Contract Progress Report

Progress Report # 2

Reporting Period: Nov. 30, 2013 to Jun. 30, 2014

Submittal Date July 1, 2014

Contract No: Department of Pesticide Regulation - **#13-C0029**

Project Name: Environmental monitoring of the constructed water quality pond at Folsom, CA

Contractor Name: UC Davis Aquatic Health Program Laboratory

I certify under penalty of law that this document and all attachments were prepared by me or under my direction in accordance with the terms and conditions of each Contract Exhibit. Based on my inquiry of the persons or persons who manage the project or those directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. All information submitted in this document and all attachments conform to and are in accordance with the state and federal laws and I so here certify with my signature. I am aware that there are significant penalties for submitting false or misleading information.

Project Director: Dr. Swee Teh (Printed Name)  (Signature)

Summary of Work to be Completed

Items for Review #	Due Date	% Of Work Complete	Date Submitted
Task 1 Macroinvertebrate Community Survey			
1.1 Kicknet Sample Collection	Dec 2015	50%	July 1, 2014
1.2 Taxonomic Identification	Dec 2015	25%	July 1, 2014
1.3 Physical Habitat and Water Quality Data	Dec 2015	38%	July 1, 2014
Task 2 Laboratory Toxicity Tests			
2.1 H. azteca and S. capricornutum Tests	Dec 2015	38%	July 1, 2014
2.2 Dilution Series Tests	Dec 2015	38%	July 1, 2014
Task 3 Habitat Sampler Exposures			
3.1 Deployment for Colonization	Dec 2015	50%	July 1, 2014
3.2 Habitat Sampler Exposure	Dec 2015	50%	July 1, 2014
3.3 Live Sorting	Dec 2015	50%	July 1, 2014
3.4 Dry Season Exposures	Dec 2015	25%	July 1, 2014
Task 4 Reporting			
4.1 Summary Tables	March 2016	38%	July 1, 2014
4.2 Brief Annual Progress Reports for 2014	June 2014	100%	July 1, 2014
4.3 Brief Annual Progress Reports for 2015	June 2015	0%	
4.4 Draft Final Project Report	March 2016	0%	

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Activities Undertaken

Summary of Completed Milestones

The following tasks were completed during this reporting period:

- Six toxicity tests (three for *Hyalella azteca* and three for *Selenastrum capricornutum*) in the laboratory
- Six field exposures utilizing local field organisms
- Two presentations given at the DPR annual meeting January 9, 2014 and Contaminants Work Team Informal Meeting March 25, 2014
- The fall 2013 macroinvertebrate survey and the sampling for the spring 2014 survey.

Task 1 Macroinvertebrate Community Survey

Two sets of benthic macroinvertebrate samples were collected and preserved, one 10/1/2013 and one on 5/6/2014. For each set, samples were collected using a 500 micron kicknet, one sample at F2, F3, F5, and F100. Each sample included three composited samples at each site (each composite was one ft^2). The set from 10/1/2013 has been processed and the invertebrates counted and identified to the lowest feasible taxonomic resolution (usually genus). F2 was particularly depauperate in terms of both total invertebrates (Fig. 1) and invertebrate richness (Fig. 2). Possible explanations include water quality issues, muddy substrate, or both. The field and laboratory exposures should help determine whether water quality at F2 is a likely cause of the low abundance and richness at F2.

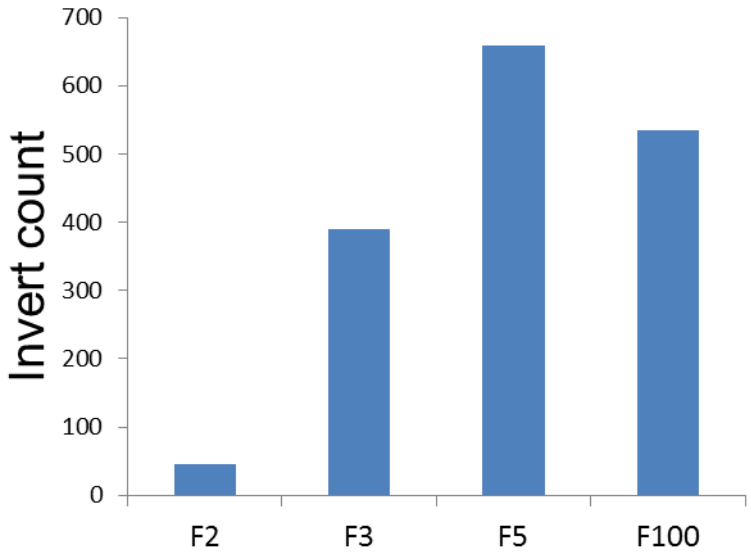

Fig. 1 Total invertebrates counted per site.

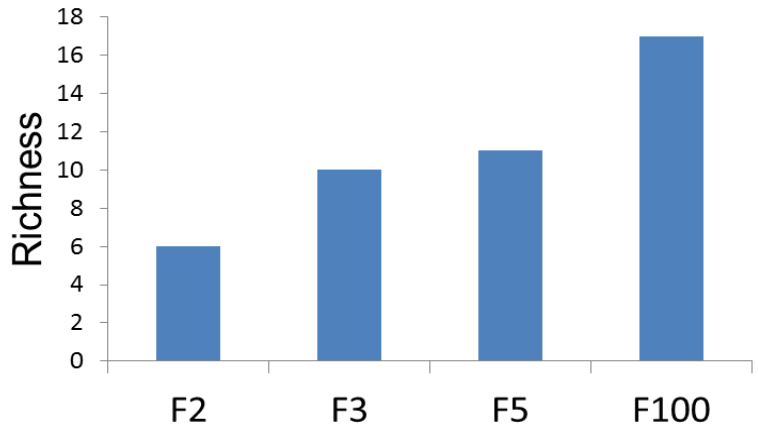

Fig. 2 Taxonomic richness per site.

Task 2 Laboratory Toxicity Tests

Three laboratory toxicity tests using *Hyalella azteca* and *Selenastrum capricornutum* were conducted during this reporting period.

Hyalella azteca

Due to the historical toxicity to *H. azteca* observed in this area, sites were tested in dilution at the outset of toxicity testing in order to quantify the number of toxic units present at each site. *H. azteca* acute 96-hr toxicity tests consisted of five 250 mL replicate glass beakers with 100 mL of sample, 10 organisms and a one inch^2 piece of nitex screen as artificial substrate. Eighty percent of the test solution was renewed at 48hrs when debris and dead organisms were removed from test chambers. Organisms were fed 1 mL of YCT (yeast, organic alfalfa and trout chow) at test initiation and after water renewal. Mortality was scored daily. A low salinity control was included for dilutions, to match the specific conductance in the field. Dilution series tests were evaluated using CETIS v. 1.1.2 (Tidepool Scientific Software, McKinleyville, CA, USA, 2006). NOEC and LOEC values were calculated using USEPA standard statistical protocols (2002). LC50 and EC50s were calculated using linear regression, non-linear regression or linear interpolation methods. PMSD (percentage minimum significant differences) of Dunnett's multiple comparison procedure was calculated for all tests. Summary tables for water quality of toxicity tests can be found in the appendix.

Selenastrum capricornutum

The *S. capricornutum* 96-hr chronic toxicity tests consisted of four 250 mL replicate glass flasks with 100 mL of sample and 1 mL of 1.0 x 106 cell/mL *S. capricornutum*. A fifth replicate flask was included for daily chemistry measurements. These tests were conducted without the addition of EDTA, due to concerns that EDTA may bind to metals which may be present in ambient samples. Cell growth was measured at test termination. *S. capricornutum* tests were evaluated by SWAMP standard statistical protocols for single-concentration toxicity tests (SWAMP Data Management Plan, Toxicity Template, 2009). Acute toxicity is defined as a statistically significant reduction in growth in a test sample compared to the laboratory control (one-tailed test, $p<0.05$) with a sample performance of less than 80% of the control. Summary tables for water quality of toxicity tests can be found in the appendix.

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November 21, 2013 initiation date
This sampling date coincided with the field exposure conducted with organza leaf litter bags.

H. aztea
The 11/21/2013 exposure had the highest number of toxic units associated with the Folsom sites tested thus far, most notably sites F2 and F3, which had 17.6 and 14.6 toxic units associated with each, respectively. Sites F5 and F100 exhibited reduced mortality of *H. azteca*, with 3.4 and 1.1 toxic units each, respectively. Survival in the controls met all toxicity test acceptability criteria (TAC), with 100% survival in the TAC control and 98% survival in the low salinity control. Table 1 outlines toxicity data for *H. azteca* tests conducted during this reporting period.

S. capricornutum
There was no toxicity observed in any treatment in the *S. capricornutum* toxicity test. Control growth was 1.465 ($x10^6$) cells/mL, whereas growth in the Folsom site treatments ranged from 1.472 cells/mL (F2) to 1.935 ($x10^6$) cells/mL (F100). There was no correlation between site location and cell growth. Table 2 outlines toxicity data for *S. capricornutum* tests conducted during this reporting period.

February 27, 2014 initiation date
This sampling date coincided with the field exposure conducted between February 26 and March 2, 2014.

H. azteca
There was less toxicity associated with this event, with 2.3 toxic units at site F2 and 5.3 toxic units at F3. There was less than one toxic unit at sites F5 and F100. Control survival ranged from 98-100%, for the TAC and low salinity controls, respectively.

S. capricornutum
There was no toxicity observed in this event, and all Folsom sites performed better than the control.

May 7, 2014 initiation date
This sampling date coincided with the field exposure conducted between May 6 and May 10, 2014.

H. azteca
This exposure had the least amount of toxicity associated with the Folsom sites. Site F2 had 1.2 toxic units and all other sites had less than one toxic unit present. Survival was 100% in both control treatments.

S. capricornutum
There was no toxicity associated with any site in this exposure. There was a reduction in cell growth at F3 (1.821 [$x10^6$] cells/mL) compared to the control (2.242 [$x10^6$] cells/mL), which was significant ($p=0.00000430$). The SWAMP statistical protocol involves the examination of significant differences in test organism performance by one-tailed heteroschedastic t-test ($p<0.05$) and a categorization of the performance of organisms exposed to the ambient sample as either greater to or less than the control performance. For the purposes of this report, samples are considered toxic only when both a significant t-test result and performance below 80% of the control is observed. For site F3, although there was a significant t-test result, this site's performance was 81.2% of the control and therefore is not considered toxic.

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Table 1. Summary of Toxic Units associated with *Hyalella azteca* laboratory toxicity tests

Date	Control Survival (%)		Low Salinity Control Survival (%)		Toxic Units*			
	Ave	SE	Ave	SE	F2	F3	F5	F100
11/20/13	100	0	98	2	17.6	14.6	3.5	1.1
2/27/14	98	2	100	0	2.3	5.3	<1	<1
5/7/14	100	0	100	0	1.2	<1	<1	<1

*A toxic unit is defined as the actual concentration present in an ambient sample divided by the 96-hr LC50 for the species of interest.

Table 2. Summary of cell growth in *Selenastrum capricornutum* laboratory toxicity tests

Date	Cell counts (x10^6)									
	Control		F2		F3		F5		F100	
	Ave	SE	Ave	SE	Ave	SE	Ave	SE	Ave	SE
11/21/13	1.465	0.131	1.472	0.042	1.800	0.102	1.589	0.095	1.935	0.160
2/27/14	1.818	0.144	2.558	0.076	2.395	0.153	2.769	0.172	2.584	0.041
5/7/14	2.242	0.024	1.970	0.089	1.821	0.019	2.149	0.121	2.261	0.059

Task 3 Habitat Sampler Exposures

Organza leaf-litter bags

In our last progress report (11/19/13) we stated that invertebrates readily colonized the leaf-litter bags at F100 and survived a dry event exposure and transport back to our lab in Davis (100% survival of 113 invertebrates). Therefore, we conducted a storm water exposure from 11/18/2013 to 11/21/2013 using the following methodology: leaf litter bags that had been colonized for two weeks were placed in organza bags and deployed at F2, F3, F5, and F100 before the storm. 48h later (after the storm), the bags were transported back to Davis, aerated, sorted into 'live' and 'dead' vials, preserved, and counted and identified. We found nearly 100% survival across all four sites (Fig. 3).

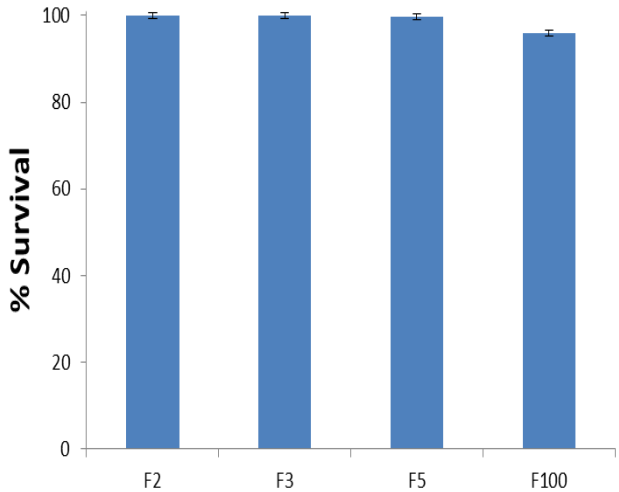

Fig 3. Percent survival by site for storm #1.

However, we noticed that the invertebrates community at F3 was dominated by flatworms, and there were very few live arthropods (Fig. 4). We were therefore concerned that the flatworms were entering the organza bags and eating the arthropods (flatworms comprise roughly 1/3 of the invertebrate population at site F3). This presents a serious problem because survival at F3 may have been low but we could not tell because flatworms may have eaten all the dead arthropods (i.e., making Fig. 3 misleading). Plotting the number of live arthropods as a function of flatworms shows a strong correlation (Fig. 5), further indicating that flatworms (and other predators) should be excluded from our habitat samplers. Thus, we cannot determine with these data whether stormwater runnoff was toxic to F100 invertebrates.

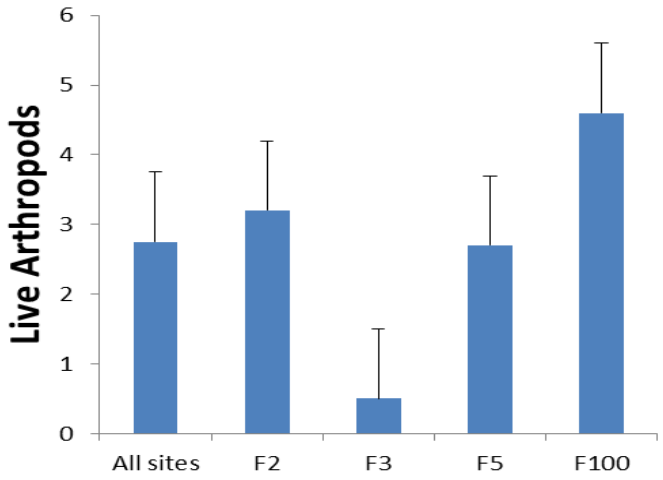

Fig. 4 Live arthropods by site. Note the low level of arthropods at F3, a site with abundant flatworms.

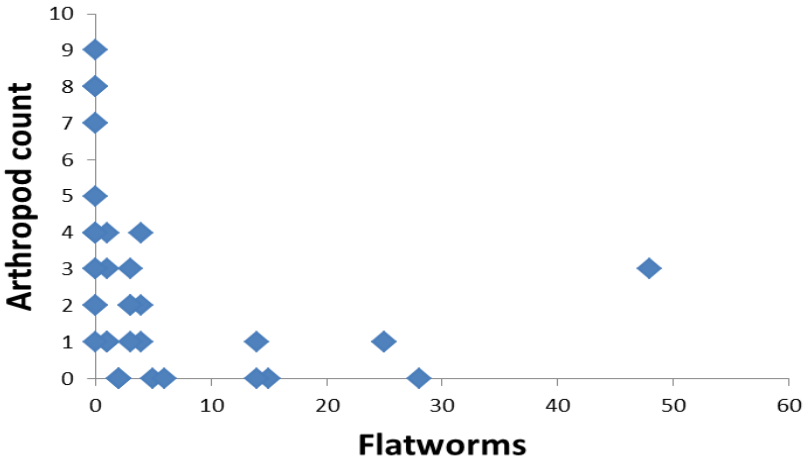

Fig. 5 A scatter-plot of arthropod and flatworm abundance in the organza leaf-litter bags.

Mesh cages

Because of the problems with flatworms infiltrating the organza bags, we changed our methodology for sampling subsequent storms. The general method was to construct small mesh cages ('biobarrels', 1" x 1", wrapped in 6"x6" 160 µm mesh and tied off with a zip-tie) into which we placed amphipods collected

from Folsom sites (generally F100, but from F5 during the most recent event because F100 was dry). Our aims with these exposures were four-fold. Our first aim was to determine whether the constructed water quality treatment pond reduced toxicity, our second aim was to determine whether stormwater at F2 and F3 was toxic to local invertebrates, our third aim was to find the optimal balance between large mesh sizes to allow flow through the mesh cages (important for oxygenating the amphipods and exposing them to storm water) and small mesh sizes (to keep flatworms out of the cages), and our final aim was to standardize our methodology for use during the 2014-15 sampling year.

Exposure from Jan 29-31, 2014
48-h storm exposure of amphipods collected from F100 and deployed to sites F2, F3, F5, F100, and a laboratory control. Percent survivals with SE in parentheses were as follows: F2: 28% (8.76%), F3: 72% (8.29%), F5:92% (2.19%), F100: 96% (1.79%), and control: 95% (2.24). Mesh size was 160 µm, cage was a small (1"x1") biobarrel, and 5 amphipods/cage were used. No flatworms were found in the cages.

Exposure from Feb 7-11, 2014
For this storm we switched to 96h exposures to make the field data more comparable to the laboratory data, and 210 µm mesh and 5 amphipods/cage were used. The switch to longer exposures did not lower the field (F100) or laboratory control survival, so we decided to move forward doing 96h exposures. Percent survivals were as follows: F2: 63.3% (3.59%), F3: 0% (0%), F5:33.33% (9.43%), F100: 73.33% (6.6%), and control: 96% (1.79%). For this event we encountered two difficulties. First, sediment deposition buried the cages at site F3, potentially contributing to the 0% survival at that site. In addition, 4 of the cages at F5 were not under water when they were collected, likely killing the amphipods. No flatworms were found in the cages.

Exposure from Feb 26-March 2, 2014
The methodology for this storm was identical to the prevous (Feb 7-11) storm, except that we began using large tent stakes at sites with mud substrate. This kept the cages off the bottom, and will hopefully prevent sediment burial. Percent survivals were as follows: F2: 0% (0%), F3: 100% (0%), F5:100% (0%), F100: 92% (4.0%), and control: 96% (1.79%). We found flatworms inside two of the cages during this event.

Exposure from May 6-10, 2014
For this event we began using 10 amphipods/cage enclosed in larger biobarrel cages (2"x2") to reduce the influence of any single amphipod on our results. Otherwise, the methodology was similar to the previous exposure (210 µm mesh, large biobarrel, 96h exposure). Percent survivals were as follows: F2: 6% (2.68%), F3: 76% (5.22%), F5: 0% (0%), F100: 98% (0.81%), and control: 100% (0.0%). During this event we found many flatworms in the F2, F3, and F5 cages, and a small number in the F100 cages. At this point we decided to run an experiment to find a mesh size that excludes flatworms better than 210 µm.

Exposure from June 2-6, 2014
When we arrived at Folsom to conduct this exposure we found that F100 had no water, F2 had no flowing water, and the water level at F3 was so low that there was not enough space to deploy the cages. Therefore, we decided to forgo the regular exposure and to compare the efficacy of three kinds of cage: 50mL centrifuge tubes with 210µm mesh, 50mL centrifuge tubes with 160 µm mesh, and a large modified biobarrel with 210 µm mesh. Because F100 was dry, we collected amphipods for use in the cages at F5. We deployed 5 replicates of the three kinds of cages in a pool of standing water at F2. We also deployed 5 replicates of the 50mL tubes with 160 µm mesh at F5. Survival was as follows: F2 50mL

tubes with 160 µm mesh: 46.7% (10.11%), F2 50mL tubes with 210 µm mesh: 3.7% (2.14%), F2 bio-barrel with 210 µm mesh 66.7% (11.55%), and F5 100% (0%). We observed many flatworms in the 210 µm cages, and a few, very small flatworms in the 160 µm cages.

Conclusions to date: We will proceed with 160 µm cages, 10 amphipods/cage, and 96h exposures.

Task 4 Reporting

This report is the brief annual progress report for June, 2014. A presentation was given at the DPR annual meeting on January 9, 2014. An additional informal update was presented at the Contaminants Work Team Meeting on March 25, 2014. These presentations are attached.

List of Attachments

- Summary tables
- Presentation given at the DPR annual meeting January 9, 2014
- Presentation given at the CWT meeting March 25, 2014

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Appendix

Contract Progress Report

Table A-1. Summary of water chemistry during a 96-hour *H. azteca* toxicity test initiated on 11/20/13 of samples collected by the California Department of Pesticide Regulation on 11/19/13.

Treatment		EC (uS/cm)		Temp (°C)		DO (mg/L)		pH		Hardness (mg/L as $CaCO_3$)	Alkalinity (mg/L as $CaCO_3$)	Unionized Ammonia (mg/L)[1]
		Min	Max	Min	Max	Min	Max	Min	Max			
Control	DIEPAMHR	348	368	20.2	22.2	8.2	8.5	7.94	8.26	96	60	0.001
	Low SC DIEPAMHR @ 100 uS/cm	118	155	20.4	22.0	8.1	8.3	7.82	8.35	N/A	N/A	N/A
F2	100%	92	137	19.6	22.0	7.4	8.2	7.75	8.16	32	20	0.035
	50%	106	127	19.7	22.0	7.7	8.0	7.67	8.09	-	-	-
	25%	113	126	20.6	21.9	8.0	8.2	7.58	8.04	-	-	-
	12.5%	111	133	20.8	21.7	7.9	8.3	7.55	8.31	-	-	-
	6.25%	115	140	18.8	22.0	8.1	8.3	7.53	8.13	-	-	-
F3	100%	107	121	20.6	21.9	8.1	8.3	7.56	8.00	28	26	0.025
	50%	110	114	19.7	21.7	7.5	8.3	7.62	8.13	-	-	-
	25%	117	134	18.8	22.0	7.9	8.4	7.60	8.11	-	-	-
	12.5%	114	126	18.9	22.0	8.1	8.3	7.67	8.27	-	-	-
	6.25%	115	135	18.9	22.1	8.0	8.2	7.77	8.14	-	-	-
F5	100%	162	162	19.1	21.9	7.9	8.2	7.67	7.92	48	34	0.026
	50%	141	147	19.2	21.8	8.1	8.2	7.75	7.95	-	-	-
	25%	130	130	19.2	22.0	8.1	8.2	7.77	8.00	-	-	-
	12.5%	121	137	19.0	21.5	8.0	8.1	7.84	8.22	-	-	-
	6.25%	118	131	19.0	21.5	8.0	8.4	7.81	8.15	-	-	-
F100	100%	161	165	19.1	23.9	7.8	8.1	7.80	8.00	52	36	0.024
	50%	141	151	19.1	21.5	8.1	8.3	7.82	8.01	-	-	-
	25%	128	140	18.6	21.4	7.9	8.5	7.89	7.97	-	-	-
	12.5%	126	127	18.7	23.7	8.0	8.3	7.84	8.28	-	-	-
	6.25%	124	132	18.6	23.8	8.0	8.4	7.82	8.14	-	-	-

1. This unionized ammonia reading is based on the ammonia-nitrogen measured upon sample receipt and upon the water chemistry measured at test initiation.

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Table A-2. Summary of water chemistry during a 96-hour *H. azteca* toxicity test initiated on 2/27/14 of samples collected by the California Department of Pesticide Regulation on 2/26/14.

Treatment		EC (uS/cm)		Temp (°C)		DO (mg/L)		pH		Hardness (mg/L as $CaCO_3$)	Alkalinity (mg/L as $CaCO_3$)	Unionized Ammonia (mg/L)[1]
		Min	Max	Min	Max	Min	Max	Min	Max			
Control	DIEPAMHR	331	362	20.1	22.8	7.4	8.4	7.68	8.23	96	58	0.002
	Low SC DIEPAMHR @ 100 uS/cm	141	153	19.6	21.6	7.6	8.4	7.43	7.89	28	18	0.000
F2	100%	97	99	20.6	22.4	7.5	8.8	7.33	7.65	24	24	0.000
	50%	116	151	21.2	23.2	7.7	8.5	7.41	7.78	-	-	-
	25%	99	129	20.8	23	7.6	8.2	7.32	7.78	-	-	-
	12.5%	99	131	20.8	22.7	7.5	8.5	7.34	7.75	-	-	-
	6.25%	98	132	20.6	22.5	6.7	8.4	7.2	7.79	-	-	-
F3	100%	104	107	20.9	22.6	7.3	8.6	7.38	7.84	16	32	0.009
	50%	105	119	20.9	22.4	7.5	8.5	7.31	7.79	-	-	-
	25%	103	127	20.8	22.4	7.6	8.7	7.27	7.77	-	-	-
	12.5%	104	130	20.4	21.9	6.8	7.9	7.3	7.72	-	-	-
	6.25%	108	132	20.7	22.0	6.6	7.8	7.22	7.82	-	-	-
F5	100%	116	126	20.4	22.4	7.6	8.6	7.52	7.87	36	36	0.000
	50%	110	128	20.2	22.1	7.4	8.5	7.41	7.9	-	-	-
	25%	106	131	20.3	22.2	7.4	8	7.27	7.89	-	-	-
	12.5%	103	132	20.3	22.1	6.9	7.8	7.28	75	-	-	-
	6.25%	103	134	20.1	22.1	7.3	7.7	7.3	7.84	-	-	-
F100	100%	142	157	20.5	22.4	7.7	8.5	7.76	7.96	48	52	0.000
	50%	120	142	20.6	22.4	7.7	8.1	7.61	7.93	-	-	-
	25%	112	139	20.4	22.3	7.6	8.1	7.34	7.88	-	-	-
	12.5%	107	137	20.0	22.4	7.0	8.0	7.29	7.92	-	-	-
	6.25%	105	135	19.8	22.3	7.1	8.0	7.27	7.87	-	-	-

1. This unionized ammonia reading is based on the ammonia-nitrogen measured upon sample receipt and upon the water chemistry measured at test initiation.

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Table A-3. Summary of water chemistry during a 96-hour *H. azteca* toxicity test initiated on 5/7/14 of samples collected by the California Department of Pesticide Regulation on 5/7/14.

Treatment		EC (uS/cm)		Temp (°C)		DO (mg/L)		pH		Hardness (mg/L as $CaCO_3$)	Alkalinity (mg/L as $CaCO_3$)	Unionized Ammonia (mg/L)1
		Min	Max	Min	Max	Min	Max	Min	Max			
Control	DIEPAMHR	308	368	21	23.3	6.5	8.6	7.58	8.2	96	56	0
	Low SC DIEPAMHR @ 100 uS/cm	104	145	20.9	23	6.9	8.6	7.31	7.78	N/A	N/A	N/A
F2	100%	107	143	21.5	23.5	6.1	8.4	7.42	8.01	40	48	0.001
	50%	104	141	21.5	22.8	6.3	8.5	7.33	7.86	-	-	-
	25%	105	138	21.1	22.5	6.3	8.5	7.26	7.88	-	-	-
	12.5%	101	134	20.8	22.6	6.3	8.7	7.22	7.76	-	-	-
	6.25%	105	134	21.2	22.2	6.3	8.5	7.16	7.77	-	-	-
F3	100%	181	214	21.5	22.3	6.2	8.6	7.64	8.19	60	66	0.000
	50%	119	173	21.1	22.4	6.5	8.7	7.43	8.01	-	-	-
	25%	121	153	21.3	22.1	6.6	8.5	7.28	7.93	-	-	-
	12.5%	112	139	21.1	21.8	6.4	8.8	7.7	7.84	-	-	-
	6.25%	109	138	21.4	21.7	6.5	8.7	7.17	7.78	-	-	-
F5	100%	54	188	20.7	22	6.3	8.7	7.66	8.26	64	74	0.000
	50%	125	160	21.2	22	6.2	8.7	7.42	8.08	-	-	-
	25%	114	149	20.7	22	6.1	8.7	7.3	7.95	-	-	-
	12.5%	109	143	20.3	21.8	6.1	8.8	7.2	7.94	-	-	-
	6.25%	104	139	21.4	22	6.4	8.6	7.16	7.86	-	-	-
F100	100%	244	279	20.5	21.8	6.4	8.7	7.97	8.5	108	112	0.000
	50%	121	203	21.3	21.8	6.5	8.7	7.61	8.39	-	-	-
	25%	135	165	21.3	22	6.4	8.6	7.41	8.21	-	-	-
	12.5%	117	146	21.2	21.8	6.2	8.7	7.27	8.04	-	-	-
	6.25%	109	150	21.1	22.1	6.7	8.5	7.2	7.97	-	-	-

1. This unionized ammonia reading is based on the ammonia-nitrogen measured upon sample receipt and upon the water chemistry measured at test initiation.

Table A-4. Summary of water chemistry during a 96-hour *S. capricornutum* tests conducted during this reporting period.

Treatment	EC (uS/cm)		Temp (°C)		DO (mg/L)		pH		Hardness (mg/L as $CaCO_3$)	Alkalinity (mg/L as $CaCO_3$)	Unionized Ammonia (mg/L)[1]
	Min	Max	Min	Max	Min	Max	Min	Max			
Test Initiation Date: November 21, 2013											
Glass Distilled	102	120	21.5	21.5	8.0	8.1	7.95	8.61	0	6	0.000
F2	162	172	21.7	21.7	8.3	8.4	8.00	8.39	32	20	0.024
F3	165	176	21.3	21.6	7.9	8.6	7.98	8.69	28	26	0.038
F5	212	238	21.3	21.7	8.4	8.5	7.88	8.74	48	34	0.023
F100	224	247	21.0	21.6	8.3	8.8	7.92	8.76	52	36	0.022
Test Initiation Date: February 27, 2014											
Glass Distilled	124	176	21.8	22.9	7.8	8.2	7.67	8.76	0	6	0.000
F2	186	197	22.0	33.8	8.0	8.4	7.89	9.10	24	24	0.000
F3	200	210	22.2	23.0	8.2	8.3	8.10	9.09	16	32	0.015
F5	222	225	21.9	23.0	7.5	8.3	8.06	9.44	36	36	0.001
F100	144	254	21.6	23.0	7.7	8.4	8.16	9.26	48	52	0.000
Test Initiation Date: May 7, 2014											
Glass Distilled	400	406	23.8	24.7	7.8	8.2	8.22	8.67	0	4	0.000
F2	195	200	24.0	24.3	7.8	8.3	8.10	9.03	40	48	0.002
F3	269	274	24.0	24.3	7.7	8.2	8.31	9.24	60	66	0.000
F5	242	243	23.9	24.3	7.7	8.4	8.29	9.16	64	74	0.000
F100	324	336	23.9	24.3	7.8	8.4	8.47	9.34	108	112	0.000

1. This unionized ammonia reading is based on the ammonia-nitrogen measured at test initiation and upon water chemistry measured at test initiation.

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Table X. Summary of water quality measured in the field at the Folsom Site for November, February and May events

Treatment	EC (uS/cm)		Salinity (ppt)		Temp (°C)		DO (mg/L)		pH	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Field Date: November 18-21, 2013										
F2	108	153	0.1	0.1	18.1	18.4	8.9	9.2	6.64	6.76
F3	237	293	0.1	0.1	15.3	18.6	1.8	6.1	6.59	7.08
F5	146	170	0.1	0.1	13.8	14.7	5.2	6.6	6.72	6.80
F100	239	254	0.1	0.1	12.8	15.0	6.4	9.1	6.86	7.27

Treatment	EC (uS/cm)		SC (uS/cm)		Temp (°C)		DO (mg/L)		pH	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Field Date: February 26 - March 2, 2014										
Lab Control	307	307	369	369	15.0	15.1	9.5	9.5	7.77	8.00
F2	88	101	110	124	14.5	15.2	9.4	10.1	6.66	6.88
F3	245	376	297	493	12.6	15.8	2.8	6.8	6.61	7.19
F5	96	134	122	167	13.5	14.5	7.0	7.2	6.72	6.76
F100	150	152	195	198	12.4	13.4	8.0	8.6	6.82	7.02
Field Date: May 6-10, 2014										
Lab Control	111	368	N/A	N/A	19.6	20.0	9.4	9.4	7.21	8.13
F2	152	211	N/A	N/A	17.9	19.3	2.8	7.0	6.64	6.88
F3	163	293	N/A	N/A	16.6	20.1	2.0	8.0	6.47	8.17
F5	132	236	N/A	N/A	15.8	17.8	3.8	6.7	6.67	7.23
F100	169	169	N/A	N/A	15.9	15.9	6.6	6.6	7.12	7.12

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Table X. Summary of hardness, alkalinity and ammonia for Folsom sites for November, February and May events

Treatment	Hardness (mg/L as $CaCO_3$)		Alkalinity (mg/L as $CaCO_3$)		Total Ammonia (mg/L)[1]	
	Min	Max	Min	Max	Min	Max
Field Date: November 18-21, 2013						
F2	48	72	44	50	0.000	0
F3	92	92	74	88	0.070	0.1
F5	52	60	58	62	0.000	0
F100	96	96	84	102	0.000	0

Treatment	Hardness (mg/L as $CaCO_3$)		Alkalinity (mg/L as $CaCO_3$)		Unionized Ammonia (mg/L)[1]	
	Min	Max	Min	Max	Min	Max
Field Date: February 26 - March 2, 2014						
Lab Control	88	88	62	62	0.000	0
F2	44	44	40	42	0.000	0.34
F3	108	236	84	206	0.010	0.33
F5	52	56	46	54	0.020	0.17
F100	80	80	86	124	0.010	0.17
Field Date: May 6-10, 2014						
Lab Control	96	96	56.0	56.0	0.000	0.000
F2	44	64	44.0	64.0	0.000	0.000
F3	72	92	92.0	98.0	0.000	0.001
F5	56	84	64.0	92.0	0.000	0.000
F100	88	124	96.0	132.0	0.000	0.000