction endpoints in some of the tests conducted during this reporting period. The data contained herein have been updated to reflect these changes.

1.0 Introduction

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***Project*:** Delta Regional Monitoring Program (SWAMP Region 5)

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***Objectives*:** The Delta RMP conducts water sampling monthly with the primary goal of tracking and documenting the effectiveness of beneficial use protection and restoration efforts through comprehensive monitoring of water quality constituents and their effects in the Delta through the use of toxicity testing and analytical chemistry. This annual report summarizes the results of toxicity tests and water quality parameters conducted on samples collected from July 28, 2015 to July 13, 2016.

2.0 Sample sites

Table 1. Summary of sample sites and locations

Site	Latitude	Longitude	Description	Referred to in Report as
510SACC3A[1]	38.36691	-121.52037	Sacramento River at Hood	Hood
541SJC501[2]	37.67556	-121.26417	San Joaquin River at Vernalis at Airport Way	SJR @ Vernalis
544LSAC13	37.97667	-121.37889	San Joaquin River at Buckley Cove	SJR @ Buckley
511ULCABR[3]	38.30667	-121.79472	Ulatis Creek at Brown Road	Ulatis Creek
544SAC002	38.23611	-121.41889	Mokelumne River at New Hope Road	Mokelumne

1. 510SACHOD-SWAMP in first event, 2. 544SJC501-SWAMP in first event, 3. 511OLCABR and 510SOL010 in first few events

2.1 Sample collection

Table 2. Summary of sample collection details.

Sample ID	Site	Collection Date/Time	Collection Method	Time of Receipt	Temp at Receipt (°C)
510SACHOD_SWAMP	Sac R. @ Hood	7/28/15; 08:45	Grab	15:15	2.6
544SAC002	Mokelumne R.	7/28/15; 09:50			5.3
544LSAC13	SJR @ Buckley	7/28/15; 11:10			6.1
544SJC501_SWAMP	SJR @ Vernalis	7/28/15; 12:15			6.8
511OLCABR	Ulatis Creek	7/28/15; 14:20			16.4
510SACC3A	Sac R. @ Hood	8/18/15; 08:40	Grab	16:00	5.7
544SAC002	Mokelumne R.	8/18/15; 09:50			5.3
544LSAC13	SJR @ Buckley	8/18/15; 11:10			5.6
541SJC501	SJR @ Vernalis	8/18/15; 12:50			7.1

Sample ID	Site	Collection Date/Time	Collection Method	Time of Receipt	Temp at Receipt
510SOL010	Ulatis Creek	8/18/15; 15:00			18.6
Field Duplicate	SJR @ Buckley	8/18/15; 11:10			5.2
510SACC3A	Sac R. @ Hood	9/23/15; 08:30	Grab	15:15	4.7
544SAC002	Mokelumne R.	9/23/15; 09:20			5.0
544LSAC13	SJR @ Buckley	9/23/15; 10:45			4.5
541SJC501	SJR @ Vernalis	9/23/15; 12:20			5.7
510SOL010	Ulatis Creek	9/23/15; 14:15			16.2
510SACC3A	Sac R. @ Hood	10/21/15; 08:00	Grab	16:00	3.5
544SAC002	Mokelumne R.	10/21/15; 09:10			1.9
544LSAC13	SJR @ Buckley	10/21/15; 10:50			5.6
541SJC501	SJR @ Vernalis	10/21/15; 12:40			7.3
510SOL010	Ulatis Creek	10/21/15; 15:00			16.5
Field Duplicate	SJR @ Vernalis	10/21/15; 12:40			6.8
510SACC3A	Sac R. @ Hood	11/10/15; 09:00	Grab	16:35	2.4
544SAC002	Mokelumne R.	11/10/15; 10:00			3.3
544LSAC13	SJR @ Buckley	11/10/15; 11:30			3.9
541SJC501	SJR @ Vernalis	11/10/15; 13:00			3.2
510SOL010	Ulatis Creek	11/10/15; 15:30			12.4
510SACC3A	Sac R. @ Hood	12/15/15; 15:00	Grab	16:25	5.6
544SAC002	Mokelumne R.	12/15/15; 14:00			3.1
544LSAC13	SJR @ Buckley	12/15/15; 12:20			2.4
541SJC501	SJR @ Vernalis	12/15/15; 11:00			2.6
511ULCABR	Ulatis Creek	12/15/15; 8:50			2.5
Field Duplicate	Sac R. @ Hood	12/15/16; 15:00			4.9
510SACC3A	Sac R. @ Hood	1/19/16; 8:30	Grab	16:30	2.9
544SAC002	Mokelumne R.	1/19/16; 9:45			3.6
544LSAC13	SJR @ Buckley	1/19/16; 10:50			3.8
541SJC501	SJR @ Vernalis	1/19/16; 12:30			3.0
511ULCABR	Ulatis Creek	1/19/16; 15:00			9.8
Field Duplicate	Ulatis Creek	1/19/16; 15:00			9.8
510SACC3A	Sac R. @ Hood	2/17/16; 8:00	Grab	15:11	4.6
544SAC002	Mokelumne R.	2/17/16; 9:00			4.0
544LSAC13	SJR @ Buckley	2/17/16; 10:10			4.3
541SJC501	SJR @ Vernalis	2/17/16; 12:00			5.1
511ULABR	Ulatis Creek	2/17/16; 14:10			9.5
Field Blank	SJR @ Buckley	2/17/16; 10:15			4.5
510SACC3A	Sac R. @ Hood	3/7/16; 14:20	Grab	15:32	7.6
544SAC002	Mokelumne R.	3/7/16; 13:30			7.1
544LSAC13	SJR @ Buckley	3/7/16; 10:15			3.8
541SJC501	SJR @ Vernalis	3/7/16; 11:50			4.3
511ULCABR	Ulatis Creek	3/7/16; 8:30			3.8

Sample ID	Site	Collection Date/Time	Collection Method	Time of Receipt	Temp at Receipt
510SACC3A	Sac R. @ Hood	4/19/16; 8:20	Grab	16:12	4.3
544SAC002	Mokelumne R.	4/19/16; 9:20			2.2
544LSAC13	SJR @ Buckley	4/19/16; 11:00			2.7
541SJC501	SJR @ Vernalis	4/19/16; 12:45			9.0
511ULCABR	Ulatis Creek	4/19/16; 15:10			20.3
Field Duplicate	SJR @ Buckley	4/19/16; 11:00			2.4
510SACC3A	Sac R. @ Hood	5/18/16; 8:30	Grab	15:20	3.3
544SAC002	Mokelumne R.	5/18/16; 9:30			3.4
544LSAC13	SJR @ Buckley	5/18/16; 10:45			7.3
541SJC501	SJR @ Vernalis	5/18/16; 12:20			7.9
511ULCABR	Ulatis Creek	5/18/16; 14:20			20.2
510SACC3A	Sac R. @ Hood	6/15/16; 8:10	Grab	16:00	4.0
544SAC002	Mokelumne R.	6/15/16; 9:15			4.5
544LSAC13	SJR @ Buckley	6/15/16; 10:50			4.3
541SJC501	SJR @ Vernalis	6/15/16; 12:40			9.4
511ULCABR	Ulatis Creek	6/15/16; 14:40			12.0
Field Duplicate	Ulatis Creek	6/15/16; 14:40			12.1
510SACC3A	Sac R. @ Hood	7/13/16; 8:20	Grab	15:40	4.4
544SAC002	Mokelumne R.	7/13/16; 9:30			3.2
544LSAC13	SJR @ Buckley	7/13/16; 11:05			6.2
541SJC501	SJR @ Vernalis	7/13/16; 12:45			5.4
511ULCABR	Ulatis Creek	7/13/16; 14:30			17.8
Field Duplicate	Mokelumne R.	7/13/16; 9:30			3.2

2.2 Sample chemistry

Table 3. Summary of water quality measurements

Sample ID	Date	Hardness (mg/L as $CaCO_3$)	Alkalinity (mg/L as $CaCO_3$)	Ammonia Nitrogen (mg/L)	Unionized Ammonia (mg/L)
Hood	7/28/15	44	52	0.51	0.047
Mokelumne		40	46	ND	ND
SJR @ Buckley		204	102	ND	ND
SJR @ Vernalis		228	164	ND	ND
Ulatis Creek		240	224	0.05*	0.010*
Hood	8/18/15	56	60	0.71	0.074
Mokelumne		44	48	ND	ND
SJR @ Buckley		204	102	0.05*	0.006*
SJR @ Vernalis		222	106	0.07*	0.006*
Ulatis Creek		140	122	ND	ND
Dup: SJR @ Buckley		254	240	ND	ND
Hood	9/23/15	56	66	0.83	0.085
Mokelumne		56	70	0.13*	0.013*
SJR @ Buckley		216	118	0.11*	0.004*
SJR @ Vernalis		80	128	ND	ND
Ulatis Creek		320	280	0.09*	0.002*

Sample ID	Date	Hardness (mg/L as	Alkalinity (mg/L as	Ammonia Nitrogen	Unionized Ammonia
Hood	10/21/15	64	68	0.79	0.051
Mokelumne		20	20	ND	ND
SJR @ Buckley		168	132	ND	ND
SJR @ Vernalis		116	92	ND	ND
Ulatis Creek		304	268	0.29	0.021
Dup: SJR @ Vernalis		112	92	ND	ND
Hood	11/10/15	60	68	1.46	0.104
Mokelumne		22	20	ND	ND
SJR @ Buckley		92	70	ND	ND
SJR @ Vernalis		60	58	ND	ND
Ulatis Creek		296	250	0.05*	0.005*
Hood	12/15/15	64	74	0.45	0.020
Mokelumne		20	22	ND	ND
SJR @ Buckley		112	78	0.10*	0.005*
SJR @ Vernalis		108	86	ND	ND
Ulatis Creek		200	180	0.10*	0.008*
Dup: Hood		64	74	0.51	0.028
Hood	1/19/16	60	58	0.21	0.020
Mokelumne		20	44	ND	ND
SJR @ Buckley		88	58	0.23	0.025
SJR @ Vernalis		108	72	0.09*	0.020*
Ulatis Creek		80	56	0.51	0.049
Dup: Ulatis Creek		76	58	0.49	0.037
Hood	2/17/16	68	74	0.38	0.014
Mokelumne		20	20	ND	ND
SJR @ Buckley		140	88	0.09*	0.004*
SJR @ Vernalis		216	130	ND	ND
Ulatis Creek		320	272	ND	ND
Field Blank		88/96/ND	58/56/4*	ND/ND/ND	ND/ND/ND
Hood	3/7/16	52	50	0.35	0.026
Mokelumne		16	18	ND	ND
SJR @ Buckley		132	82	0.23	0.018
SJR @ Vernalis		156	104	0.07*	0.007*
Ulatis Creek		76	70	0.19	0.018
Hood	4/19/16	48	50	0.30	0.011
Mokelumne		20	18	ND	ND
SJR @ Buckley		184	108	0.07*	0.004
SJR @ Vernalis		44	56	ND	ND
Ulatis Creek		284	234	ND	ND
Dup: SJR @ Buckley		184	108	ND	ND
Hood	5/18/16	44	44	0.44	0.022
Mokelumne		16	24	ND	ND
SJR @ Buckley		68	50	0.05*	0.002*
SJR @ Vernalis		88	58	ND	ND
Ulatis Creek		272	224	0.06*	0.006
Hood	6/15/16	36	48	0.53	0.024

Sample ID	Date	Hardness (mg/L as	Alkalinity (mg/L as	Ammonia Nitrogen	Unionized Ammonia
Mokelumne		20	24	ND	ND
SJR @ Buckley		116	70	ND	ND
SJR @ Vernalis		104	78	ND	ND
Ulatis Creek		352	272	0.06*	0.007*
Field Blank		88/80/ND	58/58/4*	ND/ND/ND	ND/ND/ND
Hood	7/13/16	40	44	0.43	0.044
Mokelumne		24	24	ND	ND
SJR @ Buckley		108	74	ND	ND
SJR @ Vernalis		156	110	0.06*	0.012*
Ulatis Creek		352	284	ND	ND
Dup: Mokelumne		24	24	ND	ND

*Sample result is in between the MDL and RL. Hardness MDL is 2 mg/L. Hardness RL is 6 mg/L. Alkalinity MDL is 4 mg/L. Alkalinity RL is 12 mg/L. Ammonia-nitrogen MDL is 0.05 mg/L. Ammonia-nitrogen RL is 0.15 mg/L.

2.3 Control/Dilution Waters

Table 4. Summary of water chemistry of controls

Control ID	Type/Source	Creation or Collection Date	Pretreatment	Hardness (mg/L as $CaCO_3$)	Alkalinity (mg/L as $CaCO_3$)
P. promelas	ROEPAMH	7/29/15	None	84	58
C. dubia	L1650	8/7/15 [c]		80	58
S. capricornutum	Distilled Water	7/29/15		4*	ND
P. promelas	ROEPAMH	8/18/15		82	58
S. capricornutum	Distilled Water	8/19/15		ND	4*
P. promelas	ROEPAMH	9/25/15		80	60
C. dubia	ROEPAMH[a]	9/24/15		80	61
S. capricornutum	Distilled Water	9/24/15		ND	4*
P. promelas	ROEPAMH	10/22/15		80	NR
C. dubia	L1650	10/22/15		80	NR
S. capricornutum	Distilled Water	10/22/15		ND	4*
P. promelas	ROEPAMH	11/9/15		100	60
C. dubia	L1650	11/9/15		108†	58
S. capricornutum	Distilled Water	11/11/15		ND	ND
P. promelas	ROEPAMH	12/15/15		96	58
C. dubia	L1650	12/15/16		92	62
S. capricornutum	Distilled Water	12/16/16		ND	4*
P. promelas	ROEPAMH	1/19/16		84	62
C. dubia	L1650	1/15/16		88	68†
S. capricornutum	Distilled Water	1/19/16		ND	8*
P. promelas	ROEPAMH	2/11/16		84	56†
C. dubia	L1650	2/4/16		88	60
S. capricornutum	Distilled Water	2/17/16		ND	4*
P. promelas	ROEPAMH	3/8/16		80	54†
C. dubia	L1650	3/3/16		84	56†

S. capricornutum	Distilled Water	3/8/16		ND	ND
P. promelas	ROEPAMH	4/9/16		88	56†
C. dubia	L1650	4/5/16		88	60
S. capricornutum	Distilled Water	4/20/16		ND	4*
P. promelas	ROEPAMH	5/10/16		80	52†
C. dubia	L1650	5/10/16		88	54†
S. capricornutum	Distilled Water	5/18/16		ND	4*
P. promelas	ROEPAMH	6/15/16		84	58
C. dubia	L1650	6/15/16		88	58
S. capricornutum	Distilled Water	6/16/16		ND	4*
P. promelas	ROEPAMH	7/12/16		80	56†
C. dubia	L1650	7/12/16		88	54†
S. capricornutum	Distilled Water	7/14/16		ND	ND

a: ROEPAMH made at AQUA Science b: Distilled water with nutrients added. C: The date of this control water reflects the control water used during the *C. dubia* retest of samples collected 7/28/16.
ND: Non-Detect. NR: Not Reported. *: Sample result is in between the MDL and RL. Hardness MDL is 2 mg/L. Hardness RL is 6 mg/L. Alkalinity MDL is 4 mg/L. Alkalinity RL is 12 mg/L. Ammonia-nitrogen MDL is 0.05 mg/L. Ammonia-nitrogen RL is 0.15 mg/L. † These values fell out of the USEPA Range of moderately hard specifications of 80-100 mg/L hardness and 56-64 mg/L alkalinity.

3.0 Test methods

UCD AHP toxicity testing methods are based on protocols developed by USEPA (2002) and UCD AHP SOPs (UCD AHP, 2015; SOPs 1-1, 1-2, 1-3). Chronic toxicity testing for *Pimephales promelas, Ceriodaphnia dubia* and *Selenastrum capricornutum* followed protocols outlined in *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms* (USEPA, 2002).

3.1 Water Sample Collection

Staff from the United States Geological Survey (USGS) collected water samples as subsurface grabs in clean 1-gal amber glass bottles. Water samples were transported, stored and preserved following protocols outlined in the UCD AHP and SWAMP standard operating procedures (SOPs 5-1, 5-2).

3.2 Receiving Water Quality

Meters were calibrated according to the manufacturers' specifications at the start of each field day. Ammonia-nitrogen was measured at UCD AHPL within 24 hours of sample receipt using a HACH DR-890 portable colorimeter and a HACH Am-Ver Low-Range Ammonia Test'N Tube Reagent Set. Hardness and alkalinity were measured on all ambient samples (titrimetric methods) within 48-hours of sample receipt.

3.3 Statistics

This project was designed to create data comparable with data contained in the database of California's Surface Water Ambient Monitoring Program (SWAMP). To this end, test organism performance (control v. ambient sample) was evaluated using SWAMP standard statistical protocols. The SWAMP protocol involves the examination of significant differences in test organism performance by a one-tailed heteroschedastic t-test ($\alpha = 0.05$) and a categorization of the performance of organisms exposed to the ambient sample as either greater to or less than 80% of the control performance (SWAMP QAPrP, 2008).

Toxicity tests may include conductivity controls when one or more ambient samples that have a lower or higher specific conductance than SWAMP's species specific thresholds. A low conductivity control is first statistically compared to the standard test acceptability criteria (TAC) control to determine whether a low conductivity has a negative impact on the test organism. In instances where the low conductivity control impairs a particular endpoint (i.e. *C. dubia* reproduction), the ambient sample with the lower conductivity is compared to the low conductivity control, rather than the standard TAC control, to determine whether the ambient sample is toxic. Low conductivity controls were included with each test batch to match the conductivity of the Mokelumne River at New Hope Road (544SAC002), which is consistently below 100 µS/cm.

3.4 Toxicity Testing Protocols

3.4.1 Test preparations

Before test initiation and water renewals, water samples were shaken thoroughly in their original sample containers for 60 seconds to disassociate loosely adsorbed pesticides and sub-samples were filtered through a 53-µm screen to remove debris and other organisms. Water quality measurements including pH, EC, DO and temperature were recorded for all treatments at test initiation and termination. DO and pH was measured on fresh sample water prior to renewals; pH, DO and temperature were measured on 24-hr waste water.

3.4.2 Pathogen Related Toxicity

P. promelas are considered to be infected by pathogens, a test result called Pathogen-Related Toxicity (PRT), when the Percent Coefficient of Variation (%CV) of survival between the four replicates of a treatment is greater than or equal to 40%. When high %CVs are observed, the sample and its appropriate control(s) are tested with 20 replicates containing two fish each. This modified approach maintains the same number of fish per treatment and statistical power, while the reduced number of fish per replicate minimizes the spread of pathogens to other fish. At test termination, the 20 replicates are pooled in batches of five to provide four survival and biomass replicates per sample. These four replicates are then statistically processed in the same fashion as the standard test method.

At the start of the project, typical USEPA *P. promelas* chronic toxicity test protocols were employed, which included 600 mL glass beakers as test replicates. The Mokelumne River (544LSAC002) during the September and October events exhibited Pathogen-Related Toxicity and this site was initiated in follow-up PRT toxicity tests to confirm toxicity. For these two PRT tests, replicate test chambers consisted of 30 mL plastic cups as described in USEPA. Per request of the Technical Advisory Committee, 544LSAC002 was initiated in a PRT-style test protocol in the initial screening test during the November event due to repeated observation of PRT and anticipated low conductivity at this site. Additionally, we used 600 mL Teflon beakers as replicate test chambers instead of the 600 mL glass beakers in order to reduce variability among replicates for the remainder of the sites tested in the typical USEPA fashion. However, for the remainder of the project, test replicate chambers will consist of 600 mL glass beakers for the standard USEPA protocol, and the PRT-style protocol will include the use of 50 mL glass beakers, in order to reduce the potential loss of pyrethroid toxicity due to adsorption to test chambers. PRT-style test protocols were used with site 544SAC002 (Mokelumne River at New Hope Road) with every test initiation, using 50 mL glass beakers as replicate test chambers, for events conducted December 2015-July 2016.

4.0 Test Organisms

Table 5. Summary of test organisms used

Species	Common name	Life stage	Age	Source
P. promelas	Fathead Minnow	Larval	24-48 h	AquaTox Inc.
C. dubia	Water flea	Neonate	<24 h, 8h window	Aquatic Research Organisms
S. capricornutum	Green alga	Log-phase	4-7 d	University of Texas

4.1 Pimephales promelas

Fish were purchased from Aquatox Inc (Hotsprings, AK). Upon receipt, fish were fed and acclimated to laboratory test conditions until their use in a test. Prior to test initiation and renewals, sample waters were warmed to test temperature (25 ± 1°C) in 1L glass beakers using a water bath maintained at 25 ± 2°C, and aerated at a rate of 100 bubbles per minute until DO the concentration fell below saturation (about 8.6 mg/L). Reverse-osmosis water amended with inorganic salts to USEPA moderately hard specifications (hardness: 80-100 mg/L $CaCO_3$, alkalinity: 57-64 mg/L $CaCO_3$, EC 250-300 µS/cm, pH, 7.8-8.2; USEPA, 2002) was used as the control (ROEPAMH).

Tests were initiated using fish less than 48-hr old. Each of four replicate 600 mL beakers contained 250 mL of sample water and 10 minnows. Eighty percent of the test solution was renewed daily, at which time debris and dead fish were removed from the test chambers. Fish were fed *Artemia* nauplii twice daily. Tests were conducted at 25 ± 1°C with a 16-hr light: 8-hr dark photoperiod under fluorescent and ambient light. Mortality was assessed daily. At test termination, surviving fish were dried to a constant weight at 103-105°C, and weighed using a Mettler AE163 balance to determine dry biomass.

4.2 Ceriodaphnia dubia

C. dubia were cultured in-house, following methods outlined in USEPA and in UCD AHP SOPs. Cultures originally obtained from Aquatic Research Organisms (Hampton, NH) and AQUA Science (Davis, CA), were kept in an environmental chamber maintained at 25 ± 2°C. Test organisms employed in toxicity testing were derived asexually. Prior to test initiation and renewals, waters were warmed to test temperature (25 ± 1°C) in 400 mL mason jars using a water bath maintained at 25 ± 2°C and aerated at a rate of 100 bubbles per minute until the DO concentration fell below saturation (about 8.6 mg/L). Nutrient-rich Sierra Springs™ water amended to USEPA moderately hard standards (hardness: 80-100 mg/L $CaCO_3$, alkalinity: 57-64 mg/L $CaCO_3$, EC 250-300 µS/cm, pH, 7.8-8.2; USEPA, 2002) was used as the control (L1650).

Tests were initiated using blocking by known parentage with less than 24-hr old *C. dubia*, born within an 8-hr period. Each of ten replicate 20 mL glass vials contained 15 mL of sample water and one organism. *C. dubia* were transferred into a vial of fresh solution and fed YCT and *S. capricornutum* daily. Tests were conducted at 25 ± 1°C with a 16-hr light: 8-hr dark photoperiod under fluorescent light. Mortality and reproduction were assessed daily and at termination.

4.3 Selenastrum capricornutum

S. capricornutum were cultured and maintained in-house at UCD AHP from cultures originally obtained from Star Culturing, University of Texas (Austin, TX). Axenic algal cells were placed in media for 4-7 days prior to test initiation to ensure cells were in exponential growth.

The *S. capricornutum* 96-hr chronic tests consisted of four replicate 250 mL glass flasks with 100 mL of sample and 1 mL of 1.0 x 10^6 cells/mL of *S. capricornutum*. A fifth replicate flask was inoculated and used for daily chemistry measurements. Tests were conducted without the addition of EDTA in order to minimize the chelation of metals, which could potentially be present in ambient samples. Test chambers were incubated in a temperature-controlled environmental chamber maintained at 25 ± 2°C under constant cool white fluorescent light. Flasks were kept in random placement in a mechanical shaker in constant orbital motion at 100 cycles per minute and were randomized twice daily. Cell growth was measured at test termination. Distilled water amended with nutrients (Hardness: 0 mg/L, Alkalinity: 0-4 mg/L, EC: 95-105 µS/cm, pH 7.8-8.2; USEPA, 2002) was used as the control.

5.0 Tests performed

Toxicity tests were performed on samples collected monthly by USGS. Samples were initiated with *Pimephales promelas*, *Ceriodaphnia dubia*, and *Selenastrum capricornutum*, following the aforementioned protocols outlined in Methods, Section 3.0. With those exceptions noted herein, all toxicity testing took place at the Aquatic Health Program Lab, in Davis, CA.

6.0 Quality Assurance

6.1 Test Acceptability Criteria

Test acceptability criteria (TAC) for laboratory analyses included minimum control organism survival and sub-lethal fitness requirements. Tests where organisms did not meet these minimum requirements were repeated.

- Chronic *P. promelas* toxicity tests require 80% or greater control survival and an average biomass of ≥ 0.25 mg/individual.
- Chronic *C. dubia* toxicity tests require 80% or greater average control survival, with at least 60% of the surviving females having an average of 15 neonates and three broods.
- Chronic 96-hr *S. capricornutum* toxicity tests require an average cell growth of 2 x 10^5 cells/mL and a less than 20% coefficient of variation among control replicates.

6.2 Field duplicates

For the Delta RMP Project, field duplicates are collected at a rate of 5% or one sample per every 20 samples collected to assess precision. Field duplicate samples were collected six times during this reporting period:

1. San Joaquin River at Buckley Cove (544LSAC13); August 18, 2015
2. San Joaquin River at Vernalis (541SJC501); October 21, 2015
3. Sacramento River at Hood (510SACC3A); December 15, 20153
4. Ulatis Creek at Brown Road (511ULCABR); January 19, 2016
5. San Joaquin River at Buckley Cove (544LSAC13); April 19, 2016
6. Mokelumne River at New Hope Road (544SAC002); July 13, 2016

Field duplicate samples are in agreement when the primary sample and its duplicate are either statistically similar or statistically different from the control. For all field collection dates, all endpoints were statistically similar among the primary sample and its duplicate when compared to the control.

6.3 Precision

Precision is the degree to which the primary sample agrees with its duplicate. Precision is measured by calculating the Relative Percent Difference (RPD) between sample measurements. The RPD between a sample and its duplicate was calculated by using the following equation:

$$RPD = \left(\frac{\left[2 \left| Dup_1 - Dup_2 \right| \right]}{\left[Dup_1 + Dup_2 \right]} \right) \bullet 100\%$$

RPDs were calculated on water chemistry measurements of DO, pH, EC, hardness, alkalinity and ammonia, as well as on toxicity testing endpoints such as survival, cell growth, reproduction, biomass and weight. Individual RPDs for these endpoints are outlined in Table 101. SWAMP Measurement Quality Objectives (MQOs) for precision require duplicate RPDs to be equal to or less than 20%. During this reporting period, there were six instances where the RPDs exceeded the SWAMP criterion:

1. During the October 21 sample date with site 541SJC501 (San Joaquin River at Vernalis) and its duplicate, the primary sample exhibited pathogen-related toxicity (PRT) in the *P. promelas* test, which caused 45% survival over the entire treatment (73.68% RPD). In comparison, the duplicate of 541SJC501 had 98% survival and no evidence of PRT. The average biomass for both samples also exceeded the RPD SWAMP criterion (66.09% RPD) for that same collection date, due to the observed PRT.
2. The RPD for the electrical conductivity measurement at test initiation on 10/22/15, between 541SJC501 and its duplicate was 46.43% (451 vs 281).
3. During the December 15, 2015 sample event with site 510SACC3A (Sacramento River at Hood) and its duplicate, the electrical conductivity (EC) measurements at test termination in the *C. dubia* and *S. capricornutum* tests, had RPDs of 22.65% and 21.11%, respectively.
4. During the April 19, 2016 sample event with site 544LSAC13 (San Joaquin River at Buckley Cove) and its duplicate, the RPD for ammonia-nitrogen was 46.15%.
5. In that same event, the RPD for *P. promelas* biomass was 20.91% (0.352 mg/ind. vs 0.434 mg/ind.).
6. During the July 13, 2016 sample event with site 544SAC002 (Mokelumne River at New Hope Road) and its duplicate, the EC measurements at test initiation and termination in the *C. dubia* test had RPDs of 69.4% and 102.4%, respectively.

RPD outlier follow-up

After careful consideration we consider the RPD outliers associated with the October 21 sampling event to be due to technician error. The labeling on the sample bottles for the Field Duplicate (labeled “Field QC”) and the Bottle Blank (labeled as “Lab QC) were too similar and as a result these samples were mixed up during test initiation and on Day 1 of the test. This mistake was realized on Day 2 of the test and the bottles were relabeled to reduce confusion. We believe that this mistake accounts for the RPD deviation for the initial measurement of EC at test initiation, as well as why PRT was observed in the primary sample but not its duplicate. Because of this error we will not include this Field Duplicate in our completeness calculations for *P. promelas*.

After reviewing the water quality logs for the December, April, and July dates mentioned above, it was determined that exceeded RPDs in EC measurements in the aforementioned toxicity tests were due to sample carryover caused by technicians not rinsing the EC probe thoroughly enough between samples.

The EC probe has a pocket where sample water can collect if the probe is not rinsed well enough with RO water. In all instances, the samples measured prior to the field duplicate samples had higher conductivities than the duplicate samples. This sample carryover caused an artificial increase in EC in the field duplicate samples, and can account for the RPD exceedances. Lab technicians have been instructed to rinse the EC probe more carefully between samples when taking water quality measurements.

In the April event, *P. promelas* biomass had a RPD of 20.91%. This RPD is barely above the SWAMP criterion threshold of 20%. Moreover, the primary sample of 544LSAC13 and its duplicate both had statistically similar responses when compared to the control (e.g., both samples were not significantly different), and so we consider this data to be reliable. The ammonia-nitrogen measurement between the primary San Joaquin River at Buckley Cove site and its duplicate also had an RPD which exceeded the SWAMP criterion. These measurements were on very small amounts of ammonia-nitrogen (0.05 mg/L vs 0.08 mg/L), which fell between the MDL (0.05 mg/L) and the RL (0.15 mg/L) for this analyte, and should be considered estimated values.

6.4 Bottle blanks

Bottle blank samples were collected three times during this reporting period (July 29, August 18, and October 22, 2015) to assess the cleanliness of the sample collection bottles that were washed at the AHPL. Bottle blank samples should be statistically similar to the test acceptability control. There was one instance where the bottle blank was not statistically similar to the control, in the *S. capricornutum* test initiated with the July 29, 2015 samples. The bottle blank exhibited significantly less growth than the control. The July bottle blank was statistically similar to the control for the *C. dubia* and *P. promelas* endpoints. The August and October bottle blanks were statistically similar for all three test species.

6.5 Field blanks

Field blank samples were collected twice during this reporting period (February 17 and June 15, 2016) to assess sample collection techniques. Results include total ambient conditions during sampling and laboratory sources of contamination. Field blank samples should be statistically similar to the test acceptability control. There was one instance where the field blank was not statistically similar to the control, in the *C. dubia* test initiated with the February 17, 2016 samples. The field blank exhibited significantly less reproduction (18 neonates) than the control (28 neonates). The field blank samples for the *P. promelas* and *S. capricornutum* tests of that same sample collection date both shared equivalent statistical results. Another field blank was conducted with the June 2016 collection date, and all samples shared equivalent results. As a reduced response was not observed in the follow-up field blank samples, it was determined that the previous result was a one-time occurrence, and therefore no other follow-up was conducted.

6.6 Deviations

Five deviations occurred during this reporting period:

1. Samples initiated in a *C. dubia* test from the July 29, 2015 collection date did not meet test acceptability criteria. These samples were initiated in a retest on August 8, 2015. The 36-hour holding time was missed for this retest.
2. Samples 544SAC002 (Mokelumne River at New Hope Road) and 544LSAC13 (San Joaquin River at Buckley; both collected July 28, 2015) exhibited possible *S. capricornutum* toxicity in the initial screening test, and in the case of 544SAC002, an extremely high %CV of 110%. These two samples were initiated in a follow-up retest (initiated August 8, 2015), which exceeded the 36-hour holding time. As the initial toxicity of these samples could not be

confirmed, we submitted the retest data to the database, with the likelihood of glassware or foam plug contamination as the cause of the observed toxicity.

3. The *S. capricornutum* reference toxicant test associated with the July 28, 2015 samples did not meet test acceptability criteria, with a control %CV of 24.3. This test was reset up on August 8, 2015 and was used as August RT. We do not have a successful RT test for July, however the timeliness in which the ambient test was initiated between the RT test in August and July samples was within the typical 30-day window of a RT test conducted monthly.
4. Samples initiated in a *C. dubia* test from the August 18, 2015 sample date did not meet test acceptability criteria. Subsequent retests of these samples were unsuccessful, due to ongoing *C. dubia* health problems.
5. Samples initiated in a *P. promelas* test from the September 23, 2015 sample date missed the 36-hour holding time due to FedEx losing fish en route to delivery at our laboratory. The test was set up the following morning when a new batch of fish arrived.

Deviation follow-up

QAPP protocols require a 36-hr holding time for test initiation. Although all initial screening tests are initiated by that holding time criterion, a retest almost always takes place after the initial 36-hrs have passed. An extended holding time can possibly reduce the presence of a toxicant, as labile chemicals can degrade over time. Water samples are stored in amber glass containers and kept in the dark (to reduce photo-degradation) between 0-6°C, so extreme toxicant degradation for most chemicals is unlikely. Additionally, *C. dubia* in the samples with the extended holding times as mentioned above, still demonstrated an adverse response, as the SJR @ Buckley site exhibited reduced reproduction compared to the control (16.5 vs 23.9 neonates, respectively); therefore we consider the effect of this extended holding time to be negligible on the potential loss of toxicity of the samples.

Mokelumne and SJR @ Buckley samples initiated with *S. capricornutum* during the July 28, 2015 sampling date exhibited reduced growth compared to the control as well as unusually high %CV in the Mokelumne site. As SJR @ Buckley met the TIE trigger, we initiated both this site as well as Mokelumne in a follow-up toxicity/TIE test. Toxicity was lost in both samples. Further investigations suggested that the low replicate counts in the initial screening test may have been due to glassware contamination rather than ambient surface water toxicity. As a follow-up, we replaced all foam plugs associated with the replicate test chambers, and we modified our standard operating procedures for glassware washing to reduce the chance of contamination due to the acid bath soak or acetone rinse processes.

At the start of the project, we experienced some *C. dubia* health problems, as evidenced in the July 28, 2015 sampling event, when the initial screening test did not meet TAC. These samples were initiated in a retest, which did meet TAC, and as mentioned above, we consider that data to be reliable. Moreover, the *C. dubia* RT test for July was initiated on the same day as the ambient toxicity test and did meet all TAC, which led us to believe that the health problem was resolved. However, we were unable to meet TAC criteria for the August 18, 2015 event, its associated RT test, and all subsequent retests were unsuccessful. During this time, the Sacramento-Yolo Mosquito and Vector Control District (VCD) had been actively applying pesticides adjacent to the laboratory via aerial spraying during the late evening on the nine dates between July 29 and August 17, 2015. A pan of water left outside the laboratory on the eve of one of the spraying dates was submitted to USGS for chemical analysis, where 11.3 ng/L of Metolachlor (herbicide) and 271 ng/L Chlorothalonil (fungicide) were detected, however, these compounds are not used for vector control. In order to improve project completeness, we outsourced

the *C. dubia* ambient toxicity test and associated RT test for the September 2015 event to AQUA-Science (Davis, CA) while we investigated the source of the invertebrate health problem. Additional corrective actions included replacing all glassware and lab items associated with *C. dubia* work, decontamination of the laboratory, submission of control water to USGS for chemical analysis, and the initiation of two *C. dubia* health tests.

The first health test examined possible sources of contamination, including building location, water type and food source. In addition, three sources of organisms were compared. In this test, the most noteworthy problems contributing to declining organism health were our water sources and our organisms. Two water sources (reverse osmosis and *C. dubia* control water were sent to USGS for chemical analyses, but no pesticides were detected. Our *C. dubia* cultures were replaced with new organisms from Aquatic Research Organisms (ARO; Hampton, NH), the best performers in our initial health study. A secondary health test was initiated on October 2, 2015 to evaluate several sources of water in the laboratory. The results of this second test suggest that all sources of water at the laboratory were non-toxic. Replacing our culture organisms along with other decontamination efforts have resolved the health issues, as all subsequent *C. dubia* ambient toxicity and RT tests have met all TAC criteria.

6.7 Completeness

UCD AHP strives for a minimum of 90% completeness of work performed in accordance with SWAMP guidelines. With the exception the aforementioned tests listed above; all other bioassays met test acceptability criteria. For the purposes of this project, completeness was determined by considering the number of statistical analyses that could be made between ambient samples and their appropriate control(s). Total number of samples was determined by multiplying the number of events (13) by the number of sites collected (5) with the addition of field duplicates (6), which equals 71. These results are outlined in Table 102. During this project period, 206 out of 213 samples met test acceptability criteria, therefore we consider completeness to be 96.7%.

6.8 Reference toxicant tests

In general, testing organisms were considered to be within their normal ranges of sensitivity throughout the first project year. There are a few instances where one data point fell outside of the two standard deviations of the running effect concentration mean, as outlined below. Although outside of the prescribed organism sensitivity range as per USEPA guidance, a single data point is not necessarily considered a qualification in terms of organism sensitivity, as there is a 1/20 chance that a data point will fall outside of a +/- 2 SD range due to statistical chance alone. In these cases, a single data point is noted; however a qualification regarding an organism's sensitivity is made with the second data point which falls outside the 2 SD range. *P. promelas* EC25 (January and February, 2016) and *C. dubia* LC50 (July 2015 and February 2016) endpoints had multiple data points which fell outside of their respective SD ranges, and are qualified below.

P. promelas in January and February RT tests demonstrated very robust health, and as such, were less sensitive in the biomass EC25 endpoint. There was no associated toxicity in the February sampling event. However, in all subsequent RT tests, *P. promelas* biomass fell well within the 2 SD of the running mean, and any trend towards insensitivity has since been negated. At this time we are not able to explain the cause for the observed differences in EC25 sensitivity in these two months. Therefore, fish employed in the February test may be less sensitive than normal and toxicity may not have been observed because of this lack of sensitivity.

C. dubia LC50 endpoints in the July 2015 and February 2016 RT tests exceeded the 2SD range with LC50s of 5,278 and 5,555 µS/cm, respectively. Although organism performance is less sensitive than normal in these RT tests, reductions in both survival and reproduction were observed in the Hood site in the July, 2015 sampling event, and reduced reproduction was observed in the Hood and Ulatis Creek sites in the February 2016 sampling event. Although organisms may be less sensitive during these months, the observation of reduced *C. dubia* endpoints in the ambient toxicity tests makes this an unlikely scenario and we consider these data to be reliable.

RT control charts for the AHPL are presented below. In March, 2016, the AHPL changed the way *C. dubia* RT tests were conducted, moving away from conductivity-based RT test concentrations (µS/cm), and towards measured, g/L-based concentrations, as is done with *P. promelas*. Therefore, endpoints such as LC50 and EC25, have two separate control charts presented, delineating the two different measurement units, both as µS/cm and g/L.

The September, 2015 *C. dubia* RT test conducted at AquaScience, while not presented, fell within their 2 SD limits and their reproduction PMSD was 25.9%.

Single outliers with no qualifier required:
April 2015 *S. capricornutum* IC50 exceeded SD range with an IC50 of 55.18 mg/L

- This data point is not associated with this DRMP project.

October 2015 *S. capricornutum* control algal growth exceeded SD range with an average of 3.44 ($x10^6$) cell density

- RT test exhibited high algal growth, however associated algal growth in associated October test treatments were moderate.

November 2015 *C. dubia* reproduction exceeded SD range with an average of 33.1 neonates per adult.

- This was the second month after resolving *C. dubia* health problems and cladocerans were very robust. Associated test organisms in this month demonstrated strong fecundity with greater than 30 neonates in all test treatments.

January 2016 *P. promelas* LC50 exceeded SD range with an LC50 of 6.79 g/L.

- Observed significant reduction in biomass in site 541SJC501 in January sampling event.

February 2016 *C. dubia* EC25 exceeded SD range with an EC25 of 4,162 µS/cm.

- Observed significant reduction in reproduction in sites 510SACC3A and 511ULCABR in February sampling event.

6.9 Dates of reference toxicant tests

Table 6. Summary of reference toxicant test initiations

Month	Species	Initiation Date	Associated Ambient Sample Test Date
July	*P. promelas*	7/29/15	7/29/15
	C. dubia	7/29/15	8/7/15
August	*P. promelas*	8/19/15	8/19/15
	S. capricornutum	8/8/15	
September	*P. promelas*	9/25/15	9/25/15

Month	Species	Initiation Date	Associated Ambient Sample Test Date
	*C. dubia**	9/25/15	9/24/15
	S. capricornutum	9/29/15	9/25/15
October	*P. promelas*	10/22/15	10/22/15
	C. dubia	10/28/15	
	S. capricornutum	10/8/15	
November	*P. promelas*	11/11/15	11/11/15
	C. dubia	11/9/15	
	S. capricornutum	11/9/15	
December	*P. promelas*	12/16/15	12/16/15
	C. dubia	12/3/16	
	S. capricornutum	12/3/16	
January	*P. promelas*	1/20/16	1/20/16
	C. dubia	1/21/16	
	S. capricornutum	1/7/16	
February	*P. promelas*	2/18/16	2/18/16
	C. dubia	2/2/16	
	S. capricornutum	2/15/16	
March	*P. promelas*	3/8/16	3/8/16
	C. dubia	3/8/16	
	S. capricornutum	3/3/16	
April	*P. promelas*	4/20/16	4/20/16
	C. dubia	4/7/16	
	S. capricornutum	4/1/16	
May	*P. promelas*	5/19/16	5/19/16
	C. dubia	5/19/16	
	S. capricornutum	5/5/16	
June	*P. promelas*	6/16/16	6/16/16
	C. dubia	6/6/16	
	S. capricornutum	6/9/16	
July	*P. promelas*	7/14/16	7/14/16
	C. dubia	7/14/16	
	S. capricornutum	7/7/16	

* Conducted at AQUA-Science

6.10 RT test results and control charts

Table 7. Summary of *Pimephales promelas* RT endpoints

Test Month	Control Survival (%)	Survival LC50 (g/L)	Control Biomass (mg/ind.)	Biomass EC25 (g/L)	Biomass PMSD (%)
Jul-15	0.900	4.53	0.405	1.68	22.9
Aug-15	1.000	3.88	0.316	1.68	17.3
Sep-15	0.950	4.40	0.261	1.31	29.7
Oct-15	0.947	3.78	0.300	1.81	15.3
Nov-15	1.000	3.55	0.294	1.70	19.5
Dec-15	0.975	2.57	0.347	1.83	14.9
Jan-16	0.950	6.79	0.498	3.00	25.9
Feb-16	1.000	4.85	0.324	3.55	14.2
Mar-16	0.950	2.91	0.339	1.42	8.3
Apr-16	1.000	4.49	0.398	1.96	50.0
May-16	0.900	3.76	0.390	1.93	23.9
Jun-16	0.950	3.02	0.428	1.56	11.6
Jul-16	1.000	3.80	0.296	1.82	14.7

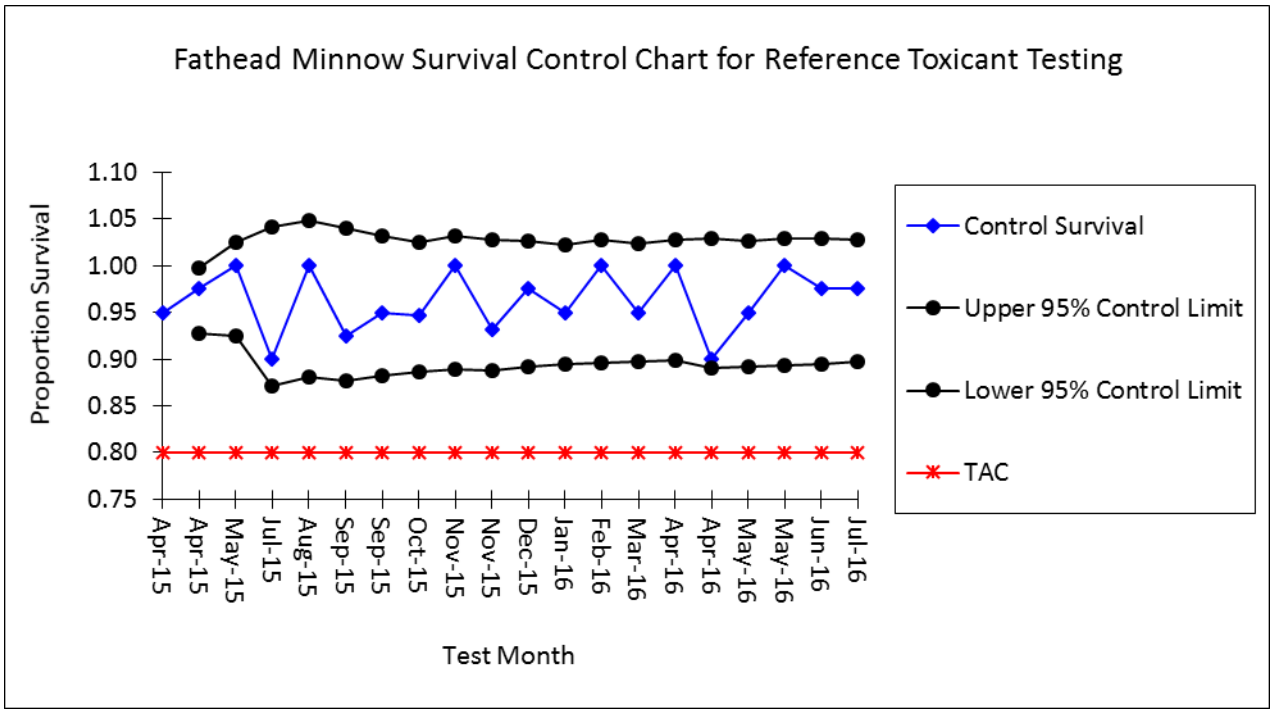

Figure 1. *P. promelas* control chart for survival

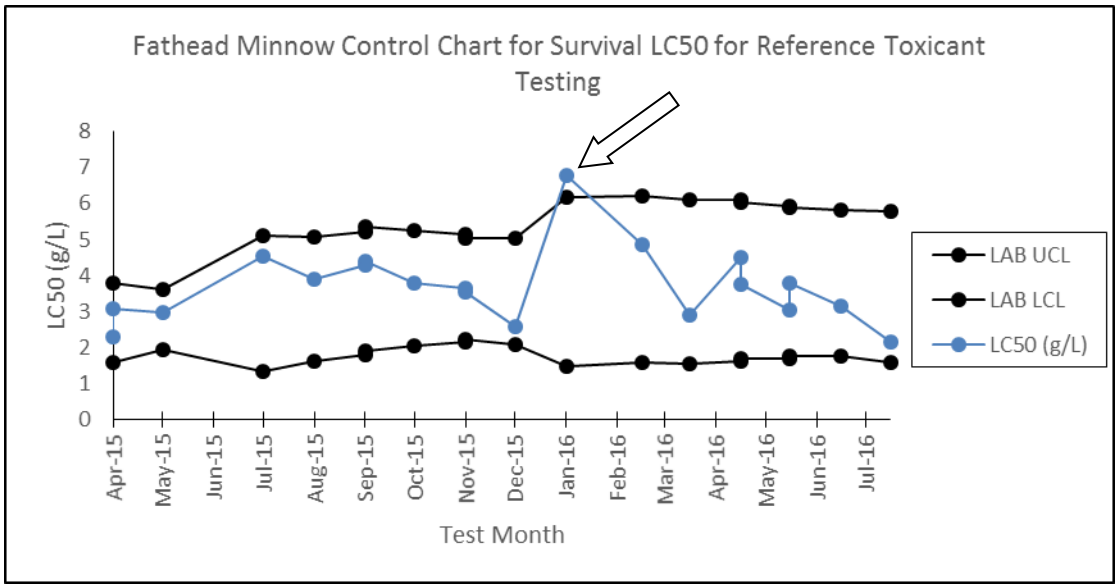

Figure 2. *P. promelas* control chart for survival LC50. Arrow indicates single outlier, no qualification

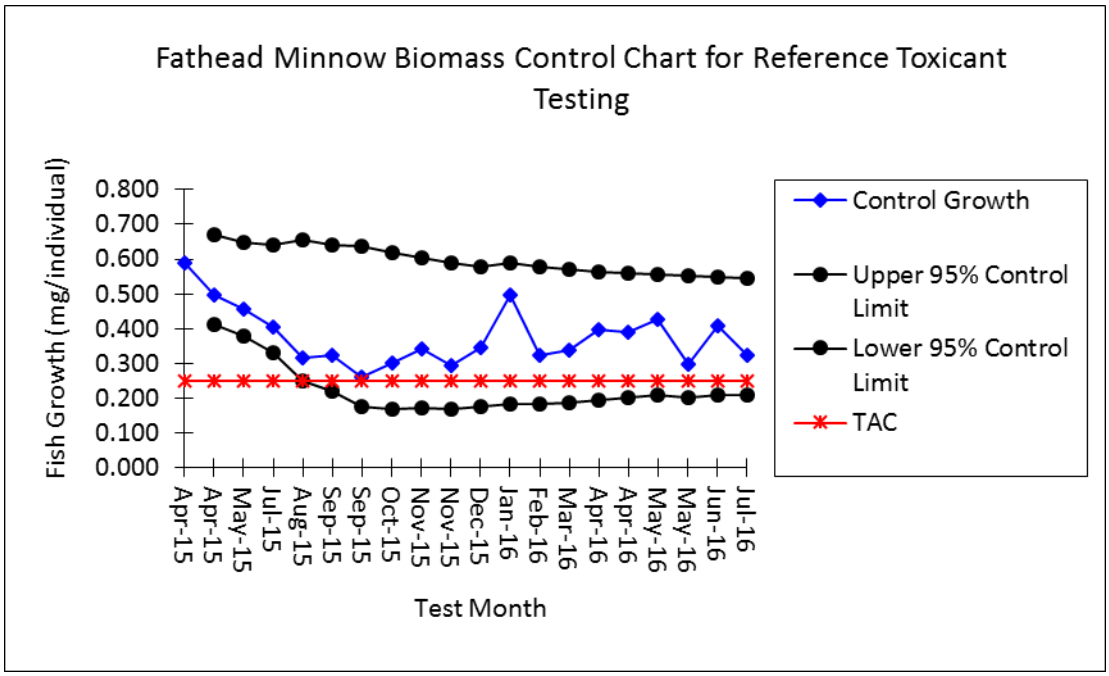

Figure 3. *P. promelas* control chart for biomass

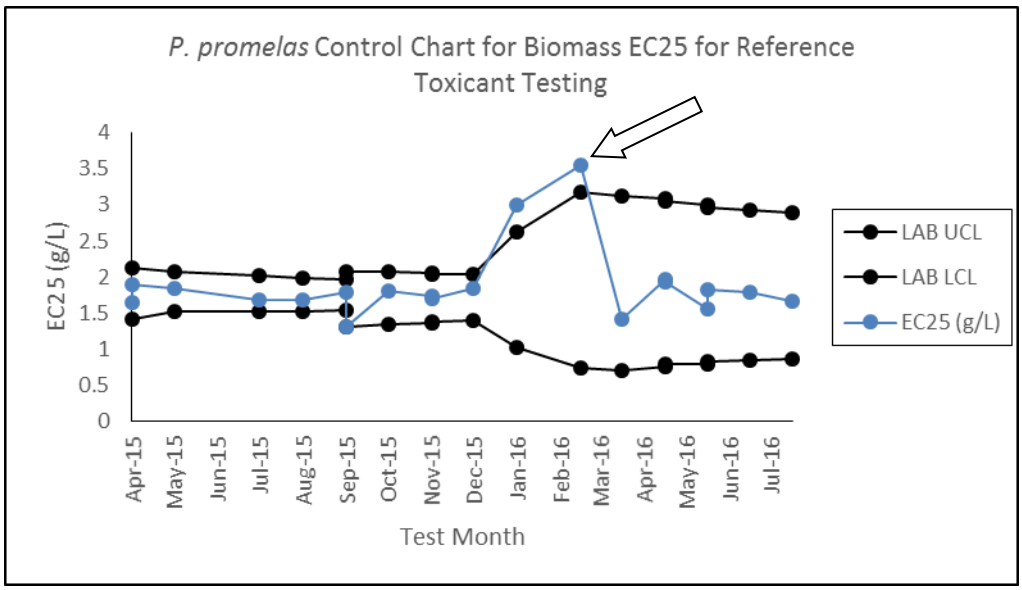

Figure 4. *P. promelas* control chart for biomass EC25. Arrow indicates second outlier; qualified in section 6.8

Table 8. Summary of *Ceriodaphnia dubia* RT endpoints

Test Month	Control Survival (%)	Survival LC50 (µS/cm)	Control Repro. (average)	Repro. EC25 (µS/cm)	Repro. PMSD (%)
Jul-15	1.00	5278	25.8	731.5	37.7
Oct-15	0.90	3923	24.1	1186.0	37.2
Nov-15	1.00	2297	33.1	1569.0	13.3
Dec-15	1.00	3281	27.9	2143.0	9.43
Jan-16	1.00	2828	29.2	1489.0	10.2
Feb-16	1.00	5555	27.9	4162.0	15.8
Mar-16	1.00	1.58 (g/L)	31.0	0.904 (g/L)	12.9
Apr-16	1.00	1.40 (g/L)	34.7	0.744 (g/L)	10.6
May-16	0.90	1.59 (g/L)	31.4	0.350 (g/L)	15.5
Jun-16	1.00	1.80 (g/L)	33.9	0.665 (g/L)	10.5
Jul-16	1.00	1.40 (g/L)	24.6	0.858 (g/L)	21.2

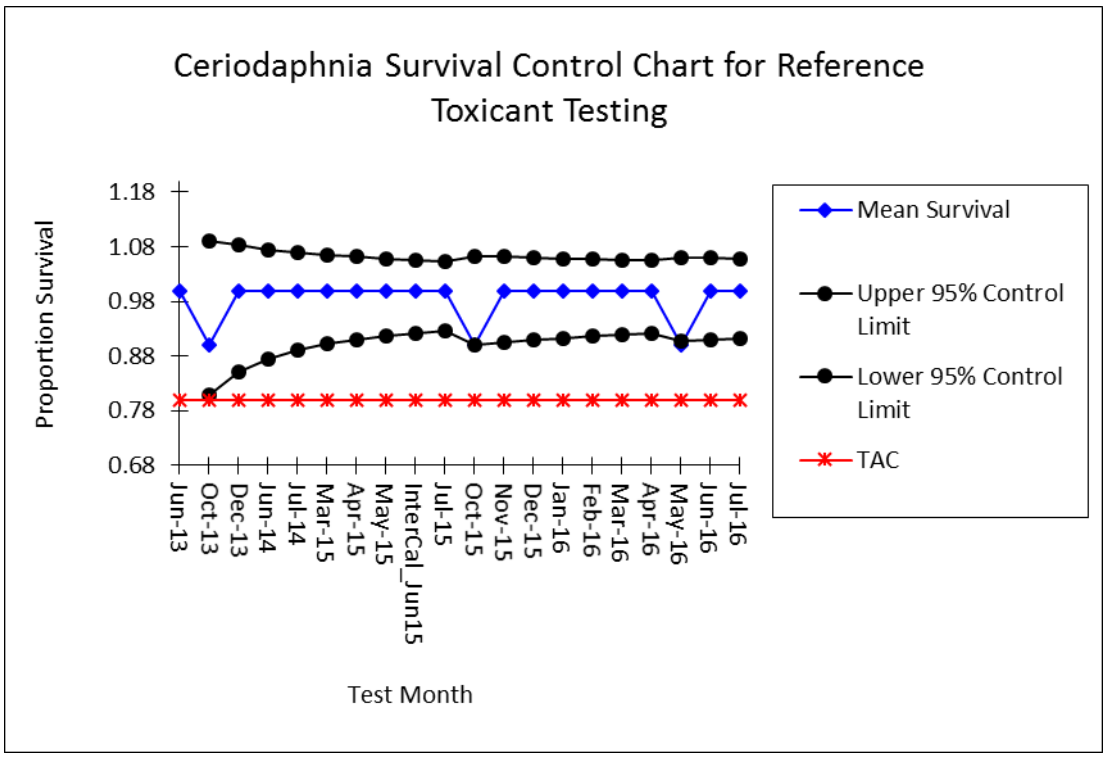

Figure 5. *C. dubia* control chart for survival

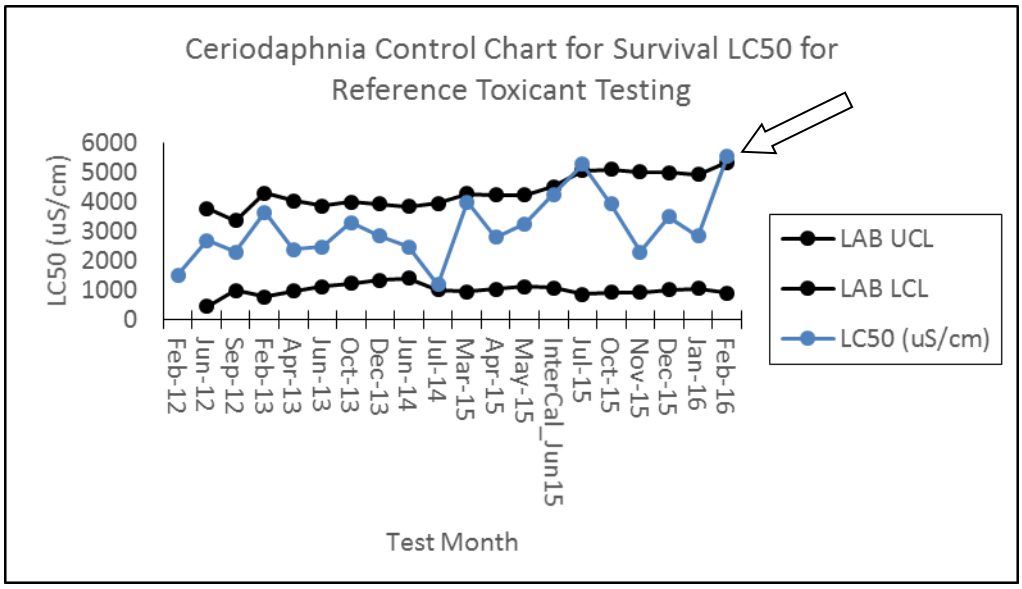

Figure 6a. *C. dubia* control chart for survival LC50: July 2015 - February 2016, µS/cm. Arrow indicates second outlier; qualified in Section 6.8.

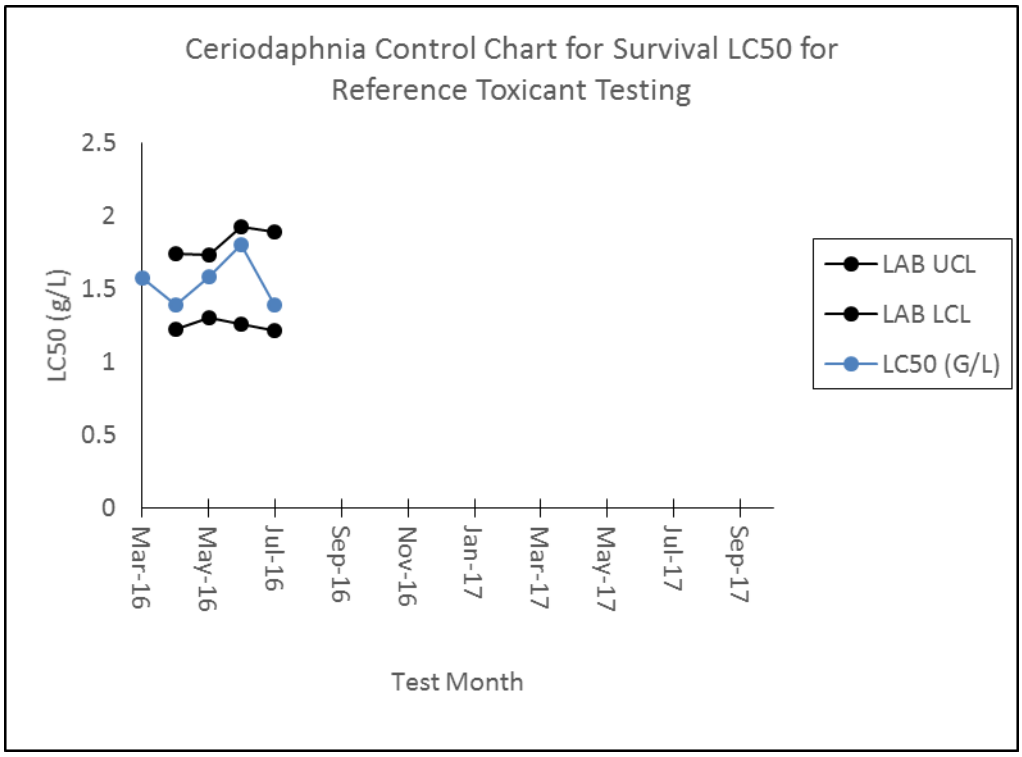

Figure 6b. *C. dubia* control chart for survival LC50: March – July, 2016, g/L

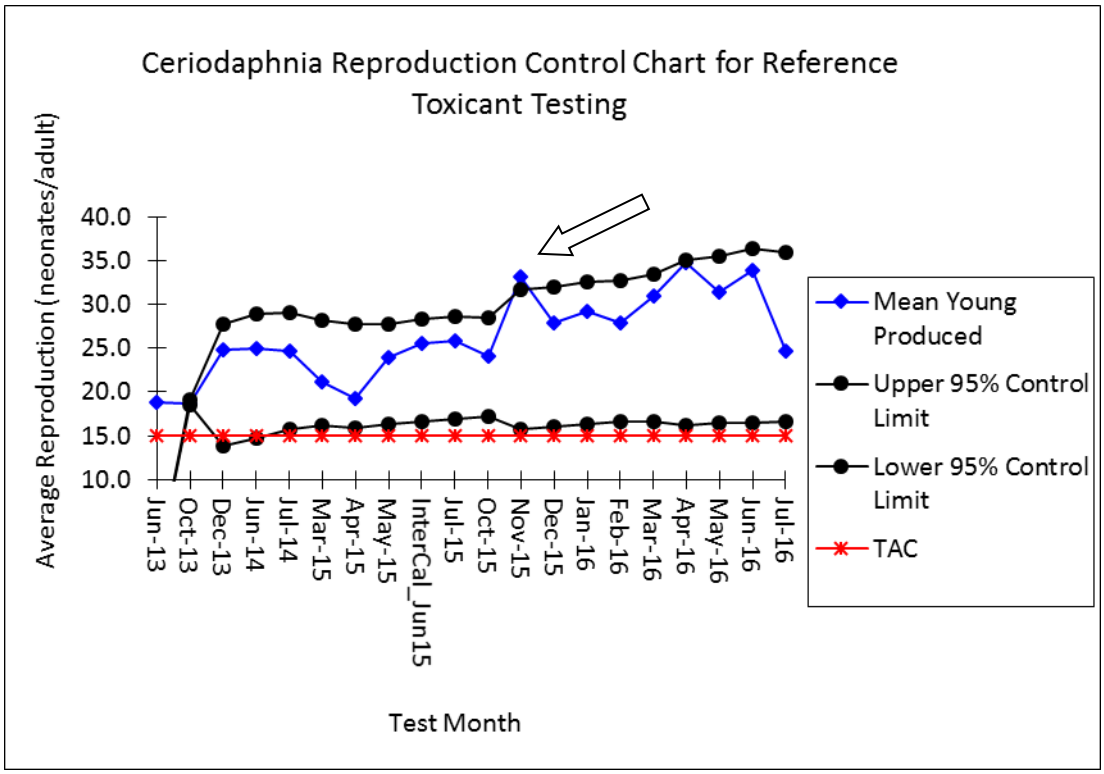

Figure 7. *C. dubia* control chart for reproduction. Arrow indicates first outlier, no qualification.

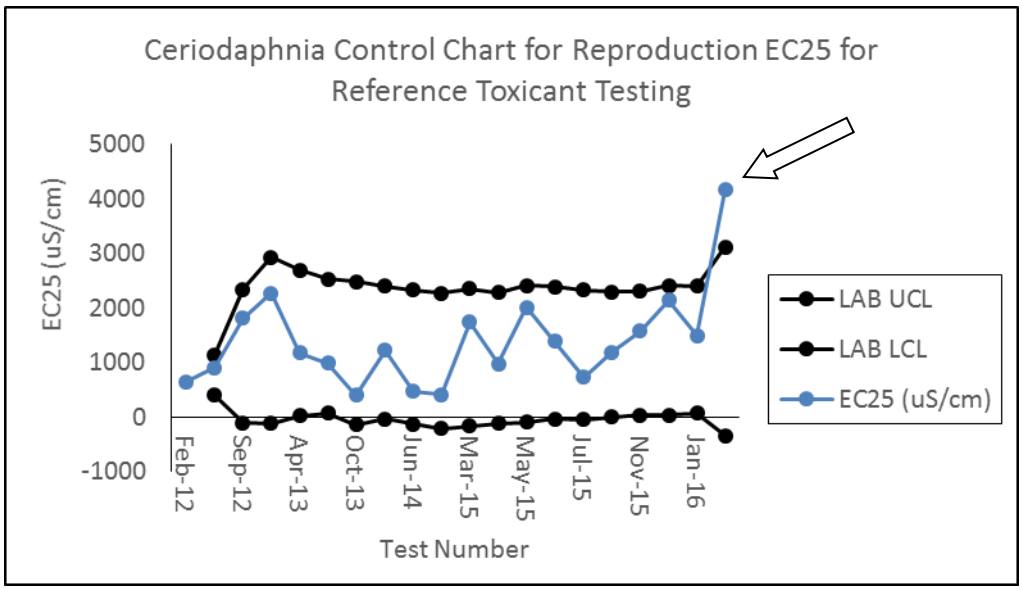

Figure 8a. *C. dubia* control chart for reproduction EC25: July 2015 – February 2016, µS/cm. Arrow indicates first outlier; no qualification.

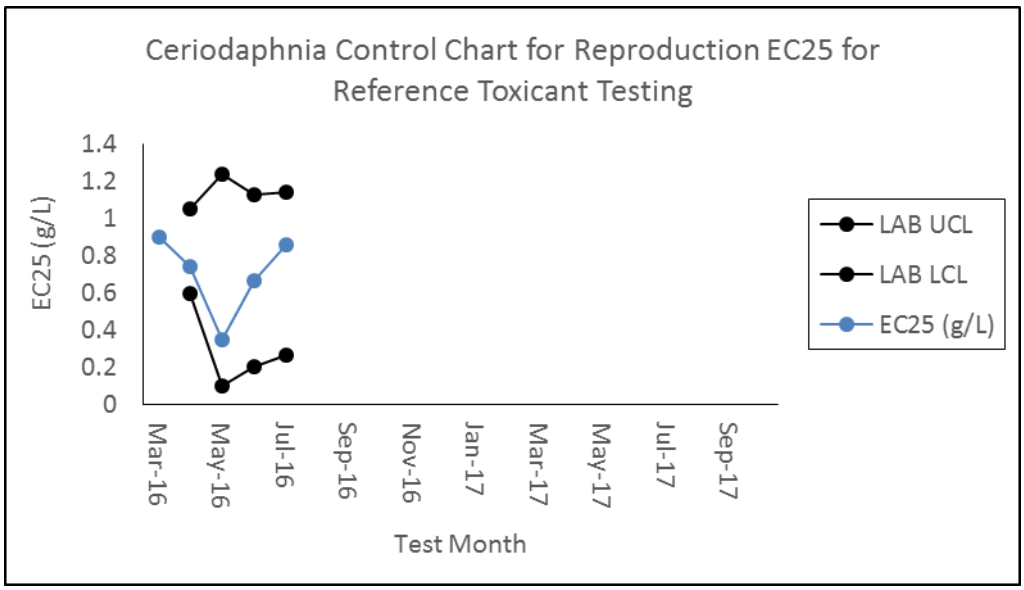

Figure 8b. *C. dubia* control chart for reproduction EC25: March – July, 2016, g/L

Table 9. Summary of *Selenastrum capricornutum* RT endpoints

Test Month	Control Growth ($x10^6$)	Growth LC50 (mg/L)	Growth PMSD (%)
Aug-15	1.760	9.25	8.44
Sep-15	2.575	19.03	10.3
Oct-15	3.447	29.77	31.2
Nov-15	1.040	18.77	14.4
Dec-15	1.610	11.44	6.57
Jan-16	1.613	31.49	9.18
Feb-16	1.522	43.40	12.4
Mar-16	2.482	21.02	8.46
Apr-16	2.206	24.02	20.1
May-16	2.159	32.23	11.4
Jun-16	2.010	17.80	9.84
Jul-16	1.754	19.80	6.82

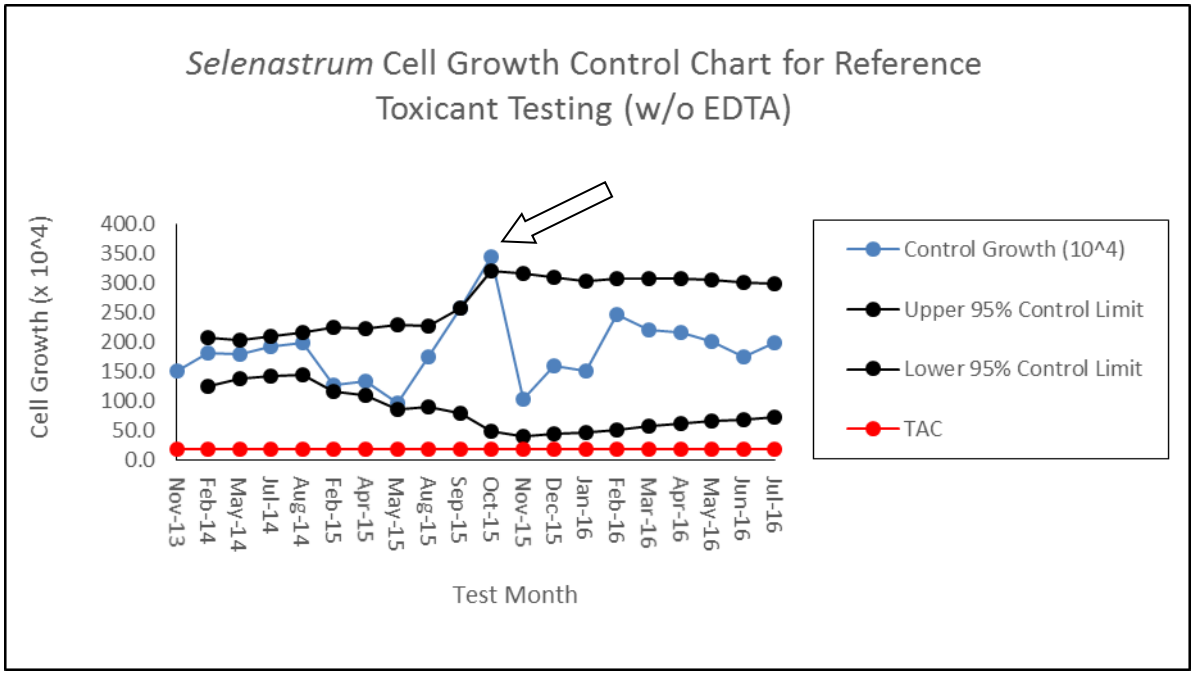

Figure 9. *S. capricornutum* control chart for growth. Arrow indicates first outlier; no qualification.

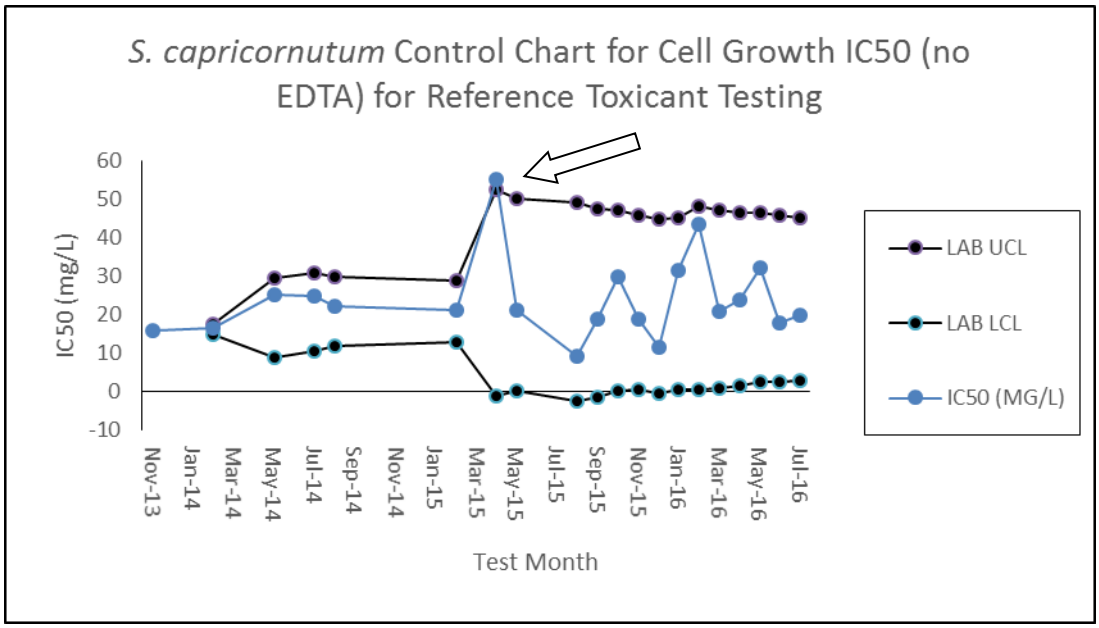

Figure 10. *S. capricornutum* control chart for growth IC50. Arrow indicates first outlier; no qualification.

7.0 Results of Ambient Monitoring Tests

7.1 Tables of test results

Table 10. Summary of *Pimephales promelas* test results

Month	Endpoint	Control	Hood	Mokelumne	SJR @ Buckley	SJR @ Vernalis	Ulatis Creek
July-15	Survival	95	95	98	90	93	94
	Biomass	0.362	0.386	0.379	0.422	0.416	0.429
Aug-15	Survival	98	98	100	100	100	100
	Biomass	0.379	0.323	0.321	0.324	0.322	0.335
Sept-15	Survival	98	95	68[+]/74	95	98	100
	Biomass	0.312	0.290	0.220[+]/0.305	0.309	0.306	0.338
Oct-15	Survival	93	93	30[+]/97	90	45[+]/100	90
	Biomass	0.313	0.297	0.111[+]/0.364	0.312	0.159[+]/0.410	0.331
Nov-15	Survival	100	93	88	95	100	100
	Biomass	0.365	0.315	0.346	0.357	0.342	0.364
Dec-15	Survival	100	95	98	100	97	100
	Biomass	0.358	0.337	0.375	0.367	0.373	0.351
Jan-16	Survival	100	100	98	97	98	100
	Biomass	0.566	0.499	0.483	0.519	0.445*	0.498
Feb-16	Survival	100	97	98	82	93	100
	Biomass	0.347	0.381	0.428	0.335	0.389	0.399
Mar-16	Survival	100	75	100	100	100	100
	Biomass	0.372	0.293	0.426	0.367	0.396	0.371
Apr-16	Survival	80	95	93	79	93	98
	Biomass	0.431	0.380	0.500	0.352	0.379	0.478
May-16	Survival	100	100	98	98	100	88

Month	Endpoint	Control	Hood	Mokelumne	SJR @ Buckley	SJR @ Vernalis	Ulatis Creek
	Biomass	0.280	0.280	0.377	0.278	0.311	0.280
Jun-16	Survival	98	95	93	100	100	100
	Biomass	0.415	0.444	0.425	0.450	0.448	0.487
Jul-16	Survival	100	98	100	100	90	100
	Biomass	0.310	0.313	0.363	0.347	0.327	0.333

*: Statistically different from control
+: Results of initial screening test/PRT follow-up test.

Table 11. Summary of *Ceriodaphnia dubia* test results

Month	Endpoint	Control	Hood	Mokelumne	SJR @ Buckley	SJR @ Vernalis	Ulatis Creek
Jul-15	Survival	100	100	100	100	100	100
	Repro.	24.4	23.8	23.7	16.5*	26.0	25.7
Sept-15	Survival	100	100	90	90	100	100
	Repro.	21.5	20.1	14.1*	21.6	22.4	23.6
Oct-15	Survival	100	90	100	100	100	88
	Repro.	31	23*	29	30	31	20*
Nov-15	Survival	100	100	100	100	90	100
	Repro.	31.8	31.5	30.3	32.2	29.8	31.2
Dec-15	Survival	100	100	100	100	80	100
	Repro.	29.9	31	32	30	31	36
Jan-16	Survival	100	100	100	0*	100	100
	Repro.	26	32	33	0*	37	18.9*
Feb-16	Survival	100	100	90	90	100	100
	Repro.	28	17*	24	18.3*	30	19*
Mar-16	Survival	100	100	80	100	90	100
	Repro.	29	29	27	31	25	32
Apr-16	Survival	100	100	100	100	100	100
	Repro.	33	25*	24	18*	24.7*	29
May-16	Survival	100	100	90	100	100	100
	Repro.	28	17.9*	18.8	19.1	31.2	30.8
Jun-16	Survival	100	100	100	90	100	100
	Repro.	32	19.6*	28	22.5*	25.7	32
Jul-16	Survival	100	70*	100	100	100	100
	Repro.	28	15*	19	24	31	32

*: Statistically different from control

Table 12. Summary of *Selenastrum capricornutum* test results. Numbers in the top box for each site are cell growth counts; numbers in the bottom box for each site represent organism performance relative to the control.

Month	Endpoint	Control	Hood	Mokelumne	SJR @ Buckley	SJR @ Vernalis	Ulatis Creek
Jul-15	Growth ($x10^6$)	2.143	2.545	0.748*/2.196	0.670*/1.956	2.285	1.947
			105%	31% / 102%	31% / 91%	107%	91%
Aug-15		1.971	2.429	2.066	1.720	2.021	2.091
			123%	105%	87%	103%	106%

Month	Endpoint	Control	Hood	Mokelumne	SJR @ Buckley	SJR @ Vernalis	Ulatis Creek
Sept-15		2.626	3.977	2.643	2.397	3.187	1.877*
			151%	101%	91%	121%	71%
Oct-15		1.445	2.755	2.671	1.695	2.891	3.231
			191%	185%	117%	200%	224%
Nov-15		1.544	3.836	2.992	2.849	2.983	1.950
			248%	194%	185%	193%	126%
Dec-15		1.063	2.648	2.559	1.938	2.716	1.753
			249%	241%	182%	256%	165%
Jan-16		1.513	1.799	2.426	1.067*	1.876	2.113
			119%	160%	71%	124%	140%
Feb-16		2.193	2.479	2.750	1.337*	2.194	1.421*
			113%	125%	62%	100%	65%
Mar-16		2.238	2.105	2.353	1.651*	2.296	2.223
			94%	105%	74%	103%	100%
Apr-16		1.660	2.207	2.476	1.120*	0.927*	2.498
			133%	149%	67%	56%	150%
May-16		1.566	2.144	2.075	1.946	0.948*	1.866
			137%	133%	124%	61%	119%
Jun-16		1.445	2.750	2.592	1.081	1.900	2.153
			190%	179%	75%	131%	149%
Jul-16		1.599	2.110	1.867	1.515	1.779	1.592
			132%	117%	95%	111%	100%

*: Statistically different from control

7.2 Summary tables for individual tests

Table 13. Results of a 7-day *P. promelas* toxicity test initiated on 7/29/15, examining the toxicity of ambient surface water samples collected on 7/28/15 by USGS.[1]

Sample	Survival (%)		Biomass (mg/individual)	
	Mean	SE	Mean	SE
ROEPAMH	95	2.9	0.362	0.022
Mokelumne	98	2.3	0.379	0.013
Hood	95	5.0	0.386	0.018
SJR @ Vernalis	93	2.5	0.416	0.009
SJR @ Buckley	90	5.8	0.422	0.023
Ulatis Creek	94	3.2	0.429	0.016
Bottle Blank	92	5.3	0.386	0.018

1. Highlighted cells indicate statistically significant reductions in survival or biomass compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.

Table 14. Results of a chronic *C. dubia* toxicity test initiated on 8/8/15, examining the toxicity of ambient surface water samples collected on 7/28/15 by USGS.[1]

Sample	Survival (%)		Reproduction	
	Mean	SE	Mean	SE
L1650	100	0.0	24	1.9
Mokelumne	100	0.0	24	1.0
Hood	100	0.0	24	1.0
SJR @ Vernalis	100	0.0	26	1.6
SJR @ Buckley	100	0.0	17	3.4
Ulatis Creek	100	0.0	26	1.0
Bottle Blank	100	0.0	23	1.0

1. Highlighted cells indicate statistically significant reductions in survival or reproduction compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.

Table 15. Results of a 96-hour chronic *S. capricornutum* toxicity test initiated on 7/29/15, examining the toxicity of ambient surface water samples collected on 7/28/15 by USGS.[1]

Sample	Cell Density ($x10^6$)		%CV
	Mean	SE	
Distilled Water	2.144	0.143	13.37
Mokelumne	0.748†	0.410	109.63
Hood	2.618	0.081	6.21
SJR @ Vernalis	2.285	0.123	10.74
SJR @ Buckley	0.699†	0.057	17.23
Ulatis Creek	1.947	0.087	8.94
Bottle Blank	1.648	0.091	11.00

1. Highlighted cells indicate statistically significant reductions in cell growth compared to the laboratory control. Data were analyzed using SWAMP statistical protocols. †Likely due to glassware contamination.

Table 16. Results of a 96-hour chronic *S. capricornutum* follow-up toxicity test initiated on 8/8/15, examining the toxicity of ambient surface water samples collected on 7/28/15 by USGS.[1]

Sample	Cell Density ($x10^6$)		%CV
	Mean	SE	
Distilled Water	1.761	0.070	7.97
Mokelumne	2.196	0.051	4.61
SJR @ Buckley	1.956	0.068	6.94

1. Highlighted cells indicate statistically significant reductions in cell growth compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.

Table 17. Results of a *P. promelas* 7-day toxicity test initiated on 8/19/15, examining the toxicity of ambient surface water samples collected on 8/18/15 by USGS.[1]

Sample	Survival (%)		Biomass (mg/individual)	
	Mean	SE	Mean	SE
ROEPAMH	98	2.5	0.379	0.06
Hood	98	2.5	0.323	0.00
Mokelumne	100	0.0	0.321	0.01
SJR @ Buckley	100	0.0	0.324	0.01
Dup: SJR @ Buckley	100	0.0	0.305	0.01
SJR @ Vernalis	100	0.0	0.322	0.01
Ulatis Creek	100	0.0	0.335	0.02
Bottle Blank	100	0.0	0.327	0.01

1. Highlighted cells indicate statistically significant reductions in survival or biomass compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.

Table 18. Results of a 96-hour chronic *S. capricornutum* toxicity test initiated on 8/19/15, examining the toxicity of ambient surface water samples collected on 8/18/15 by USGS.[1]

Sample	Cell Density ($x10^6$)		%CV
	Mean	SE	
Distilled Water	1.971	0.068	6.94
Hood	2.429	0.103	8.47
Mokelumne	2.066	0.050	4.86
SJR @ Buckley	1.720	0.080	9.25
Dup: SJR @ Buckley	1.801	0.038	4.20
SJR @ Vernalis	2.021	0.094	9.29
Ulatis Creek	2.091	0.047	4.50
Bottle Blank	1.611	0.072	8.91

1. Highlighted cells indicate statistically significant reductions in cell growth compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.

Table 19. Results of a 7-day *P. promelas* toxicity test initiated on 9/25/15, examining the toxicity of ambient surface water samples collected on 9/23/15 by USGS.[1]

Sample	Survival (%)		Biomass (mg/individual)	
	Mean	SE	Mean	SE
ROEPAMH	98	2.5	0.312	0.005
Hood	95	2.9	0.290	0.018
Mokelumne	68	22.5	0.220	0.074
SJR @ Buckley	95	5.0	0.309	0.018
SJR @ Vernalis	98	2.5	0.306	0.007
Ulatis Creek	100	0.0	0.338	0.007

1. Highlighted cells indicate statistically significant reductions in survival or biomass compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.

Table 20. Results of a 7-day *P. promelas* Pathogen-Related Toxicity follow-up test initiated on 10/1/15, examining the toxicity of ambient surface water samples collected on 9/23/15 by USGS.[1]

Sample	Survival (%)		Biomass (mg/individual)	
	Mean	SE	Mean	SE
ROEPAMH	92	2.6	0.536	0.179
Mokelumne	74	5.3	0.305	0.020

1. Highlighted cells indicate statistically significant reductions in survival or biomass compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.

Table 21. Results of a chronic *C. dubia* toxicity test initiated on 9/24/15 by AQUA-Science, examining the toxicity of ambient surface water samples collected on 9/23/15 by USGS.[1]

Sample	Survival (%)		Reproduction[2]	
	Mean	SE	Mean	SE
L1650	100	0.0	22	1.4
Hood	100	0.0	20	1.4
Mokelumne	90	0.1	14	3.0
SJR @ Buckley	90	0.1	22	1.4
SJR @ Vernalis	100	0.0	22	1.0
Ulatis Creek	100	0.0	24	2.7

1. Highlighted cells indicate statistically significant reductions in survival or reproduction compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.
2. Changes in test termination protocols affected the reproduction endpoint. This table has been corrected to reflect these changes.

Table 22. Results of a 96-hour chronic *S. capricornutum* toxicity test initiated on 9/24/15, examining the toxicity of ambient surface water samples collected on 9/23/15 by USGS.[1]

Sample	Cell Density ($x10^6$)		%CV
	Mean	SE	
Distilled Water	2.626	0.095	7.23
Hood	3.977	0.057	2.86
Mokelumne	2.643	0.134	10.14
SJR @ Buckley	2.397	0.180	14.99
SJR @ Vernalis	3.187	0.081	5.06
Ulatis Creek	1.877	0.055	5.85

1. Highlighted cells indicate statistically significant reductions in cell growth compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.

Table 23. Results of a 7-day *P. promelas* toxicity test initiated on 10/22/15, examining the toxicity of ambient surface water samples collected on 10/21/15 by USGS.[1]

Sample	Survival (%)		Biomass (mg/individual)	
	Mean	SE	Mean	SE
ROEPAMH	93	4.8	0.313	0.008
Hood	93	4.8	0.297	0.016
Mokelumne	30	23.5	0.113	0.064
SJR @ Buckley	90	4.1	0.312	0.009
541SJC501	45	24.0	0.159	0.074
Ulatis Creek	90	10.0	0.331	0.021
Dup: SJR @ Vernalis	98	2.5	0.316	0.009
Bottle Blank	63	23.9	0.219	0.109
Low EC Control	98	2.5	0.281	0.009

1. Highlighted cells indicate statistically significant reductions in survival or biomass compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.

Table 24. Results of a 7-day *P. promelas* Pathogen-Related Toxicity follow-up test initiated on 10/29/15, examining the toxicity of ambient surface water samples collected on 10/21/15 by USGS.[1]

Sample	Survival (%)		Biomass (mg/individual)	
	Mean	SE	Mean	SE
ROEPAMH	98	2.5	0.379	0.015
Mokelumne	97	2.8	0.355	0.012
SJR @ Vernalis	100	0.0	0.410	0.006
Bottle Blank	98	2.5	0.396	0.013

1. Highlighted cells indicate statistically significant reductions in survival or biomass compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.

Table 25. Results of a chronic *C. dubia* toxicity test initiated on 10/22/15, examining the toxicity of ambient surface water samples collected on 10/21/15 by USGS.[1]

Sample	Survival (%)		Reproduction	
	Mean	SE	Mean	SE
L1650	100	0.0	30	1.7
Hood	90	0.1	23	2.7
Mokelumne	100	0.0	29	0.8
SJR @ Buckley	100	0.0	30	0.7
SJR @ Vernalis	100	0.0	31	0.9
Ulatis Creek	88	0.1	20	4.2
Dup: SJR @ Vernalis	100	0.0	32	1.5
Bottle Blank	100	0.0	27	1.4
Low EC Control	90	0.1	17	2.8

1. Highlighted cells indicate statistically significant reductions in survival or reproduction compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.

Table 26. Results of a 96-hour chronic *S. capricornutum* toxicity test initiated on 10/22/15, examining the toxicity of ambient surface water samples collected on 10/21/15 by USGS.[1]

Sample	Cell Density ($x10^6$)		%CV
	Mean	SE	
Distilled Water	1.445	0.033	4.57
Hood	2.755	0.145	10.51
Mokelumne	2.671	0.230	17.24
SJR @ Buckley	1.695	0.117	13.79
SJR @ Vernalis	2.891	0.196	13.55
Ulatis Creek	3.264	0.244	15.21
Dup: SJR @ Vernalis	2.661	0.114	7.41
Bottle Blank	1.195	0.137	19.85

1. Highlighted cells indicate statistically significant reductions in cell growth compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.

Table 27. Results of a 7-day *P. promelas* toxicity test initiated 11/11/15, examining the toxicity of ambient surface water samples collected on 11/10/15 by USGS.[1]

Sample	Survival (%)		Biomass (mg/individual)	
	Mean	SE	Mean	SE
ROEPAMH	100	0.0	0.365	0.020
Hood	93	4.8	0.315	0.020
Mokelumne	88	6.3	0.346	0.032
SJR @ Buckley	95	5.0	0.357	0.013
SJR @ Vernalis	100	0.0	0.342	0.010
Ulatis Creek	100	0.0	0.364	0.012
Low EC Control	100	0.0	0.355	0.010

1. Highlighted cells indicate statistically significant reductions in survival or biomass compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.

Table 28. Results of a chronic *C. dubia* toxicity test initiated 11/11/15, examining the toxicity of ambient surface water samples collected on 11/10/15 by USGS.[1]

Sample	Survival (%)		Reproduction[2]	
	Mean	SE	Mean	SE
L1650	100	0.0	32	0.7
Hood	100	0.0	32	1.1
Mokelumne	100	0.0	30	0.9
SJR @ Buckley	100	0.0	32	1.5
SJR @ Vernalis	90	0.1	30	4.6
Ulatis Creek	100	0.0	31	3.1
Low EC Control	100	0.0	26	0.8

1. Highlighted cells indicate statistically significant reductions in survival or reproduction compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.
2. Changes in test termination protocol affected the reproduction endpoint. This table has been updated to reflect these changes.

Table 29. Results of a 96-hour chronic *S. capricornutum* toxicity test initiated 11/11/15, examining the toxicity of ambient surface water samples collected on 11/10/15 by USGS.[1]

Sample	Cell Density (x10^6)		%CV
	Mean	SE	
Distilled Water	1.454	0.029	4.095
Hood	3.836	0.063	3.289E-06
Mokelumne	2.992	0.021	1.39E-06
SJR @ Buckley	2.850	0.069	4.87E-06
SJR @ Vernalis	2.983	0.042	2.81E-06
Ulatis Creek	1.950	0.102	1.05E-05

1. Highlighted cells indicate statistically significant reductions in cell growth compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.

Table 30. Results of a 7-day *P. promelas* toxicity test initiated on 12/16/15, examining the toxicity of ambient surface water samples collected on 12/15/15 by USGS.[1]

Sample	Survival (%)		Biomass (mg/individual)	
	Mean	SE	Mean	SE
ROEPAMH	100	0.00	0.358	0.020
Hood	95	5.00	0.337	0.008
SJR @ Buckley	100	0.00	0.367	0.005
SJR @ Vernalis	97	2.78	0.373	0.007
Ulatis Creek	100	0.00	0.351	0.017
Dup: Hood	100	0.00	0.364	0.010
PRT: ROEPAMH	100	0.00	0.501	0.094
PRT: Mokelumne	98	2.50	0.375	0.014
PRT: Low EC Control	98	2.50	0.388	0.014

1. Highlighted cells indicate statistically significant reductions in survival or biomass compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.

Table 31. Results of a chronic *C. dubia* toxicity test initiated on 12/16/15, examining the toxicity of ambient surface water samples collected on 12/15/15 by USGS.[1]

Sample	Survival (%)		Reproduction[2]	
	Mean	SE	Mean	SE
L1650	100	0.00	30	0.83
Hood	100	0.00	31	0.57
Mokelumne	100	0.00	32	0.61
SJR @ Buckley	100	0.00	30	1.14
SJR @ Vernalis	80	0.13	31	1.43
Ulatis Creek	100	0.00	36	0.46
Dup: Hood	100	0.00	30	0.56
Low EC Control	100	0.00	13	1.55

1. Highlighted cells indicate statistically significant reductions in survival or reproduction compared to the0.76 laboratory control. Data were analyzed using SWAMP statistical protocols.
2. Changes in test termination protocols affected the reproduction endpoint. This table has been updated to reflect those changes.

Table 32. Results of a 96-hour chronic *S. capricornutum* toxicity test initiated on 12/16/15, examining the toxicity of ambient surface water samples collected on 12/15/15 by USGS.[1]

Sample	Cell Density (x10^6)		%CV
	Mean	SE	
Distilled Water	1.063	0.024	4.46
Hood	2.648	0.129	9.78
Mokelumne	2.559	0.027	2.12
SJR @ Buckley	1.938	0.028	2.79
SJR @ Vernalis	2.716	0.073	5.39
Ulatis Creek	1.753	0.024	2.72
Dup: Hood	2.713	0.084	6.21

1. Highlighted cells indicate statistically significant reductions in cell growth compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.

Table 33. Results of a *P. promelas* 7-day toxicity test initiated on 1/20/16, examining the toxicity of ambient surface water samples collected on 1/19/16 by USGS.[1]

Sample	Survival (%)		Biomass (mg/individual)	
	Mean	SE	Mean	SE
ROEPAMH	100	0.00	0.566	0.031
Hood	100	0.00	0.499	0.020
SJR @ Buckley	97	2.78	0.519	0.017
SJR @ Vernalis	98	2.50	0.445	0.009
Ulatis Creek	100	0.00	0.498	0.032
Dup: 511ULCABR	100	0.00	0.514	0.021
PRT: ROEPAMH	90	4.08	0.437	0.023
PRT: Mokelumne	98	2.50	0.483	0.038
PRT: Low EC Control	93	4.79	0.456	0.024

1. Highlighted cells indicate statistically significant reductions in survival or biomass compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.

Table 34. Results of a chronic *C. dubia* toxicity test initiated on 1/20/16, examining the toxicity of ambient surface water samples collected on 1/19/16 by USGS.[1]

Sample	Survival (%)		Reproduction	
	Mean	SE	Mean	SE
L1650	100	0.00	26	1.15
Hood	100	0.00	32	0.87
Mokelumne	100	0.00	33	1.00
SJR @ Buckley	0	0.00	0	0.00
SJR @ Vernalis	100	0.00	37	1.01
Ulatis Creek	100	0.00	19	1.49
Dup: Ulatis Creek	100	0.00	21	1.53
Low EC Control	90	0.10	22	0.79

1. Highlighted cells indicate statistically significant reductions in survival or reproduction compared to the0.76 laboratory control. Data were analyzed using SWAMP statistical protocols.

Table 35. Results of an acute *C. dubia* dilution series toxicity test initiated 1/21/16, examining the toxicity of site 544LSAC13 collected on 1/19/16 by USGS.

Sample	Survival (%)	
	Mean	SE
SSEPAMH	94	6.25
SJR @ Buckley: 6.25%	95	5.00
SJR @ Buckley: 12.5%	100	0.00
SJR @ Buckley: 25%	85	15.00
SJR @ Buckley: 50%	100	0.00
SJR @ Buckley: 100%	95	5.00

Table 36. Results of a chronic *C. dubia* Phase I Toxicity Identification Evaluation initiated 1/23/16, examining the toxicity of site 544LSAC13 collected on 1/19/16 by USGS.

Sample	Survival (%)		Reproduction [1]
	Mean	SE	
SSEPAMH	100	0.00	8
SSEPAMH + MeOH @ 0.6%	100	0.00	0
SSEPAMH + Eluate addback @ 3x	100	0.00	0
SSEPAMH + 10 mg/L EDTA	100	0.00	0
SSEPAMH + 40 mg/L EDTA	100	0.00	0
SSEPAMH + BSA @ 30x equivalence	91	5.34	0
SSEPAMH + BSA @ 100x equivalence	100	0.00	4
SSEPAMH + Carboxylesterase @ 30x	100	0.00	9
SSEPAMH + Carboxylesterase @ 100x	100	0.00	12
SSEPAMH C8 Blank	100	0.00	4
SSEPAMH Centrifuged	100	0.00	0
SJR @ Buckley	100	0.00	60
SJR @ Buckley + 2.5 mg/L EDTA	100	0.00	56
SJR @ Buckley + 10 mg/L EDTA	100	0.00	46
SJR @ Buckley + 40 mg/L EDTA	80	8.16	0
SJR @ Buckley + BSA @ 30x equivalence	90	5.77	62
SJR @ Buckley + BSA @ 100x equivalence	100	0.00	46
SJR @ Buckley + Carboxylesterase @ 30x	100	0.00	75
SJR @ Buckley + Carboxylesterase @ 100x	100	0.00	93
SJR @ Buckley C8 Rinsate	100	0.00	61
SJR @ Buckley Centrifuged	100	0.00	30

1. Acute protocol-style test that was extended to 7 days due to lack of toxicity. Reproduction observed daily and was summed across replicates, not averaged, as each replicate held five *C. dubia*.

Table 37. Results of an acute *C. dubia* mini PBO Toxicity Identification Evaluation initiated 1/25/16, examining the toxicity of site 544LSAC13 collected on 1/19/16 by USGS.

Sample	Survival (%)		Reproduction [1]
	Mean	SE	
SSEPAMH	100	0.00	4
SSEPAMH + 50 ppb PBO	100	0.00	11
SSEPAMH + 100 ppb PBO	100	0.00	7
SJR @ Buckley	92	4.81	54
SJR @ Buckley + 50 ppb PBO	100	0.00	67
SJR @ Buckley + 100 ppb PBO	100	0.00	72

1. Reproduction observed daily and was summed across replicates, not averaged, as each replicate held five *C. dubia*.

Table 38. Results of an acute *C. dubia* mini PBO follow-up test initiated 2/17/16, examining the toxicity of site 544LSAC13 collected on 1/19/16 by USGS.

Sample	Survival (%)		Reproduction [1]
	Mean	SE	
SSEPAMH	75	9.57	0
SSEPAMH + MeOH	100	0.00	0
SSEPAMH + Eluate	100	0.00	0
SSEPAMH + MeOH + Eluate	80	14.14	0
SSEPAMH + Eluate + PBO	95	5.00	0

1. Reproduction observed daily and was summed across replicates, not averaged, as each replicate held five *C. dubia*.

Table 39. Results of a 96-hour chronic *S. capricornutum* toxicity test initiated on 1/20/16, examining the toxicity of ambient surface water samples collected on 1/19/16 by USGS.[1]

Sample	Cell Density ($x10^6$)		%CV
	Mean	SE	
Distilled Water	1.513	0.096	12.69
Hood	1.799	0.069	7.67
Mokelumne	2.426	0.096	7.88
SJR @ Buckley	1.067	0.082	15.40
SJR @ Vernalis	1.876	0.047	5.02
Ulatis Creek	2.113	0.094	8.92
Dup: Ulatis Creek	2.034	0.062	6.07

1. Highlighted cells indicate statistically significant reductions in cell growth compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.

Table 40. Results of a 7-day *P. promelas* toxicity test initiated on 2/18/16, examining the toxicity of ambient surface water samples collected on 2/17/16 by USGS.[1]

Sample	Survival (%)		Biomass (mg/individual)	
	Mean	SE	Mean	SE
ROEPAMH	100	0.00	0.347	0.012
Hood	97	2.78	0.381	0.025
SJR @ Buckley	82	14.32	0.335	0.048
SJR @ Vernalis	93	4.79	0.389	0.016
Ulatis Creek	100	0.00	0.399	0.015
Field Blank	100	0.00	0.376	0.013
PRT: ROEPAMH	93	2.50	0.434	0.020
PRT: Mokelumne	98	2.50	0.428	0.017
PRT: Low EC Control	95	2.89	0.418	0.026

1. Highlighted cells indicate statistically significant reductions in survival or biomass compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.

Table 41. Results of a chronic *C. dubia* toxicity test initiated on 2/18/16, examining the toxicity of ambient surface water samples collected on 2/17/16 by USGS.[1]

Sample	Survival (%)		Reproduction	
	Mean	SE	Mean	SE
L1650	100	0.00	28	0.81
Hood	100	0.00	17	2.67
Mokelumne	90	0.10	24	1.03
SJR @ Buckley	90	0.10	24	1.74
SJR @ Vernalis	100	0.00	30	0.52
Ulatis Creek	100	0.00	19	1.45
Field Blank	90	0.10	15	2.31
Low EC Control	90	0.10	16	2.10

1. Highlighted cells indicate statistically significant reductions in survival or reproduction compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.
2. A typographical error was found with the field blank, which affected the reproduction endpoint. This table has been updated to reflect that change.

Table 42. Results of a 96-hour chronic *S. capricornutum* toxicity test initiated on 2/18/16, examining the toxicity of ambient surface water samples collected on 2/17/16 by USGS.[1]

Sample	Cell Density ($x10^6$)		%CV
	Mean	SE	
Distilled Water	2.193	0.055	4.98
Hood	2.479	0.099	8.02
Mokelumne	2.750	0.096	6.97
SJR @ Buckley	1.337	0.076	11.33
SJR @ Vernalis	2.194	0.061	5.52
Ulatis Creek	1.421	0.074	10.36
Field Blank	2.240	0.067	6.02

1. Highlighted cells indicate statistically significant reductions in cell growth compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.

Table 43. Results of a 7-day *P. promelas* toxicity test initiated on 3/8/16, examining the toxicity of ambient surface water samples collected on 3/7/16 by USGS.[1]

Sample	Survival (%)		Biomass (mg/individual)	
	Mean	SE	Mean	SE
ROEPAMH	100	0.00	0.372	0.011
Hood	75	25.00	0.293	0.098
SJR @ Buckley	100	0.00	0.367	0.015
SJR @ Vernalis	100	0.00	0.396	0.007
Ulatis Creek	100	0.00	0.371	0.024
PRT: ROEPAMH	100	0.00	0.436	0.015
PRT: Mokelumne	100	0.00	0.426	0.014
PRT: Low EC Control	88	4.79	0.353	0.043

1. Highlighted cells indicate statistically significant reductions in survival or biomass compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.

Table 44. Results of a 7-day *P. promelas* Pathogen-Related Toxicity follow-up test initiated on 3/15/16, examining the toxicity of Sacramento River at Hood collected on 3/7/16 by USGS.[1]

Sample	Survival (%)		Biomass (mg/individual)	
	Mean	SE	Mean	SE
ROEPAMH	100	0.00	0.477	0.007
Hood	93	7.50	0.410	0.011

1. Highlighted cells indicate statistically significant reductions in survival or biomass compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.

Table 45. Results of a chronic *C. dubia* toxicity test initiated on 3/8/16, examining the toxicity of ambient surface water samples collected on 3/7/16 by USGS.[1]

Sample	Survival (%)		Reproduction	
	Mean	SE	Mean	SE
L1650	100	0.00	29	1.20
Hood	100	0.00	29	1.93
Mokelumne	80	0.13	27	3.21
SJR @ Buckley	100	0.00	31	1.33
SJR @ Vernalis	90	0.10	25	3.21
Ulatis Creek	100	0.00	32	1.09
Low EC Control	100	0.00	24	0.84

1. Highlighted cells indicate statistically significant reductions in survival or reproduction compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.

Table 46. Results of a 96-hour chronic *S. capricornutum* toxicity test initiated on 3/8/16, examining the toxicity of ambient surface water samples collected on 3/7/16 by USGS.[1]

Sample	Cell Density ($x10^6$)		%CV
	Mean	SE	
Distilled Water	2.238	0.072	6.45
Hood	2.105	0.081	7.66
Mokelumne	2.353	0.221	18.75
SJR @ Buckley	1.651	0.092	11.09
SJR @ Vernalis	2.296	0.187	16.32
Ulatis Creek	2.223	0.133	11.94

1. Highlighted cells indicate statistically significant reductions in cell growth compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.

Table 47. Results of a 7-day *P. promelas* toxicity test initiated 4/20/16, examining the toxicity of ambient surface water samples collected on 4/19/16 by USGS.[1]

Sample	Survival (%)		Biomass (mg/individual)	
	Mean	SE	Mean	SE
ROEPAMH	80	4.08	0.341	0.021
Hood	95	3.06	0.380	0.007
SJR @ Buckley	79	10.44	0.352	0.045
SJR @ Vernalis	93	4.79	0.379	0.015
Ulatis Creek	98	2.50	0.478	0.006
Dup: SJR @ Buckley	90	7.07	0.434	0.021
PRT: ROEPAMH	98	2.50	0.490	0.022
PRT: Mokelumne	93	4.79	0.500	0.026
PRT: Low EC Control	90	4.08	0.456	0.027

1. Highlighted cells indicate statistically significant reductions in survival or biomass compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.

Table 48. Results of a chronic *C. dubia* toxicity test initiated 4/20/16, examining the toxicity of ambient surface water samples collected on 4/19/16 by USGS.[1]

Sample	Survival (%)		Reproduction[3]	
	Mean	SE	Mean	SE
L1650	100	0.00	33	0.79
Hood	100	0.00	25	2.28
Mokelumne[2]	100	0.00	24	1.90
SJR @ Buckley	100	0.00	18	1.77
SJR @ Vernalis	100	0.00	25	1.58
Ulatis Creek	100	0.00	29	2.32
Dup: SJR @ Buckley	100	0.00	16	1.51
Low EC Control	90	0.10	18	2.59

1. Highlighted cells indicate statistically significant reductions in survival or reproduction compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.
2. This site was compared to the Low EC Control and was not significantly different.
3. Typographical errors were found with SJR at Buckley and Vernalis, which affected the reproduction endpoint. This table has been updated to reflect those changes.

Table 49. Results of a 96-hour chronic *S. capricornutum* toxicity test initiated 4/20/16, examining the toxicity of ambient surface water samples collected on 4/19/16 by USGS.[1]

Sample	Cell Density (x10^6)		%CV
	Mean	SE	
Distilled Water	1.660	0.051	6.16
Hood	2.207	0.062	5.59
Mokelumne	2.476	0.020	1.61
SJR @ Buckley	1.120	0.059	10.61
SJR @ Vernalis	0.927	0.094	20.35
Ulatis Creek	2.498	0.133	10.69
Dup: SJR @ Buckley	1.206	0.079	13.13

1. Highlighted cells indicate statistically significant reductions in cell growth compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.

Table 50. Results of a 7-day *P. promelas* toxicity test initiated 5/19/16, examining the toxicity of ambient surface water samples collected on 5/18/16 by USGS.[1]

Sample	Survival (%)		Biomass (mg/individual)	
	Mean	SE	Mean	SE
ROEPAMH	100	0.00	0.280	0.005
Hood	100	0.00	0.280	0.007
SJR @ Buckley	98	2.50	0.278	0.010
SJR @ Vernalis	100	0.00	0.311	0.004
Ulatis Creek	88	12.50	0.280	0.036
PRT: ROEPAMH	93	4.79	0.342	0.004
PRT: Mokelume	98	2.50	0.377	0.011
PRT: Low EC Control	98	2.50	0.362	0.014

1. Highlighted cells indicate statistically significant reductions in survival or biomass compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.

Table 51. Results of a chronic *C. dubia* toxicity test initiated 5/19/16, examining the toxicity of ambient surface water samples collected on 5/18/16 by USGS.[1]

Sample	Survival (%)		Reproduction[2]	
	Mean	SE	Mean	SE
L1650	100	0.00	28	1.51
Hood	100	0.00	18	2.04
Mokelumne[3]	90	0.10	19	0.82
SJR @ Buckley	100	0.00	19	1.81
SJR @ Vernalis	100	0.00	31	2.83
Ulatis Creek	100	0.00	31	1.98
Low EC Control	100	0.00	17	0.74

1. Highlighted cells indicate statistically significant reductions in survival or reproduction compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.
2. Changes in test termination protocols affected the survival and reproduction endpoints. This table has been updated to reflect these changes.
3. This site was compared to the Low Conductivity Control.

Table 52. Results of a 96-hour chronic *S. capricornutum* toxicity test initiated 5/19/16, examining the toxicity of ambient surface water samples collected on 5/18/16 by USGS.[1]

Sample	Cell Density (x10^6)		%CV
	Mean	SE	
Distilled Water	1.566	0.024	3.06
Hood	2.144	0.030	2.80
Mokelumne	2.075	0.046	4.47
SJR @ Buckley	1.946	0.036	3.70
SJR @ Vernalis	0.948	0.043	9.02
Ulatis Creek	1.866	0.030	3.25

1. Highlighted cells indicate statistically significant reductions in cell growth compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.

Table 53. Results of a 7-day *P. promelas* toxicity test initiated 6/16/16, examining the toxicity of ambient surface water samples collected on 6/15/16 by USGS.[1]

Sample	Survival (%)		Biomass (mg/individual)	
	Mean	SE	Mean	SE
ROEPAMH	98	2.50	0.415	0.016
Hood	95	2.89	0.444	0008
SJR @ Buckley	100	0.00	0.450	0.012
SJR @ Vernalis	100	0.00	0.448	0.009
Ulatis Creek	100	0.00	0.487	0.018
Field Blank	100	0.00	0.425	0.011
PRT: ROEPAMH	90	5.77	0.415	0.039
PRT: Mokelumne	93	4.79	0.425	0.020
PRT: Low EC Control	98	2.50	0.421	0.011

1. Highlighted cells indicate statistically significant reductions in survival or biomass compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.

Table 54. Results of a chronic *C. dubia* toxicity test initiated 6/16/16, examining the toxicity of ambient surface water samples collected on 6/15/16 by USGS.[1]

Sample	Survival (%)		Reproduction[2]	
	Mean	SE	Mean	SE
L1650	100	0.00	32	1.02
Hood	100	0.00	20	1.50
Mokelumne	100	0.00	28	2.17
SJR @ Buckley	90	0.13	23	3.64
SJR @ Vernalis	100	0.10	26	1.97
Ulatis Creek	100	0.00	32	0.88
Low EC Control	70	0.15	25	0.38
Field Blank	100	0.00	32	0.68

1. Highlighted cells indicate statistically significant reductions in survival or reproduction compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.
2. Changes in test termination protocol affected the survival and reproduction endpoints. This table has been updated to reflect these changes.

Table 55. Results of a 96-hour chronic *S. capricornutum* toxicity test initiated 6/16/16, examining the toxicity of ambient surface water samples collected on 6/15/16 by USGS.[1]

Sample	Cell Density ($x10^6$)		%CV
	Mean	SE	
Distilled Water	1.445	0.028	3.90
Hood	2.750	0.158	11.52
Mokelumne	2.592	0.162	12.54
SJR @ Buckley	1.081	0.207	38.38
SJR @ Vernalis	1.900	0.212	22.36
Ulatis Creek	2.153	0.051	4.69
Field Blank	1.644	0.051	6.16

1. Highlighted cells indicate statistically significant reductions in cell growth compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.

Table 56. Results of a 7-day *P. promelas* toxicity test initiated 7/14/16, examining the toxicity of ambient surface water samples collected on 7/13/16 by USGS.[1]

Sample	Survival (%)		Biomass (mg/individual)	
	Mean	SE	Mean	SE
ROEPAMH	100	0.00	0.310	0.010
Hood	98	2.50	0.313	0.010
SJR @ Buckley	100	0.00	0.347	0.011
SJR @ Vernalis	90	4.08	0.327	0.014
Ulatis Creek	100	0.00	0.333	0.009
PRT: ROEPAMH	98	2.50	0.377	0.010
PRT: Mokelumne	100	0.00	0.363	0.005
PRT: Dup, Mokelumne	100	0.00	0.375	0.015
PRT: Low EC Control	98	2.50	0.367	0.011

1. Highlighted cells indicate statistically significant reductions in survival or biomass compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.

Table 57. Results of a chronic *C. dubia* toxicity test initiated 7/14/16, examining the toxicity of ambient surface water samples collected on 7/13/16 by USGS.[1]

Sample	Survival (%)		Reproduction	
	Mean	SE	Mean	SE
L1650	100	0.00	28	0.60
Hood	70	0.15	15	3.27
Mokelumne[2]	100	0.00	19	1.01
SJR @ Buckley	100	0.00	24	0.82
SJR @ Vernalis	100	0.00	31	3.17
Ulatis Creek	100	0.00	32	1.38
Dup: Mokelumne	100	0.00	20	1.65
Low EC Control	100	0.00	17	0.89

1. Highlighted cells indicate statistically significant reductions in survival or reproduction compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.
2. This site was compared to the Low EC Control and was not significantly different.

Table 58. Results of a 96-hour chronic *S. capricornutum* toxicity test initiated 7/14/16, examining the toxicity of ambient surface water samples collected on 7/13/16 by USGS.[1]

Sample	Cell Density (x10^6)		%CV
	Mean	SE	
Distilled Water	1.599	0.126	15.73
Hood	2.110	0.118	11.17
Mokelumne	1.867	0.048	5.10
SJR @ Buckley	1.515	0.104	13.71
SJR @ Vernalis	1.779	0.060	6.71
Ulatis Creek	1.592	0.040	5.03
Dup: Mokelumne	2.038	0.101	9.88

1. Highlighted cells indicate statistically significant reductions in cell growth compared to the laboratory control. Data were analyzed using SWAMP statistical protocols.

7.3 Tabulate QA data

Table 59. Relative Percent Differences among field duplicates

Endpoint	Species	Relative Percent Differences (%)	Field Date	Sample
Survival	*P. promelas*	0.00	8/18/15	544LSAC13 San Joaquin River @ Buckley Cove
Biomass		6.00		
EC		2.06, 1.15		
DO		0.48,2.75, 1.06, 0.64, 1.70, 5.45, 0.13, 2.99, 0.13, 0.73, 0.76, 1.70, 3.13		
pH		1.21, 1.07, 0.12, 0.48, 0.36, 1.74, 0.49, 3.66, 0.36, 1.69, 0.12, 2.20, 0.12, 0.25		
Temperature		0.83, 0.00, 0.40, 0.81, 0.86, 0.00, 1.59, 2.79		
Growth	*S. capricornutum*	4.59		
EC		0.45, 3.84		
DO		0.82, 6.02		
pH		0.48, 0.12, 0.24, 1.99		
Temperature		0.45, 0.42, 2.49, 0.42, 0.83		
Hardness	NA	8.45		
Alkalinity		3.85		
Ammonia		33.33* (both values ND)		
Survival	*P. promelas*	73.68*	10/21/15	541SJC501 San Joaquin River at Vernalis
Biomass		66.09*		
EC		46.43*, 0.66		
DO		0.73, 9.99, 0.61, 0.24, 1.73, 1.09, 9.75, 2.01, 0.24, 0.12, 1.86, 1.29, 1.35		
pH		2.58, 1.61, 2.58, 1.01, 0.50, 1.76, 1.36, 3.50, 0.24, 0.12, 0.12, 0.00,		

Endpoint	Species	Relative Percent Differences (%)	Field Date	Sample
		0.61, 0.12		
Temperature		0.00, 0.00, 0.00, 0.43, 1.27, 0.42, 1.23, 0.87		
Survival	*C. dubia*	0.00		
Reproduction		1.90		
EC		4.73, 0.99		
DO		0.83, 0.26, 2.21, 1.62, 0.38, 1.36, 0.62, 0.72, 3.00, 1.46, 7.60, 0.87, 0.73, 0.47		
pH		0.72, 0.48, 1.23, 0.61, 0.13, 0.24, 0.25, 0.97, 0.12, 1.21, 0.00, 0.12, 1.11, 0.48		
Temperature		0.41, 0.00, 3.32, 0.00, 3.39, 0.79, 0.40		
Growth	*S. capricornutum*	8.26		
EC		0.19, 1.82		
DO		0.47, 0.47		
pH		0.12, 0.24, 0.00, 0.95, 0.48		
Temperature		0.82, 1.17, 0.40, 1.17, 0.81		
Hardness	NA	3.51		
Alkalinity		0.00		
Ammonia		0.00		
Survival	*P. promelas*	5.13	12/15/15	510SACC3A Sacramento River at Hood
Biomass		7.63		
EC		1.09 1.05		
DO		2.46 0.12 0.00 1.71 1.34 0.97 2.62 0.72 0.12 0.24 0.37 1.68 0.73		
pH		0.49 0.74 2.03 0.49 0.62 0.74 0.37 0.24 0.37 0.25 0.37 0.12 3.79		
Temperature		1.35 1.75 0.44 0.44 0.43 0.00 0.45 0.42		
Survival	*C. dubia*	0.00		
Reproduction		5.28		
EC		22.65* 0.64		
DO		0.60 3.07 1.32 3.41 4.20 0.24 0.97 0.12 1.83 0.49 1.72 0.84 3.45 0.87 1.27		
pH		0.00 0.50 0.24 0.49 0.84 0.49 0.12 0.00 0.24 0.25 1.61 0.49		
Temperature		0.43 0.83 0.41 1.65 0.84 2.92 1.21		
Growth	*S.*	2.42		

Endpoint	Species	Relative Percent Differences (%)	Field Date	Sample
EC	*capricornutum*	0.71 22.11*		
DO		1.62 1.32		
pH		1.47 0.96 2.45 0.31 1.26		
Temperature		1.21 2.00 1.21 3.62 0.86		
Hardness	NA	0.00		
Alkalinity		0.00		
Ammonia		12.50		
Survival	*P. promelas*	0.00	1/19/16	511ULCABR Ulatis Creek at Brown Road
Biomass		3.19		
EC		1.36 3.12		
DO		3.14 1.76 0.25 3.23 0.14 0.64 0.00 0.13 6.50 4.68 3.87 0.91 1.30 1.26		
pH		1.77 0.62 0.12 0.13 0.64 0.00 0.63 0.51 6.18 0.00 4.57 0.26 0.91 0.50		
Temperature		0.44 0.00 0.00 0.40 0.42 1.19 0.85 0.43		
Survival	*C. dubia*	0.00		
Reproduction		9.00		
EC		3.10 0.67		
DO		0.13 0.84 1.84 0.65 8.89 0.38 0.36 4.08 0.63 2.91 0.24 5.26		
pH		0.25 1.30 1.74 0.65 0.93 1.35 0.25 0.65 0.26 0.53 1.25 0.92		
Temperature		0.40 1.74 0.38 0.00 0.41 0.81		
Growth	*S. capricornutum*	3.80		
EC		1.31 10.27		
DO		0.33 0.37		
pH		0.62 0.62 0.48 0.00 0.86		
Temperature		0.40 2.04 0.40 1.20 0.78		
Hardness	NA	5.13		
Alkalinity		3.51		
Ammonia		4.00		
Survival	*P. promelas*	13.29	4/19/16	544LSAC13 San Joaquin River at Buckley Cove
Biomass		20.91*		
EC		0.59 8.39		
DO		0.49 1.81 1.86 0.87 0.48 2.03 0.13 3.23 0.99 0.87 2.14 3.02 0.40		
pH		0.06 0.02 0.13 0.08 0.07 0.06 0.04 0.09 0.04 0.04		

Endpoint	Species	Relative Percent Differences (%)					Field Date	Sample
		0.02	0.01	0.09	0.03			
Temperature		0.42	0.84	0.41	0.00	1.31		
		0.41	0.00	0.00				
Survival	*C. dubia*	0.00						
Reproduction		3.64						
EC		0.48	0.57					
DO		1.08	0.13	0.12	1.72	0.25		
		0.00	0.71	1.53	2.74	0.25		
		0.99	6.03					
pH		0.15	0.07	0.11	0.04	0.02		
		0.09	0.00	0.01	0.03	0.09		
		0.00	0.02					
Temperature		0.41	0.81	0.40	0.81	0.40		
		0.00	3.29					
Growth	*S. capricornutum*	7.36						
EC		2.57	0.00					
DO		0.60	0.51					
pH		0.01	0.01	0.05	0.00			
Temperature		0.41	0.00	0.41	0.00	0.43		
Hardness	NA	0.00						
Alkalinity		0.00						
Ammonia		49.16*						
Survival	*P. promelas*	0.00					7/13/16	544SAC002 Mokelumne River at New Hope Road
Biomass		3.50						
EC		4.73	11.42					
DO		0.37	0.66	0.37	2.11	0.49		
		0.68	1.40	0.98	0.24	0.27		
		0.50	0.57	0.00	0.63			
pH		0.06	0.04	0.03	0.06	0.04		
		0.01	0.07	0.03	0.01	0.12		
		0.09	0.03	0.01	0.02			
Temperature		0.00	0.82	0.83	0.82	0.41		
		0.40	0.42					
Survival	*C. dubia*	0.00						
Reproduction		4.08						
EC		69.48*	102.43*					
DO		0.12	0.65	0.12	3.70	0.00		
		2.16	2.66	0.48	1.64	0.40		
		0.37	1.52	0.93				
pH		0.12	0.15	0.04	0.10	0.10		
		0.00	0.25	0.01	0.08	0.10		
		0.01	0.02	0.02				
Temperature		0.41	1.28	0.42	0.82	0.00		
		2.06	0.41					
Growth	*S.*	8.78						

Endpoint	Species	Relative Percent Differences (%)					Field Date	Sample
EC	*capricornutum*	11.67	18.60					
DO		0.36	5.63					
pH		0.47	0.28	0.23	0.07	0.04		
Temperature		0.41	0.00	0.41	0.40	5.63		
Hardness		0.00						
Alkalinity	NA	0.00						
Ammonia		0.00						

* These RPDs did not meet SWAMP MQOs. Please see RPD section above.

Table 60. Project completeness

Species	Expected Number of Events	Completed Number of Events	Completeness (%)
P. promelas	71	70	98.6
C. dubia	71	65	91.6
S. capricornutum	71	71	100.0
Average of three species' completeness over the project:			**96.7**

8.0 Toxicity Identification Evaluations

Samples which exhibit a 50% reduction in any endpoint compared to the appropriate control are initiated in a Toxicity Identification Evaluations (TIEs). In 2015, two samples met this TIE criterion: site 544SAC002 (Mokelumne River at New Hope Road) and site 544LSAC13 (San Joaquin River at Buckley Cove) in the *S. capricornutum* test initiated on July 29, 2015. These samples were initiated in a follow-up toxicity test on August 8, 2015, and in addition to a retest of the ambient samples, included C8 column manipulations. As mentioned in Section 6 (Deviations) above, we were unable to recover toxicity of these samples thus, the toxicity observed in the initial screening test was likely due to glassware contamination.

In 2016, the San Joaquin River at Buckley Cove (544LSAC13) met the TIE trigger in the January 19, 2016 event, with *C. dubia* exhibiting 100% mortality within 24 h of test initiation. This site was initiated in a dilution series test on the same day as observed toxicity, January 21, 2016; however all dilutions in this test exhibited good survival, exceeding 80%. A Phase I TIE was initiated on January 23, 2016, and again, all treatments exhibited good survival, at least 80%. On January 25, 2016, the San Joaquin River at Buckley Cove site was initiated in a mini-PBO follow-up test, and no mortality was observed (minimum 92% survival in all treatments). Finally, on February 17, 2016, the concentrated sample eluate was tested with PBO to rule out pyrethroids as the potential toxicant (known for their hydrophobic nature, toxicity may be lost due to adsorption to storage and test chambers), but no mortality was observed (95% survival). Through multiple follow-up tests, we were not able to recover the toxicity observed in the initial screening test, and we cannot determine the cause or source of that toxicity at this time.

9.0 Summary

Samples were collected monthly from July 28, 2015 to July 13, 2016. During this period there were 30 instances of observed toxicity, observed in 18 tests conducted during the reporting period, and are outlined below in Table 61.

The San Joaquin River at Buckley Cove (544LSAC13) had the highest number of significantly reduced endpoints (10), with one *C. dubia* survival impairment, five *C. dubia* reproductive impairments, and four instances of reduced algal growth. The Sacramento River at Hood (510SACC3A) had one *C. dubia* survival impairment and seven instances of reduced *C. dubia* fecundity. The San Joaquin River at Vernalis (541JSC501) had one instance of Pathogen-Related Toxicity, one reduced *P. promelas* biomass endpoint, two instances of reduced algal growth and one instance of reduced *C. dubia* reproduction. Ulatis Creek at Brown Road (510SOL010/511ULCABR) had four instances of impairment, two each of reduced *C. dubia* reproduction and reduced algal growth. The Mokelumne River at New Hope Road had three instances of toxicity, two of which were Pathogen-Related Toxicity with *P. promelas* that was alleviated when initiated in the follow-up PRT style protocol toxicity test (which led to using PRT-style protocol for the remainder of the project period in initial screening tests), and one instance of reduced *C. dubia* reproduction. These instances of observed toxicity, other than those described above, did not meet applicable TIE triggers and therefore we are unable to determine the cause or source of toxicity at this time.

Table 61. Summary of toxicity

Site Name	Site Location	Sample Date	Spp.	Endpoint	Follow-up
544LSAC13	SJR at Buckley Cove	7/28/15	*C. dubia*	Reproduction	
544SAC002	Mokelumne River at New Hope Rd.	9/23/15	FHM	PRT	Toxicity alleviated
			C. dubia	Reproduction	
510SOL010	Ulatis Creek at Brown Rd.		Algae	Cell growth	
544SAC002	Mokelumne River at New Hope Rd.	10/21/15	FHM	PRT	Toxicity alleviated
541SJC501	SJR at Vernalis		FHM	PRT	Toxicity alleviated
510SACC3A	Sac River at Hood		*C. dubia*	Reproduction	
510SOL010	Ulatis Creek at Brown Rd.		*C. dubia*	Reproduction	
544LSAC13	SJR at Buckley Cove	1/19/16	*C. dubia*	Survival	TIE: Lost Toxicity
				Reproduction	
510SACC3A	Sac River at Hood		*C. dubia*	Reproduction	
541SJC501	SJR at Vernalis		FHM	Biomass	
544LSAC13	SJR at Buckley Cove		Algae	Growth	
544SACC3A	Sac River at Hood	2/17/16	*C. dubia*	Reproduction	
511ULCABR	Ulatis Creek at Brown Rd.		*C. dubia*	Reproduction	
			Algae	Growth	
544LSAC13	SJR @ Buckley Cove		Algae	Growth	
544LSAC13	SJR @ Buckley Cove	3/7/16	Algae	Growth	
510SACC3A	Sac River @ Hood	4/19/16	*C. dubia*	Reproduction	
544LSAC13	SJR @ Buckley Cove		*C. dubia*	Reproduction	
			Algae	Growth	
541SJC501	SJR @ Vernalis		Algae	Growth	
			C. dubia	Reproduction	
541SJC501	SJR @ Vernalis	5/18/16	Algae	Growth	
510SACC3A	Sac River @ Hood		*C. dubia*	Reproduction	
544LSAC13	SJR @ Buckley Cove		*C. dubia*	Reproduction	
510SACC3A	Sac River @ Hood	6/15/16	*C. dubia*	Reproduction	
544LSAC13	SJR @ Buckley Cove		*C. dubia*	Reproduction	
510SACC3A	Sac River @ Hood	7/13/16	*C. dubia*	Survival	
				Reproduction	