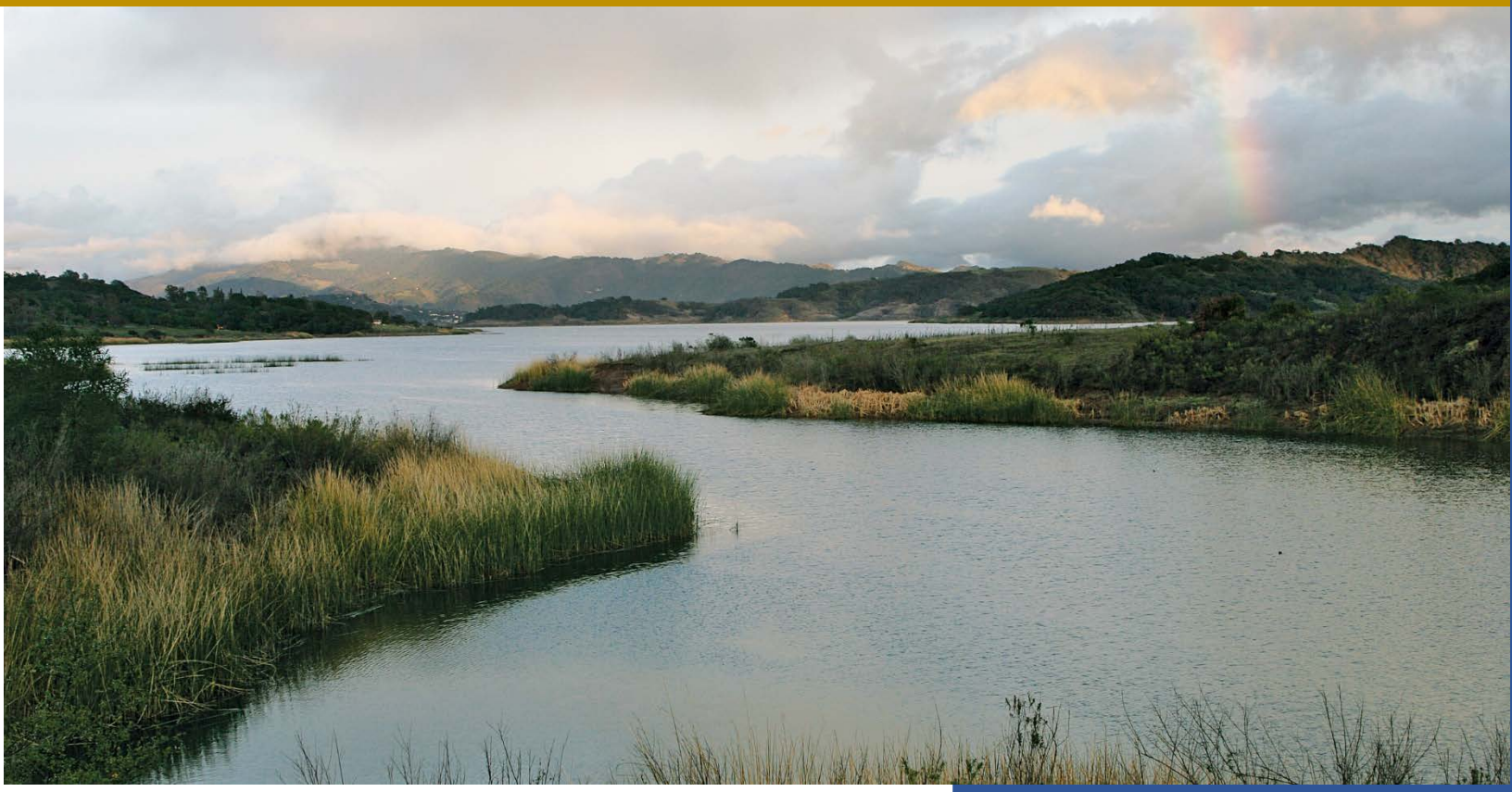
Ventura Countywide Stormwater Quality Management Program

2017-2018
Permit Year

Ventura Countywide Stormwater Quality Management Program Annual Report

Attachment D Monitoring Appendices H - L



Camarillo
County of Ventura
Fillmore
Moorpark
Ojai
Oxnard
Port Hueneme
Santa Paula
Simi Valley
Thousand Oaks
Ventura
Ventura County Watershed Protection District

December 14, 2018

Appendix H. RWQCB Permission of Toxicity Species Substitution

California Regional Water Quality Control Board

Los Angeles Region

Recipient of the 2001 *Environmental Leadership Award* from Keep California Beautiful

Linda S. Adams
Agency Secretary

320 W. 4th Street, Suite 200, Los Angeles, California 90013
Phone (213) 576-6600 FAX (213) 576-6640 - Internet Address: http://www.waterboards.ca.gov/losangeles

Arnold Schwarzenegger
Governor

October 28, 2009

Ms. Norma Camacho, Director
Ventura County Watershed Protection District
800 South Victoria Ave., L#1600
Ventura, CA 93009-1600

Certified Mail
Return Receipt Requested
Claim No. 7009 0820 0001 6811 7509

SUBJECT: TOXICITY TEST SPECIES SUBSTITUTION, VENTURA COUNTY MUNICIPAL SEPARATE STORM SEWER SYSTEM DISCHARGE (MS4) PERMIT (BOARD ORDER No. 09-0057; NPDES No. CAS004002)

Dear Ms. Camacho:

On October 14, 2009, the Regional Board staff received a request from the Ventura County Watershed Protection District (County) to substitute topsmelt, *Atherinops affinis*, with the inland silverside, *Menidia beryllina*, due to the unavailability of topsmelt from the supplier. After consultation with US EPA staff, Regional Board staff denied the request. On October 15, 2009, the Regional Board received an e-mail from the County, titled "Notification of toxicity exception - (species unavailable) Ventura County MS4 NPDES Permit Order No. 09-0057 (Monitoring Program)". The County's e-mail communication was submitted pursuant to requirements in subparts D.5 and D.8(b) of the Ventura County MS4 Permit's Monitoring Program (Monitoring Program), which requires an explanation of the circumstance with documentation when toxicity tests cannot be performed to comply with the requirements of this permit, and written authorization from the Regional Board Executive Officer to substitute test species.

In order to evaluate the appropriateness of substituting topsmelt, *Atherinops affinis*, with the inland silverside, *Menidia beryllina*, in toxicity testing at mass emissions stations in the future, the Regional Board requires the County to conduct comparative static renewal toxicity tests on both species as follows. During the next storm event of this permit year (2009-10) and the first storm event of next permit year (2010-11), the County shall conduct toxicity tests on both topsmelt, *Atherinops affinis*, and the inland silverside, *Menidia beryllina*, along with giant kelp, *Macrocystis pyrifera*, and the purple sea urchin, *Strongylocentrotus purpuratus*, pursuant to subpart D.8(a) of the Monitoring Program. The County shall submit the results of the comparative toxicity tests as part of its reporting requirements.

In the event that topsmelt, *Atherinops affinis*, is unavailable for testing during future sampling events conducted under the Monitoring Program, the County shall follow the protocol set forth in subpart D.5 of the Monitoring Program. The County shall notify the Regional Board by phone and e-mail as soon as possible if a test species is unavailable. Notification shall be sent directly to me as well as Tracy Woods, Stormwater Permitting Unit, with a copy to Renee Purdy, Chief, Regional Programs Section. The County shall submit to the Regional Board documentation of species unavailability from both the County's contract lab and the contract lab's supplier at least 48 hours prior to the planned sampling event to provide adequate time for my staff to evaluate any request for species substitution. Any approval or denial of a request for species substitution must be authorized pursuant to subpart D.8(b) of the Monitoring Program.

If you have any questions, please contact me at (213) 576-6605, or Renee Purdy at (213) 576-6783.

Sincerely,

Tracy J. Egoscue,
Executive Officer

cc: Mr. Bruce Fujimoto, Division of Water Quality, State Water Resources Control Board
Mr. Gerhardt Hubner, Ventura County Watershed Protection District
Mr. Arne Anselm, Ventura County Watershed Protection District

Appendix I. Aquatic Toxicity Testing Lab Results

Kelly Hahs
Ventura County Watershed Protection District
800 South Victoria Ave., L#1610
Ventura, CA 93009

February 5, 2018

Kelly:

I have enclosed our report "Evaluation of the Toxicity of Ventura County Watershed Protection District Stormwater Samples" for the samples that were collected January 8-9, 2018. The results of this testing are summarized below.

Toxicity summary for VCWPD mass emission station stormwater samples.

Sample Station	Toxicity Present Relative to the Lab Control treatment?		
	Atherinops affinis		Purple Urchin
	Survival	Growth	Fertilization
ME-CC	no	no	
ME-SCR			no[a]
ME-VR2	**YES**	**YES**	

a - The fertilization response in the Salt Control treatment was significantly less than in the Lab Water Control, indicating that the use of artificial sea salt may have impaired fertilization. Accordingly, the test data were analyzed comparing the site water treatment to the Salt Control.

Toxicity summary for VCWPD major outfall station stormwater samples.

Sample Station	Toxicity Present Relative to the Lab Control treatment?				
	Selenastrum capricornutum	*Ceriodaphnia dubia*		Fathead Minnow	
	Growth	Survival	Reproduction	Survival	Growth
MO-CAM				no	**YES**
MO-OJA				**YES**[b]	**YES**[b]
MO-MEI				**YES**[b]	**YES**[b]
MO-VEN		no	**YES**		
MO-OXN				**YES**[b]	**YES**[b]
MO-HUE		no	**YES**		
MO-THO		no	no/**Yes**[a]		
MO-MPK	no				
MO-SIM		no	no		
MO-FIL		no	no		
MO-SPA				no	**YES**

* As per EPA guidance, samples with a significant reduction in survival are not evaluated for growth toxicity.
a – There was an outlier replicate in the Lab Control treatment. Per EPA instructions, the results are presented including and excluding the outlier.
b – Pathogen-related mortality (PRM) was observed in this treatment.

Chronic Toxicity of VCWPD Stormwater to Purple Urchin Fertilization
There was ***no*** significant reduction in purple urchin fertilization in the ME-SCR stormwater sample.

It is important to note that the fertilization response in the Salt Control treatment was significantly less than in the Lab Water Control, indicating that the use of artificial sea salt may have impaired fertilization. Accordingly, the test data were analyzed comparing the site water treatment to the Salt Control. For future testing events, a new box of artificial sea salt will be used to adjust the salinity of the site water.

Chronic Toxicity of VCWPD Stormwater to *Atherinops affinis* (Topsmelt)
There was ***no*** significant reduction in topsmelt survival or growth in the ME-CC stormwater sample. There ***was*** a significant reduction in topsmelt survival and growth in the ME-VR2 stormwater sample.

It is important to note that low dissolved oxygen (D.O.) measurements were observed in the ME-VR2 sample, and aeration of the test could not maintain the D.O. ≥4 mg/L, potentially causing the reduction in survival and growth in this treatment rather than a contaminant. As large amounts of solids in the sample may have caused the low D.O. values, we recommend sample filtration (using a sterile 0.45-µm filter) be considered prior to testing future samples collected from this location, as well as aerating this sample at test initiation.

Chronic Toxicity of VCWPD Stormwater to *Selenastrum capricornutum*
There was ***no*** significant reduction in *S. capricornutum* growth in the MO-MPK stormwater sample.

Chronic Toxicity of VCWPD Stormwater to *Ceriodaphnia dubia*
There was ***no*** significant reduction in *C. dubia* survival in any of the stormwater samples. There was ***no*** significant reduction in *C. dubia* reproduction in the MO-SIM, MO-THO, and MO-FIL stormwater samples when an outlier replicate in the Lab Control treatment was excluded from the analyses; there was a significant reduction in the MO-THO stormwater sample when the Lab Control outlier replicate was included in the analyses. There ***was*** a significant reduction in reproduction in the MO-HUE and MO-VEN stormwater samples (both including and excluding the outlier replicate in the Lab Control).

Chronic Toxicity of VCWPD Stormwater to Fathead Minnows
There was ***no*** significant reduction in fathead minnow survival in the MO-CAM and MO-SPA stormwater samples; there ***was*** a significant reduction in survival in the MO-OJA, MO-MEI, and MO-OXN stormwater samples. There ***was*** a significant reduction in fathead minnow growth in all stormwater samples tested.

It is important to note that low dissolved oxygen (D.O.) was observed in the MO-MEI sample, and aeration of the test could not maintain the D.O. ≥4 mg/L, potentially causing the reduction in survival and growth in this treatment rather than a contaminant. As large amounts of solids in the sample may have caused the low D.O. values, we recommend sample filtration (using a sterile 0.45-µm filter) be considered prior to testing future samples collected from this location, as well as aerating this sample at test initiation.

Please also note, pathogen related mortalities (PRM) were observed in the MO-OJA, MO-OXN, and MO-MEI samples. PRM is considered an artifact of the test methodology. PRM is well documented in the EPA guidelines (EPA-821-R-02-013) as caused by microorganisms, and it is acknowledged that PRM interferes with the toxicity evaluation. PRM was not observed in the Lab Control treatment, indicating that the source of pathogens was the ambient water sample. To resolve the observation of PRM in the affected samples, future testing could be performed following the protocol using 20 test replicates noted in the EPA testing manual.

If you have any questions regarding the performance and interpretation of these tests, feel free to contact me or my colleague Stephen Clark at (707) 207-7760.

Sincerely,

Stevi Vasquez
Project Manager

Evaluation of the Toxicity of Ventura County Watershed Protection District Stormwater Samples

Samples collected January 8-9, 2018

Prepared For:

Ventura County Watershed Protection District
800 South Victoria Ave., L#1610
Ventura, CA 93009

Prepared By:

Pacific EcoRisk
2250 Cordelia Road
Fairfield, CA 94534

February 2018

PACIFIC ECORISK
ENVIRONMENTAL CONSULTING & TESTING

Evaluation of the Toxicity of Ventura County Watershed Protection District Stormwater Samples

Samples collected January 8-9, 2018

Table of Contents

Appendices

1. INTRODUCTION

Under contract to Ventura County Watershed Protection District, Pacific EcoRisk (PER) has been contracted to evaluate the toxicity of stormwater samples collected for the Ventura County Watershed Protection District (VCWPD). This evaluation consists of performing the following US EPA short-term chronic toxicity tests:

- echinoderm sperm fertilization test with the purple urchin, *Strongylocentrotus purpuratus*;
- 7-day survival and growth test with the topsmelt, *Atherinops affinis;*
- 96-hour algal growth test with the green alga, *Selenastrum capricornutum;*
- 3-brood survival and reproduction test with the crustacean, *Ceriodaphnia dubia*; and
- 7-day survival and growth test with larval fathead minnows (*Pimephales promelas*).

These toxicity tests were conducted on stormwater samples collected on January 8-9, 2018. This report describes the performance and results of these tests.

2. CHRONIC TOXICITY TEST PROCEDURES

The methods used in conducting the chronic toxicity tests followed the guidance established by the following EPA manuals:

- "Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms" (EPA/600/R-95/136); and
- "Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, Fourth Edition" (EPA-821-R-02-013).

2.1 Sample Receipt and Handling

On January 8-9, VCWPD staff collected stormwater samples from 14 stations into appropriately-cleaned containers. These samples were transported on ice and under chain-of-custody to the PER laboratory in Fairfield, CA. Upon receipt at the laboratory, aliquots of the water samples were collected for analysis of initial water quality characteristics (Tables 1a and 1b). The samples were then stored at 0-6˚C except when being used to prepare test solutions. The chain-of-custody records for the collection and delivery of these samples are presented in Appendix A.

Table 1a. Initial water quality characteristics of the VCWPD mass emission station stormwater samples.

Date Sample Received	Sample ID	Temp. (°C)	pH	D.O. (mg/L)	Conductivity (µS/cm)	Total Ammonia (mg/L N)
1/10/18	ME-CC	0.0	7.58	8.5	1032	<1.0
1/10/18	ME-SCR	0.0	7.96	10.7	3216	<1.0
1/10/18	ME-VR2	0.0	7.76	8.1	1654	2.4

Table 1b. Initial water quality characteristics of the VCWPD major outfall station stormwater samples.								
Date Sample Received	Sample ID	Temp. (°C)	pH	D.O. (mg/L)	Alkalinity (mg/L)	Hardness (mg/L)	Conductivity (µS/cm)	Total Ammonia (mg/L N)
1/10/18	MO-CAM	0.0	7.80	8.4	494	120	524	<1.0
1/10/18	MO-OJA	0.0	7.65	8.0	855	120	322	1.6
1/10/18	MO-MEI	0.0	7.47	8.2	840	194	631	3.1
1/10/18	MO-VEN	0.0	7.56	8.6	320	76	253	<1.0
1/10/18	MO-OXN	0.0	7.39	8.4	268	76	249	<1.0
1/10/18	MO-HUE	0.0	7.50	8.1	1225	505	3017	<1.0
1/10/18	MO-THO	0.0	7.66	8.6	712	226	678	<1.0
1/10/18	MO-MPK	0.0	7.62	8.8	472	112	428	<1.0
1/10/18	MO-SIM	0.0	7.77	9.1	720	250	764	1.0
1/10/18	MO-FIL	0.0	7.65	9.1	298	66	180	<1.0
1/10/18	MO-SPA	0.0	7.48	8.7	306	66	197	1.2

2.2 Echinoderm Fertilization Toxicity Testing with *Strongylocentrotus purpuratus*

The echinoderm sperm cell fertilization test consists of exposing purple sea urchin or sand dollar sperm to the stormwater, after which the effects on successful fertilization of the eggs are determined. The specific procedures used in this testing are described below.

Sperm and eggs were generated from gravid adult purple urchins, *S. purpuratus*. The gravid adult urchins were obtained from a commercial supplier (Alexi Gabriel, San Diego, CA). Upon receipt at the lab, the urchins were held at 12˚C. Spawning of the urchins was induced by injection with 0.5 M KCl, followed by vigorous shaking of the animals to stimulate gamete release, as per EPA guidelines. The gametes from each spawning individual were collected and examined microscopically; the gametes exhibiting the best quality (as determined from morphology and trial fertilization) were pooled to provide a composite of high quality sperm and a composite of high quality eggs.

The Lab Water Control medium for this test consisted of 1-µm filtered seawater (collected from the UC Granite Canyon Marine Lab). The stormwater sample was adjusted to the test salinity of approximately 33 ppt using an artificial sea salt (Tropic Marin®). As an additional QA measure, and in order to assess any potential artefactual toxicity that might have been caused by the addition of the sea salt to the sample, a Salt Control consisting of Type 1 lab water (reverse-osmosis, de-ionized water) adjusted to a salinity of 33 ppt using the same artificial sea salt was prepared and tested. Routine water quality characteristics (pH, D.O., and salinity) were measured for each test solution prior to use in this test.

There were four replicates at each test treatment. Each test replicate consisted of a 30-mL glass vial to which five mL of appropriate test solution was added. The test was initiated with the inoculation of an appropriate quantity of sperm into each replicate vial to achieve a final sperm-to-egg ratio of 2000:1. After a 20-min exposure period, approximately 1000 eggs were inoculated into each vial. After an additional 20-min exposure, the test was terminated with all of the test embryos being fixed by the addition of 0.5 mL of 1% glutaraldehyde.

The contents of each preserved test vial were subsequently examined microscopically to determine the percentage of embryos exhibiting successful fertilization. The resulting percentage fertilization data were analyzed to determine any impairment(s) caused by the stormwater; all statistical analyses were performed using the CETIS statistical software.

2.3 Survival and Growth Toxicity Testing with Topsmelt (*Atherinops affinis*)

The chronic toxicity test with topsmelt consists of exposing larval fish to the stormwater samples for seven days, after which effects on survival and growth are evaluated. The specific procedures used in this testing are described below.

The larval topsmelt used in these tests were obtained from a commercial supplier (Aquatic Biosystems, Fort Collins, CO). Upon receipt at the testing lab, the larval fish were maintained in aerated Lab Water Control medium, and were fed brine shrimp nauplii *ad libitum* during the pre-test holding period.

The Lab Water Control medium for these tests consisted of 1-µm filtered U.C. Granite Canyon Marine Laboratory seawater. The stormwater samples were adjusted to a salinity of approximately 33 ppt via addition of an artificial sea salt (Crystal Seas®-bioassay grade). The samples were tested at the 100% concentration only. Routine water quality characteristics (pH, D.O., and salinity) were measured for each test solution prior to use in these tests.

There were five replicates for each test treatment, each replicate consisting of 400 mL of test solution in a 600-mL glass beaker. The tests were initiated by randomly allocating five 15-day old topsmelt into each replicate beaker. The beakers were randomly positioned in a temperature-controlled room at 20°C (with temperature being monitored daily), under a 16L:8D photoperiod. These test fish were fed brine shrimp nauplii twice daily.

Each day of the tests, fresh test solutions were prepared as before. The test replicate beakers were examined, with any dead animals, uneaten food, wastes, and other detritus being removed. The number of live fish in each replicate was determined and then approximately 80% of the test solution in each beaker was carefully poured out and replaced with fresh test solution. “Old” water quality characteristics (pH and D.O.) were measured on the old test water collected from one randomly selected replicate at each treatment. The test beakers were then placed back into the temperature-controlled room.

After seven days exposure, the tests were terminated and the number of live fish in each replicate beaker was recorded. The fish from each replicate were then carefully euthanized in methanol, rinsed in de-ionized water, and transferred to a pre-tared weighing pan. The fish were then dried at 100˚C for >24 hrs and re-weighed to determine the total weight of fish in each replicate; the total weight was then divided by the initial number of fish per replicate to determine the "biomass value". The resulting survival and growth (biomass value) data were analyzed to determine any impairment(s) caused by the stormwater samples; all statistical analyses were performed using the CETIS® statistical software (TidePool Scientific, McKinleyville, CA).

2.4 Algal Growth Toxicity Testing with *Selenastrum capricornutum*

The short-term chronic toxicity algal test consists exposing *Selenastrum capricornutum* to the stormwater for 96 hrs, after which the effects on cell growth are evaluated. The specific procedures used in this testing are described below.

The Lab Water Control medium for this test consisted of Type 1 lab water (reverse-osmosis, de-ionized water). The stormwater sample was tested at the 100% concentration only. The Lab Water Control medium and the stormwater sample were filtered through sterile 0.45 µm filters and then spiked with nutrients, as per EPA guidelines. "New" water quality characteristics (pH, D.O., and conductivity) were measured on the resulting test solutions prior to use in the test.

There were 4 replicates at each test treatment, each replicate consisting of a 250-mL glass Erlenmeyer flask containing 100 mL of test solution; an additional replicate was established at each test treatment for the measurement of test solution water quality characteristics during the test and at test termination. Each flask was inoculated to an initial algal cell density of 10,000 cells/mL from a laboratory culture of *Selenastrum* that is maintained in log growth phase.

These flasks were loosely capped and randomly positioned within a temperature-controlled room at 25°C, under continuous cool-white fluorescent illumination. Each replicate flask was shaken a minimum of three times daily. The temperature and pH were determined daily for the designated "water quality" replicate at each treatment.

After 96 (±2) hrs exposure, the algal cell density in each replicate flask was determined by spectrophotometric analysis. The resulting cell density data were analyzed to determine any growth impairment, or toxicity, caused by the stormwater; all statistical analyses were performed using the CETIS statistical software.

2.5 Survival and Reproduction Toxicity Testing with *Ceriodaphnia dubia*

The short-term chronic *Ceriodaphnia* test consists of exposing individual females to the stormwater samples for the length of time it takes for the Lab Control treatment females to

produce three broods (typically 6-8 days), after which effects on survival and reproduction are evaluated. The specific procedures used in this testing are described below.

The Lab Water Control medium for this test consisted of modified US EPA synthetic moderately hard water, prepared by addition of reagent grade chemicals to Type 1 lab water. The stormwater samples were tested at the 100% concentration only. Each treatment consisted of a 200 mL aliquot of test solution to which the alga *S. capricornutum* and Yeast-Cerophyll®-Trout food (YCT) had been added to provide food for the test organisms. "New" water quality characteristics (pH, D.O., and conductivity) were measured on these food-amended test solutions prior to use in these tests.

There were 10 replicates for each test treatment, each replicate consisting of 15 mL of test solution in a 30-mL plastic cup. The tests were initiated by allocating one neonate (<24 hours old and within 8 hours of age) *C. dubia,* obtained from in-house laboratory cultures, into each replicate cup. The replicate cups were placed in a temperature-controlled room at 25˚C, under cool white fluorescent lighting on a 16L:8D photoperiod.

Each day of the test, fresh test solutions were prepared and characterized as before, and a new set of replicate cups was prepared. The original test replicate cups were examined, with surviving original individual organisms being transferred to the corresponding new cup. The contents of each of the remaining old replicate cups was carefully examined and the number of neonate offspring produced by each original organism was determined, after which the "old" water quality characteristics (pH, D.O., and conductivity) were measured for the old test solution from randomly-selected replicate(s) at each treatment.

After it was determined that ≥60% of the *Ceriodaphnia* in the Lab Control treatments had produced their third brood of offspring, the tests were terminated. The resulting survival and reproduction data were analyzed to determine any impairments caused by the stormwater samples. All statistical analyses were performed using the CETIS statistical software.

2.6 Survival and Growth Toxicity Testing with Larval Fathead Minnows

The short-term chronic fathead minnow test consists of exposing larval fish to the stormwater for 7 days, after which effects on survival and growth are evaluated. The specific procedures used in this testing are described below.

The larval fathead minnows used in these tests were obtained from a commercial supplier (Aquatox, Hot Springs, AR). Upon receipt at the lab, the larval fish were maintained in aerated tanks of EPA moderately-hard water at 25˚C, and were fed brine shrimp nauplii *ad libitum*.

The Lab Water Control medium for this test consisted of EPA synthetic moderately-hard water. The stormwater samples were tested at the 100% concentration only. "New" water quality

characteristics (pH, D.O., and conductivity) were measured on these test solutions prior to use in the tests.

There were 4 replicates for each test treatment, each replicate consisting of 200 mL of test solution in a 600-mL glass beaker. The test was initiated by randomly allocating 10 larval fathead minnows (<48 hours old) into each replicate. The replicate beakers were placed in a temperature-controlled room at 25˚C, under cool-white fluorescent lighting on a 16L:8D photoperiod. The test fish were fed brine shrimp nauplii twice daily.

Each day of the test, fresh test solutions were prepared for each treatment, and water quality characteristics were determined as before. The replicate beakers were examined, with any dead animals, uneaten food, wastes, and other detritus being removed. The number of live fish in each replicate was determined and then approximately 80% of the old test media in each beaker was carefully poured out and replaced with fresh test solution. “Old” water quality characteristics (pH, D.O., and conductivity) were measured on the old test water that had been discarded from one randomly selected replicate at each treatment.

After 7 days exposure, the test was terminated and the number of live fish in each replicate beaker was recorded. The fish from each replicate were then carefully euthanized in methanol, rinsed in de-ionized water, and transferred to a pre-tared weighing pan. These fish were then dried at 100˚C for >24 hours and re-weighed to determine the total weight of fish in each replicate. The total weight was then divided by the initial number of fish per replicate to determine the “biomass value.” The resulting survival and biomass data were analyzed to determine any impairment caused by the stormwater samples. All statistical analyses were performed using the CETIS statistical software.

3. RESULTS

3.1 Effects of VCWPD Emission Station Stormwater on Purple Urchin Fertilization

The results of this test are summarized in Table 2. There was no significant reduction in fertilization in the ME-SCR stormwater sample. The test data and summary of statistical analyses for this test are presented in Appendix B.

Table 2. Effects of VCWPD emission station stormwater on purple urchin fertilization.

Test Initiation Date (Time)	Treatment/Sample ID	Mean % Fertilization
1/10/18 (1107)	Lab Control	99.0
	Salt Control	31.5[a]
	ME-SCR	72.0

a - The fertilization response in the Salt Control treatment was significantly less than in the Lab Water Control, indicating that the use of artificial sea salt may have impaired fertilization. Accordingly, the test data were analyzed comparing the stormwater sample to the Salt Control.

3.2 Effects of VCWPD Emission Station Stormwater on *Atherinops affinis*

The results for these tests are summarized in Table 3. There was no significant reduction in survival or growth in the ME-CC stormwater sample. There was a significant reduction in both survival and growth in the ME-VR2 stormwater sample. The test data and summary of statistical analyses for these tests are presented in Appendix C.

Table 3. Effects of VCWPD emission station stormwater on *Atherinops affinis.*

Test Initiation Date (Time)	Treatment/Sample ID	Mean % Survival	Mean Biomass Value (mg)
1/10/18 (1710)	Lab Control	92.0	1.54
	ME-CC	100	1.88
	ME-VR2	**16.0*[a]**	**0.27*[b]**

* The response at this test treatment was significantly less than the Lab Control treatment response ($p < 0.05$).

a - Low dissolved oxygen (D.O.) values were observed in this test treatment, and aeration of the test could not maintain the D.O. >4 mg/L, potentially causing the reduced survival and growth in this treatment rather than a contaminant.

b – The EPA manual indicates that "concentrations that had a significant toxic effect on one of the observed responses would not be subsequently tested for an effect on some other response as only applying to dilution series testing." The Surface Water Ambient Monitoring Program (SWAMP) Roundtable has ruled that this does not apply to testing of 100% solution testing, and that hypothesis test results for both the survival and sub-lethal endpoints must be reported for SWAMP compliant programs. We have complied with this requirement by indicating that this treatment is toxic to survival and reproduction.

3.3 Effects of VCWPD Major Outfall Station Stormwater on *Selenastrum capricornutum*

The results for this test are summarized in Table 4. There was no significant reduction in algal growth in the MO-MPK stormwater sample. The test data and summary of statistical analyses for this test are presented in Appendix D

Table 4. Effects of VCWPD major outfall station stormwater on *Selenastrum capricornutum*.

Test Initiation Date (Time)	Treatment/Sample ID	Mean Algal Cell Density (cells/mL x 10^6)
1/10/18 (1709)	Lab Control	2.58
	MO-MPK	4.44

3.4 Effects of VCWPD Major Outfall Station Stormwater on *Ceriodaphnia dubia*

The results for this test are summarized in Table 5. There was no significant reduction in *C. dubia* survival in any of the stormwater samples tested. There was no significant reduction in *C. dubia* reproduction in the MO-SIM, MO-THO, and MO-FIL stormwater samples when an outlier replicate in the Lab Control treatment was excluded from the analyses; there was a significant reduction in the MO-THO stormwater sample when the Lab Control outlier replicate was included in the analyses. There was a significant reduction in reproduction in the MO-HUE and MO-VEN stormwater samples (both including and excluding the outlier replicate in the Lab Control). The test data and summary of statistical analyses excluding outliers are presented in Appendix E; the summary of statistical analyses including outliers is presented in Appendix F.

Table 5. Effects of VCWPD major outfall station stormwater on *Ceriodaphnia dubia*.

Test Initiation Date (Time)	Treatment/Sample ID	Mean % Survival	Mean Reproduction (# neonates/female)
1/10/18 (1900)	Lab Control	100	34.3/36.0[a]
	MO-SIM	100	38.1/36.1[a]
	MO-THO	100	**29.2***
	MO-HUE	70	**9.3***
	MO-VEN	90	**17.0***
	MO-FIL	100	33.2/31.5[a]

* The response at this test treatment was significantly less than the Lab Control treatment response ($p < 0.05$).

a - Analysis of the data indicated the presence of an outlier in this treatment, and the results reported above are for the analyses of the test data excluding the outlier. As per EPA guidelines, the test data were analyzed both with and without the outlier, and the results of both sets of analyses are reported in the appendices.

3.5 Effects of VCWPD Major Outfall Station Stormwater on Fathead Minnows

The results for this test are summarized in Table 6. There was no significant reduction in fathead minnow survival in the MO-CAM and MO-SPA stormwater samples; there was a significant reduction in survival in the MO-OJA, MO-MEI, and MO-OXN stormwater samples. There was a significant reduction in fathead minnow growth in all stormwater samples tested. The test data and summary of statistical analyses for this test are presented in Appendix G.

Table 6. Effects of VCWPD major outfall station stormwater on fathead minnows.

Test Initiation Date (Time)	Treatment/Sample ID	Mean % Survival	Mean Biomass Value (mg)
1/10/18 (1854)	Lab Control	100	1.01
	MO-CAM	100	**0.87***
	MO-OJA	**65.0***	**0.32*[a,c]**
	MO-MEI	**36.7***	**0.13*[a,b,c]**
	MO-OXN	**87.5***	**0.60*[a,c]**
	MO-SPA	87.5	**0.44***

* The response at this test treatment was significantly less than the Lab Control treatment response ($p < 0.05$).

a - Pathogen related mortalities (PRM) were observed in this treatment. PRM is considered an artifact of the test methodology. PRM is well documented in the EPA guidelines (EPA-821-R-02-013) as caused by microorganisms, and it is acknowledged that PRM interferes with the toxicity evaluation. PRM was not observed in the Lab Control treatment, indicating that the source of pathogens was the stormwater sample.

b - Low dissolved oxygen (D.O.) values were observed in this test treatment, potentially causing the reduced survival and growth rather than a contaminant. Sample filtration and aeration should be considered prior to conducting future testing on this site water.

c – The EPA manual indicates that "concentrations that had a significant toxic effect on one of the observed responses would not be subsequently tested for an effect on some other response as only applying to dilution series testing." The Surface Water Ambient Monitoring Program (SWAMP) Roundtable has ruled that this does not apply to testing of 100% solution testing, and that hypothesis test results for both the survival and sub-lethal endpoints must be reported for SWAMP compliant programs. We have complied with this requirement by indicating that this treatment is toxic to survival and reproduction.

4. AQUATIC TOXICITY DATA QUALITY CONTROL

Two QC measures were assessed during the toxicity testing:

- Maintenance of acceptable test conditions; and
- Negative Control testing;

4.1 Maintenance of Acceptable Test Conditions

Due to the timing of the storm and concern for VCWPD staff safety, the samples were collected over two days and transported to PER the following morning. Tests using samples that were collected on January 8 were initiated outside the 36 hr hold time, but within 72 hrs as allowed in the VCWPD MRP. During the routine D.O. check of the *A. affinis* test on Day 1, a low D.O. of <1.0 mg/L was measured in the ME-VR2 sample, resulting in aeration for the remainder of testing. Despite aeration, the sample continued to exhibit low D.O. values (possibly due to the amount of solids present), potentially causing the observed reduction in survival and growth. During the routine D.O. check of the fathead minnow test on Day 0, a low D.O. of 3.1 mg/L and <1.0 mg/L was measured in the MO-OJA and MO-MEI samples, respectively, resulting in aeration for the remainder of testing; the MO-SPA sample was aerated on Day 1 due to a low D.O. of 4.1 mg/L, and the MO-CAM sample was aerated on Day 5 due to a low D.O. of 4.8 mg/L. Despite aeration of the MO-MEI sample, the sample continued to exhibit low D.O. values (possibly due to the amount of solids present), potentially causing the observed reduction in survival and growth.

Pathogen related mortalities (PRM) were observed in the fathead minnow test in sites MO-OJA MO-OXN, and MO-MEI. PRM is considered an artifact of the test methodology. PRM is well documented in the EPA guidelines (EPA-821-R-02-013) as caused by microorganisms, and it is acknowledged that PRM interferes with the toxicity evaluation. PRM was not observed in the Lab Control treatment, indicating that the source of pathogens was the ambient water sample.

The Salt Control treatment in the purple urchin fertilization test was significantly less than in the Lab Water Control, indicating that the use of artificial sea salt may have impaired fertilization.

Otherwise, all other test conditions (pH, D.O., temperature, etc.) were within acceptable limits. All analyses were performed according to laboratory Standard Operating Procedures.

4.2 Negative Control Testing

The responses at the Lab Control treatments were acceptable.

5. SUMMARY AND CONCLUSIONS

An evaluation of the toxicity of VCWPD stormwater samples was conducted utilizing samples collected on January 8-9, 2018. A summary of test results is provided below.

Chronic Toxicity of VCWPD Stormwater to Purple Urchin Fertilization
There was ***no*** significant reduction in purple urchin fertilization in the ME-SCR stormwater sample.

Chronic Toxicity of VCWPD Stormwater to *Atherinops affinis* (Topsmelt)
There was ***no*** significant reduction in topsmelt survival or growth in the ME-CC stormwater sample. There ***was*** a significant reduction in topsmelt survival and growth in the ME-VR2 stormwater sample.

Chronic Toxicity of VCWPD Stormwater to *Selenastrum capricornutum*
There was ***no*** significant reduction in *S. capricornutum* growth in the MO-MPK stormwater sample.

Chronic Toxicity of VCWPD Stormwater to *Ceriodaphnia dubia*
There was ***no*** significant reduction in *C. dubia* survival in any of the stormwater samples. There was ***no*** significant reduction in *C. dubia* reproduction in the MO-SIM, MO-THO, and MO-FIL stormwater samples when an outlier replicate in the Lab Control treatment was excluded from the analyses; there was a significant reduction in the MO-THO stormwater sample when the Lab Control outlier replicate was included in the analyses. There ***was*** a significant reduction in reproduction in the MO-HUE and MO-VEN stormwater samples (both including and excluding the outlier replicate in the Lab Control).

Chronic Toxicity of VCWPD Stormwater to Fathead Minnows
There was ***no*** significant reduction in fathead minnow survival in the MO-CAM and MO-SPA stormwater samples; there ***was*** a significant reduction in survival in the MO-OJA, MO-MEI, and MO-OXN stormwater samples. There ***was*** a significant reduction in fathead minnow growth in all stormwater samples tested.

Appendix A

Chain-of-Custody Records for the Collection and Delivery of the VCWPD Samples

Pacific EcoRisk
2250 Cordelia Rd., Fairfield, CA 94534
(707) 207-7760 FAX (707) 207-7916

CHAIN-OF-CUSTODY RECORD

Results To:	Ventura County Watershed Protection District	**Invoice To:**	Ventura County Public Works Agency
Address:	800 South Victoria Ave., L#1610 Ventura, CA 93009-1610	**Address:**	Engineering Services Division 800 South Victoria Ave, L#1670 Ventura, CA 93009-1670
Phone:	(805) 658-4375	**Phone:**	
Attn:	Kelly Hahs	**Attn:**	Victoria Escoto
E-mail:	Kelly.Hahs@ventura.org	**E-mail:**	
Project Name:	NPDES Stormwater Monitoring Program - 2017/18-1 (Wet)		
P.O.#/Ref:	Contract No. AE18-015		

	Client Sample ID	Sample Date	Sample Time	Sample Matrix*	Grab/ Comp	Container Number	Container Type	Topsmelt (*Atherinops affinis*) Survival and Growth, EPA	Purple Urchin (*S. purpuratus*) Sperm Fertilization, EPA 1008.0	*Selenastrum Capricornutum* Algal Growth, EPA 1003.0	*Ceriodaphnia dubia* Survival and Reproduction, EPA 1002.0	Fathead Minnow (*P. promelas*) Survival and Growth, EPA 1000.0						Collected by	
1	ME-CC	1/9/18	0940	FW	Grab	2	2.5-gal jerrican	X										JM	JM, TS
2	ME-SCR	↓	1245	FW	Grab	2	2.5-gal jerrican		X										JM, TS
3	ME-VR2	↓	1110	FW	Grab	2	2.5-gal jerrican	X											JM, TS
4	MO-CAM	1/8/18	2100	FW	Grab	2	2.5-gal jerrican					X							JM, DL
5	MO-OJA	↓	1315	FW	Grab	2	2.5-gal jerrican					X							WBC, TS
6	MO-MEI	↓	1415	FW	Grab	2	2.5-gal jerrican					X							WBC, TS
7	MO-VEN	↓	1707	FW	Grab	2	2.5-gal jerrican				X								JM, DL
8																			
9																			
10																			

REQUESTED ANALYSIS

Samples collected by:

Comments/Special Instruction:

All sites/species: 100% concentration only

Perform TIE if >50% effect; notify client immediately if toxicity is observed

RELINQUISHED BY: KELLY HAHS	**RECEIVED BY:**
Signature:	**Signature:**
Print: KELLY HAHS	**Print:** Vernie Chaban
Organization: VCWPD	**Organization:** Fed Ex cc
Date: 1/9/18 **Time:** 1512	**Date:** 1/9/18 **Time:** 1512
RELINQUISHED BY:	**RECEIVED BY:**
Signature:	**Signature:**
Print:	**Print:** Samantha Cowdin
Organization:	**Organization:** PER
Date: **Time:**	**Date:** 1/10/18 **Time:** 0745

***Example Matrix Codes**: (**EFF** - Effluent) (**FW** = Freshwater); (**SW** = Saltwater); (**WW** = Wastewater); (**STRMW** = Stormwater); (**SED** = Sediment); or other

Pacific EcoRisk
2250 Cordelia Rd., Fairfield, CA 94534
(707) 207-7760 FAX (707) 207-7916

CHAIN-OF-CUSTODY RECORD

Results To:	Ventura County Watershed Protection District	**Invoice To:**	Ventura County Public Works Agency
Address:	800 South Victoria Ave., L#1610 Ventura, CA 93009-1610	**Address:**	Engineering Services Division 800 South Victoria Ave., L#1670 Ventura CA 93009-1670
Phone:	(805) 658-4375	**Phone:**	
Attn:	Kelly Hahs	**Attn:**	Victoria Escoto
E-mail:	Kelly.Hahs@ventura.org	**E-mail:**	
Project Name:	NPDES Stormwater Monitoring Program - 2017/18-1 (Wet)		
P.O.#/Ref:	Contract No. AE18-015		

	Client Sample ID	Sample Date	Sample Time	Sample Matrix*	Grab/ Comp	Container Number	Container Type	Topsmelt (*Atherinops affinis*) Survival and Growth, EPA	Purple Urchin (*S. purpuratus*) Sperm Fertilization, EPA 1008.0	*Selenastrum Capricornutum* Algal Growth, EPA 1003.0	*Ceriodaphnia dubia* Survival and Reproduction, EPA 1002.0	Fathead Minnow (*P. promelas*) Survival and Growth, EPA 1000.0							Collected by:
		REQUESTED ANALYSIS																	
1	MO-OXN	1/8/18	1835	FW	Grab	2	2.5-gal jerrican					X							JM, DL
2	MO-HUE		1955	FW	Grab	2	2.5-gal jerrican				X								JM, DL
3	MO-THO		2010	FW	Grab	2	2.5-gal jerrican				X								LM, PD
4	MO-MPK		1740	FW	Grab	2	2.5-gal jerrican			X									LM, PD
5	MO-SIM		1910	FW	Grab	2	2.5-gal jerrican				X								LM, PD
6	MO-FIL		1645	FW	Grab	2	2.5-gal jerrican				X								WBC, TS
7	MO-SPA		1600	FW	Grab	2	2.5-gal jerrican					X							WBC, TS
8																			
9																			
10																			

Samples collected by:

Comments/Special Instruction:

All sites/species: 100% concentration only

Perform TIE if >50% effect; notify client immediately if toxicity is observed

MO-HUE: If salinity >2ppt, perform additional topsmelt test for comparison

RELINQUISHED BY:	**RECEIVED BY:**
Signature: Kelly Hahs	**Signature:** Bench
Print: KELLY HAHS	**Print:** Vendo Choban
Organization: VCWPD	**Organization:** FedEx CC
Date: 1/9/18 **Time:** 1512	**Date:** 1/9/18 **Time:** 1512
RELINQUISHED BY:	**RECEIVED BY:**
Signature:	**Signature:** Samantha Cowden
Print:	**Print:** Samantha Cowden
Organization:	**Organization:** DFR
Date: **Time:**	**Date:** 1/10/18 **Time:** 0745

***Example Matrix Codes**: (**EFF** - Effluent) (**FW** = Freshwater); (**SW** = Saltwater); (**WW** = Wastewater); (**STRMW** = Stormwater); (**SED** = Sediment); or other

Appendix B

Test Data and Summary of Statistics for the Evaluation of the Chronic Toxicity of the VCWPD Stormwater to Purple Urchin Fertilization

CETIS Summary Report

Echinoid Fertilization Test — **Pacific EcoRisk**

Batch ID:	00-1165-2942	**Test Type:**	Fertilization	**Analyst:**	Stevi Vasquez
Start Date:	10 Jan-18 11:07	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Not Applicable
Ending Date:	10 Jan-18 11:47	**Species:**	Strongylocentrotus purpuratus	**Brine:**	Tropic Marin
Duration:	40m	**Source:**	Alexi Gabriel	**Age:**	N/A

Comments:
Statistics comparing site water to salt control due to salt interference

Sample Code	Sample ID	Sample Date	Receipt Date	Sample Age	Client Name	Project
VCWPD_0110_SP	05-6408-6491	10 Jan-18 11:07	10 Jan-18 11:07	n/a (11.9 °C)	Ventura County Watersh	27911
VCWPD_SP_SALT	02-8057-2399	10 Jan-18 11:07	10 Jan-18 11:07	n/a (11.9 °C)		
ME-SCR	04-8509-6239	09 Jan-18 12:45	10 Jan-18 07:45	22h (0 °C)		

Sample Code	Material Type	Sample Source	Station Location	Lat/Long
VCWPD_0110_SP	Lab Water	Ventura County Watershed Prote	LABQA	
VCWPD_SP_SALT	Salt Control	Ventura County Watershed Prote	Salt Control	
ME-SCR	Ambient Water	Ventura County Watershed Prote	ME-SCR	

Single Comparison Summary

Analysis ID	Endpoint	Comparison Method	P-Value	Comparison Result
04-6358-0783	Fertilization Rate	Equal Variance t Two-Sample Test	1.2E-04	VCWPD_SP_SALT failed fertilization rate
18-5155-7018	Fertilization Rate	Equal Variance t Two-Sample Test	0.9949	ME-SCR passed fertilization rate

Fertilization Rate Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
VCWPD_0110_SP	LW	4	0.990	0.972	1.000	0.980	1.000	0.006	0.012	1.17%	0.00%
VCWPD_SP_SALT	SA	4	0.315	0.000	0.646	0.150	0.610	0.104	0.208	66.06%	68.18%
ME-SCR		4	0.720	0.625	0.815	0.650	0.790	0.030	0.059	8.26%	27.27%

Fertilization Rate Detail

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4
VCWPD_0110_SP	LW	1.000	0.980	1.000	0.980
VCWPD_SP_SALT	SA	0.310	0.150	0.610	0.190
ME-SCR		0.740	0.700	0.650	0.790

Fertilization Rate Binomials

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4
VCWPD_0110_SP	LW	100/100	98/100	100/100	98/100
VCWPD_SP_SALT	SA	31/100	15/100	61/100	19/100
ME-SCR		74/100	70/100	65/100	79/100

Echinoid Fertilization Test — **Pacific EcoRisk**

Analysis ID:	04-6358-0783	**Endpoint:**	Fertilization Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	23 Jan-18 10:53	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Alt Hyp	Comparison Result	PMSD
Angular (Corrected)	C > T	VCWPD_SP_SALT failed fertilization rate	8.94%

Equal Variance t Two-Sample Test

Sample I	vs	Sample II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Lab Water Control		Salt Control*	7.75	1.94	0.223	6	CDF	1.2E-04	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1.5876	1.5876	1	60.1	2.4E-04	Significant Effect
Error	0.158408	0.0264013	6			
Total	1.74601		7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	17.8	47.5	0.0411	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.899	0.645	0.2810	Normal Distribution

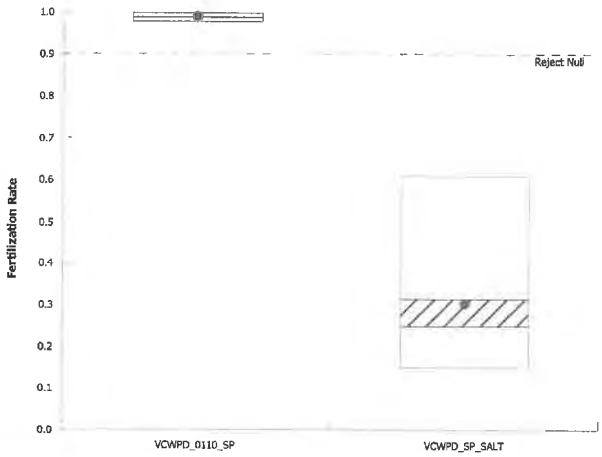
Fertilization Rate Summary

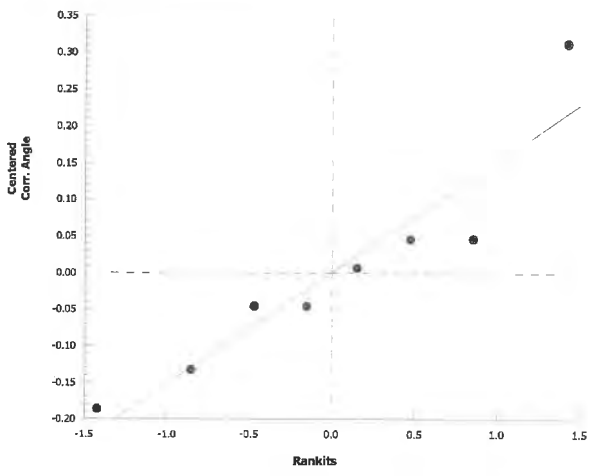
Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_0110_SP	LW	4	0.990	0.972	1.000	0.990	0.980	1.000	0.006	1.17%	0.00%
VCWPD_SP_SALT	SA	4	0.315	0.000	0.646	0.250	0.150	0.610	0.104	66.06%	68.18%

Angular (Corrected) Transformed Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_0110_SP	LW	4	1.47	1.39	1.56	1.47	1.43	1.52	0.0265	3.60%	0.00%
VCWPD_SP_SALT	SA	4	0.584	0.228	0.94	0.521	0.398	0.896	0.112	38.29%	60.41%

Graphics





Echinoderm Fertilization Toxicity Test Data Sheet

Client: **Ventura County Water Protection District**
Test Material: Salt Control
Test Species: *S. purpuratus*
Test ID #: 76374
Project #: 27911
Sample Salinity adjusted with : Tropic Marin

Test Start Date: 1/10/18
Test End Date: 1/10/18
Enumeration Date: 1/12/18
Investigator: CO

Concentration	Replicate	Number of Fertilized Eggs	Number of Unfertilized Eggs	Total Number of Eggs	Percent Fertilization
Control	A	100	0	100	100
	B	98	2	100	98
	C	100	0	100	100
	D	98	2	100	98
Salt Control	A	31	69	100	31
	B	15	85	100	15
	C	61	39	100	61
	D	19	81	100	19

Echinoderm Fertilization Toxicity Test Water Chemistry Data

Client: Ventura County Water Protection District
Test Material: Salt Control
Test Species *S. purpuratus*
Test ID#: 76374 Project #: 27911
Sample Salinity adjusted with : Tropic Marin

Organism Log#: 10721 Age: N/A
Organism Supplier: Alexi
Control/Diluent: FSW
Test Date: 1/10/18 Randomization: —

Treatment	Temperature (°C)	pH	D.O. (mg/L)	Salinity (ppt)	Signoff
Lab Control	11.9	7.77	9.4	33.8	Date: 1/10/18
Salt Control	11.9	8.37	8.6	33.4	Sample ID: —
					Test Solution Prep: JC
					New WQ: TA
					Innoculation Time: 1107
					Innoculation Signoff: CD
Meter ID	35A	PH19	RD09	EC08	

Echinoid Fertilization Test — **Pacific EcoRisk**

Analysis ID:	18-5155-7018	**Endpoint:**	Fertilization Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	23 Jan-18 10:53	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Alt Hyp	Comparison Result	PMSD
Angular (Corrected)	C > T	ME-SCR passed fertilization rate	61.19%

Equal Variance t Two-Sample Test

Sample I	vs	Sample II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Salt Control		ME-SCR	-3.69	1.94	0.227	6	CDF	0.9949	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.371461	0.371461	1	13.6	0.0102	Significant Effect
Error	0.163295	0.0272158	6			
Total	0.534756		7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	11.3	47.5	0.0772	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.921	0.645	0.4399	Normal Distribution

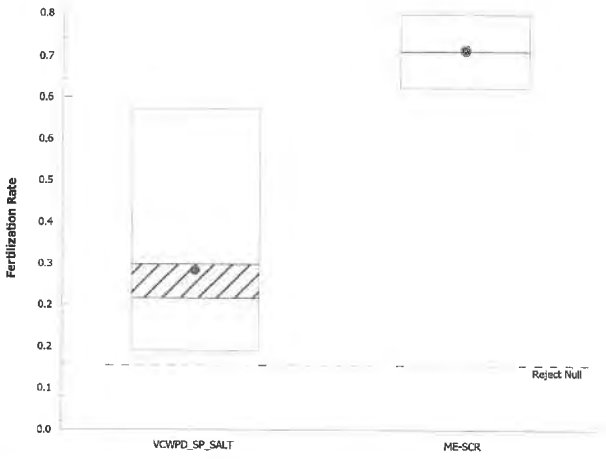
Fertilization Rate Summary

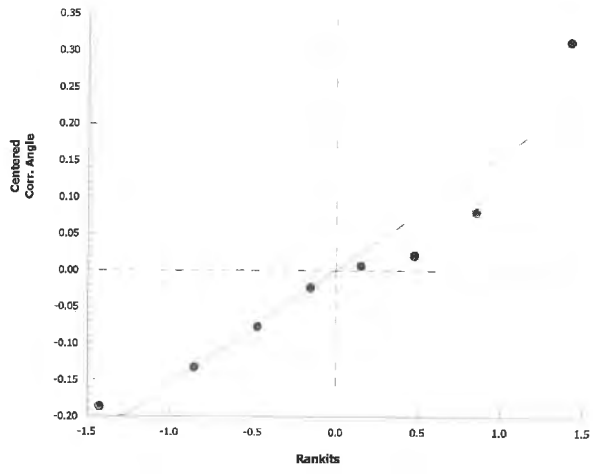
Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_SP_SALT	SA	4	0.315	0.000	0.646	0.250	0.150	0.610	0.104	66.06%	0.00%
ME-SCR		4	0.720	0.625	0.815	0.720	0.650	0.790	0.030	8.26%	-128.57%

Angular (Corrected) Transformed Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_SP_SALT	SA	4	0.584	0.228	0.94	0.521	0.398	0.896	0.112	38.29%	0.00%
ME-SCR		4	1.01	0.909	1.12	1.01	0.938	1.09	0.0333	6.57%	-73.81%

Graphics





Echinoderm Fertilization Toxicity Test Data Sheet

Client: **Ventura County Water Protection District**
Test Material: ME-SCR
Test Species: *S. purpuratus*
Test ID #: 76374
Project #: 27911
Sample Salinity adjusted with : Tropic Marin

Test Start Date: 1/10/18
Test End Date: 1/10/18
Enumeration Date: 1/12/18
Investigator: CO

Concentration	Replicate	Number of Fertilized Eggs	Number of Unfertilized Eggs	Total Number of Eggs	Percent Fertilization
Lab Water Control	A	100	0	100	100
	B	98	2	100	98
	C	100	0	100	100
	D	98	2	100	98
100%	A	74	26	100	74
	B	70	30	100	70
	C	65	35	100	65
	D	79	21	100	79

Echinoderm Fertilization Toxicity Test Water Chemistry Data

Client: **Ventura County Water Protection District**
Test Material: ME-SCR
Test Species *S. purpuratus*
Test ID#: 76374 Project #: 27911
Sample Salinity adjusted with : Tropic Marin

Organism Log#: 10721 Age: N/A
Organism Supplier: Aloxi
Control/Diluent: FSW
Test Date: 1/10/18 Randomization: -

Treatment	Temperature (°C)	pH	D.O. (mg/L)	Salinity (ppt)	Signoff
Lab Water Control	11.9	7.77	9.4	33.8	Date: 1/10/18
100%	11.9	7.98	8.5	33.8	Sample ID: 48473
Meter ID	35A	PH19	RD09	EC08	Test Solution Prep: RE
					New WQ: TA
					Innoculation Time: 1107
					Innoculation Signoff: CJ

Appendix C

Test Data and Summary of Statistics for the Evaluation of the Chronic Toxicity of the VCWPD Stormwater to *Atherinops affinis*

CETIS Summary Report

Chronic Larval Fish Survival and Growth Test — **Pacific EcoRisk**

Batch ID:	21-3784-5775	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Stevi Vasquez
Start Date:	10 Jan-18 17:10	**Protocol:**	EPA/600/R-95/136 (1995)	**Diluent:**	Not Applicable
Ending Date:	17 Jan-18 08:19	**Species:**	Atherinops affinis	**Brine:**	Crystal Sea
Duration:	6d 15h	**Source:**	Aquatic Biosystems, CO	**Age:**	15

Sample Code	Sample ID	Sample Date	Receipt Date	Sample Age	Client Name	Project
VCWPD_0110_AA	13-7829-4867	10 Jan-18 17:10	10 Jan-18 17:10	n/a (19.4 °C)	Ventura County Watersh	27911
ME-CC	16-7887-2972	09 Jan-18 09:40	10 Jan-18 07:45	32h (0 °C)		
ME-VR2	15-2479-1239	09 Jan-18 11:10	10 Jan-18 07:45	30h (0 °C)		

Sample Code	Material Type	Sample Source	Station Location	Lat/Long
VCWPD_0110_AA	Lab Water	Ventura County Watershed Prote	LABQA	
ME-CC	Ambient Water	Ventura County Watershed Prote	ME-CC	
ME-VR2	Ambient Water	Ventura County Watershed Prote	ME-VR2	

SIngle Comparison Summary

Analysis ID	Endpoint	Comparison Method	P-Value	Comparison Result
06-5541-8475	7d Survival Rate	Wilcoxon Rank Sum Two-Sample Test	1.0000	ME-CC passed 7d survival rate
20-2662-0289	7d Survival Rate	Wilcoxon Rank Sum Two-Sample Test	0.0040	ME-VR2 failed 7d survival rate
18-3002-9316	Mean Dry Biomass-mg	Equal Variance t Two-Sample Test	0.9740	ME-CC passed mean dry biomass-mg
15-0896-2589	Mean Dry Biomass-mg	Equal Variance t Two-Sample Test	1.4E-05	ME-VR2 failed mean dry biomass-mg

7d Survival Rate Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
VCWPD_0110_AA	LW	5	0.920	0.698	1.000	0.600	1.000	0.080	0.179	19.44%	0.00%
ME-CC		5	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.00%	-8.70%
ME-VR2		5	0.160	0.049	0.271	0.000	0.200	0.040	0.089	55.90%	82.61%

Mean Dry Biomass-mg Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
VCWPD_0110_AA	LW	5	1.54	1.18	1.9	1.11	1.93	0.131	0.292	19.01%	0.00%
ME-CC		5	1.88	1.67	2.09	1.73	2.17	0.0752	0.168	8.94%	-22.36%
ME-VR2		5	0.268	0.0639	0.472	0	0.42	0.0735	0.164	61.33%	82.58%

7d Survival Rate Detail

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
VCWPD_0110_AA	LW	1.000	0.600	1.000	1.000	1.000
ME-CC		1.000	1.000	1.000	1.000	1.000
ME-VR2		0.200	0.200	0.200	0.200	0.000

Mean Dry Biomass-mg Detail

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
VCWPD_0110_AA	LW	1.62	1.11	1.49	1.93	1.54
ME-CC		1.81	1.86	2.17	1.85	1.73
ME-VR2		0.42	0.362	0.324	0.234	0

7d Survival Rate Binomials

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
VCWPD_0110_AA	LW	5/5	3/5	5/5	5/5	5/5
ME-CC		5/5	5/5	5/5	5/5	5/5
ME-VR2		1/5	1/5	1/5	1/5	0/5

Chronic Larval Fish Survival and Growth Test — **Pacific EcoRisk**

Analysis ID:	06-5541-8475	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	23 Jan-18 13:25	**Analysis:**	Nonparametric-Two Sample	**Official Results:**	Yes

Data Transform	Alt Hyp	Comparison Result	PMSD
Angular (Corrected)	C > T	ME-CC passed 7d survival rate	15.21%

Wilcoxon Rank Sum Two-Sample Test

Sample I	vs	Sample II	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision(α:5%)
Lab Water Control		ME-CC	30	n/a	1	8	Exact	1.0000	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.021087	0.021087	1	1	0.3466	Non-Significant Effect
Error	0.168696	0.021087	8			
Total	0.189783		9			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Levene Equality of Variance Test	7.11	11.3	0.0285	Equal Variances
Variances	Mod Levene Equality of Variance Test	1	13.7	0.3559	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.625	0.741	1.1E-04	Non-Normal Distribution

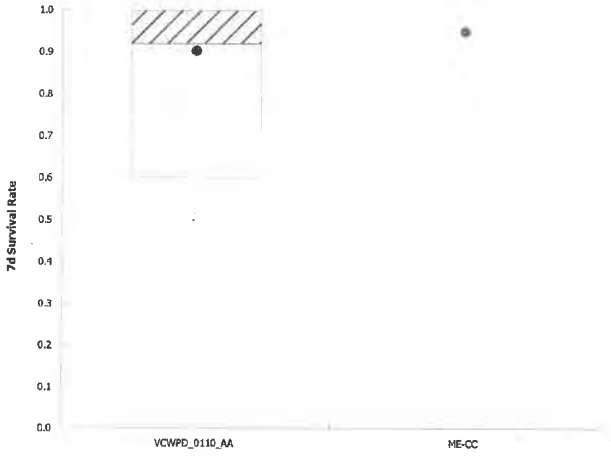
7d Survival Rate Summary

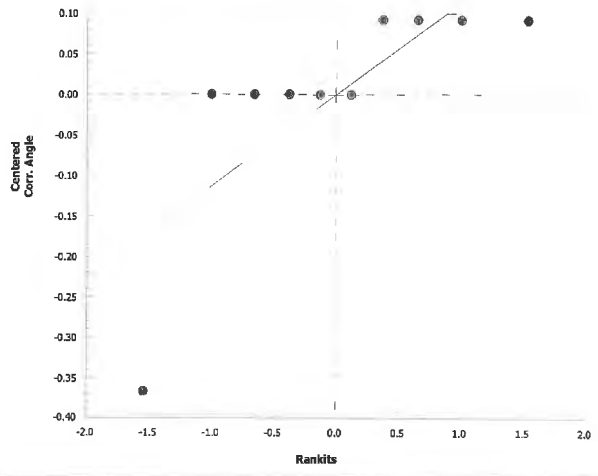
Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_0110_AA	LW	5	0.920	0.698	1.000	1.000	0.600	1.000	0.080	19.44%	0.00%
ME-CC		5	1.000	1.000	1.000	1.000	1.000	1.000	0.000	0.00%	-8.70%

Angular (Corrected) Transformed Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_0110_AA	LW	5	1.25	0.998	1.51	1.35	0.886	1.35	0.0918	16.38%	0.00%
ME-CC		5	1.35	1.35	1.35	1.35	1.35	1.35	0	0.00%	-7.33%

Graphics





Chronic Larval Fish Survival and Growth Test — **Pacific EcoRisk**

Analysis ID:	18-3002-9316	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.2
Analyzed:	23 Jan-18 13:25	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C > T	ME-CC passed mean dry biomass-mg	18.24%

Equal Variance t Two-Sample Test

Sample I	vs	Sample II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Lab Water Control		ME-CC	-2.28	1.86	0.281	8	CDF	0.9740	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.295838	0.295838	1	5.2	0.0521	Non-Significant Effect
Error	0.455313	0.0569142	8			
Total	0.751152		9			

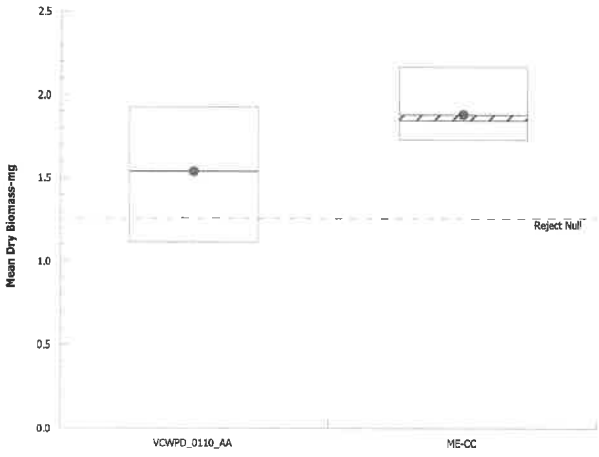
Distributional Tests

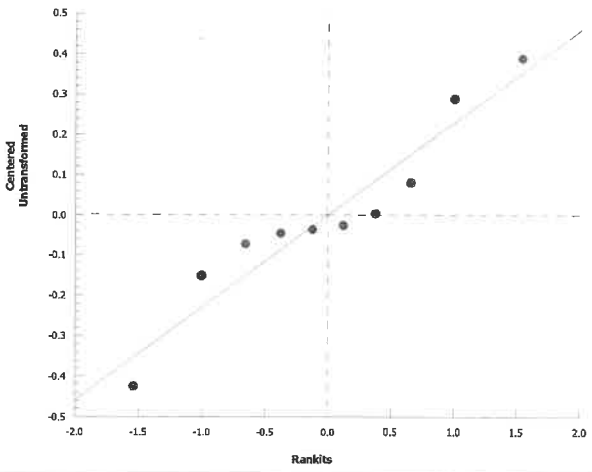
Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	3.02	23.2	0.3094	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.934	0.741	0.4854	Normal Distribution

Mean Dry Biomass-mg Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_0110_AA	LW	5	1.54	1.18	1.9	1.54	1.11	1.93	0.131	19.01%	0.00%
ME-CC		5	1.88	1.67	2.09	1.85	1.73	2.17	0.0752	8.94%	-22.36%

Graphics





7 Day Chronic Topsmelt (*A. affinis*) Toxicity Test Data

Client: **Ventura County Water Protection District** Organism Log#: 10725 Age: 15 days

Test Material: ~~SD 11/2/18 MO CC~~ ME-CC Organism Supplier: ABS

Test ID#: 76371 Project #: 27911 Control Water: FSW

Test Date: 1/10/18 Randomization: 5.3.4 Control Water Batch: —

Test Treatment	Temp (°C)	pH new	pH old	D.O. (mg/L) new	D.O. (mg/L) old	Salinity (ppt)	# Live Organisms A	B	C	D	E	SIGN-OFF
Lab Water Control	19.4	7.56		7.4		34.1	5	5	5	5	5	Date: 1/10/18 Test Solution Prep: SF
100%	20.0	7.88		8.8		33.7	5	5	5	5	5	Initiation Time: 1710 Initiation Signoff: RG
Meter ID	58A	PH21		RD12		EC11	New WQ: IA					Sample ID: 48472
Lab Water Control	20.1	7.13	7.55	5.4	7.2	34.2	5	5	5	5	5	Date: 1/11/18 Test Solution Prep: MS
100%	20.1	7.78	7.79	8.3	5.3	33.3	5	5	5	5	5	Renewal Time: 1640 Renewal Signoff: EP
Meter ID	81A	PH19	PH21	RD10	RD11	EC11	New WQ: TF		Old WQ: LZ			Sample ID: 48472
Lab Water Control	20.2	7.88	7.83	8.6	7.4	34.2	5	5	5	5	5	Date: 1/12/18 Test Solution Prep: SD
100%	20.1	7.90	8.08	6.9	6.5	34.3	5	5	5	5	5	Renewal Time: 1440 Renewal Signoff: CO
Meter ID	40A	PH15	PH23	RD11	RD09	EC11	New WQ: TA		Old WQ: TA			Sample ID: 48472
Lab Water Control	20.0	7.70	7.55	9.1	7.3	34.3	5	5	5	5	5	Date: 1/13/18 Test Solution Prep: EP
100%	20.0	7.67	7.85	7.4	6.5	33.7	5	5	5	5	5	Renewal Time: 1335 Renewal Signoff: SMC
Meter ID	40A	PH19	PH19	RD10	RD10	EC12	New WQ: LZ		Old WQ: TA			Sample ID: 48472
Lab Water Control	20.1	7.79	7.54	10.1	8.4	33.8	5	5	5	5	5	Date: 1/14/18 Test Solution Prep: SD
100%	20.5	7.71	7.84	7.6	7.5	33.6	5	5	5	5	5	Renewal Time: 1625 Renewal Signoff: CO
Meter ID	58A	PH19	PH19	RD10	RD10	EC08	New WQ: LZ		Old WQ: LZ			Sample ID: 48472
Lab Water Control	20.1	7.69	7.65	8.6	7.2	34.1	5	4	5	5	5	Date: 1/15/18 Test Solution Prep: TR
100%	20.2	7.74	7.85	8.0	6.3	33.5	5	5	5	5	5	Renewal Time: 1440 Renewal Signoff: MM
Meter ID	92A	PH21	PH23	RD12	RD12	EC10	New WQ: TA		Old WQ: AF			Sample ID: 48472
Lab Water Control	20.0	7.75	7.57	9.2	6.9	34.2	5	4	5	5	5	Date: 1/16/18 Test Solution Prep: JV
100%	20.6	7.72	7.90	8.2	6.8	33.6	5	5	5	5	5	Renewal Time: 1453 Renewal Signoff: RG
Meter ID	10A	PH23	PH23	RD12	RD12	EC11	New WQ: IA		Old WQ: IA			Sample ID: 48472
Lab Water Control	19.6		7.58		6.8	35.7	5	3	5	5	5	Date: 1/17/18 Termination Time: 0819
100%	20.4		7.88		6.6	34.0	5	5	5	5	5	Termination Signoff: RG
Meter ID	94A		PH19		RD10	EC12			Old WQ: TA			

RG 1/10/18

Chronic Topsmelt Dry Weight and Biomass Data

Client: **Ventura County Water Protection District** Test ID #: 76371 Project # 27911

Sample: **ME-CCC** Tare Weight Date: 1/13/18 Sign-off: RAP

Test Date: 1/10/18 Final Weight Date: 1/15/18 Sign-off: RAP

Pan ID	Concentration	Replicate	Initial Pan Weight (mg)	Final Pan Weight (mg)	Initial # of Organisms	Biomass Value (mg)
1	Lab Water	A	412.06	420.15	5	1.62
2	Control	B	407.22	412.78	5	1.11
3		C	411.80	419.26	5	1.49
4		D	414.56	424.20	5	1.93
5		E	412.03	419.74	5	1.54
6	100%	A	410.12	419.17	5	1.810 for 1/24/18
7		B	398.90	405.18	5	1.86
8		C	411.44	422.29	5	2.17
9		D	400.73	409.96	5	1.85
10		E	413.19	421.84	5	1.73
QA 1			402.34	402.36		

Chronic Larval Fish Survival and Growth Test — **Pacific EcoRisk**

Analysis ID:	20-2662-0289	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	23 Jan-18 13:25	**Analysis:**	Nonparametric-Two Sample	**Official Results:**	Yes

Data Transform	Alt Hyp	Comparison Result	PMSD
Angular (Corrected)	C > T	ME-VR2 failed 7d survival rate	17.18%

Wilcoxon Rank Sum Two-Sample Test

Sample I	vs	Sample II	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision(α:5%)
Lab Water Control		ME-VR2*	15	n/a	0	8	Exact	0.0040	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1.75318	1.75318	1	65.5	4.0E-05	Significant Effect
Error	0.214062	0.0267578	8			
Total	1.96725		9			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	3.72	23.2	0.2314	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.644	0.741	1.9E-04	Non-Normal Distribution

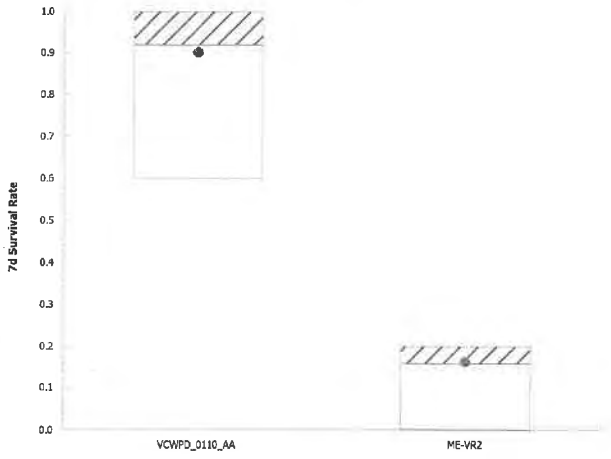
7d Survival Rate Summary

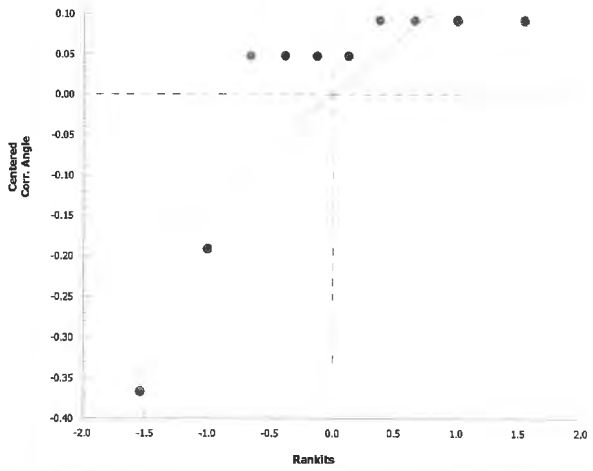
Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_0110_AA	LW	5	0.920	0.698	1.000	1.000	0.600	1.000	0.080	19.44%	0.00%
ME-VR2		5	0.160	0.049	0.271	0.200	0.000	0.200	0.040	55.90%	82.61%

Angular (Corrected) Transformed Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_0110_AA	LW	5	1.25	0.998	1.51	1.35	0.886	1.35	0.0918	16.38%	0.00%
ME-VR2		5	0.416	0.284	0.548	0.464	0.226	0.464	0.0476	25.60%	66.81%

Graphics





Chronic Larval Fish Survival and Growth Test — **Pacific EcoRisk**

Analysis ID:	15-0896-2589	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.2
Analyzed:	23 Jan-18 13:25	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C > T	ME-VR2 failed mean dry biomass-mg	18.13%

Equal Variance t Two-Sample Test

Sample I	vs	Sample II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Lab Water Control		ME-VR2*	8.47	1.86	0.279	8	CDF	1.4E-05	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	4.0348	4.0348	1	71.7	2.9E-05	Significant Effect
Error	0.450166	0.0562707	8			
Total	4.48497		9			

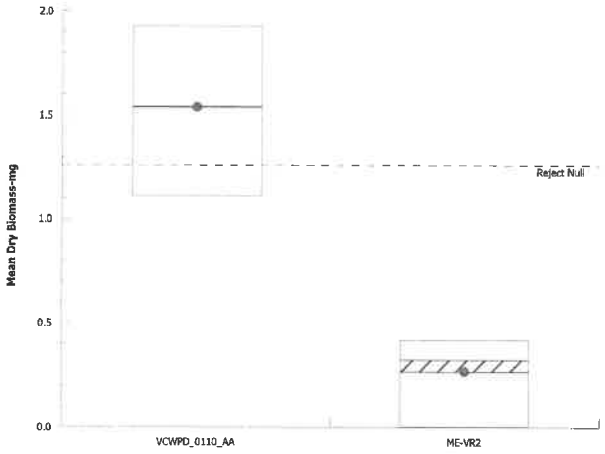
Distributional Tests

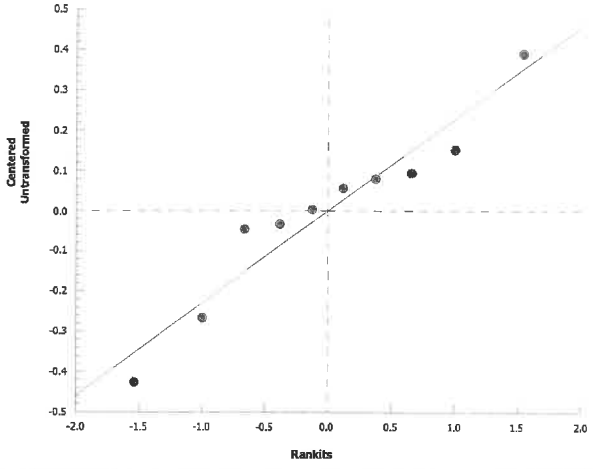
Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	3.17	23.2	0.2904	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.946	0.741	0.6177	Normal Distribution

Mean Dry Biomass-mg Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_0110_AA	LW	5	1.54	1.18	1.9	1.54	1.11	1.93	0.131	19.01%	0.00%
ME-VR2		5	0.268	0.0639	0.472	0.324	0	0.42	0.0735	61.33%	82.58%

Graphics





7 Day Chronic Topsmelt (*A. affinis*) Toxicity Test Data

Client: **Ventura County Water Protection District**
Test Material: ~~SD/12/18 MO-VR2~~ ME-VR2
Test ID#: 76372 Project #: 27911
Test Date: 1/10/18 Randomization: 5,3,4

Organism Log#: 10725 Age: 15 days
Organism Supplier: ABS
Control Water: FSW
Control Water Batch: —

Test Treatment	Temp (°C)	pH new	pH old	D.O. (mg/L) new	D.O. (mg/L) old	Salinity (ppt)	# Live Organisms A	B	C	D	E	SIGN-OFF
Lab Water Control	19.4	7.56		7.4		34.1	5	5	5	5	5	Date: 1/10/18 Test Solution Prep: SF
100%	20.8	7.35		7.3		33.7	5	5	5	5	5	Initiation Time: 1710 Initiation Signoff: RB
Meter ID	58A	pH21		RD12		EC11	New WQ: LA					Sample ID: 48474
Lab Water Control	20.1	7.13	7.55	5.4	7.2	34.2	5	5	5	5	5	Date: 1/11/18 Test Solution Prep: MS
100%	20.2	7.14	7.47	5.7	4.9	33.5	5	5	5	5	5	Renewal Time: 1640 Renewal Signoff: EP
Meter ID	81A	PH19	PH24	RD10	RD11	EC11	New WQ: TF		Old WQ: LZ			Sample ID: 48474
Lab Water Control	20.2	7.88	7.83	8.6	7.4	34.2	5	5	5	5	5	Date: 1/12/18 Test Solution Prep: SD
100%	20.2	7.55	7.97	4.0	6.7	33.5	5	5	5	5	5	Renewal Time: 1440 Renewal Signoff: CD
Meter ID	40A	PH15	PH23	RD11	RD09	EC11	New WQ: TA		Old WQ: TA			Sample ID: 48474
Lab Water Control	20.0	7.70	7.55	9.1	7.3	34.3	5	5	5	5	5	Date: 1/13/18 Test Solution Prep: EP
100%	20.0	6.95	7.69	4.4	6.5	32.9	5	5	5	5	4	Renewal Time: 1335 Renewal Signoff: SMC
Meter ID	40A	PH19	PH19	RD10	RD10	EC12	New WQ: LZ		Old WQ: TA			Sample ID: 48474
Lab Water Control	20.1	7.79	7.54	10.1	8.4	33.8	5	5	5	5	5	Date: 1/14/18 Test Solution Prep: SD
100%	20.0	7.08	7.83	5.7	6.5	33.7	5	5	4	4	4	Renewal Time: 1625 Renewal Signoff: CD
Meter ID	58A	PH19	PH19	RD10	RD10	EC08	New WQ: LZ		Old WQ:		LZ	Sample ID: 48474
Lab Water Control	20.1	7.69	7.65	8.6	7.2	34.1	5	4	5	5	5	Date: 1/15/18 Test Solution Prep: TK
100%	20.1	7.09	7.41	6.1	1.8	33.7	5	4	4	4	2	Renewal Time: 1440 Renewal Signoff: MM
Meter ID	92A	PH21	PH23	RD12	RD12	EC10	New WQ: TA		Old WQ: RAF			Sample ID: 48474
Lab Water Control	20.0	7.75	7.57	9.2	6.9	34.2	5	4	5	5	5	Date: 1/16/18 Test Solution Prep: RD
100%	20.1	7.04	7.87	6.2	5.0	32.4	1	1	1	2	0	Renewal Time: 1453 Renewal Signoff: RB
Meter ID	101A	PH23	PH23	RD12	RD12	EC11	New WQ: TA		Old WQ: TA			Sample ID: 48474
Lab Water Control	19.6		7.58		6.8	35.7	5	4 3	5	5	5	Date: 1/17/18 Termination Time: 819
100%	19.9		7.68		1.8	39.8	1	1 RB 1/17/18	1	1	—	Termination Signoff: RB
Meter ID	99A		PH19		RD10	EC12			Old WQ: TA			

Chronic Topsmelt Dry Weight and Biomass Data

Client: **Ventura County Water Protection District** Test ID #: 76372 Project # 27911

Sample: **ME-VR2** Tare Weight Date: 1/13/18 Sign-off: RAP

Test Date: 1/10/18 Final Weight Date: 1/18/18 Sign-off: RAP

Pan ID	Concentration	Replicate	Initial Pan Weight (mg)	Final Pan Weight (mg)	Initial # of Organisms	Biomass Value (mg)
1	Lab Water	A	412.06	420.15	5	1.62
2	Control	B	407.22	412.78	5	1.11
3		C	411.80	419.26	5	1.49
4		D	414.56	424.20	5	1.93
5		E	412.03	419.74	5	1.54
11	100%	A	403.31	405.41	5	0.420
12		B	408.43	410.24	5	0.362
13		C	419.03	420.65	5	0.324
14		D	410.13	411.30	5	0.234
15		E	412.913	—	5	—
QA 1			402.34	~~411.31~~ 402.36 SW 1/23/18		

Appendix D

Test Data and Summary of Statistics for the Evaluation of the Chronic Toxicity of the VCWPD Stormwater to *Selenastrum capricornutum*

CETIS Summary Report

Report Date: 23 Jan-18 10:10 (p 1 of 1)
Test Code: VCWPD_0110_SC | 08-8674-4232

Algal Growth Test — **Pacific EcoRisk**

Batch ID:	13-9292-7768	**Test Type:**	Cell Growth	**Analyst:**	Stevi Vasquez
Start Date:	10 Jan-18 17:09	**Protocol:**	EPA-821-R-02-013 (2002)	**Diluent:**	Not Applicable
Ending Date:	14 Jan-18 15:42	**Species:**	Selenastrum capricornutum	**Brine:**	Not Applicable
Duration:	95h	**Source:**	In-House Culture	**Age:**	7

Sample Code	Sample ID	Sample Date	Receipt Date	Sample Age	Client Name	Project
VCWPD_0110_SC	17-0818-5856	10 Jan-18 17:09	10 Jan-18 17:09	n/a (24.7 °C)	Ventura County Watersh	27911
MO-MPK	16-7264-4240	08 Jan-18 17:40	10 Jan-18 07:45	47h (0 °C)		

Sample Code	Material Type	Sample Source	Station Location	Lat/Long
VCWPD_0110_SC	Lab Water	Ventura County Watershed Prote	LABQA	
MO-MPK	Ambient Water	Ventura County Watershed Prote	MO-MPK	

Single Comparison Summary

Analysis ID	Endpoint	Comparison Method	P-Value	Comparison Result
03-3077-5433	96h Cell Density-without ED	Equal Variance t Two-Sample Test	1.0000	MO-MPK passed 96h cell density-without edt

96h Cell Density-without EDTA Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
VCWPD_0110_SC	LW	4	2.58E+6	2.28E+6	2.88E+6	2.38E+6	2.83E+6	9.42E+4	1.88E+5	7.29%	0.00%
MO-MPK		4	4.44E+6	3.97E+6	4.91E+6	4.15E+6	4.72E+6	1.47E+5	2.94E+5	6.62%	-71.83%

96h Cell Density-without EDTA Detail

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4
VCWPD_0110_SC	LW	2.60E+6	2.52E+6	2.83E+6	2.38E+6
MO-MPK		4.22E+6	4.15E+6	4.72E+6	4.66E+6

CETIS Analytical Report

Report Date: 23 Jan-18 10:10 (p 1 of 1)
Test Code: VCWPD_0110_SC | 08-8674-4232

Algal Growth Test — **Pacific EcoRisk**

Analysis ID:	03-3077-5433	**Endpoint:**	96h Cell Density-without EDTA	**CETIS Version:**	CETISv1.9.2
Analyzed:	23 Jan-18 10:10	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C > T	MO-MPK passed 96h cell density-without edta	13.14%

Equal Variance t Two-Sample Test

Sample I	vs	Sample II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Lab Water Control		MO-MPK	-10.6	1.94	3E+05	6	CDF	1.0000	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	6.882E+12	6.882E+12	1	113	4.1E-05	Significant Effect
Error	3.658E+11	6.096E+10	6			
Total	7.248E+12		7			

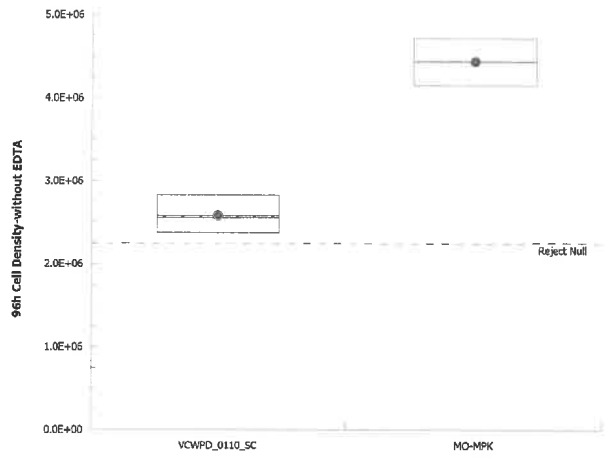
Distributional Tests

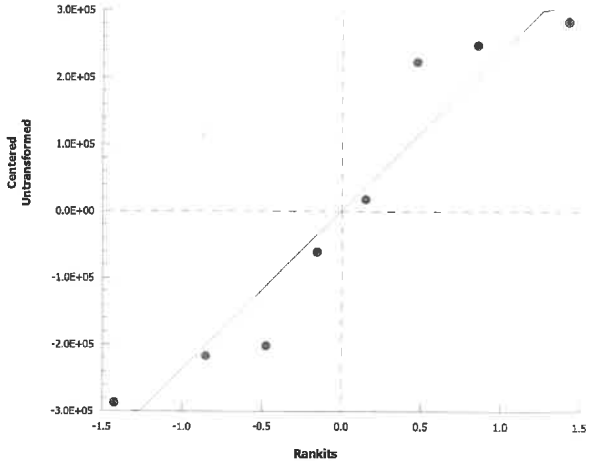
Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	2.44	47.5	0.4840	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.891	0.645	0.2398	Normal Distribution

96h Cell Density-without EDTA Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_0110_SC	LW	4	2.58E+6	2.28E+6	2.88E+6	2.56E+6	2.38E+6	2.83E+6	9.42E+4	7.29%	0.00%
MO-MPK		4	4.44E+6	3.97E+6	4.91E+6	4.44E+6	4.15E+6	4.72E+6	1.47E+5	6.62%	-71.83%

Graphics





Selenastrum capricornutum Algal Toxicity Test Data Sheet

Client: **Ventura County Water Protection District** Test Material: **MO-MPK**

Test Start Date: 1/10/18 Test ID #: 76385 Project #: 27911

Test End Date: 1/14/18 Control/Diluent: **Type I NO EDTA** Shelf #: TCR6/R6/S1

Treatment	Cell Density (cells/mL x 10^6)				Mean Cell Density (cells/mL x 10^6)
	Rep A	Rep B	Rep C	Rep D	
Lab Water Control	2.60	2.52	2.83	2.38	2.58
100%	4.22	4.15	4.72	4.66	4.44

This datasheet has been reviewed for completeness and consistency with Test Acceptability Criteria and/or other issues of concern.	Control Mean Density (cells/mL x 10^6)	% CV	Date:	Time:	Signoff:
	2.58	7.29	1/14/18	1750	

Initial Count: 10,000 cells/mL Termination Time: 1542 Enumerating Scientist:

Test Treatment	Temp (°C)	pH	D.O. (mg/L)	Conductivity (µS/cm)	Sign-Off
Lab Water Control	24.7	7.50	9.2	88	Date: 1/10/18
100%	24.7	7.69	9.6	448	Sample ID: 48482
					Test Solution Prep: NL
					New WQ: SJB
					Innoculation Time: 1709
Meter ID	86A	PH19	RD09	EC05	Innoculation Signoff: NL
Lab Water Control	24.5	7.59			Date: 1/11/18
100%	24.5	7.66			WQ Time: 0900
Meter ID	86A	PH23			WQ Signoff: KL
Lab Water Control	24.5	8.58			Date: 1-12-18
100%	24.5	8.09			WQ Time: 0745
Meter ID	86A	PH19			WQ Signoff: YL
Lab Water Control	24.5	9.72			Date: 1-13-18
100%	24.5	9.02			WQ Time: 0800
Meter ID	86A	PH19			WQ Signoff: YL
Lab Water Control	24.1	10.14	15.3	112	Date: 1-14-18
100%	24.1	10.10	17.8	484	WQ Time: 0730
Meter ID	86A	PH19	RD10	EC08	WQ Signoff: YL

Initial Test Conditions	Alkalinity	Hardness	Light Intensity (ftc)
	✓ 58	✓ 128	385

Appendix E

Test Data and Summary of Statistics for the Evaluation of the Chronic Toxicity of the VCWPD Stormwater to *Ceriodaphnia dubia*: Analysis Excluding Statistical Outliers

CETIS Summary Report

Ceriodaphnia Survival and Reproduction Test — **Pacific EcoRisk**

Batch ID:	10-5499-9558	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Stevi Vasquez
Start Date:	10 Jan-18 19:00	**Protocol:**	EPA-821-R-02-013 (2002)	**Diluent:**	Not Applicable
Ending Date:	16 Jan-18 15:57	**Species:**	Ceriodaphnia dubia	**Brine:**	Not Applicable
Duration:	5d 21h	**Source:**	In-House Culture	**Age:**	1

Comments:
Statistics excluding outliers Ctl rep F, MO-SIM rep J, MO-FIL rep J

Sample Code	Sample ID	Sample Date	Receipt Date	Sample Age	Client Name	Project
VCWPD_0110_CD	00-9939-2463	10 Jan-18 19:00	10 Jan-18 19:00	n/a (24.8 °C)	Ventura County Watersh	27911
MO-SIM	04-5362-3980	08 Jan-18 19:10	10 Jan-18 07:45	48h (0 °C)		
MO-THO	13-4720-4584	08 Jan-18 20:10	10 Jan-18 07:45	47h (0 °C)		
MO-HUE	06-2500-0619	08 Jan-18 19:55	10 Jan-18 07:45	47h (0 °C)		
MO-VEN	20-7418-3199	08 Jan-18 17:07	10 Jan-18 07:45	50h (0 °C)		
MO-FIL	16-0520-2198	08 Jan-18 16:45	10 Jan-18 07:45	50h (0 °C)		

Sample Code	Material Type	Sample Source	Station Location	Lat/Long
VCWPD_0110_CD	Lab Water	Ventura County Watershed Prote	LABQA	
MO-SIM	Ambient Water	Ventura County Watershed Prote	MO-SIM	
MO-THO	Ambient Water	Ventura County Watershed Prote	MO-THO	
MO-HUE	Ambient Water	Ventura County Watershed Prote	MO-HUE	
MO-VEN	Ambient Water	Ventura County Watershed Prote	MO-VEN	
MO-FIL	Ambient Water	Ventura County Watershed Prote	MO-FIL	

Single Comparison Summary

Analysis ID	Endpoint	Comparison Method	P-Value	Comparison Result
01-3332-1705	Reproduction	Equal Variance t Two-Sample Test	0.9858	MO-SIM passed reproduction
05-0177-0688	Reproduction	Unequal Variance t Two-Sample Test	0.0813	MO-THO passed reproduction
08-8099-4214	Reproduction	Equal Variance t Two-Sample Test	<1.0E-37	MO-HUE failed reproduction
07-1555-1656	Reproduction	Equal Variance t Two-Sample Test	6.1E-05	MO-VEN failed reproduction
03-6879-7596	Reproduction	Equal Variance t Two-Sample Test	0.2397	MO-FIL passed reproduction
20-4436-3365	Survival	Fisher Exact Test	1.0000	MO-SIM passed survival
19-1279-2050	Survival	Fisher Exact Test	1.0000	MO-THO passed survival
13-0342-1024	Survival	Fisher Exact Test	0.1053	MO-HUE passed survival
14-1753-0262	Survival	Fisher Exact Test	0.5000	MO-VEN passed survival
10-3675-5835	Survival	Fisher Exact Test	1.0000	MO-FIL passed survival

Reproduction Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
VCWPD_0110_CD	LW	9	34.3	31.5	37.2	28	38	1.24	3.71	10.80%	0.00%
MO-SIM		9	38.1	35.9	40.3	34	42	0.964	2.89	7.59%	-11.00%
MO-THO		10	29.2	22	36.4	10	41	3.2	10.1	34.66%	14.95%
MO-HUE		10	9.3	3.41	15.2	0	23	2.6	8.23	88.53%	72.91%
MO-VEN		10	17	9.93	24.1	0	32	3.12	9.88	58.10%	50.49%
MO-FIL		9	33.2	31.1	35.3	27	37	0.909	2.73	8.21%	3.24%

Survival Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
VCWPD_0110_CD	LW	10	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.00%	0.00%
MO-SIM		10	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.00%	0.00%
MO-THO		10	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.00%	0.00%
MO-HUE		10	0.700	0.354	1.000	0.000	1.000	0.153	0.483	69.01%	30.00%
MO-VEN		10	0.900	0.674	1.000	0.000	1.000	0.100	0.316	35.14%	10.00%
MO-FIL		10	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.00%	0.00%

Ceriodaphnia Survival and Reproduction Test — Pacific EcoRisk

Reproduction Detail

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
VCWPD_0110_CD	LW	28	38	33	38	37		34	38	30	33
MO-SIM		36	39	42	38	40	34	41	39	34	
MO-THO		36	19	32	10	36	34	39	23	22	41
MO-HUE		7	23	11	12	20	0	14	0	6	0
MO-VEN		32	24	8	29	23	0	13	12	14	15
MO-FIL		33	37	35	33	35	27	33	33	33	

Survival Detail

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
VCWPD_0110_CD	LW	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
MO-SIM		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
MO-THO		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
MO-HUE		1.000	1.000	1.000	1.000	1.000	0.000	1.000	0.000	1.000	0.000
MO-VEN		1.000	1.000	1.000	1.000	1.000	0.000	1.000	1.000	1.000	1.000
MO-FIL		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Survival Binomials

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
VCWPD_0110_CD	LW	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
MO-SIM		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
MO-THO		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
MO-HUE		1/1	1/1	1/1	1/1	1/1	0/1	1/1	0/1	1/1	0/1
MO-VEN		1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1	1/1
MO-FIL		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

CETIS Analytical Report

Ceriodaphnia Survival and Reproduction Test			Pacific EcoRisk
Analysis ID: 20-4436-3365	**Endpoint:** Survival	**CETIS Version:** CETISv1.9.2	
Analyzed: 23 Jan-18 10:32	**Analysis:** Single 2x2 Contingency Table	**Official Results:** Yes	

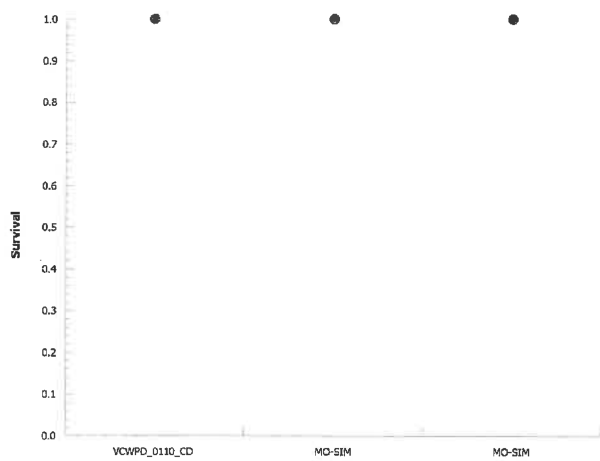
Fisher Exact Test

Sample I vs	Sample II	Test Stat	P-Type	P-Value	Decision(α:5%)
Lab Water Control	MO-SIM	1.000	Exact	1.0000	Non-Significant Effect

Data Summary

Sample	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
VCWPD_0110_CD	LW	10	0	10	1	0	0.0%
MO-SIM		10	0	10	1	0	0.0%

Graphics



Ceriodaphnia Survival and Reproduction Test — **Pacific EcoRisk**

Analysis ID:	01-3332-1705	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.2
Analyzed:	23 Jan-18 10:39	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C > T	MO-SIM passed reproduction	7.97%

Equal Variance t Two-Sample Test

Sample I	vs	Sample II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Lab Water Control		MO-SIM	-2.41	1.75	2.74	16	CDF	0.9858	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	64.2222	64.2222	1	5.81	0.0283	Significant Effect
Error	176.889	11.0556	16			
Total	241.111		17			

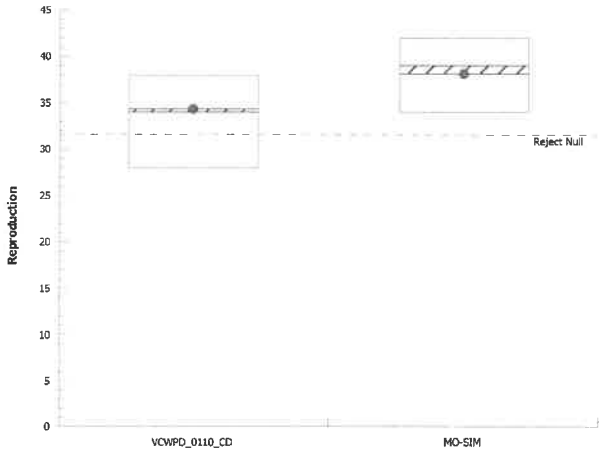
Distributional Tests

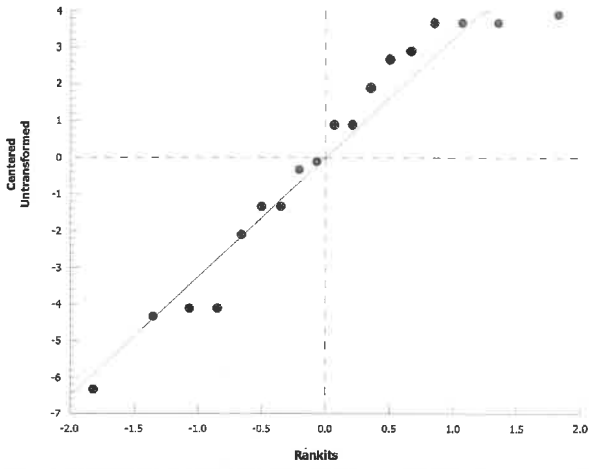
Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	1.64	7.5	0.4974	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.923	0.855	0.1452	Normal Distribution

Reproduction Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_0110_CD	LW	9	34.3	31.5	37.2	34	28	38	1.24	10.80%	0.00%
MO-SIM		9	38.1	35.9	40.3	39	34	42	0.964	7.59%	-11.00%

Graphics





Short-Term Chronic 3-Brood *Ceriodaphnia dubia* Survival & Reproduction Test Data

Client: **Ventura County Water Protection District** Material: **MO-SIM** Test Date: 1/10/18

Project #: 27911 Test ID: 76383 Randomization 10.7.3 Control Water: Modified EPAMH

Lab Water Control

Day	pH New	pH Old	D.O. New	D.O. Old	Cond. (µS/cm)	Temp (°C)	Survival / Reproduction A	B	C	D	E	F	G	H	I	J	SIGN-OFF
0	7.60		7.7		334	24.8	0	0	0	0	0	0	0	0	0	0	Date: 1/10/18 New WQ: Test Init.: TK Sol'n Prep: SF Old WQ: Time: 1980
1	7.93	7.72	9.2	8.3	337	25.6	0	0	0	0	0	0	0	0	0	0	Date: 1/11/18 New WQ: TF Counts: PMC Sol'n Prep: SF Old WQ: MB Time: 1900
2	7.77	8.16	8.5	7.3	325	25.3	0	0	0	0	0	0	0	0	0	0	Date: 1/12/18 New WQ: CA Counts: JAF Sol'n Prep: SD Old WQ: MB Time: 1935
3	7.72	7.73	10.0	8.7	329	25.4	0	0	0	0	6	0	0	0	0	0	Date: 1/13/18 New WQ: LE Counts: CD Sol'n Prep: EP Old WQ: TA Time: 1445
4	7.64	7.68	9.6	7.8	330	25.4	6	7	6	7	0	12	6	7	6	7	Date: 1/14/18 New WQ: F Counts: Je Sol'n Prep: SD Old WQ: ISL Time: 1500
5	7.79	7.78	8.3	7.4	332	25.0	10	13	11	12	12	19	11	14	9	10	Date: 1/15/18 New WQ: TA Counts: MS Sol'n Prep: SO Old WQ: KD Time: 1444
6	7.78	7.83	8.4	7.6	343	25.1	12	18	16	19	19	20	17	17	15	16	Date: 1/16/18 New WQ: JG Counts: CD Sol'n Prep: JG Old WQ: JG Time: 1557
7																	Date: New WQ: Counts: Sol'n Prep: Old WQ: Time:
8																	Date: Old WQ: Counts: Time:
						Total=	28	38	33	38	37	51	34	38	30	33	Mean Neonates/Female = 36.0

100%

Day	pH New	pH Old	D.O. New	D.O. Old	Cond. (µS/cm)	Survival / Reproduction A	B	C	D	E	F	G	H	I	J	SAMPLE ID
0	7.55		9.9		739	0	0	0	0	0	0	0	0	0	0	48483
1	7.50	7.71	9.7	8.2	744	0	0	0	0	0	0	0	0	0	0	48483
2	7.39	8.04	8.1	8.2	704	0	0	0	0	0	0	0	0	0	0	48483
3	7.10	7.70	7.2	8.6	715	0	0	0	0	0	0	0	0	0	0	48483
4	7.10	7.62	7.5	7.5	703	6	6	7	5	7	5	7	7	5	6	48483
5	7.96	7.83	6.2	7.9	715	10	12	14	12	14	12	12	12	10	12	48483
6	6.89	7.80	6.2	7.9	708	20	21	21	21	19	17	22	20	19	0	48483
7																
8																
						Total=	36	39	42	38	40	34	41	39	34	18	Mean Neonates/Female = 36.1

Ceriodaphnia Survival and Reproduction Test — **Pacific EcoRisk**

Analysis ID:	19-1279-2050	**Endpoint:**	Survival	**CETIS Version:**	CETISv1.9.2
Analyzed:	23 Jan-18 10:32	**Analysis:**	Single 2x2 Contingency Table	**Official Results:**	Yes

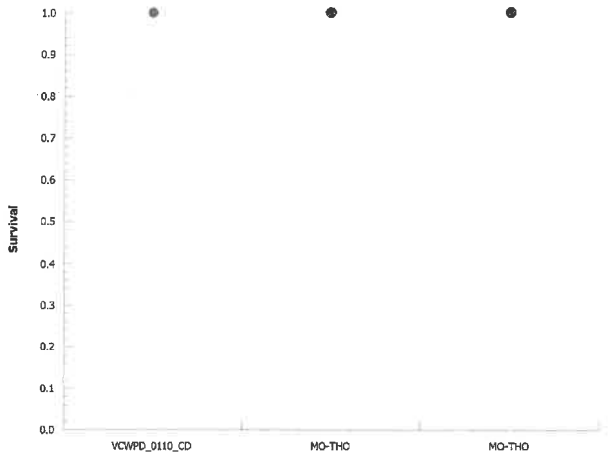
Fisher Exact Test

Sample I	vs	Sample II	Test Stat	P-Type	P-Value	Decision(α:5%)
Lab Water Control		MO-THO	1.000	Exact	1.0000	Non-Significant Effect

Data Summary

Sample	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
VCWPD_0110_CD	LW	10	0	10	1	0	0.0%
MO-THO		10	0	10	1	0	0.0%

Graphics



Ceriodaphnia Survival and Reproduction Test — **Pacific EcoRisk**

Analysis ID:	05-0177-0688	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.2
Analyzed:	23 Jan-18 10:39	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C > T	MO-THO passed reproduction	17.94%

Unequal Variance t Two-Sample Test

Sample I	vs	Sample II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Lab Water Control		MO-THO	1.5	1.8	6.16	11	CDF	0.0813	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	124.821	124.821	1	2.06	0.1697	Non-Significant Effect
Error	1031.6	60.6824	17			
Total	1156.42		18			

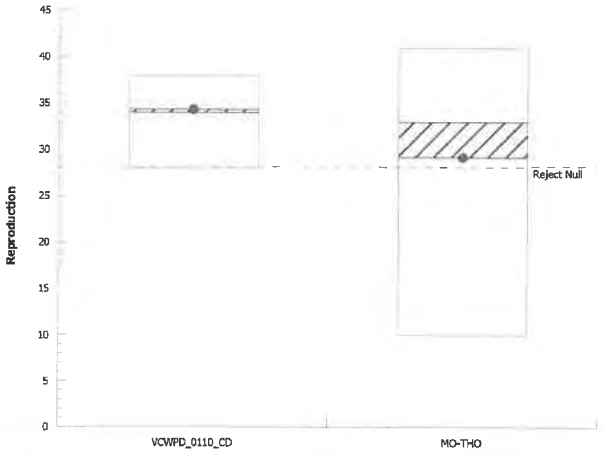
Distributional Tests

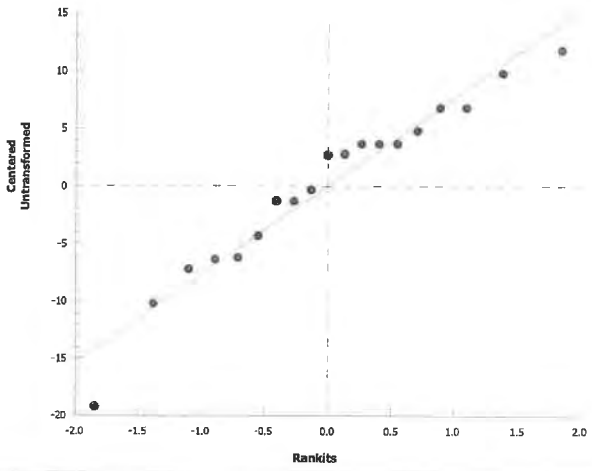
Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	7.45	7.34	0.0095	Unequal Variances
Distribution	Shapiro-Wilk W Normality Test	0.953	0.861	0.4365	Normal Distribution

Reproduction Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_0110_CD	LW	9	34.3	31.5	37.2	34	28	38	1.24	10.80%	0.00%
MO-THO		10	29.2	22	36.4	33	10	41	3.2	34.66%	14.95%

Graphics





Short-Term Chronic 3-Brood *Ceriodaphnia dubia* Survival & Reproduction Test Data

Client: **Ventura County Water Protection District** Material: **MO-THO** Test Date: 1/10/18

Project #: 27911 Test ID: 76382 Randomization 10.7.3 Control Water: Modified EPAMH

Lab Water Control

Day	pH New	pH Old	D.O. New	D.O. Old	Cond. (µS/cm)	Temp (°C)	Survival / Reproduction A	B	C	D	E	F	G	H	I	J
0	7.60		7.7		334	24.8	0	0	0	0	0	0	0	0	0	0
1	7.93	7.72	9.2	8.3	337	25.6	0	0	0	0	0	0	0	0	0	0
2	7.77	8.16	8.5	7.3	325	25.3	0	0	0	0	0	0	0	0	0	0
3	7.72	7.73	10.0	8.7	329	25.4	0	0	0	0	6	0	0	0	0	0
4	7.64	7.68	9.6	7.8	330	25.4	6	7	6	7	0	12	6	7	6	7
5	7.79	7.78	8.3	7.4	332	25.0	10	13	11	12	12	19	11	14	9	10
6	7.78	7.85	8.4	7.6	343	25.1	12	18	16	19	19	20	17	17	15	16
7																
8																
						Total=	28	38	33	38	37	51	34	38	30	33

SIGN-OFF

Date: 1/10/18 New WQ: Test Init.: TK
Sol'n Prep: SF SF Time: 1900

Date: 1/11/18 New WQ: TF Counts: SME
Sol'n Prep: SF Old WQ: MB Time: 1900

Date: 1/12/18 New WQ: [illegible] Counts: [illegible]
Sol'n Prep: SD Old WQ: MB Time: 1885

Date: 1/13/18 New WQ: [illegible] Counts: CD
Sol'n Prep: EP Old WQ: [illegible] Time: 1445

Date: 1/14/18 New WQ: [illegible] Counts: [illegible]
Sol'n Prep: SD Old WQ: [illegible] Time: 1500

Date: 1/15/18 New WQ: [illegible] Counts: MB
Sol'n Prep: JO Old WQ: [illegible] Time: 1446

Date: 1/16/18 New WQ: [illegible] Counts: CD
Sol'n Prep: [illegible] Old WQ: [illegible] Time: 1557

Date: New WQ: Counts:
Sol'n Prep: Old WQ: Time:

Date: Old WQ: Counts:
Time:

Mean Neonates/Female = 36.0

100%

Day	pH New	pH Old	D.O. New	D.O. Old	Cond. (µS/cm)	Survival / Reproduction A	B	C	D	E	F	G	H	I	J
0	7.59		9.6		658	0	0	0	0	0	0	0	0	0	0
1	7.53	7.77	9.4	7.8	667	0	0	0	0	0	0	0	0	0	0
2	7.38	8.12	8.0	7.9	650	0	0	0	0	0	0	0	0	0	0
3	7.12	7.81	7.6	8.5	666	0	0	0	0	0	0	0	0	0	0
4	7.10	7.71	6.9	7.3	666	6	7	6	4	6	7	7	8	6	7
5	7.03	7.00	6.2	7.4	671	8	12	8	6	8	10	12	14	0	12
6	7.02	7.76	7.1	6.9	664	22	0	18	0	22	17	20	1	16	22
7															
8															
						Total= 36	19	32	10	36	34	39	23	22	41

SAMPLE ID

48481
48481
48481
48481
48481
48481
48481
48481

Mean Neonates/Female = 29.2

Ceriodaphnia Survival and Reproduction Test — **Pacific EcoRisk**

Analysis ID:	13-0342-1024	**Endpoint:**	Survival	**CETIS Version:**	CETISv1.9.2
Analyzed:	23 Jan-18 10:32	**Analysis:**	Single 2x2 Contingency Table	**Official Results:**	Yes

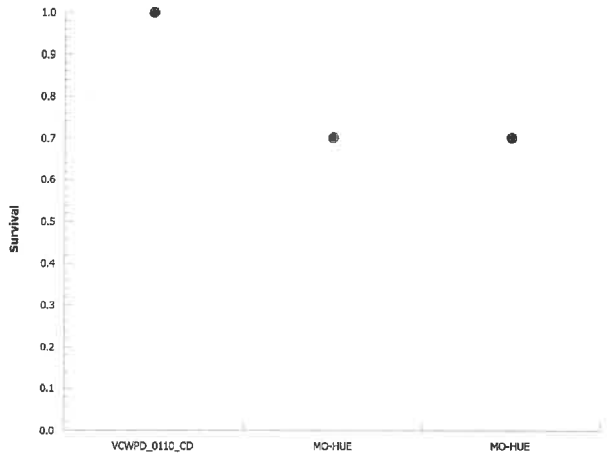
Fisher Exact Test

Sample I	vs	Sample II	Test Stat	P-Type	P-Value	Decision(α:5%)
Lab Water Control		MO-HUE	0.105	Exact	0.1053	Non-Significant Effect

Data Summary

Sample	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
VCWPD_0110_CD	LW	10	0	10	1	0	0.0%
MO-HUE		7	3	10	0.7	0.3	30.0%

Graphics



Ceriodaphnia Survival and Reproduction Test — **Pacific EcoRisk**

Analysis ID:	08-8099-4214	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.2
Analyzed:	23 Jan-18 10:39	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C > T	MO-HUE failed reproduction	15.15%

Equal Variance t Two-Sample Test

Sample I	vs	Sample II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Lab Water Control		MO-HUE*	8.37	1.74	5.2	17	CDF	<1.0E-37	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	2968.43	2968.43	1	70.1	2.0E-07	Significant Effect
Error	720.1	42.3588	17			
Total	3688.53		18			

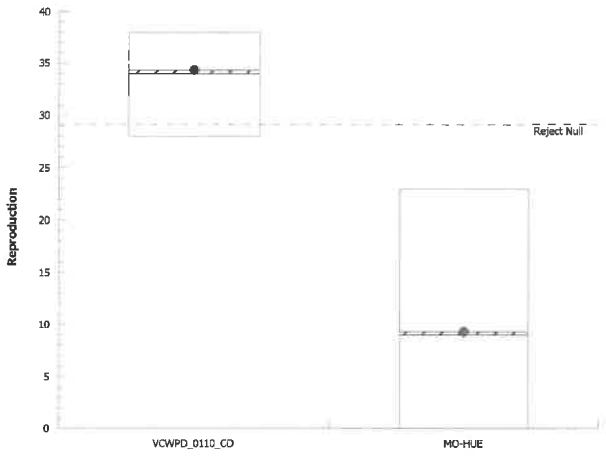
Distributional Tests

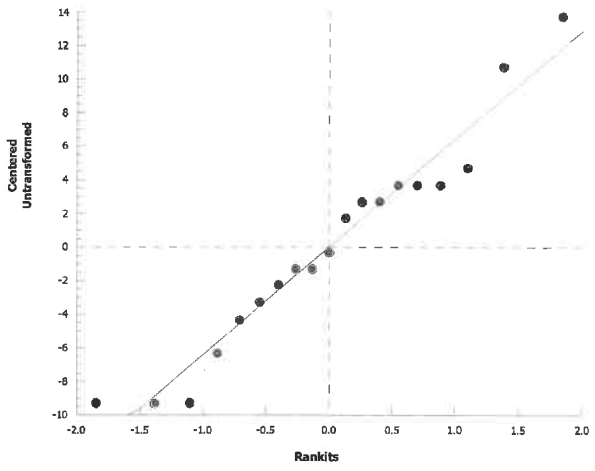
Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	4.93	7.34	0.0348	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.951	0.861	0.4105	Normal Distribution

Reproduction Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_0110_CD	LW	9	34.3	31.5	37.2	34	28	38	1.24	10.80%	0.00%
MO-HUE		10	9.3	3.41	15.2	9	0	23	2.6	88.53%	72.91%

Graphics





Short-Term Chronic 3-Brood *Ceriodaphnia dubia* Survival & Reproduction Test Data

Client: **Ventura County Water Protection District** Material: **MO-HUE** Test Date: 1/10/18

Project #: 27911 Test ID: 76381 Randomization 10.7.3 Control Water: Modified EPAMH

	Day	pH New	pH Old	D.O. New	D.O. Old	Cond. (µS/cm)	Temp (°C)	Survival / Reproduction A	B	C	D	E	F	G	H	I	J	SIGN-OFF
Lab Water Control	0	7.60		7.7		334	24.8	0	0	0	0	0	0	0	0	0	0	Date: 1/10/18 New WQ: Test Init.: TK Sol'n Prep: SW STM Time: 1900
	1	7.93	7.72	9.2	8.3	337	25.6	0	0	0	0	0	0	0	0	0	0	Date: 1/11/18 New WQ: TF Counts: SMC Sol'n Prep: SW Old WQ: MB Time: 1900
	2	7.77	8.16	8.5	7.3	325	25.3	0	0	0	0	0	0	0	0	0	0	Date: 1/12/18 New WQ: CA Counts: TFK Sol'n Prep: SD Old WQ: MB Time: 1885
	3	7.72	7.73	10.0	8.7	329	25.4	0	0	0	0	6	0	0	0	0	0	Date: 1/13/18 New WQ: EE Counts: CD Sol'n Prep: EP Old WQ: TA Time: 1445
	4	7.64	7.69	9.6	7.9	330	25.4	6	7	6	7	0	12	6	7	6	7	Date: 1/14/18 New WQ: FT Counts: TE Sol'n Prep: SD Old WQ: KL Time: 1500
	5	7.97	7.78	8.3	7.4	332	25.0	10	13	11	12	12	19	11	14	9	10	Date: 1/15/18 New WQ: TA Counts: MB Sol'n Prep: SD Old WQ: TA Time: 1446
	6	7.78	7.83	8.4	7.6	343	25.1	12	18	16	19	19	20	17	17	15	16	Date: 1/16/18 New WQ: TA Counts: CD Sol'n Prep: SW Old WQ: TA Time: 1557
	7																	Date: New WQ: Counts: Sol'n Prep: Old WQ: Time:
	8																	Date: Old WQ: Counts: Time:
							Total=	28	38	33	38	37	51	34	38	30	33	Mean Neonates/Female = 36.0

	Day	pH New	pH Old	D.O. New	D.O. Old	Cond. (µS/cm)	Survival / Reproduction A	B	C	D	E	F	G	H	I	J	SAMPLE ID
100%	0	7.37		8.5		2968	0	0	0	0	0	0	0	0	0	0	48480
	1	7.42	7.92	8.6	8.1	2953	0	0	0	0	0	0	0	0	0	0	48480
	2	7.35	8.18	7.5	8.0	2868	0	0	0	0	0	0	0	X/0	0	0	48480
	3	7.20	7.91	7.4	8.3	2977	0	0	0	0	0	X/0	0	–	0	X/0	48480
	4	7.20	7.85	7.0	7.4	2927	3	7	5	0	3	–	1	–	0	–	48480
	5	7.12	7.99	7.4	7.5	2943	4	8	6	6	8	–	5	✓	6	–	48480
	6	7.06	7.95	8.1	7.2	2928	0	8	0	6	9	–	8	–	0	–	48480
	7												–		–		–	
	8														✓			
							Total=	7	23	11	12	20	X/0	14	X/6	6	X/6	Mean Neonates/Female = 9.3

Ceriodaphnia Survival and Reproduction Test — **Pacific EcoRisk**

Analysis ID:	14-1753-0262	**Endpoint:**	Survival	**CETIS Version:**	CETISv1.9.2
Analyzed:	23 Jan-18 10:32	**Analysis:**	Single 2x2 Contingency Table	**Official Results:**	Yes

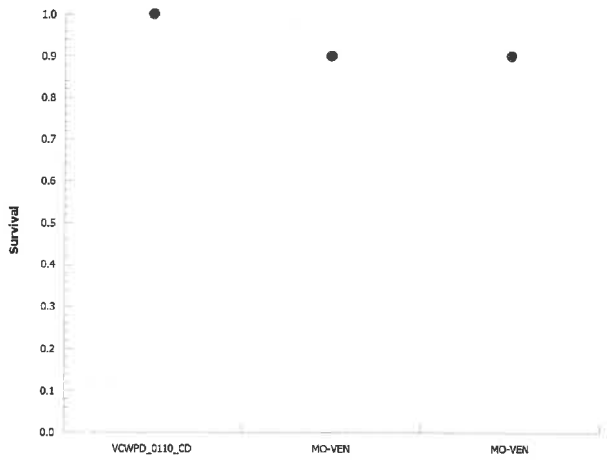
Fisher Exact Test

Sample I	vs	Sample II	Test Stat	P-Type	P-Value	Decision(α:5%)
Lab Water Control		MO-VEN	0.500	Exact	0.5000	Non-Significant Effect

Data Summary

Sample	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
VCWPD_0110_CD	LW	10	0	10	1	0	0.0%
MO-VEN		9	1	10	0.9	0.1	10.0%

Graphics



Ceriodaphnia Survival and Reproduction Test — **Pacific EcoRisk**

Analysis ID:	07-1555-1656	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.2
Analyzed:	23 Jan-18 10:39	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C > T	MO-VEN failed reproduction	17.75%

Equal Variance t Two-Sample Test

Sample I	vs	Sample II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Lab Water Control		MO-VEN*	4.95	1.74	6.09	17	CDF	6.1E-05	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1423.16	1423.16	1	24.5	1.2E-04	Significant Effect
Error	988	58.1176	17			
Total	2411.16		18			

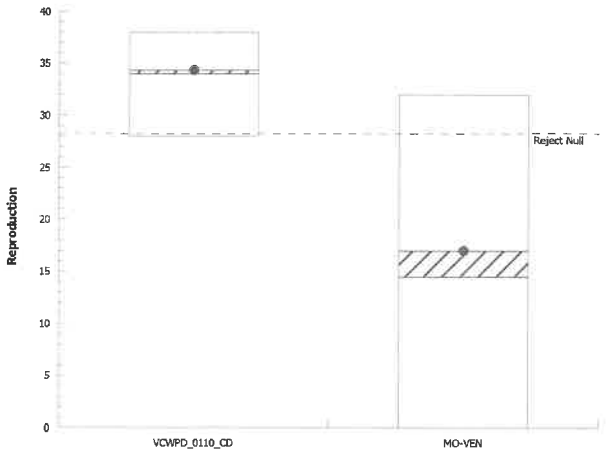
Distributional Tests

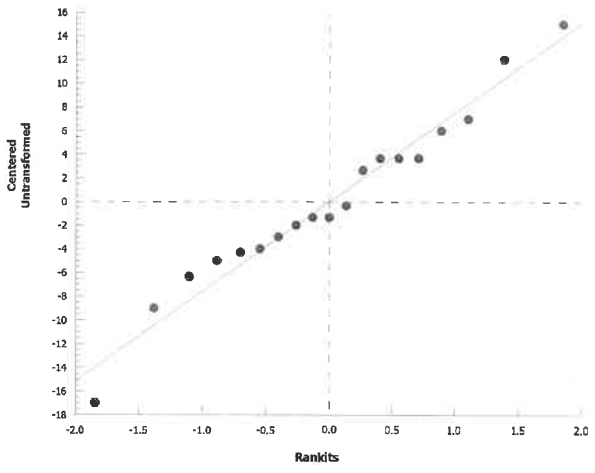
Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	7.09	7.34	0.0112	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.978	0.861	0.9110	Normal Distribution

Reproduction Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_0110_CD	LW	9	34.3	31.5	37.2	34	28	38	1.24	10.80%	0.00%
MO-VEN		10	17	9.93	24.1	14.5	0	32	3.12	58.10%	50.49%

Graphics





Short-Term Chronic 3-Brood *Ceriodaphnia dubia* Survival & Reproduction Test Data

Client: **Ventura County Water Protection District** Material: **MO-VEN** Test Date: 1/10/18

Project #: 27911 Test ID: 76380 Randomization 10.7.3 Control Water: Modified EPAMH

Lab Water Control

Day	pH New	pH Old	D.O. New	D.O. Old	Cond. (µS/cm)	Temp (°C)	Survival / Reproduction A	B	C	D	E	F	G	H	I	J
0	7.60		7.7		334	24.8	0	0	0	0	0	0	0	0	0	0
1	7.93	7.72	9.2	8.3	337	25.6	0	0	0	0	0	0	0	0	0	0
2	7.77	8.16	8.5	7.3	325	25.3	0	0	0	0	0	0	0	0	0	0
3	7.72	7.73	10.0	8.7	329	25.4	0	0	0	0	6	0	0	0	0	0
4	7.64	7.68	9.6	7.8	330	25.4	6	7	6	7	0	12	6	7	6	7
5	7.97	7.78	8.3	7.4	332	25.0	10	13	11	12	12	19	11	14	9	10
6	7.78	7.83	8.4	7.6	343	25.1	12	18	16	19	19	20	17	17	15	16
7																
8																
						Total=	28	38	33	38	37	51	34	38	30	33

SIGN-OFF

Date: 1/10/18 New WQ: Test Init.: TK
Sol'n Prep: SF Old WQ: Time: 1900

Date: 1/11/18 New WQ: TF Counts: SMO
Sol'n Prep: SF Old WQ: MB Time: 1900

Date: 1/12/18 New WQ: CA Counts: APE
Sol'n Prep: SD Old WQ: MB Time: 1835

Date: 1/13/18 New WQ: LZ Counts: A
Sol'n Prep: EP Old WQ: TA Time: 1445

Date: 1/14/18 New WQ: F Counts: R
Sol'n Prep: SD Old WQ: KL Time: 1500

Date: 1/15/18 New WQ: TA Counts: MB
Sol'n Prep: JO Old WQ: KG Time: 1446

Date: 1/16/18 New WQ: Counts: CO
Sol'n Prep: Old WQ: Time: 1557

Date: New WQ: Counts:
Sol'n Prep: Old WQ: Time:

Date: Old WQ: Counts:
Time:

Mean Neonates/Female = 36.0

100%

Day	pH New	pH Old	D.O. New	D.O. Old	Cond. (µS/cm)	Survival / Reproduction A	B	C	D	E	F	G	H	I	J	SAMPLE ID
0	7.29		9.5		251	0	0	0	0	0	0	0	0	0	0	48478
1	7.30	4 (7.46 MB 1/14/18)	8.9	8.0	253	0	0	0	0	0	0	0	0	0	0	48478
2	7.07	7.79	6.8	7.4	240	0	0	0	0	0	X/0	0	0	0	0	48478
3	6.74	7.43	6.6	8.3	246	0	0	0	0	0	-	0	0	0	0	48478
4	6.71	7.39	6.8	7.3	251	5	6	4	4	6	-	5	4	4	4	48478
5	6.73	7.47	6.1	7.7	252	4	6	4	7	7	-	8	6	0	0	48478
6	6.59	7.37	6.9	4.6	247	19	12	0	18	10	-	0	2	10	11	48478
7											/					
8											/					
						Total= 32	24	8	29	23	X/0	13	12	14	15	Mean Neonates/Female = 17.0

Ceriodaphnia Survival and Reproduction Test — **Pacific EcoRisk**

Analysis ID:	10-3675-5835	**Endpoint:**	Survival	**CETIS Version:**	CETISv1.9.2
Analyzed:	23 Jan-18 10:32	**Analysis:**	Single 2x2 Contingency Table	**Official Results:**	Yes

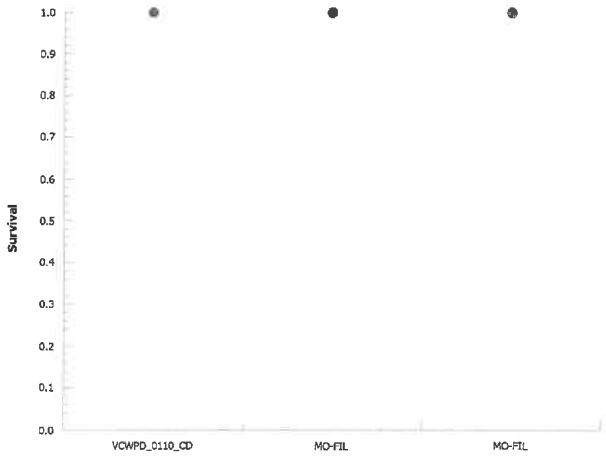
Fisher Exact Test

Sample I	vs	Sample II	Test Stat	P-Type	P-Value	Decision(α:5%)
Lab Water Control		MO-FIL	1.000	Exact	1.0000	Non-Significant Effect

Data Summary

Sample	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
VCWPD_0110_CD	LW	10	0	10	1	0	0.0%
MO-FIL		10	0	10	1	0	0.0%

Graphics



Ceriodaphnia Survival and Reproduction Test — Pacific EcoRisk

Analysis ID:	03-6879-7596	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.2
Analyzed:	23 Jan-18 10:39	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C > T	MO-FIL passed reproduction	7.80%

Equal Variance t Two-Sample Test

Sample I	vs	Sample II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Lab Water Control		MO-FIL	0.724	1.75	2.68	16	CDF	0.2397	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	5.55556	5.55556	1	0.524	0.4795	Non-Significant Effect
Error	169.556	10.5972	16			
Total	175.111		17			

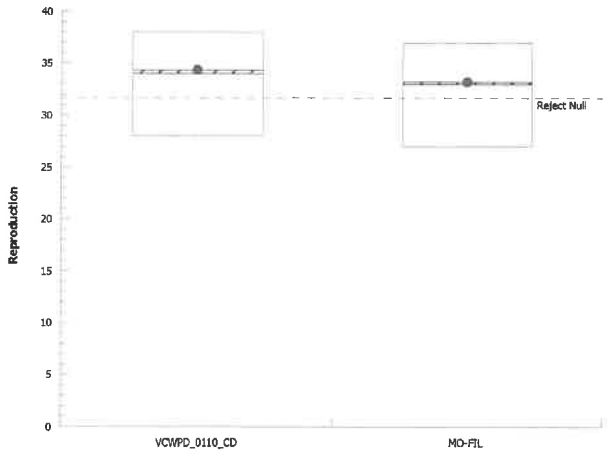
Distributional Tests

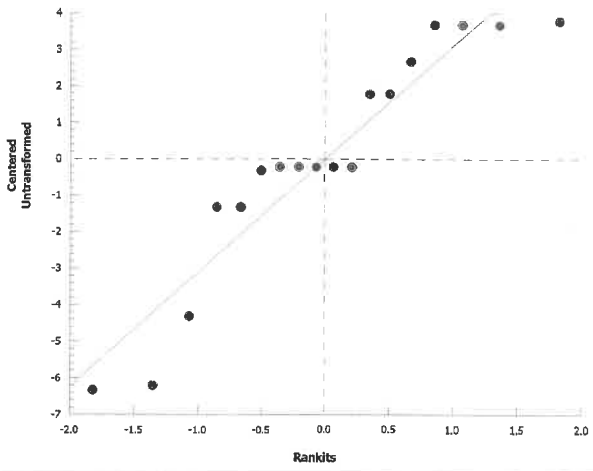
Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	1.85	7.5	0.4038	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.887	0.855	0.0349	Normal Distribution

Reproduction Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_0110_CD	LW	9	34.3	31.5	37.2	34	28	38	1.24	10.80%	0.00%
MO-FIL		9	33.2	31.1	35.3	33	27	37	0.909	8.21%	3.24%

Graphics





Short-Term Chronic 3-Brood *Ceriodaphnia dubia* Survival & Reproduction Test Data

Client: **Ventura County Water Protection District** Material: **MO-FIL** Test Date: 1/10/19

Project #: 27911 Test ID: 76384 Randomization 10.7.3 Control Water: Modified EPAMH

	Day	pH New	pH Old	D.O. New	D.O. Old	Cond. (µS/cm)	Temp (°C)	Survival / Reproduction A	B	C	D	E	F	G	H	I	J
Lab Water Control	0	7.60		7.7		334	24.8	0	0	0	0	0	0	0	0	0	0
	1	7.93	7.72	9.2	8.3	337	25.6	0	0	0	0	0	0	0	0	0	0
	2	7.77	8.16	8.5	7.3	325	25.3	0	0	0	0	0	0	0	0	0	0
	3	7.72	7.73	10.0	8.7	329	25.4	0	0	0	0	6	0	0	0	0	0
	4	7.64	7.68	9.6	7.8	330	25.4	6	7	6	7	0	12	6	7	6	7
	5	7.97	7.78	8.3	7.4	332	25.0	10	13	11	12	12	19	11	14	9	10
	6	7.78	7.83	8.4	7.6	343	25.1	12	18	16	19	19	20	17	17	15	16
	7																
	8																
							Total=	28	38	33	38	37	51	34	38	30	33

SIGN-OFF

Date: 1/10/19 New WQ: Test Init.: TK
Sol'n Prep: SF SFB Time: 1900

Date: 1/11/19 New WQ: TF Counts: SMC
Sol'n Prep: SF Old WQ: MB Time:

Date: 1/12/19 New WQ: CA Counts:
Sol'n Prep: SD Old WQ: MS Time: 1535

Date: 1/13/18 New WQ: EZ Counts: CD
Sol'n Prep: EP Old WQ: TA Time: 1445

Date: 1/14/18 New WQ: FT Counts: FE
Sol'n Prep: SD Old WQ: KL Time: 1500

Date: 1/15/18 New WQ: TA Counts: NB
Sol'n Prep: JO Old WQ: KO Time: 1446

Date: 1/16/18 New WQ: Counts: CD
Sol'n Prep: 2 Old WQ: Time: 1557

Date: New WQ: Counts:
Sol'n Prep: Old WQ: Time:

Date: Old WQ: Counts:
Time:

Mean Neonates/Female = 36.0

	Day	pH New	pH Old	D.O. New	D.O. Old	Cond. (µS/cm)	Survival / Reproduction A	B	C	D	E	F	G	H	I	J
100%	0	7.63		10.1		177	0	0	0	0	0	0	0	0	0	0
	1	7.60	7.73	10.0	8.4	185	0	0	0	0	0	0	0	0	0	0
	2	7.43	7.77	9.4	8.2	172	0	0	0	0	0	0	0	0	0	0
	3	7.08	7.54	8.9	8.6	179	0	0	0	0	0	0	0	0	0	0
	4	7.07	7.46	8.0	7.8	182	5	5	5	6	6	4/14/19 46	4	5	6	8
	5	7.01	7.56	8.0	7.9	186	8	10	10	8	8	7	8	9	8	8
	6	6.94	7.31	8.4	5.3	186	20	22	20	19	21	14	21	20	19	0
	7															
	8															
							Total=	33	37	35	33	35	27	33	33	33	16

SAMPLE ID

48484
48484
48484
48484
48484
48484
48484

Mean Neonates/Female = 31.5

Appendix F

Summary of Statistics for the Evaluation of the Chronic Toxicity of the VCWPD Stormwater to *Ceriodaphnia dubia*: Analysis Including Statistical Outliers

Ceriodaphnia Survival and Reproduction Test — **Pacific EcoRisk**

Batch ID:	10-5499-9558	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	Stevi Vasquez
Start Date:	10 Jan-18 19:00	**Protocol:**	EPA-821-R-02-013 (2002)	**Diluent:**	Not Applicable
Ending Date:	16 Jan-18 15:57	**Species:**	Ceriodaphnia dubia	**Brine:**	Not Applicable
Duration:	5d 21h	**Source:**	In-House Culture	**Age:**	1

Comments:
Statistics including outliers Ctl rep F, MO-SIM rep J, MO-FIL rep J

Sample Code	Sample ID	Sample Date	Receipt Date	Sample Age	Client Name	Project
VCWPD_0110_CD	00-9939-2463	10 Jan-18 19:00	10 Jan-18 19:00	n/a (24.8 °C)	Ventura County Watersh	27911
MO-SIM	04-5362-3980	08 Jan-18 19:10	10 Jan-18 07:45	48h (0 °C)		
MO-THO	13-4720-4584	08 Jan-18 20:10	10 Jan-18 07:45	47h (0 °C)		
MO-HUE	06-2500-0619	08 Jan-18 19:55	10 Jan-18 07:45	47h (0 °C)		
MO-VEN	20-7418-3199	08 Jan-18 17:07	10 Jan-18 07:45	50h (0 °C)		
MO-FIL	16-0520-2198	08 Jan-18 16:45	10 Jan-18 07:45	50h (0 °C)		

Sample Code	Material Type	Sample Source	Station Location	Lat/Long
VCWPD_0110_CD	Lab Water	Ventura County Watershed Prote	LABQA	
MO-SIM	Ambient Water	Ventura County Watershed Prote	MO-SIM	
MO-THO	Ambient Water	Ventura County Watershed Prote	MO-THO	
MO-HUE	Ambient Water	Ventura County Watershed Prote	MO-HUE	
MO-VEN	Ambient Water	Ventura County Watershed Prote	MO-VEN	
MO-FIL	Ambient Water	Ventura County Watershed Prote	MO-FIL	

Single Comparison Summary

Analysis ID	Endpoint	Comparison Method	P-Value	Comparison Result
03-3713-5778	Reproduction	Equal Variance t Two-Sample Test	0.5133	MO-SIM passed reproduction
01-7621-4106	Reproduction	Equal Variance t Two-Sample Test	0.0442	MO-THO failed reproduction
17-5059-3054	Reproduction	Equal Variance t Two-Sample Test	<1.0E-37	MO-HUE failed reproduction
20-0218-1483	Reproduction	Equal Variance t Two-Sample Test	3.6E-05	MO-VEN failed reproduction
00-9603-5900	Reproduction	Equal Variance t Two-Sample Test	0.0603	MO-FIL passed reproduction
20-4436-3365	Survival	Fisher Exact Test	1.0000	MO-SIM passed survival
19-1279-2050	Survival	Fisher Exact Test	1.0000	MO-THO passed survival
13-0342-1024	Survival	Fisher Exact Test	0.1053	MO-HUE passed survival
14-1753-0262	Survival	Fisher Exact Test	0.5000	MO-VEN passed survival
10-3675-5835	Survival	Fisher Exact Test	1.0000	MO-FIL passed survival

Reproduction Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
VCWPD_0110_CD	LW	10	36	31.5	40.5	28	51	2	6.32	17.57%	0.00%
MO-SIM		10	36.1	31.2	41	18	42	2.19	6.92	19.17%	-0.28%
MO-THO		10	29.2	22	36.4	10	41	3.2	10.1	34.66%	18.89%
MO-HUE		10	9.3	3.41	15.2	0	23	2.6	8.23	88.53%	74.17%
MO-VEN		10	17	9.93	24.1	0	32	3.12	9.88	58.10%	52.78%
MO-FIL		10	31.5	27.2	35.8	16	37	1.9	6.02	19.12%	12.50%

Survival Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
VCWPD_0110_CD	LW	10	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.00%	0.00%
MO-SIM		10	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.00%	0.00%
MO-THO		10	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.00%	0.00%
MO-HUE		10	0.700	0.354	1.000	0.000	1.000	0.153	0.483	69.01%	30.00%
MO-VEN		10	0.900	0.674	1.000	0.000	1.000	0.100	0.316	35.14%	10.00%
MO-FIL		10	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.00%	0.00%

Ceriodaphnia Survival and Reproduction Test — **Pacific EcoRisk**

Reproduction Detail

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
VCWPD_0110_CD	LW	28	38	33	38	37	51	34	38	30	33
MO-SIM		36	39	42	38	40	34	41	39	34	18
MO-THO		36	19	32	10	36	34	39	23	22	41
MO-HUE		7	23	11	12	20	0	14	0	6	0
MO-VEN		32	24	8	29	23	0	13	12	14	15
MO-FIL		33	37	35	33	35	27	33	33	33	16

Survival Detail

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
VCWPD_0110_CD	LW	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
MO-SIM		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
MO-THO		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
MO-HUE		1.000	1.000	1.000	1.000	1.000	0.000	1.000	0.000	1.000	0.000
MO-VEN		1.000	1.000	1.000	1.000	1.000	0.000	1.000	1.000	1.000	1.000
MO-FIL		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Survival Binomials

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
VCWPD_0110_CD	LW	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
MO-SIM		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
MO-THO		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
MO-HUE		1/1	1/1	1/1	1/1	1/1	0/1	1/1	0/1	1/1	0/1
MO-VEN		1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1	1/1
MO-FIL		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Ceriodaphnia Survival and Reproduction Test — **Pacific EcoRisk**

Analysis ID:	03-3713-5778	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.2
Analyzed:	23 Jan-18 10:32	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C > T	MO-SIM passed reproduction	14.28%

Equal Variance t Two-Sample Test

Sample I	vs	Sample II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Lab Water Control		MO-SIM	-0.0337	1.73	5.14	18	CDF	0.5133	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.05	0.05	1	0.00114	0.9735	Non-Significant Effect
Error	790.9	43.9389	18			
Total	790.95		19			

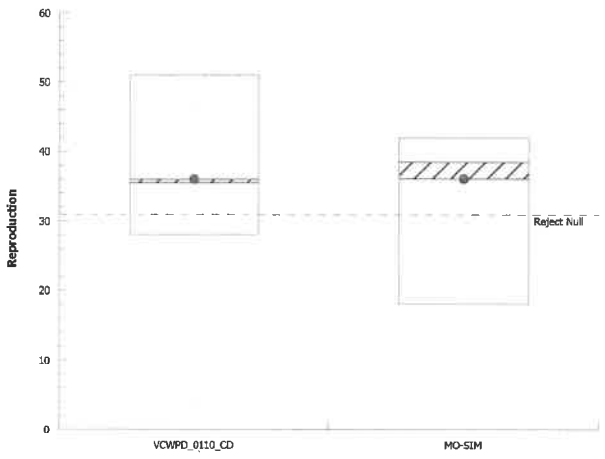
Distributional Tests

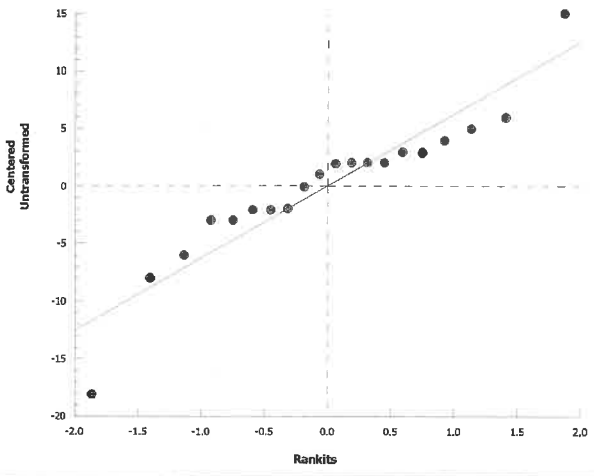
Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	1.2	6.54	0.7932	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.91	0.866	0.0643	Normal Distribution

Reproduction Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_0110_CD	LW	10	36	31.5	40.5	35.5	28	51	2	17.57%	0.00%
MO-SIM		10	36.1	31.2	41	38.5	18	42	2.19	19.17%	-0.28%

Graphics





Ceriodaphnia Survival and Reproduction Test — **Pacific EcoRisk**

Analysis ID:	01-7621-4106	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.2
Analyzed:	23 Jan-18 10:33	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C > T	MO-THO failed reproduction	18.18%

Equal Variance t Two-Sample Test

Sample I	vs	Sample II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Lab Water Control		MO-THO*	1.8	1.73	6.54	18	CDF	0.0442	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	231.2	231.2	1	3.25	0.0883	Non-Significant Effect
Error	1281.6	71.2	18			
Total	1512.8		19			

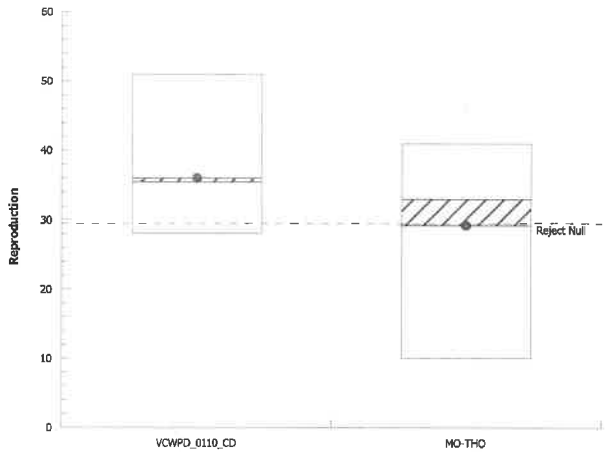
Distributional Tests

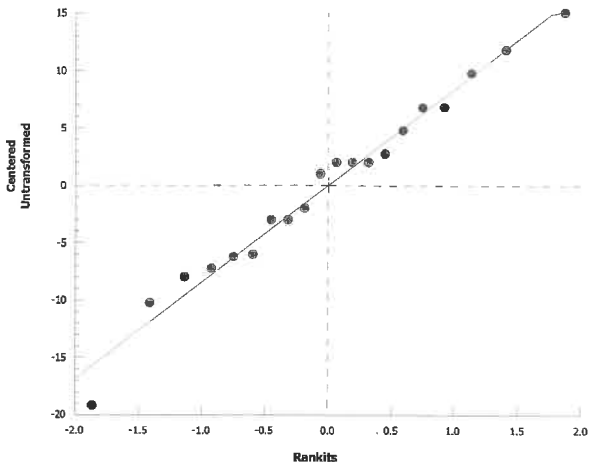
Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	2.56	6.54	0.1776	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.983	0.866	0.9687	Normal Distribution

Reproduction Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_0110_CD	LW	10	36	31.5	40.5	35.5	28	51	2	17.57%	0.00%
MO-THO		10	29.2	22	36.4	33	10	41	3.2	34.66%	18.89%

Graphics





Ceriodaphnia Survival and Reproduction Test — **Pacific EcoRisk**

Analysis ID:	17-5059-3054	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.2
Analyzed:	23 Jan-18 10:33	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C > T	MO-HUE failed reproduction	15.81%

Equal Variance t Two-Sample Test

Sample I	vs	Sample II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Lab Water Control		MO-HUE*	8.13	1.73	5.69	18	CDF	<1.0E-37	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	3564.45	3564.45	1	66.1	1.9E-07	Significant Effect
Error	970.1	53.8944	18			
Total	4534.55		19			

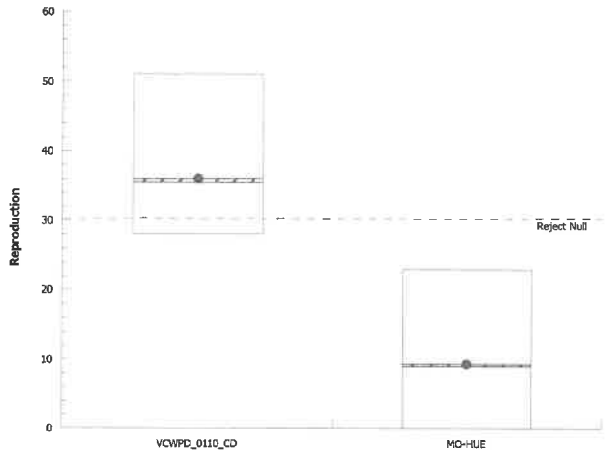
Distributional Tests

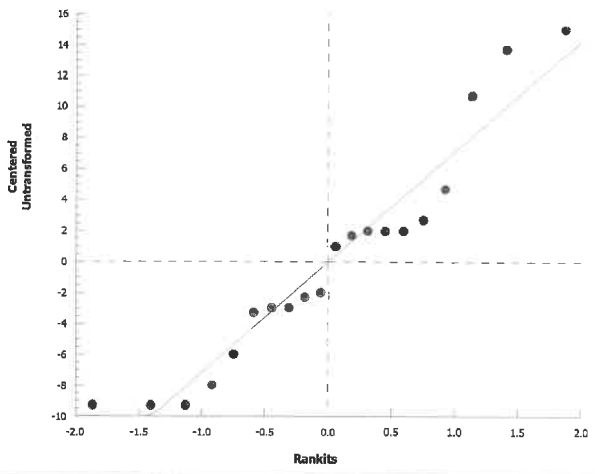
Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	1.69	6.54	0.4440	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.922	0.866	0.1097	Normal Distribution

Reproduction Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_0110_CD	LW	10	36	31.5	40.5	35.5	28	51	2	17.57%	0.00%
MO-HUE		10	9.3	3.41	15.2	9	0	23	2.6	88.53%	74.17%

Graphics





Ceriodaphnia Survival and Reproduction Test — **Pacific EcoRisk**

Analysis ID:	20-0218-1483	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.2
Analyzed:	23 Jan-18 10:33	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C > T	MO-VEN failed reproduction	17.86%

Equal Variance t Two-Sample Test

Sample I	vs	Sample II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Lab Water Control		MO-VEN*	5.12	1.73	6.43	18	CDF	3.6E-05	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1805	1805	1	26.2	7.1E-05	Significant Effect
Error	1238	68.7778	18			
Total	3043		19			

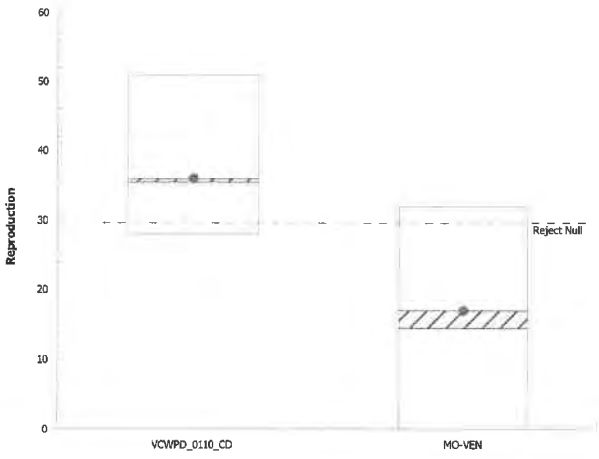
Distributional Tests

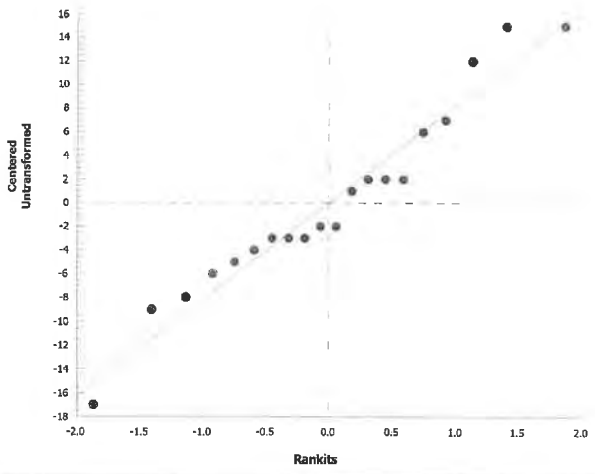
Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	2.44	6.54	0.2003	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.955	0.866	0.4454	Normal Distribution

Reproduction Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_0110_CD	LW	10	36	31.5	40.5	35.5	28	51	2	17.57%	0.00%
MO-VEN		10	17	9.93	24.1	14.5	0	32	3.12	58.10%	52.78%

Graphics





Ceriodaphnia Survival and Reproduction Test — **Pacific EcoRisk**

Analysis ID:	00-9603-5900	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.2
Analyzed:	23 Jan-18 10:33	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C > T	MO-FIL passed reproduction	13.30%

Equal Variance t Two-Sample Test

Sample I	vs	Sample II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Lab Water Control		MO-FIL	1.63	1.73	4.79	18	CDF	0.0603	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	101.25	101.25	1	2.65	0.1206	Non-Significant Effect
Error	686.5	38.1389	18			
Total	787.75		19			

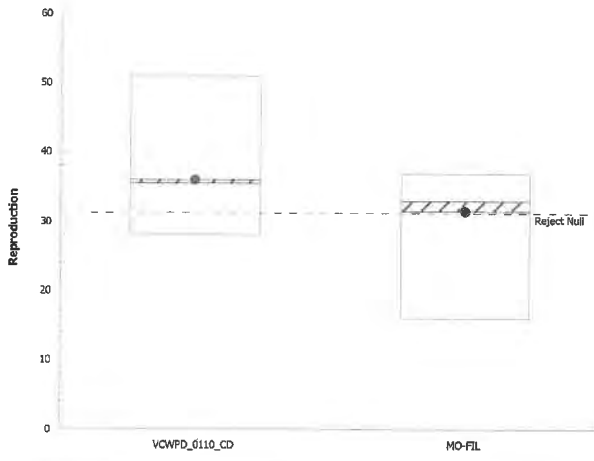
Distributional Tests

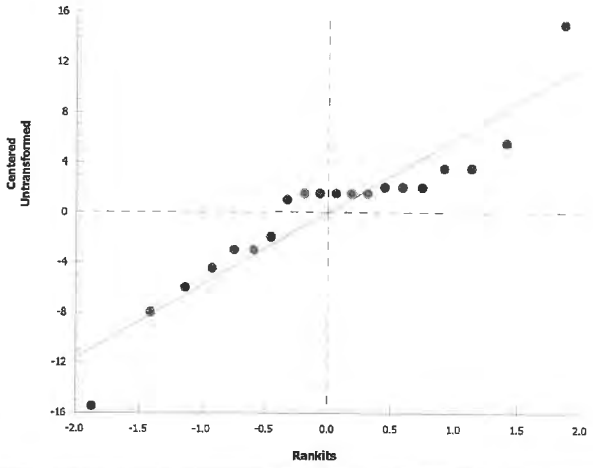
Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	1.1	6.54	0.8867	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.898	0.866	0.0379	Normal Distribution

Reproduction Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_0110_CD	LW	10	36	31.5	40.5	35.5	28	51	2	17.57%	0.00%
MO-FIL		10	31.5	27.2	35.8	33	16	37	1.9	19.12%	12.50%

Graphics





Appendix G

Test Data and Summary of Statistics for the Evaluation of the Chronic Toxicity of the VCWPD Stormwater to Fathead Minnows

Chronic Larval Fish Survival and Growth Test — **Pacific EcoRisk**

Batch ID:	21-0074-7853	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Stevi Vasquez
Start Date:	10 Jan-18 18:54	**Protocol:**	EPA-821-R-02-013 (2002)	**Diluent:**	Not Applicable
Ending Date:	17 Jan-18 10:12	**Species:**	Pimephales promelas	**Brine:**	Not Applicable
Duration:	6d 15h	**Source:**	Aquatox, AR	**Age:**	1

Sample Code	Sample ID	Sample Date	Receipt Date	Sample Age	Client Name	Project
VCWPD_0110_PP	02-9133-6553	10 Jan-18 18:54	10 Jan-18 18:54	n/a (25 °C)	Ventura County Watersh	27911
MO-CAM	09-3592-8642	08 Jan-18 21:00	10 Jan-18 07:45	46h (0 °C)		
MO-OJA	10-0779-6329	08 Jan-18 13:15	10 Jan-18 07:45	54h (0 °C)		
MO-MEI	04-3325-6801	08 Jan-18 14:15	10 Jan-18 07:45	53h (0 °C)		
MO-OXN	01-3928-4384	08 Jan-18 18:35	10 Jan-18 07:45	48h (0 °C)		
MO-SPA	04-4468-3543	08 Jan-18 16:00	10 Jan-18 07:45	51h (0 °C)		

Sample Code	Material Type	Sample Source	Station Location	Lat/Long
VCWPD_0110_PP	Lab Water	Ventura County Watershed Prote	LABQA	
MO-CAM	Ambient Water	Ventura County Watershed Prote	MO-CAM	
MO-OJA	Ambient Water	Ventura County Watershed Prote	MO-OJA	
MO-MEI	Ambient Water	Ventura County Watershed Prote	MO-MEI	
MO-OXN	Ambient Water	Ventura County Watershed Prote	MO-OXN	
MO-SPA	Ambient Water	Ventura County Watershed Prote	MO-SPA	

SIngle Comparison Summary

Analysis ID	Endpoint	Comparison Method	P-Value	Comparison Result
19-4487-5780	7d Survival Rate	Wilcoxon Rank Sum Two-Sample Test	1.0000	MO-CAM passed 7d survival rate
12-1690-2831	7d Survival Rate	Equal Variance t Two-Sample Test	0.0010	MO-OJA failed 7d survival rate
01-9296-1538	7d Survival Rate	Unequal Variance t Two-Sample Test	0.0406	MO-MEI failed 7d survival rate
13-4595-3620	7d Survival Rate	Wilcoxon Rank Sum Two-Sample Test	0.0143	MO-OXN failed 7d survival rate
19-5274-5468	7d Survival Rate	Unequal Variance t Two-Sample Test	0.0949	MO-SPA passed 7d survival rate
18-0874-4515	Mean Dry Biomass-mg	Equal Variance t Two-Sample Test	0.0011	MO-CAM failed mean dry biomass-mg
16-4488-8619	Mean Dry Biomass-mg	Equal Variance t Two-Sample Test	5.8E-05	MO-OJA failed mean dry biomass-mg
12-7660-8970	Mean Dry Biomass-mg	Equal Variance t Two-Sample Test	1.7E-05	MO-MEI failed mean dry biomass-mg
14-1753-9085	Mean Dry Biomass-mg	Equal Variance t Two-Sample Test	4.7E-05	MO-OXN failed mean dry biomass-mg
13-2261-9250	Mean Dry Biomass-mg	Equal Variance t Two-Sample Test	5.8E-05	MO-SPA failed mean dry biomass-mg

7d Survival Rate Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
VCWPD_0110_PP	LW	4	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.00%	0.00%
MO-CAM		4	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.00%	0.00%
MO-OJA		4	0.650	0.374	0.926	0.400	0.800	0.087	0.173	26.65%	35.00%
MO-MEI		3	0.367	0.000	1.000	0.000	0.700	0.203	0.351	95.78%	63.33%
MO-OXN		4	0.875	0.795	0.955	0.800	0.900	0.025	0.050	5.71%	12.50%
MO-SPA		4	0.875	0.636	1.000	0.700	1.000	0.075	0.150	17.14%	12.50%

Mean Dry Biomass-mg Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
VCWPD_0110_PP	LW	4	1.01	0.963	1.06	0.978	1.05	0.0155	0.031	3.06%	0.00%
MO-CAM		4	0.868	0.793	0.944	0.812	0.927	0.0237	0.0473	5.45%	14.25%
MO-OJA		4	0.321	0.0769	0.564	0.129	0.488	0.0766	0.153	47.77%	68.35%
MO-MEI		3	0.132	-0.18	0.444	0	0.25	0.0725	0.126	94.94%	86.93%
MO-OXN		4	0.602	0.468	0.735	0.49	0.691	0.0419	0.0838	13.92%	40.57%
MO-SPA		4	0.442	0.243	0.641	0.305	0.591	0.0626	0.125	28.29%	56.32%

Chronic Larval Fish Survival and Growth Test — **Pacific EcoRisk**

7d Survival Rate Detail

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4
VCWPD_0110_PP	LW	1.000	1.000	1.000	1.000
MO-CAM		1.000	1.000	1.000	1.000
MO-OJA		0.800	0.400	0.700	0.700
MO-MEI		0.700	0.400	0.000	
MO-OXN		0.900	0.800	0.900	0.900
MO-SPA		1.000	1.000	0.800	0.700

Mean Dry Biomass-mg Detail

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4
VCWPD_0110_PP	LW	0.978	1.05	0.998	1.02
MO-CAM		0.86	0.874	0.927	0.812
MO-OJA		0.488	0.129	0.384	0.281
MO-MEI		0.25	0.147	0	
MO-OXN		0.626	0.49	0.691	0.6
MO-SPA		0.591	0.491	0.305	0.382

7d Survival Rate Binomials

Sample	Code	Rep 1	Rep 2	Rep 3	Rep 4
VCWPD_0110_PP	LW	10/10	10/10	10/10	10/10
MO-CAM		10/10	10/10	10/10	10/10
MO-OJA		8/10	4/10	7/10	7/10
MO-MEI		7/10	4/10	0/10	
MO-OXN		9/10	8/10	9/10	9/10
MO-SPA		10/10	10/10	8/10	7/10

Chronic Larval Fish Survival and Growth Test — **Pacific EcoRisk**

Analysis ID:	19-4487-5780	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	23 Jan-18 13:40	**Analysis:**	Nonparametric-Two Sample	**Official Results:**	Yes

Wilcoxon Rank Sum Two-Sample Test

Sample I	vs	Sample II	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision(α:5%)
Lab Water Control		MO-CAM	18	n/a	1	6	Exact	1.0000	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0	0	1	65500	<1.0E-37	Significant Effect
Error	0	0	6			
Total	0		7			

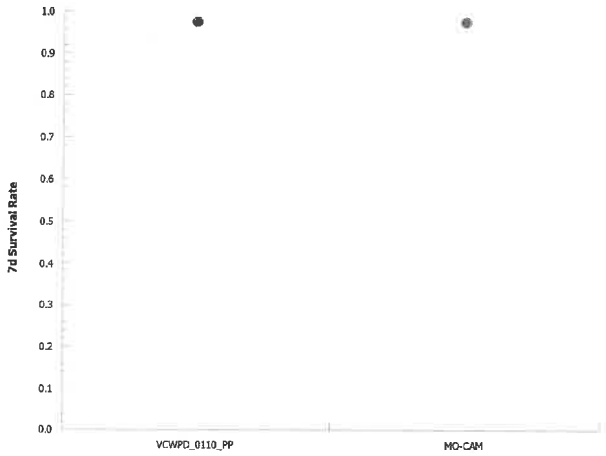
7d Survival Rate Summary

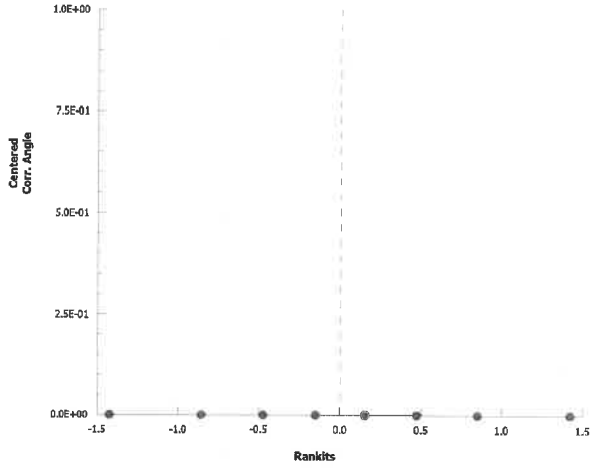
Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_0110_PP	LW	4	1.000	1.000	1.000	1.000	1.000	1.000	0.000	0.00%	0.00%
MO-CAM		4	1.000	1.000	1.000	1.000	1.000	1.000	0.000	0.00%	0.00%

Angular (Corrected) Transformed Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_0110_PP	LW	4	1.41	1.41	1.41	1.41	1.41	1.41	0	0.00%	0.00%
MO-CAM		4	1.41	1.41	1.41	1.41	1.41	1.41	0	0.00%	0.00%

Graphics





Chronic Larval Fish Survival and Growth Test — Pacific EcoRisk

Analysis ID:	18-0874-4515	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.2
Analyzed:	23 Jan-18 13:41	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C > T	MO-CAM failed mean dry biomass-mg	5.43%

Equal Variance t Two-Sample Test

Sample I	vs	Sample II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Lab Water Control		MO-CAM*	5.1	1.94	0.055	6	CDF	0.0011	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0416168	0.0416168	1	26	0.0022	Significant Effect
Error	0.0096057	0.0016009	6			
Total	0.0512225		7			

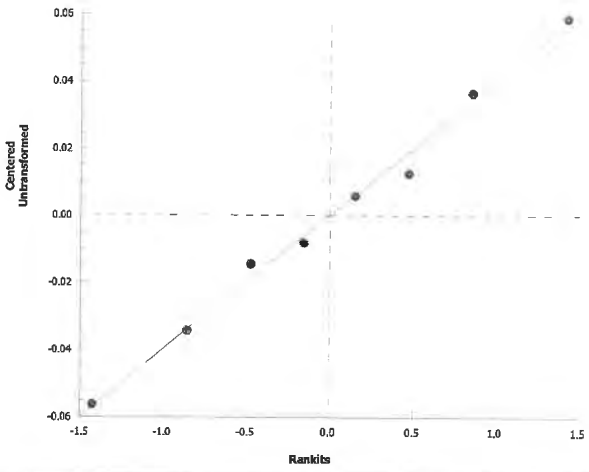
Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	2.32	47.5	0.5064	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.991	0.645	0.9962	Normal Distribution

Mean Dry Biomass-mg Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_0110_PP	LW	4	1.01	0.963	1.06	1.01	0.978	1.05	0.0155	3.06%	0.00%
MO-CAM		4	0.868	0.793	0.944	0.867	0.812	0.927	0.0237	5.45%	14.25%

Graphics



7 Day Chronic Fathead Minnow Toxicity Test Data

Client: Ventura County Water Protection District
Test Material: MO-CAM
Test ID#: 76375 Project #: 27911
Test Date: 1/10/18 Randomization: 4.6.6

Organism Log#: 10722 Age: 48hr
Organism Supplier: Aquatox
Control: EPAMH
Control Water Batch: 2043

Test Treatment	Temp (°C)	pH new	pH old	D.O. (mg/L) new	D.O. (mg/L) old	Conductivity (µS/cm)	# Live Organisms A	B	C	D	SIGN-OFF
Lab Water Control	25.0	7.95		8.4		283	10	10	10	10	Date: 1/10/18
100%	25.2	7.63		9.1		513	10	10	10	10	Test Solution Prep: SF
Meter ID	58A	PH19		RD09		EC08	New WQ: TA				Sample ID: 48475
Lab Water Control	25.1	7.83	7.53	9.0	5.9	315	10	10	10	10	Initiation Time: 1854
100%	25.2	7.41	7.33	10.3	6.6	511	10	10	10	10	Initiation Signoff: RG
Meter ID	98A	PH19	PH23	RD10	RD09	EC11	New WQ: TF		Old WQ: TA		Date: 1/11/18
Lab Water Control	24.6	8.10	8.06	8.7	8.1	284	10	10	10	10	Test Solution Prep: SF
100%	25.2	7.52	7.59	9.2	7.0	503	10	10	10	10	Sample ID: 48475
Meter ID	98A	PH19	PH19	RD12	RD11	EC12	New WQ: LA		Old WQ: LA		Renewal Time: 1630
Lab Water Control	24.9	7.93	7.73	9.3	8.4	287	10	10	10	10	Renewal Signoff: TK
100%	25.1	7.20	7.52	9.0	8.2	478	10	10	10	10	Date: 1/12/18
Meter ID	81A	PH19	PH21	RD10	RD12	EC12	New WQ: LZ		Old WQ: LZ		Test Solution Prep: SD
Lab Water Control	24.1	8.10	7.72	8.4	8.1	299	10	10	10	10	Sample ID: 48475
100%	24.6	7.35	7.32	7.9	6.3	484	10	10	10	10	Renewal Time: 1430
Meter ID	40A	PH23	PH17	RD11	RD10	EC10	New WQ: FT		Old WQ: LZ		Renewal Signoff: SD 48475 EP
Lab Water Control	24.0	8.16	7.84	8.6	7.9	287	10	10	10	10	Date: 1/13/18
100%	24.1	7.29	7.45	9.46	6.9	519	10	10	10	10	Test Solution Prep: EP
Meter ID	58A	PH21	PH23	RD11	RD12	EC11	New WQ: RAF		Old WQ: RAF		Sample ID: 48475
Lab Water Control	24.1	8.03	7.77	7.2	7.4	285	10	10	10	10	Renewal Time: 1130
100%	24.6	7.15	7.59	9.3	6.8	509	10	10	10	10	Renewal Signoff: TK
Meter ID	98A	PH21	PH21	RD11	RD11	EC10	New WQ: KG		Old WQ: RAF		Date: 1/14/18
Lab Water Control	24.3		7.70		7.6	318	10	10	10	10	Test Solution Prep: SD
100%	24.3		7.57		7.2	583	10	10	10	10	Sample ID: 48475
Meter ID	99A		PH19		RD10	EC12			Old WQ: KL		Renewal Time: 1515
											Renewal Signoff: SD 1/14 48475 CO
											Date: 1/15/18
											Test Solution Prep: JO
											Sample ID: 48475
											Renewal Time: 1300
											Renewal Signoff: JO
											Date: 1/16/18
											Test Solution Prep: JO
											Sample ID: ~~48475~~ 48475
											Renewal Time: 1435
											Renewal Signoff: WC
											Date: 1/17/18
											Termination Time: 1012
											Termination Signoff: RG

Fathead Minnow Dry Weight Data Sheet

Client: **Ventura County Water Protection District** Test ID #: 76375 Project #: 27911

Test Material: **MO-CAM** Tare Weight Date: 1/13/18 Sign-off: SDB

Test Date: 1/10/18 Final Weight Date: 1/18/18 Sign-off: RAP

Pan ID	Treatment	Replicate	Initial Pan Weight (mg)	Final Pan Weight (mg)	Initial # of Organisms	Biomass Value (mg)
1	Lab Water	A	412.86	422.64	10	0.978
2	Control	B	409.52	420.01	10	1.05
3		C	410.70	420.68	10	0.998
4		D	408.96	419.21	10	1.03
5	100%	A	405.83	414.43	10	0.860
6		B	407.50	416.24	10	0.874
7		C	408.47	417.74	10	0.927
8		D	410.53	418.65	10	0.812
QA 1			416.56	416.57		
Balance ID:			Bal 04	Bal 04		

Chronic Larval Fish Survival and Growth Test — **Pacific EcoRisk**

Analysis ID:	12-1690-2831	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	23 Jan-18 13:40	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Alt Hyp	Comparison Result	PMSD
Angular (Corrected)	C > T	MO-OJA failed 7d survival rate	10.79%

Equal Variance t Two-Sample Test

Sample I	vs	Sample II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Lab Water Control		MO-OJA*	5.18	1.94	0.176	6	CDF	0.0010	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.43893	0.43893	1	26.8	0.0021	Significant Effect
Error	0.0982907	0.0163818	6			
Total	0.537221		7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Levene Equality of Variance Test	6.42	13.7	0.0444	Equal Variances
Variances	Mod Levene Equality of Variance Test	2.13	13.7	0.1945	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.792	0.645	0.0234	Normal Distribution

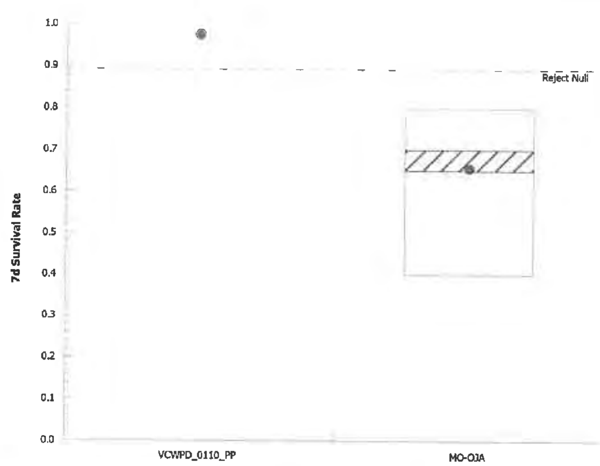
7d Survival Rate Summary

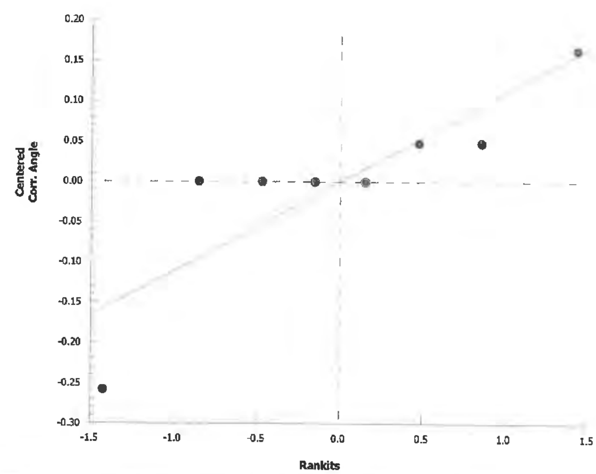
Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_0110_PP	LW	4	1.000	1.000	1.000	1.000	1.000	1.000	0.000	0.00%	0.00%
MO-OJA		4	0.650	0.374	0.926	0.700	0.400	0.800	0.087	26.65%	35.00%

Angular (Corrected) Transformed Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_0110_PP	LW	4	1.41	1.41	1.41	1.41	1.41	1.41	0	0.00%	0.00%
MO-OJA		4	0.944	0.656	1.23	0.991	0.685	1.11	0.0905	19.18%	33.18%

Graphics





CETIS Analytical Report

Chronic Larval Fish Survival and Growth Test — Pacific EcoRisk

Analysis ID:	16-4488-8619	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.2
Analyzed:	23 Jan-18 13:47	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C > T	MO-OJA failed mean dry biomass-mg	14.99%

Equal Variance t Two-Sample Test

Sample I	vs	Sample II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Lab Water Control		MO-OJA*	8.86	1.94	0.152	6	CDF	5.8E-05	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.95773	0.95773	1	78.5	1.2E-04	Significant Effect
Error	0.0732098	0.0122016	6			
Total	1.03094		7			

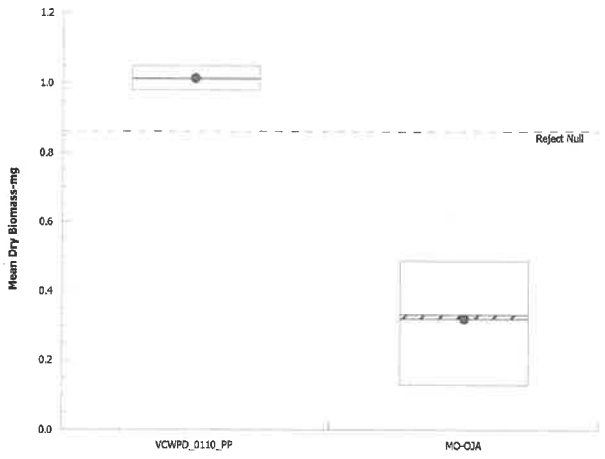
Distributional Tests

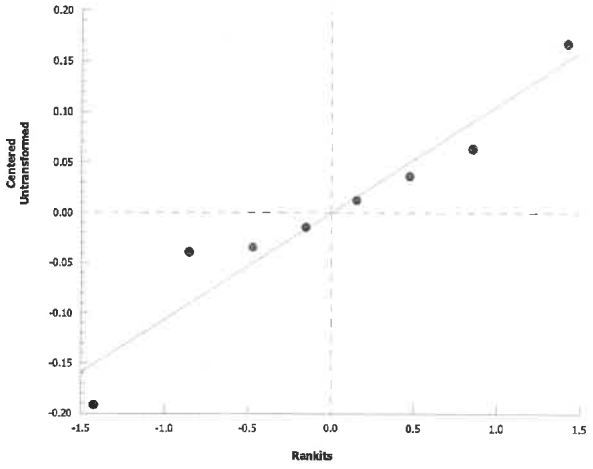
Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	24.3	47.5	0.0263	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.95	0.645	0.7135	Normal Distribution

Mean Dry Biomass-mg Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_0110_PP	LW	4	1.01	0.963	1.06	1.01	0.978	1.05	0.0155	3.06%	0.00%
MO-OJA		4	0.321	0.0769	0.564	0.332	0.129	0.488	0.0766	47.77%	68.35%

Graphics





7 Day Chronic Fathead Minnow Toxicity Test Data

Client: Ventura County Water Protection District
Organism Log#: 10722 Age: <48hr
Test Material: MO-OJA
Organism Supplier: Aquatox
Test ID#: 76376 Project #: 27911
Control: EPAMH
Test Date: 1/10/18 Randomization: 4.6.6
Control Water Batch: 2043

Test Treatment	Temp (°C)	pH new	pH old	D.O. (mg/L) new	D.O. (mg/L) old	Conductivity (µS/cm)	# Live Organisms A	B	C	D	SIGN-OFF
Lab Water Control	25.0	7.95		8.4		283	10	10	10	10	Date: 1/10/18 Test Solution Prep: SF
100%	24.7	7.65		7.9		322	10	10	10	10	Sample ID: 48476 Initiation Time: 1854
Meter ID	58A	PH19		RD09		EC08	New WQ: TA		Old WQ:		Initiation Signoff: RC
Lab Water Control	25.1	7.83	7.53	9.0	5.9	315	10	10	10	10	Date: 1/11/18 Test Solution Prep: SF
100%	25.0	7.49	7.63	8.6	6.7	334	TK 9	10	10	10	Sample ID: 48476 Renewal Time: 1630
Meter ID	98A	PH19	PH23	RD10	RD09	EC11	New WQ: TF		Old WQ: TF		Renewal Signoff: TK
Lab Water Control	24.6	8.10	8.06	8.7	8.1	284	10	10	10	10	Date: 1/12/18 Test Solution Prep: SD
100%	24.7	7.40	7.97	5.0	6.8	336	9	10	10	10	Sample ID: 48476 Renewal Time: 1430
Meter ID	98A	pH19	pH19	RD12	RD11	EC12	New WQ: TA		Old WQ: TA		Renewal Signoff: 48476 EP SD thaw
Lab Water Control	24.9	7.93	7.73	9.3	8.4	287	10	10	10	10	Date: 1/13/18 Test Solution Prep: EP
100%	24.8	7.13	7.80	4.3	7.8	342	9	4	10	10	Sample ID: 48476 Renewal Time: 1130
Meter ID	81A	PH19	PH21	RD10	RD12	EC12	New WQ: LZ		Old WQ: LZ		Renewal Signoff: TK
Lab Water Control	24.1	8.10	7.72	8.4	8.1	299	10	10	10	10	Date: 1/14/18 Test Solution Prep: SD
100%	23.7	7.16	7.73	4.5	6.6	361	9	4	10	10	Sample ID: 48476 Renewal Time: 1515
Meter ID	40A	pH23	PH19	RD11	RD10	EC10	New WQ: FT		Old WQ: LZ		Renewal Signoff: CO
Lab Water Control	24.0	8.16	7.84	8.6	7.9	287	10	10	10	10	Date: 1/15/18 Test Solution Prep: JO
100%	23.4	7.03	7.66	7.4	6.0	368	8	4	7	10	Sample ID: 48476 Renewal Time: 1300
Meter ID	58A	pH21	pH23	RD11	RD12	EC11	New WQ: RAF		Old WQ: RAF		Renewal Signoff: JL
Lab Water Control	24.1	8.03	7.77	7.2	7.4	285	10	10	10	10	Date: 1/16/18 Test Solution Prep: JV
100%	24.0	7.01	7.58	5.3	6.3	370	8	4	7	8	Sample ID: ~~48476~~ 48476 Renewal Time: 1435
Meter ID	98A	PH21	PH23	RD11	RD11	EC10	New WQ: KD		Old WQ: RAF		Renewal Signoff: WE
Lab Water Control	24.3		7.70		7.6	318	10	10	10	10	Date: 1/17/18 Termination Time: 1012
100%	24.3		7.28		6.8	423	8	4	7	7	Termination Signoff: RC
Meter ID	98A		PH19		RD10	EC12			Old WQ: KL		

Fathead Minnow Dry Weight Data Sheet

Client: **Ventura County Water Protection District** Test ID #: 76376 Project #: 27911

Test Material: **MO-OJA** Tare Weight Date: 1/13/18 Sign-off: SGB

Test Date: 1/10/18 Final Weight Date: 1/15/18 Sign-off: RAP

Pan ID	Treatment	Replicate	Initial Pan Weight (mg)	Final Pan Weight (mg)	Initial # of Organisms	Biomass Value (mg)
1	Lab Water	A	412.86	422.64	10	0.978
2	Control	B	409.57	420.01	10	1.05
3		C	410.70	420.68	10	0.990
4		D	408.96	419.21	10	1.03
9	100%	A	404.68	409.56	10	0.488
10		B	407.77	409.06	10	0.129
11		C	415.66	419.50	10	0.384
12		D	403.79	406.60	10	0.281
QA1			416.56	416.57		
Balance ID:			Bal04	Bal04		

Chronic Larval Fish Survival and Growth Test — **Pacific EcoRisk**

Analysis ID: 01-9296-1538 **Endpoint:** 7d Survival Rate **CETIS Version:** CETISv1.9.2
Analyzed: 23 Jan-18 13:41 **Analysis:** Parametric-Two Sample **Official Results:** Yes

Data Transform	Alt Hyp	Comparison Result	PMSD
Angular (Corrected)	C > T	MO-MEI failed 7d survival rate	58.27%

Unequal Variance t Two-Sample Test

Sample I	vs	Sample II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Lab Water Control		MO-MEI*	3.29	2.92	0.71	2	CDF	0.0406	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1.09842	1.09842	1	15.5	0.0110	Significant Effect
Error	0.354455	0.0708911	5			
Total	1.45287		6			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Levene Equality of Variance Test	9.63	16.3	0.0268	Equal Variances
Variances	Mod Levene Equality of Variance Test	38.3	21.2	0.0035	Unequal Variances
Distribution	Shapiro-Wilk W Normality Test	0.825	0.563	0.0720	Normal Distribution

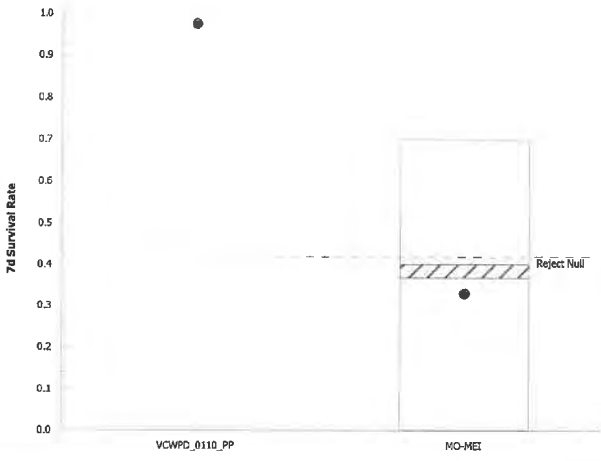
7d Survival Rate Summary

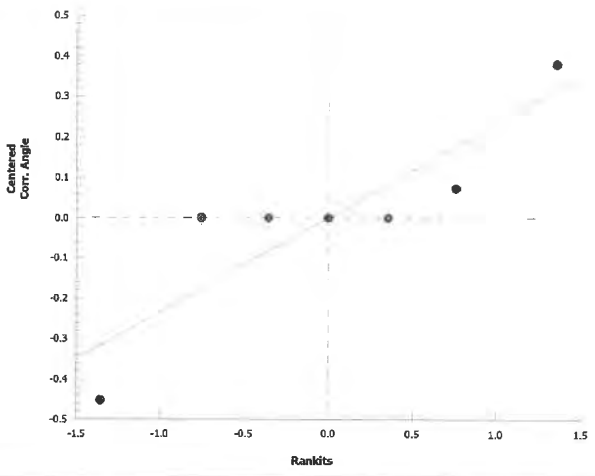
Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_0110_PP	LW	4	1.000	1.000	1.000	1.000	1.000	1.000	0.000	0.00%	0.00%
MO-MEI		3	0.367	0.000	1.000	0.400	0.000	0.700	0.203	95.78%	63.33%

Angular (Corrected) Transformed Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_0110_PP	LW	4	1.41	1.41	1.41	1.41	1.41	1.41	0	0.00%	0.00%
MO-MEI		3	0.612	-0.434	1.66	0.685	0.159	0.991	0.243	68.84%	56.69%

Graphics





Chronic Larval Fish Survival and Growth Test — **Pacific EcoRisk**

Analysis ID:	12-7660-8970	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.2
Analyzed:	23 Jan-18 13:41	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C > T	MO-MEI failed mean dry biomass-mg	12.62%

Equal Variance t Two-Sample Test

Sample I	vs	Sample II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Lab Water Control		MO-MEI*	13.9	2.02	0.128	5	CDF	1.7E-05	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1.32805	1.32805	1	193	3.5E-05	Significant Effect
Error	0.0344617	0.0068923	5			
Total	1.36251		6			

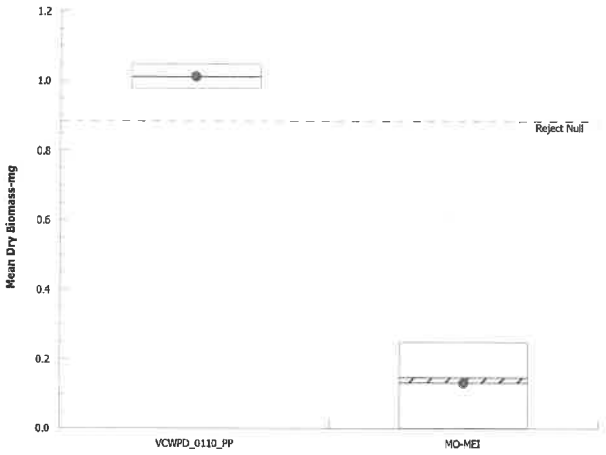
Distributional Tests

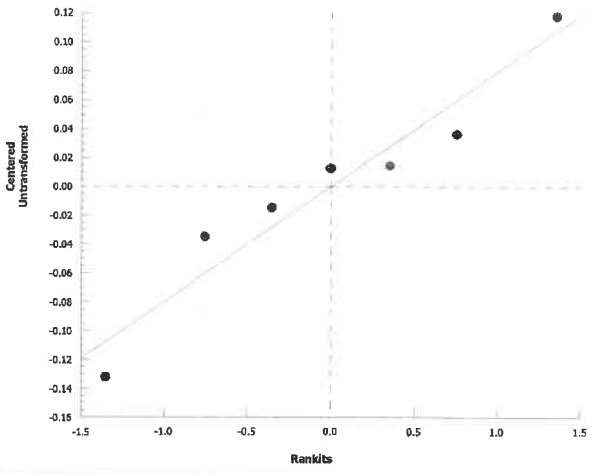
Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	16.4	49.8	0.0485	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.955	0.563	0.7743	Normal Distribution

Mean Dry Biomass-mg Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_0110_PP	LW	4	1.01	0.963	1.06	1.01	0.978	1.05	0.0155	3.06%	0.00%
MO-MEI		3	0.132	-0.18	0.444	0.147	0	0.25	0.0725	94.94%	86.93%

Graphics





7 Day Chronic Fathead Minnow Toxicity Test Data

Client: Ventura County Water Protection District
Test Material: MO-MEI
Test ID#: 76377 Project #: 27911
Test Date: 1/10/18 Randomization: 4.66
Organism Log#: 10722 Age: <48hr
Organism Supplier: Aquatox
Control: EPAMH
Control Water Batch: 2043

Test Treatment	Temp (°C)	pH new	pH old	D.O. (mg/L) new	D.O. (mg/L) old	Conductivity (µS/cm)	# Live Organisms A	B	C	D	SIGN-OFF
Lab Water Control	25.0	7.95		8.4		283	10	10	10	10	Date: 1/10/18 Test Solution Prep: SF
100%	25.0	7.45		7.6		592	10	10	10	10	Sample ID: 48477 Initiation Time: 1854
Meter ID	58A	PH19		RD09		EC05	New WQ: TA				Initiation Signoff: TA
Lab Water Control	25.1	7.83	7.53	9.0	5.9	315	10	10	10	10	Date: 1/11/18 Test Solution Prep: SF
100%	25.1	7.22	7.56	6.5	6.4	601	10	10	10	9	Sample ID: 48477 Renewal Time: 1630
Meter ID	98A	PH19	PH23	RD10	RD09	EC11	New WQ: TF		Old WQ: ~~TF~~		Renewal Signoff: TK
Lab Water Control	24.6	8.10	8.06	8.7	8.1	284	10	10	10	10	Date: 1/12/18 Test Solution Prep: SD
100%	24.8	7.22	7.89	4.8	5.0	617	10	10	10	9	Sample ID: 48477 Renewal Time: 1430
Meter ID	98A	pH19	pH19	RD12	RD11	EC12	New WQ: LA		Old WQ: LA		Renewal Signoff: ~~48477~~ EP switch s
Lab Water Control	24.9	7.93	7.73	9.3	8.4	287	10	10	10	10	Date: 1/13/18 Test Solution Prep: EP
100%	24.8	6.89	7.71	5.1	5.9	641	*	9	9	8	Sample ID: 48477 Renewal Time: 1130
Meter ID	81A	PH19	PH21	RD10	RD12	EC12	New WQ: LZ		Old WQ: LZ		Renewal Signoff: TK
Lab Water Control	24.1	8.10	7.72	8.4	8.1	299	10	10	10	10	Date: 1/14/18 Test Solution Prep: SD
100%	23.6	~~6.84~~ 7.36	7.56	7.0	3.8	~~646~~ 638	-	8	6	5	Sample ID: 48477 Renewal Time: 1515
Meter ID	40A	PH23	PH19	RD11	RD10	EC10	New WQ: FT		Old WQ: LZ		Renewal Signoff: CD
Lab Water Control	24.0	8.16	7.84	8.6	7.9	287	10	10	10	10	Date: 1/15/18 Test Solution Prep: JO
100%	23.6	6.74	7.43	4.9	2.8	649	-	8	6	3	Sample ID: 48477 Renewal Time: 1300
Meter ID	58A	pH21	pH23	RD11	RD12	EC11	New WQ: RAF		Old WQ: RAF		Renewal Signoff: JL
Lab Water Control	24.1	8.03	7.77	7.2	7.4	285	10	10	10	10	Date: 1/16/18 Test Solution Prep: AV
100%	24.0	6.46	7.85	4.7	5.7	638	-	7	4	1	Sample ID: 48477 Renewal Time: 1435
Meter ID	98A	PH21	pH21	RD11	RD11	EC10	New WQ: KG		Old WQ: RAF		Renewal Signoff: AR
Lab Water Control	24.3		7.70		7.6	318	10	10	10	10	Date: 1/17/18 Termination Time: 1012
100%	24.4		7.66		4.3	702	-	7	4	0	Termination Signoff: RG
Meter ID	99A		pH19		RD10	EC12			Old WQ: KL		

* replicate spilled; exclude from data

Fathead Minnow Dry Weight Data Sheet

Client: **Ventura County Water Protection District** Test ID #: 76377 Project #: 27911

Test Material: **MO-MEI** Tare Weight Date: 1/13/18 Sign-off: SJB

Test Date: 1/10/18 Final Weight Date: 1/16/18 Sign-off: RAP

Pan ID	Treatment	Replicate	Initial Pan Weight (mg)	Final Pan Weight (mg)	Initial # of Organisms	Biomass Value (mg)
1	Lab Water	A	412.86	422.64	10	0.978
2	Control	B	409.52	420.01	10	1.05
3		C	410.70	420.68	10	0.998
4		D	408.96	419.21	10	1.03
13	100%	A	407.52	—	—	—
14		B	418.07	420.57	10	0.250
15		C	410.65	412.12	10	0.147
16		D	417.30	—	10	—
QA2			411.92	411.89		
Balance ID:			Bal04	Bal04		

Chronic Larval Fish Survival and Growth Test — **Pacific EcoRisk**

Analysis ID:	13-4595-3620	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	23 Jan-18 13:41	**Analysis:**	Nonparametric-Two Sample	**Official Results:**	Yes

Data Transform	Alt Hyp	Comparison Result	PMSD
Angular (Corrected)	C > T	MO-OXN failed 7d survival rate	5.10%

Wilcoxon Rank Sum Two-Sample Test

Sample I	vs	Sample II	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision(α:5%)
Lab Water Control		MO-OXN*	10	n/a	0	6	Exact	0.0143	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0787605	0.0787605	1	31.3	0.0014	Significant Effect
Error	0.0151011	0.0025169	6			
Total	0.0938616		7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Levene Equality of Variance Test	9	13.7	0.0240	Equal Variances
Variances	Mod Levene Equality of Variance Test	1	13.7	0.3559	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.706	0.645	0.0027	Non-Normal Distribution

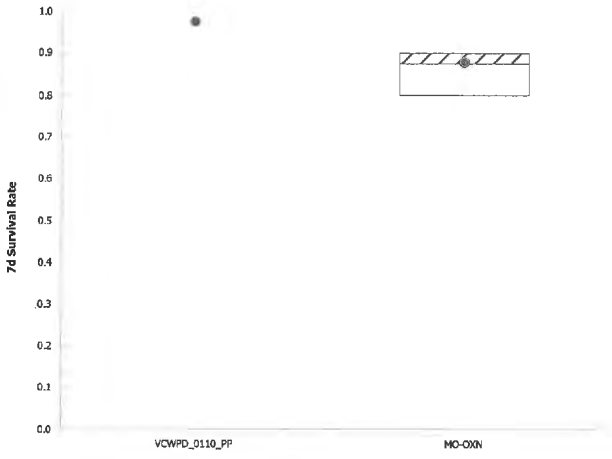
7d Survival Rate Summary

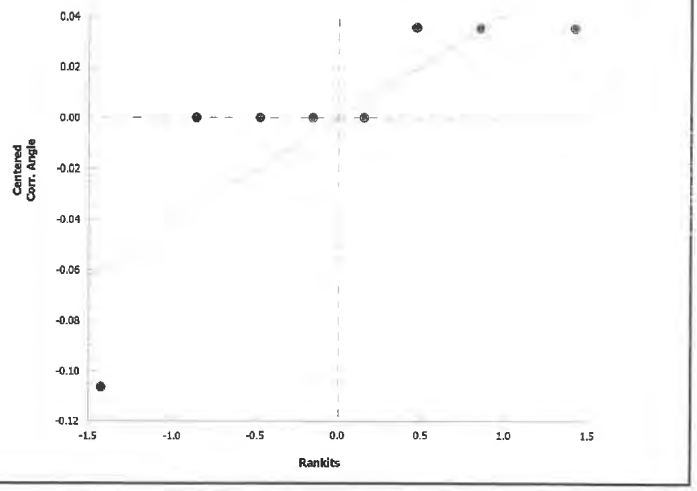
Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_0110_PP	LW	4	1.000	1.000	1.000	1.000	1.000	1.000	0.000	0.00%	0.00%
MO-OXN		4	0.875	0.795	0.955	0.900	0.800	0.900	0.025	5.71%	12.50%

Angular (Corrected) Transformed Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_0110_PP	LW	4	1.41	1.41	1.41	1.41	1.41	1.41	0	0.00%	0.00%
MO-OXN		4	1.21	1.1	1.33	1.25	1.11	1.25	0.0355	5.85%	14.05%

Graphics





Chronic Larval Fish Survival and Growth Test — **Pacific EcoRisk**

Analysis ID:	14-1753-9085	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.2
Analyzed:	23 Jan-18 13:41	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C > T	MO-OXN failed mean dry biomass-mg	8.57%

Equal Variance t Two-Sample Test

Sample I	vs	Sample II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Lab Water Control		MO-OXN*	9.2	1.94	0.087	6	CDF	4.7E-05	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.337433	0.337433	1	84.6	9.3E-05	Significant Effect
Error	0.0239339	0.003989	6			
Total	0.361367		7			

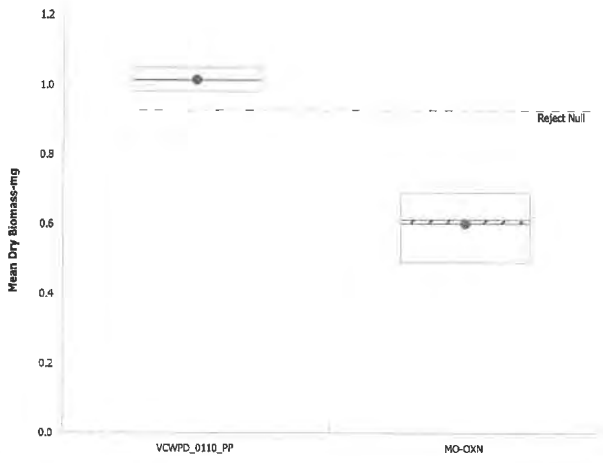
Distributional Tests

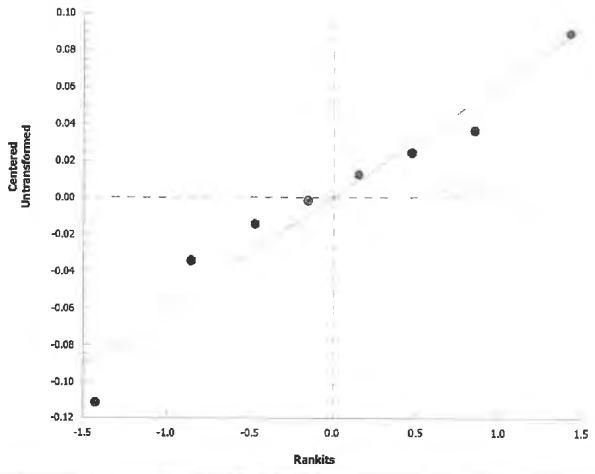
Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	7.28	47.5	0.1371	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.961	0.645	0.8204	Normal Distribution

Mean Dry Biomass-mg Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_0110_PP	LW	4	1.01	0.963	1.06	1.01	0.978	1.05	0.0155	3.06%	0.00%
MO-OXN		4	0.602	0.468	0.735	0.613	0.49	0.691	0.0419	13.92%	40.57%

Graphics





7 Day Chronic Fathead Minnow Toxicity Test Data

Client: **Ventura County Water Protection District** Organism Log#: 10722 Age: 24 hr

Test Material: MO-OXN Organism Supplier: Aquatox

Test ID#: 76378 Project #: 27911 Control: EPAMH

Test Date: 1/10/18 Randomization: 4.6.6 Control Water Batch: 2093

Test Treatment	Temp (°C)	pH new	pH old	D.O. (mg/L) new	D.O. (mg/L) old	Conductivity (µS/cm)	# Live Organisms A	B	C	D	SIGN-OFF
Lab Water Control	25.0	7.95		8.4		283	10	10	10	10	Date: 1/10/18
100%	24.6	7.38		8.8		242	10	10	10	10	Test Solution Prep: SF
Meter ID	58A	PH19		RD09		EC08	New WQ: TA				Sample ID: 48479
Lab Water Control	25.1	7.83	7.53	9.0	5.9	315	10	10	10	10	Initiation Time: 1854
100%	24.9	7.20	7.22	10.1	6.5	242	10	10	9	10	Initiation Signoff: RC
Meter ID	98A	PH19	PH23	RD10	RD09	EC11	New WQ: TF		Old WQ: TA		Date: 1/11/18
Lab Water Control	24.6	8.10	8.06	8.7	8.1	284	10	10	10	10	Test Solution Prep: SF
100%	24.9	7.02	7.34	8.9	6.3	237	10	10	9	10	Sample ID: 48479
Meter ID	98A	PH19	PH19	RD12	RD11	EC12	New WQ: TA		Old WQ: CA		Renewal Time: 1630
Lab Water Control	24.9	7.93	7.73	9.3	8.4	287	10	10	10	10	Renewal Signoff: TK
100%	24.8	6.75	7.33	7.7	7.9	242	10	9	9	10	Date: 1/12/18
Meter ID	81A	PH19	PH21	RD10	RD12	EC12	New WQ: CZ		Old WQ: CZ		Test Solution Prep: SD
Lab Water Control	24.1	8.10	7.72	8.4	8.1	299	10	10	10	10	Sample ID: 48479
100%	24.0	6.93	7.25	6.9	6.2	242	10	8	9	10	Renewal Time: 1430
Meter ID	40A	PH23	PH19	RD11	RD10	EC10	New WQ: FT		Old WQ: CZ		Renewal Signoff: EP
Lab Water Control	24.0	8.16	7.84	8.6	7.9	247	10	10	10	10	Date: 1/13/18
100%	24.0	7.29	7.38	7.7	7.5	247	10	8	9	9	Test Solution Prep: EP
Meter ID	58A	PH21	PH23	RD11	RD12	EC11	New WQ: RAF		Old WQ: RAF		Sample ID: 48479
Lab Water Control	24.1	8.03	7.77	7.2	7.4	285	10	10	10	10	Renewal Time: 1130
100%	23.4	6.72	7.41	8.0	5.8	245	10	8	9	9	Renewal Signoff: TK
Meter ID	98A	PH21	PH21	RD11	RD11	EC10	New WQ: KL		Old WQ: RAF		Date: 1/14/18
Lab Water Control	24.3		7.70		7.6	318	10	10	10	10	Test Solution Prep: SD
100%	24.2		7.37		6.0	281	9	8	9	9	Sample ID: 48479
Meter ID	99A		PH19		RD10	EC12			Old WQ: KL		Renewal Time: 1500
											Renewal Signoff: JL
Lab Water Control	24.1		7.77		7.4	285	10	10	10	10	Date: 1/16/18
100%	23.4		7.41		5.8	245	10	8	9	9	Test Solution Prep: JL
Meter ID	98A		PH21		RD11	EC10	New WQ: KL		Old WQ: RAF		Sample ID: 48479
Lab Water Control	24.3		7.70		7.6	318	10	10	10	10	Renewal Time: 1435
100%	24.2		7.37		6.0	281	9	8	9	9	Renewal Signoff: LL
Meter ID	99A		PH19		RD10	EC12			Old WQ: KL		Date: 1/17/18
											Termination Time: 1012
											Termination Signoff: RC

Fathead Minnow Dry Weight Data Sheet

Client: **Ventura County Water Protection District** Test ID #: 76378 Project #: 27911

Test Material: **MO-OXN** Tare Weight Date: 1/13/18 Sign-off: SJB

Test Date: 1/10/18 Final Weight Date: 1/16/18 Sign-off: RAF

Pan ID	Treatment	Replicate	Initial Pan Weight (mg)	Final Pan Weight (mg)	Initial # of Organisms	Biomass Value (mg)
1	Lab Water	A	412.86	422.64	10	0.978
2	Control	B	409.52	420.01	10	1.05
3		C	410.70	420.68	10	0.998
4		D	408.96	VISIBLE 419.21	10	1.03
17	100%	A	411.57	417.83	10	0.624
18		B	408.89	413.79	10	0.490
19		C	404.21	411.12	10	0.691
20		D	417.11	423.11	10	0.600
QA2			411.92	411.89		
Balance ID:			Bal04	Bal04		

Chronic Larval Fish Survival and Growth Test — **Pacific EcoRisk**

Analysis ID:	19-5274-5468	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	23 Jan-18 13:41	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Alt Hyp	Comparison Result	PMSD
Angular (Corrected)	C > T	MO-SPA passed 7d survival rate	16.00%

Unequal Variance t Two-Sample Test

Sample I	vs	Sample II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Lab Water Control		MO-SPA	1.69	2.35	0.253	3	CDF	0.0949	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0658349	0.0658349	1	2.85	0.1421	Non-Significant Effect
Error	0.138397	0.0230662	6			
Total	0.204232		7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Levene Equality of Variance Test	58.7	13.7	2.6E-04	Unequal Variances
Variances	Mod Levene Equality of Variance Test	39.1	13.7	7.7E-04	Unequal Variances
Distribution	Shapiro-Wilk W Normality Test	0.891	0.645	0.2370	Normal Distribution

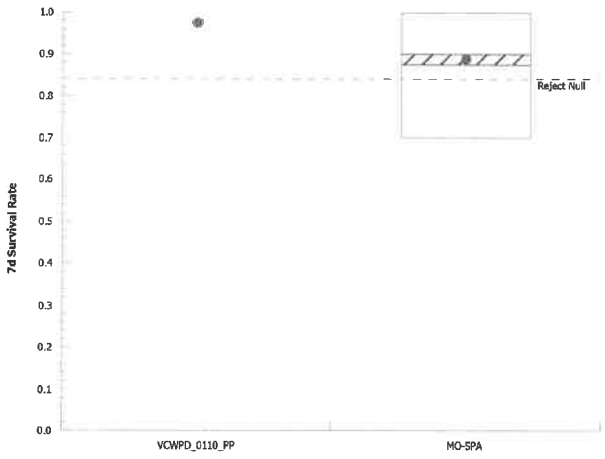
7d Survival Rate Summary

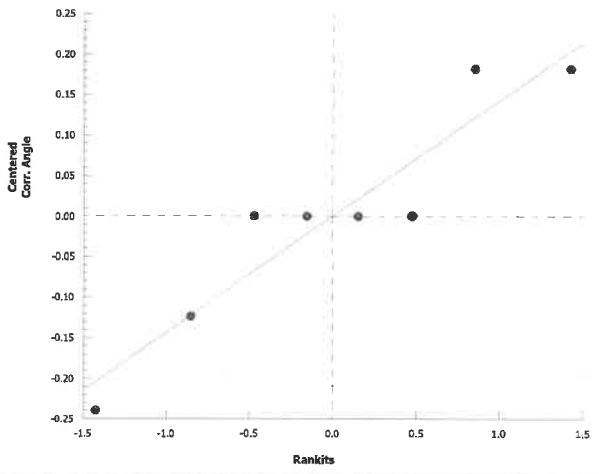
Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_0110_PP	LW	4	1.000	1.000	1.000	1.000	1.000	1.000	0.000	0.00%	0.00%
MO-SPA		4	0.875	0.636	1.000	0.900	0.700	1.000	0.075	17.14%	12.50%

Angular (Corrected) Transformed Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_0110_PP	LW	4	1.41	1.41	1.41	1.41	1.41	1.41	0	0.00%	0.00%
MO-SPA		4	1.23	0.889	1.57	1.26	0.991	1.41	0.107	17.45%	12.85%

Graphics





Chronic Larval Fish Survival and Growth Test — Pacific EcoRisk

Analysis ID:	13-2261-9250	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.2
Analyzed:	23 Jan-18 13:47	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Data Transform	Alt Hyp	Comparison Result	PMSD
Untransformed	C > T	MO-SPA failed mean dry biomass-mg	12.37%

Equal Variance t Two-Sample Test

Sample I	vs	Sample II	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Lab Water Control		MO-SPA*	8.85	1.94	0.125	6	CDF	5.8E-05	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.65037	0.65037	1	78.3	1.2E-04	Significant Effect
Error	0.0498593	0.0083099	6			
Total	0.700229		7			

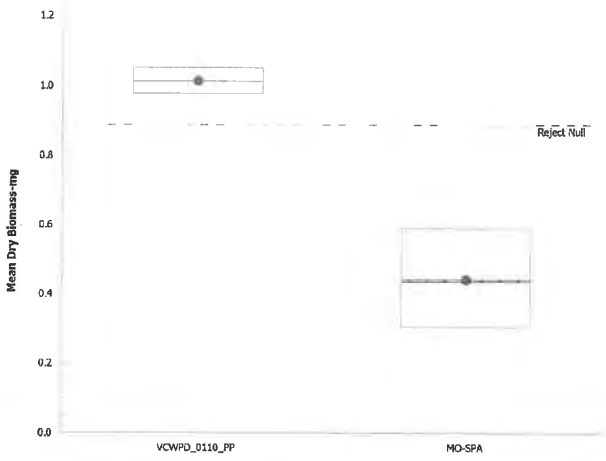
Distributional Tests

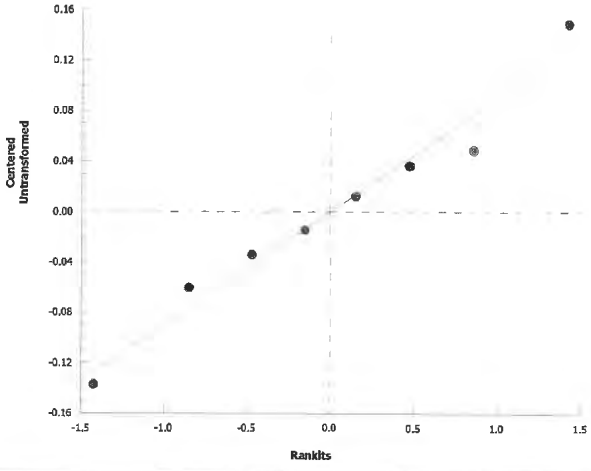
Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F Test	16.3	47.5	0.0465	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.984	0.645	0.9794	Normal Distribution

Mean Dry Biomass-mg Summary

Sample	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
VCWPD_0110_PP	LW	4	1.01	0.963	1.06	1.01	0.978	1.05	0.0155	3.06%	0.00%
MO-SPA		4	0.442	0.243	0.641	0.437	0.305	0.591	0.0626	28.29%	56.32%

Graphics





7 Day Chronic Fathead Minnow Toxicity Test Data

Client: **Ventura County Water Protection District** Organism Log#: 10722 Age: <48hr

Test Material: MO-SPA Organism Supplier: Aquatox

Test ID#: 76379 Project #: 27911 Control: EPAMH

Test Date: 1/10/18 Randomization: 4.6.t Control Water Batch: 2043

Test Treatment	Temp (°C)	pH new	pH old	D.O. (mg/L) new	D.O. (mg/L) old	Conductivity (µS/cm)	# Live Organisms A	B	C	D	SIGN-OFF
Lab Water Control	25.0	7.95		8.4		287	10	10	10	10	Date: 1/10/18 Test Solution Prep: SF
100%	25.1	7.39		9.2		193	10	10	10	10	Sample ID: 48485 Initiation Time: 1854
Meter ID	58A	PH19		RD09		EC08	New WQ: TA				Initiation Signoff: RC
Lab Water Control	25.1	7.83	7.53	9.0	5.9	315	10	10	10	10	Date: 1/11/18 Test Solution Prep: SF
100%	25.1	7.27	7.21	10.4	6.3	195	10	10	9	9	Sample ID: 48485 Renewal Time: 1630
Meter ID	98A	PH19	PH23	RD10	RD09	EC11	New WQ: TF		Old WQ: TF EF 1/12/18		Renewal Signoff: TK
Lab Water Control	24.6	8.10	8.06	8.7	8.1	284	10	10	10	10	Date: 1/12/18 Test Solution Prep: SD
100%	24.8	7.14	7.59	8.7	7.1	190	10	10	9	10	Sample ID: 48485 Renewal Time: 1430
Meter ID	98A	pH19	pH19	RD12	RD11	EC12	New WQ: CA		Old WQ: CA		Renewal Signoff: EP
Lab Water Control	24.9	7.93	7.73	9.3	8.4	287	10	10	10	10	Date: 1/13/18 Test Solution Prep: EP
100%	24.7	6.72	7.35	6.2	7.7	194	10	10	8	10	Sample ID: 48485 Renewal Time: 1130
Meter ID	81A	PH19	PH21	RD10	RD12	EC12	New WQ: LZ		Old WQ: LZ		Renewal Signoff: TK
Lab Water Control	24.1	8.10	7.72	8.4	8.1	299	10	10	10	10	Date: 1/14/18 Test Solution Prep: SD
100%	23.6	6.81	7.34	6.9	6.4	194	10	10	8	9	Sample ID: 48485 Renewal Time: 1515
Meter ID	40A	pH23	PH19	RD11	RD10	EC10	New WQ: FT		Old WQ: LZ		Renewal Signoff: CD
Lab Water Control	24.0	8.16	7.94	8.6	7.9	287	10	10	10	10	Date: 1/15/18 Test Solution Prep: JO
100%	24.0	6.89	7.40	7.8	7.5	199	10	10	8	7	Sample ID: 48485 Renewal Time: 1300
Meter ID	58A	pH21	pH23	RD11	RD12	EC11	New WQ: RAP		Old WQ: RAP		Renewal Signoff: JL
Lab Water Control	24.1	8.05	7.77	7.2	7.4	285	10	10	10	10	Date: 1/16/18 Test Solution Prep: JL
100%	23.4	6.70	7.53	8.0	6.3	197	10	10	8	7	Sample ID: 48485 Renewal Time: 1435
Meter ID	98A	PH21	PH21	RD11	RD11	EC10	New WQ: KL		Old WQ: RAP		Renewal Signoff: WC
Lab Water Control	24.3		7.70		7.6	318	10	10	10	10	Date: 1/17/18 Termination Time: 1012
100%	24.0		7.40		7.0	223	10	10	8	7	Termination Signoff: RB
Meter ID	99A		PH19		RD10	EC12			Old WQ: KL		

Fathead Minnow Dry Weight Data Sheet

Client: **Ventura County Water Protection District** Test ID #: 76379 Project #: 27911

Test Material: **MO-SPA** Tare Weight Date: 1/13/18 Sign-off: SDB

Test Date: 1/10/18 Final Weight Date: 1/18/18 Sign-off: RAP

Pan ID	Treatment	Replicate	Initial Pan Weight (mg)	Final Pan Weight (mg)	Initial # of Organisms	Biomass Value (mg)
1	Lab Water	A	412.86	422.64	10	0.978
2	Control	B	409.52	420.01	10	1.05
3		C	410.70	420.68	10	0.998
4		D	418.96	419.21	10	1.03
21	100%	A	413.15	419.06	10	0.591
22		B	399.50	404.41	10	0.491
23		C	399.77	402.82	10	0.305
24		D	414.53	418.35	10	0.382
QA2			411.92	411.89		
Balance ID:			Bal 04	Bal 04		

Appendix J. Dry-Weather Analytical Monitoring Results

	Site ID	Port Hueneme-3	Unincorporated-4	Camarillo-1	Fillmore-1
		DRY-HUE3	DRY-UNI4	MO-CAM	MO-FIL
	At Major Outfall?	No	No	Yes	Yes
	Location	Bubbling Springs @ RR xing	Arroyo Santa Rosa at Box Canyon confluence	Camarillo Hills Drain	North Fillmore Drain
	Date	08/20/18	08/21/18	08/21/18	08/20/18
	Time	14:30	10:10	7:40	11:20
Site Description	**Conveyence Type**	Natural channel	Box culvert	Box culvert	Box culvert
	Dimensions	N/A	N/A	8' x 24'	N/A
	Dominant Land Use	Commercial & residential	Residential & rural	Commercial & residential	Residential
	Site Elevation	0	250	100	430
Weather	**Weather**	Partly cloudy	Partly Cloudy	Overcast	Clear
	Wind Condtion	Calm	Calm	Calm	Calm
	Air Temp. (^{0}C)	28	24	22	32
Trash	**Trash (general area)**	Light	None	Light	None
	Trash (stream banks)	Light	Light	Light	Light
Observations	**Water Clarity**	Clear	Clear	Clear	Clear
	Water Color	Gray	Clear	Yellow	Clear
	Odors	None	None	None	None
	Floatables	Oily sheen	None	Other	None
	Foam	None	None	None	None
	Stains/ deposits	None	None	None	None
	Structural condition	Natural channel	Concrete channel	Concrete channel	Rip rap with concrete bottom to natural bottom
	Vegetation Condition	Maintained grass/park	Grasses in soft bottom section	Small herbaceous growth in expansion joints	Grasses, macrophytes
	Biology	>100 ducks in area plus Canadian Geese and other birds	None	Aquatic snails	Aquatic snails
	Algae (suspended)	None	Green 5%	Green 1%	Green 80%
	Algae (substrate)	None	Green 50%	Green 50%	Green 50%
Water Chemistry (Field)	**Dissolved Oxygen (%)**	2.3	166.3	109.0	197.0
	Dissolved Oxygen (mg/L)	0.15	13.39	9.26	15.52
	Conductivity (µS)	11040	1479	2654	1615
	Specific Conductance (µS)	10180	1478	2743	1517
	Salinity (ppt)	5.6	0.7	1.4	0.8
	Water Temp. (^{0}C)	28.3	25.7	23.4	28.4
	Water Temp. (^{0}F)	82.9	78.3	74.1	83.1
	pH	7.39	9.53	8.32	8.5
	Turbidity (NTU)	40.23	4.84	52.47	2.67
Water Chemistry (Lab)	**Total Organic Carbon (mg/L)**	7.5	16	55	4.7
	Total Hardness as $CaCO_3$ (mg/L)	1,940	502	851	619
	Total Calcium (mg/L)	360	81.4	225	162
	Total Magnesium (mg/L)	252	72.5	70.4	52.0
	Dissolved Copper (µg/L)	<0.13	6.6	14	5.3
	Dissolved Lead (µg/L)	<0.031	<0.031	0.24	0.035 (DNQ)
	Dissolved Zinc (µg/L)	1.3 (DNQ)	2.9 (DNQ)	9.3	2.5 (DNQ)
	Total Coliform (MPN/100 mL)	155,310	>2,419,600	816,400	2,098
	***E. coli* (MPN/100 mL)**	30,760	4,352	19,863	218
Estimated Flow	**Flow Status**	Ponded	Flowing	Flowing	Flowing
	Water Width (ft.)	~25	1.5	4.0	5.0
	Water Depth (ft.)	~1-2	0.01	0.01	0.20
	Flow Velocity (ft/s)	~0	1.50	~0.1	<0.1
	Flow Rate (ft^3/s)	~ 0	~0.02	~0.05	~0.05
	Comments	Flow is very low and surface flow seemed to be changing direction. Floatables garbage and oily sheen.	pH #1 9.52, #2 9.53	Floatables thin scum layer at choke point of channel	

	Site ID	Moorpark-1	Ojai-6	Oxnard-2	Santa Paula-4
		MO-MPK	DRY-OJA6	DRY-OXN2	DRY-SPA4
	At Major Outfall?	Yes	No	No	No
	Location	Walnut Canyon	Tributary to Fox Barranca	Stroube Drain	Richmond Rd Drain
	Date	08/21/18	08/20/18	08/20/18	08/20/18
	Time	8:40	12:25	8:40	10:40
Site Description	Conveyence Type	Box culvert	Natural channel	Natural channel	Epoxy coated metal pipe
	Dimensions	5' x 12'	N/A	N/A	1'6"
	Dominant Land Use	Commercial & residential	Residential	Commercial & residential	Residential
	Site Elevation	460	720	70	343
Weather	Weather	Overcast	Clear	Partly cloudy	Clear
	Wind Condtion	Calm	Calm	Calm	Calm
	Air Temp. (^{0}C)	23	31	24.5	30
Trash	Trash (general area)	Light	None	Moderate	None
	Trash (stream banks)	None	Moderate	Moderate	None
Observations	Water Clarity	Clear	Clear	Clear	Clear
	Water Color	Clear	Clear	Clear	Clear
	Odors	None	None	None	None
	Floatables	None	Other	None	None
	Foam	None	None	None	None
	Stains/ deposits	None	None	None	None
	Structural condition	Concrete channel	Natural channel	Concrete channel to rip rap	Pipe to concreted rip rap
	Vegetation Condition	None	Some vines including blackberry, poison oak	Duckweed	Mulefat, mint, grasses below pipe
	Biology	Aquatic snails	None	None	None
	Algae (suspended)	None	Green 5%	Green 30%	None
	Algae (substrate)	None	None	Green 40%	Green 10%
Water Chemistry (Field)	Dissolved Oxygen (%)	116.1	88.5	95.9	98.2
	Dissolved Oxygen (mg/L)	9.91	7.66	8.42	8.66
	Conductivity (µS)	1368	1313	1402	1289
	Specific Conductance (µS)	1421	1387	1475	1390
	Salinity (ppt)	0.7	0.7	0.7	0.7
	Water Temp. (^{0}C)	23.0	22.3	22.3	21.2
	Water Temp. (^{0}F)	73.4	72.1	72.1	70.2
	pH	8.79	8.05	8.51	7.74
	Turbidity (NTU)	5.63	12.83	2.04	0.23
Water Chemistry (Lab)	Total Organic Carbon (mg/L)	24	2.0	10	0.64
	Total Hardness as $CaCO_3$ (mg/L)	253	709	573	571
	Total Calcium (mg/L)	55.0	210	150	157
	Total Magnesium (mg/L)	28.1	45.0	47.9	43.6
	Dissolved Copper (µg/L)	4.0	0.20 (DNQ)	4.0	0.20 (DNQ)
	Dissolved Lead (µg/L)	0.15 (DNQ)	<0.031	<0.031	<0.031
	Dissolved Zinc (µg/L)	3.6 (DNQ)	1.0 (DNQ)	5.3	1.1 (DNQ)
	Total Coliform (MPN/100 mL)	410,600	4,352	86,640	323
	E. coli (MPN/100 mL)	3,448	630	426	<10
Estimated Flow	Flow Status	Flowing	Flowing	Flowing	Flowing
	Water Width (ft.)	2.0	5.0	8.0	1.0
	Water Depth (ft.)	0.01	0.20	0.30	0.20
	Flow Velocity (ft/s)	1.00	<0.1	0.25	1.50
	Flow Rate (ft^3/s)	~0.05	~0.1	0.60	0.30
	Comments		Floatables looks like pollen		

	Site ID	Simi Valley-1	Thousand Oaks-1	Ventura-5
		MO-SIM	MO-THO	DRY-VEN5
	At Major Outfall?	Yes	Yes	No
	Location	Bus Canyon Drain	North Fork Arroyo Conejo at Hill Canyon WWTP	Dent Drain
	Date	08/21/18	08/21/18	08/20/18
	Time	9:25	11:00	13:20
Site Description	Conveyence Type	Box culvert	Natural channel	Natural channel
	Dimensions	7' x 16'	N/A	7.5' x 20'(toe) x 35'(top)
	Dominant Land Use	Commercial & residential	Commercial, residential & rural	Residential & rural
	Site Elevation	760	280	77
Weather	Weather	Overcast	Clear	Partly cloudy
	Wind Condtion	Calm	Calm	Slight breeze
	Air Temp. (^{0}C)	23	28	34
Trash	Trash (general area)	Light	None	Light
	Trash (stream banks)	Moderate	None	Light
Observations	Water Clarity	Clear	Clear	Clear
	Water Color	Clear	Clear	Clear
	Odors	Other	None	None
	Floatables	None	Other	None
	Foam	None	None	None
	Stains/ deposits	None	None	None
	Structural condition	Concrete channel	Rip-rap with natural bottom	Flap gate RCP to natural channel
	Vegetation Condition	None	Reeds, grasses, trees on banks	Abundant river primrose
	Biology	None	1 carp ~1.5'	None
	Algae (suspended)	Green 5%	Yellow-green 5%	None
	Algae (substrate)	Green 60% Brown 20%	Yellow-green 90%	None
Water Chemistry (Field)	Dissolved Oxygen (%)	138.5	68.3	83.3
	Dissolved Oxygen (mg/L)	11.97	6.57	6.76
	Conductivity (µS)	2641	1381	1642
	Specific Conductance (µS)	2783	1372	1614
	Salinity (ppt)	1.4	0.6	0.8
	Water Temp. (^{0}C)	22.2	25.2	26.0
	Water Temp. (^{0}F)	72.0	77.4	78.8
	pH	8.26	7.69	7.28
	Turbidity (NTU)	1.93	0.86	8.75
Water Chemistry (Lab)	Total Organic Carbon (mg/L)	2.7	6.7	11
	Total Hardness as $CaCO_3$ (mg/L)	1,210	173	577
	Total Calcium (mg/L)	314	35.7	158
	Total Magnesium (mg/L)	103	20.5	44.4
	Dissolved Copper (µg/L)	0.51	2.2	0.46 (DNQ)
	Dissolved Lead (µg/L)	0.055 (DNQ)	0.047 (DNQ)	0.032(DNQ)
	Dissolved Zinc (µg/L)	<0.94	34	4.3 (DNQ)
	Total Coliform (MPN/100 mL)	24,196	8,664	72,700
	E. coli (MPN/100 mL)	228	20	1,012
Estimated Flow	Flow Status	Flowing	Flowing	Flowing
	Water Width (ft.)	4.0	12.0	12.0
	Water Depth (ft.)	0.10	1.20	~2
	Flow Velocity (ft/s)	~1.5	<0.01	<0.1
	Flow Rate (ft^3/s)	~0.75	~0.1	~0.1
	Comments	Urine odor.	Floatables leaves.	

Appendix K. Formulas for WQO determination

BASIN PLAN and CALIFORNIA TOXICS RULE OBJECTIVES: FORMULAS

AMMONIA (BASIN PLAN)

Basin Plan Ammonia Objective formula selection is based on wet or dry event, COLD/MIGR designation status, early life stages (ELS) status, and salinity.
See the flow charts below to determine which formula to use:

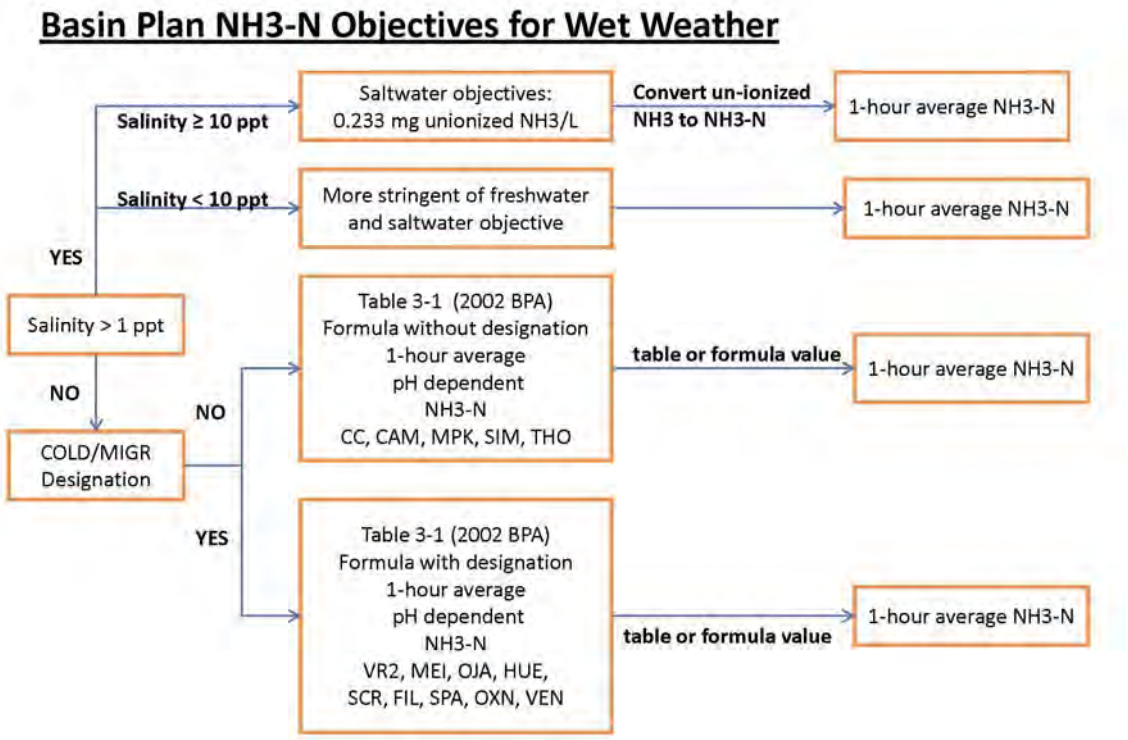


Table 3-1: One hour Average Objective for Ammonia-N for Freshwaters (mg N/L)

COLD and/or MIGR:

$$= \frac{0.275}{1 + 10^{7.204-pH}} + \frac{39.0}{1 + 10^{pH-7.204}}$$

NOT COLD and/or MIGR:

$$= \frac{0.411}{1 + 10^{7.204-pH}} + \frac{58.4}{1 + 10^{pH-7.204}}$$

Saltwater 1-hour objective for Ammonia-N

$$= 0.233 * (1 + 10^{\left[\left(9.245+0.116*\frac{19.9273*S}{1000-1.005109*S}\right)+0.0324(298-T)+\frac{(0.0415)P}{T}-pH\right]})$$

Where T= temperature expressed in °K (Note: Kelvin = Celsius + 273)
S = salinity (ppt)
P = pressure (assumed to be 1 atm)

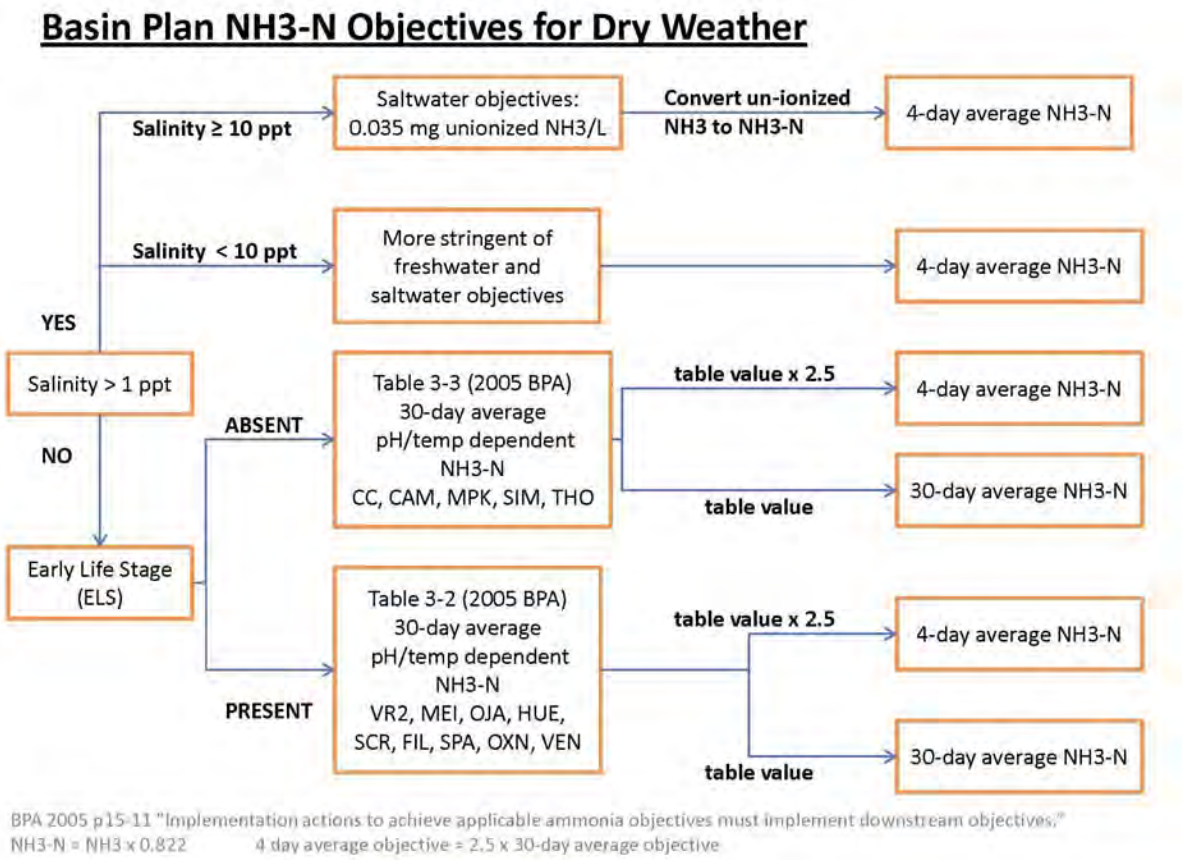


Table 3-2: 30-Day Average Objective for Ammonia-N for Freshwaters Applicable to Waters Subject to the "Early Life Stage Present" Condition (mg N/L)

$$= \left(\frac{0.0577}{1+10^{7.688-pH}} + \frac{2.487}{1+10^{pH-7.688}}\right) * MIN\left(2.85, 1.45 * 10^{0.028*(25-T)}\right)$$

Where T= temperature expressed in °C.
Highest four-day average within the 30-day period shall not exceed 2.5 times the 30-day average objective as calculated above.

Table 3-3: 30-Day Average Objective for Ammonia-N for Freshwaters Applicable to Waters Subject to the "Early Life Stage Absent" Condition (mg N/L)

$$= \left(\frac{0.0577}{1+10^{7.688-pH}} + \frac{2.487}{1+10^{pH-7.688}}\right) * 1.45 * 10^{0.028*(25-MAX(T,7))}$$

Where T= temperature expressed in °C.
Highest four-day average within the 30-day period shall not exceed 2.5 times the 30-day average objective as calculated above.

Saltwater 4-day objective for Ammonia-N

$$= 0.035 * (1 + 10^{\left[\left(9.245+0.116*\frac{19.9273*S}{1000-1.005109*S}\right)+0.0324(298-T)+\frac{(0.0415)P}{T}-pH\right]})$$

Where T= temperature expressed in °K (Note: Kelvin = Celsius + 273)
S = salinity (ppt)
P = pressure (assumed to be 1 atm)

PENTACHLOROPHENOL (CTR)

$$CMC = \exp(1.005(pH) - 4.869)$$
$$CCC = \exp(1.005(pH) - 5.134)$$

METALS (CTR)

[cadmium, chromium, copper, lead, nickel, silver, zinc]

$$CMC = WER * (Acute\ Conversion\ Factor) * (\exp\{m_A[1n(hardness)] + b_A\})$$
$$CCC = WER * (Chronic\ Conversion\ Factor) * (\exp\{m_C[1n(hardness)] + b_C\})$$

Note1: CCC formula contains error in CTR (says “Acute” not “Chronic” for Conversion Factor).
Note2: see note to Table 2 of Paragraph (b)(2) in the CTR, “The term conversion factor represents the recommended conversion factor for converting a metal criterion expressed as the total recoverable fraction in the water column to a criterion expressed as the dissolved fraction in the water column.”
Note3: Conversion factors (CF) are provided as values in a table for chromium, copper, nickel, silver, and zinc. CF for cadmium and lead are calculated based on hardness, i.e.

$$Cadmium\ Acute\ CF = 1.136672 - [(\ln\{hardness\})\ (0.041838)]$$
$$Cadmium\ Chronic\ CF = 1.101672 - [(\ln\{hardness\})\ (0.041838)]$$
$$Lead\ Acute\ and\ Chronic\ CF = 1.46203 - [(\ln\{hardness\})\ (0.145712)]$$

Note4: Only two WER in Ventura County and no stations discharge within the applicable reaches - Lower Calleguas Creek (Reach 2 which is Portrero Rd south to Mugu Lagoon) has a WER for copper of 3.69 and Mugu Lagoon copper WER is 1.51.

Appendix L. Pyrethroid Insecticides Study 2012-2018 Final Report

Ventura Countywide Stormwater Quality Management Program

PYRETHROID INSECTICIDES STUDY

2012 - 2018 FINAL REPORT

PREPARED BY THE:

VENTURA COUNTY WATERSHED PROTECTION DISTRICT

SUBMITTED ON BEHALF OF:

VENTURA COUNTY WATERSHED PROTECTION DISTRICT
COUNTY OF VENTURA
CITY OF CAMARILLO
CITY OF FILLMORE
CITY OF MOORPARK
CITY OF OJAI
CITY OF OXNARD
CITY OF PORT HUENEME
CITY OF SANTA PAULA
CITY OF SIMI VALLEY
CITY OF THOUSAND OAKS
CITY OF VENTURA

December 15, 2018

EXECUTIVE SUMMARY

Monitoring of sediment for pyrethroids, total organic carbon, and toxicity to *Hyalella azteca* was conducted at two sites in the Calleguas Creek, Ventura River, and Santa Clara River watersheds in 2012, 2015, and 2018, as required by Monitoring Program No. CI 7388, as part of the Ventura County Municipal Separate Storm Sewer System National Pollutant Discharge Elimination System Permit, Order No. R4-2010-0108 (Permit).

The most commonly detected pyrethroids were bifenthrin and permethrin. The hypothetical contribution to toxicity was calculated for these pyrethroids based on their concentration, the amount of total organic carbon present in the sample, and a reference concentration known to cause significant toxicity to *Hyalella azteca* in sediment samples. For most samples, the hypothetical and observed toxicity agreed that the concentrations should not result in significant toxicity. However, in one sample, WOOD 2012, there was significant hypothetical and observed toxicity, indicating that bifenthrin was the likely cause of the observed toxicity. This site is in a predominantly agricultural area. In two samples, SCR Up 2015 and VR Down 2015, significant toxicity was observed but hypothetical toxicity was low, indicating that the cause of the toxicity was a pollutant that was not part of this study. Both of these sites are associated with multiple land uses, including urban and agriculture. A field duplicate was collected at CC Down in 2015, and while the sample and its duplicate did not show significant observed toxicity, the duplicate had high hypothetical toxicity, while the original sample did not. The lack of observed toxicity suggests that the high concentration in the duplicate may have been the result of an error or subsampling difference at the chemistry laboratory. This site is located in an agricultural area with upstream urban influences.

Two non-pyrethroid pesticides (pendimethalin and dichloran) were also frequently detected. The reference documents do not include reference concentrations for calculating hypothetical toxicity, but the lack of observed toxicity at sites with higher concentrations of these pesticides indicate that these are not likely a cause for toxicity.

Bifenthrin and permethrin are both used in significant quantities for regulated applications for structural and agricultural pest control in Ventura County but are also known to have unregulated applications for residential and industrial uses, which are not tracked. Due to the presence of significant toxicity in some of the samples that may or may not be attributable to urban contributions of pyrethroids, the recommendation to mitigate urban contributions of pyrethroids in the three sampled watersheds is to continue to target pesticide use in the Ventura Countywide Stormwater Management Program's (Program) education and outreach campaigns. The agricultural contributions are not under the jurisdiction of the Program and would need to be addressed through other avenues.

No trends are apparent over the Permit term, however the impact of the Thomas Fire (over 281,000 acres burnt in December 2017 and January 2018, including much of the Ventura and Santa Clara River watersheds) and the heavy rains and sediment loads following the fire may have affected the composition of the samples in 2018.

INTRODUCTION

Pyrethroid insecticide monitoring of sediments is required by Monitoring Program No. CI 7388, as part of the Ventura County Municipal Separate Storm Sewer System National Pollutant Discharge Elimination System Permit, Order No. R4-2010-0108 (Permit). The Permit specifies that the Principal Permittee (Ventura County Watershed Protection District (District)) shall perform a Pyrethroid Insecticides Study (Study) to accomplish the following objectives:

i. Establish baseline data for major watersheds;
ii. Evaluate whether pyrethroid insecticide concentrations are at or approaching levels known to be toxic to sediment-dwelling aquatic organisms;
iii. Determine if pyrethroids discovered are from urban sources; and
iv. Assess any trends over the permit term.

The first round of sediment monitoring for the Study was conducted in April 2012 by the District at two locations in both the Ventura River and Santa Clara River watersheds. Data from the Calleguas Creek Watershed (CCW) Toxicity Total Maximum Daily Load (TMDL) monitoring program was used to meet the requirements for that watershed, as allowed by the Permit. However, the 2012 TMDL data were unavailable in time for the 2012 report, so 2008-2010 data were included in that report and the 2011 and 2012 data were included in the 2015 report. Two sites in the Calleguas Creek Watershed were added to the District monitoring in 2015 to increase comparability and avoid issues with different detection levels, sampling strategies, and reporting cycles between the TMDL and this Study. Therefore, only TMDL data from 2012 is included in these reports. The second and third rounds of the Study were conducted in April 2015 and May 2018, respectively, by the District at two sites each in the Ventura River, Santa Clara River, and Calleguas Creek watersheds.

The samples were analyzed for total organic carbon (TOC) and eight specific pyrethroid pesticides required by the Permit (bifenthrin, cyfluthrin, cypermethrin, deltamethrin (co-elutes with tralomethrin, which is listed in the Permit if the laboratory is capable of analyzing for it), esfenvalerate (co-elutes with the non-required fenvalerate), lambda-cyhalothrin, and permethrin, as well as several pyrethroid and non-pyrethroid pesticides that are not required by the permit but are standard outputs of the analytical method. All sediment samples were tested for toxicity through a 10-day survival bioassay using 7–10-day old *Hyalella azteca*.

Hypothetical toxicity units (TU_H) were calculated to compare the expected relative toxicity of different samples and pyrethroids. TU_H are calculated by normalizing the sediment pyrethroid concentrations to TOC concentration (to account for hydrophobicity) and then dividing by the *Hyalella azteca* 10-day median lethal concentration (LC50[1]) for each detected pyrethroid, if available. TU_H cannot be calculated for detected analytes without LC50s in the reference documents (e.g. non-pyrethroids such as pendimethalin and dichloran) or for analytes that may be present at levels below the method detection limit (i.e. non-

[1] LC50 is the lethal concentration required to kill 50% of the population.

detects), so their hypothetical contributions to toxicity are unknown. Pollutants other than those analyzed may also be contributing to toxicity, however this study was focused on pyrethroid pollutants.

In 2012, two pyrethroids were detected in the Study samples: bifenthrin (three sites) and permethrin (one site); and one pyrethroid (bifenthrin) was detected in the TMDL samples (two sites). All TU_H were less than one indicating the samples were non-toxic. This was supported by the lack of toxicity seen in the analysis of the sediment samples, except for the two TMDL sites, which had significant toxicity. Two non-pyrethroid pesticides were also detected in the Study samples: pendimethalin (two sites) and dichloran (one site) but were not tested in the TMDL.

In 2015, two of the eight Permit-required pyrethroid pesticides were detected: bifenthrin (three sites) and permethrin (one site). One non-required pyrethroid (fenpropathrin at one site) and two non-pyrethroid pesticides (dichloran at one site and pendimethalin at three sites) were also detected. All TU_H were less than one except for bifenthrin in the CC Down duplicate, however there was not significant toxicity in the measured sample. Some toxicity was observed in 2015 at SCR Up and VR Down. None of the Permit required pyrethroids were detected at SCR up. Bifenthrin was detected in VR Down, however other sites with higher concentrations exhibited no toxicity, and the calculated hypothetical toxicity for VR Down based on the bifenthrin concentration was not toxic.

In 2018, the third round of the study was conducted and pyrethroids were not detected in any of the Study samples. One non-pyrethroid pesticide (Dichloran) was detected at one site. Significant toxicity was not observed in any of the 2018 samples.

Ventura County has been subjected to increased environmental stresses in recent years. In addition to the ongoing severe drought, the Ventura River and Santa Clara River watersheds were heavily impacted by the Thomas Fire, which started on December 4, 2017 and continued through January 9, 2018, burning over 281,000 acres to become the largest fire recorded in California history at that time. The fire burned most of the open space and forest lands in the Ventura River Watershed and a significant amount of open space in the Santa Clara River Watershed, as well as orchards, homes, and other structures from Fillmore to Santa Barbara. Areas that did not burn (especially within the Ojai Valley) were still subject to heavy ash deposition.

The first storm of the 2017/18 wet season occurred in January 2018 and the heavy rain on the burned area resulted in higher than typical runoff and sediment loads, which took many weeks to settle out. Most of the rain for the 2017/18 wet season fell during March, when a series of large storms moved through the area, again increasing runoff and sediment loads. Samples for the 2018 Study were collected in May.

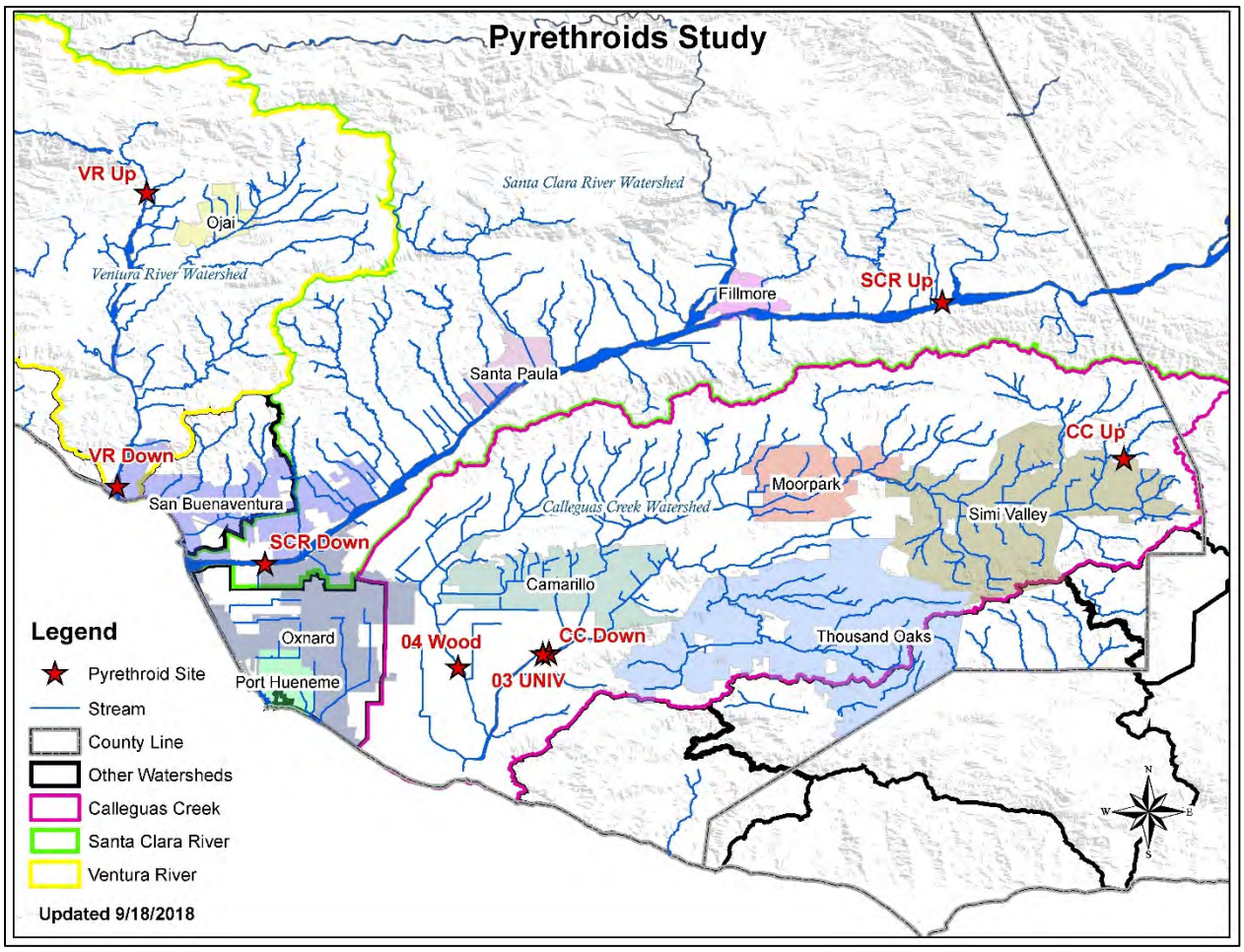
METHOD

The Permit specifies that monitoring is to be conducted every three years for the duration of the Permit (i.e. 2012, 2015, 2018, etc.), after sediment has settled within the water body and safe access can be assured. In-stream sediment samples for chemical analysis and toxicity testing were collected using stainless steel scoops according to methods developed by the USGS and outlined in *Guidelines for Collecting and Processing Samples of Stream Bed Sediment for Analysis of Trace Elements and Organic Contaminants for the National Water Quality Assessment Program (1994)*. When possible, sediment sampling stations encompassed a section of the reach approximately 100 meters in length upstream from water-column sampling stations, but this varied depending on site conditions. Five to ten wadeable depositional zones (low energy areas where fine-grained particles can accumulate) within the reach were targeted (when possible) to obtain a sample representative of the site.

Two sites, an upstream site and a downstream site, were selected on the main stem in the Ventura River, Santa Clara River, and Calleguas Creek watersheds (Figure 1). The upstream site was located higher in the watershed to reduce the influence of urban sources and the downstream site was located low in the watershed to include urban contributions. It was not possible in all cases to exclude upstream sources of agriculture and/or urban runoff, including some sources outside of Ventura County. For the Ventura River watershed, the upstream site (VR Up) is on the Ventura River above the Casitas Municipal Water District's diversion structure near the north end of Rice Road in Meiners Oaks. The downstream site (VR Down) is on the Ventura River near the Main Street Bridge in Ventura. For the Santa Clara River watershed, the upstream site (SCR Up) is on the Santa Clara River east of Torrey Road near the Los Angeles/Ventura County Line and the downstream site (SCR Down) is on the Santa Clara River near the Victoria Avenue Bridge in Ventura. For the Calleguas Creek watershed, the upstream site (CC Up) is in Las Llajas Canyon above Las Llajas Dam, north of Simi Valley, and the downstream site (CC Down) is on Calleguas Creek at the Camarillo Street (formerly University Drive) Bridge. Factors such as safety, ease of entry, upstream land use, hydrology, and long-term accessibility (including landowner permission) were considered in site selection.

For the first round of the Study (2012), two sites from the Calleguas Creek Watershed (CCW) Toxicity Total Maximum Daily Load (TMDL) monitoring program were used to meet the requirements for that watershed, as allowed by the Permit. The TMDL sites were 03_UNIV (UNIV) – co-located with CC Down, and 04_WOOD (WOOD) – Revolon Slough at Wood Road. To increase comparability between samples, watersheds, and years, and eliminate differences between the Study and the TMDL (e.g. detection levels, sampling strategies, collection methods, reporting cycles, etc.), the TMDL sites were replaced with CC Up and CC Down beginning in 2015.

Figure 1. Pyrethroid Sampling Locations



As described in the Ventura County MS4 Pyrethroid Insecticides Monitoring Quality Assurance Project Plan (QAPP), the top layer (~1 cm) of the most recently deposited sediment was collected with a pre-cleaned stainless-steel scoop as specified in the Permit. The quantity of sediment required for the tests precluded sampling directly into glass jars, so the sediment was deposited in a 24" by 36" 2mm polyethylene bag per site. The bag was closed and the sediment was manually homogenized onsite by squeezing and rotating the bag. Homogenized sediment was placed in two 8 oz wide-mouth glass jars and placed on ice for TOC and pyrethroid analysis. The jars were placed in the freezer at the end of the sampling day for pickup by the chemistry lab courier the following day. The remaining sediment (~ 3 liters) was double- bagged and kept on ice until delivered to the toxicity laboratory.

All sediment samples were analyzed for total organic carbon (TOC) by EPA 9060, pyrethroids by GC/MS NCI-SIM, and toxicity to 7—10-day old *Hyalella azteca*, as described in *Aquatic Toxicity Due to Residential use of Pyrethroid Insecticides*[2]. Water quality field measurements were taken with hand-held probes.

[2] *Aquatic Toxicity Due to Residential Use of Pyrethroid Insecticides*; Weston, D., Holmes, R., You, J., Lydy, M.J (2005). Environ. Sci. Technol.; (Article); 2005; 39(24); 9780 pp.

The stainless-steel trowels used for the Study were cleaned prior to sample collection with Alconox laboratory detergent and tap water, rinsed with distilled water, and air dried. They were then sealed in Ziploc bags until arrival at the site. An equipment blank was collected by the laboratory from one clean, unused stainless-steel trowel by rinsing it with one liter of laboratory grade de-ionized water and analyzing the rinsate for TOC by SM 5310C and pyrethroids by GC/MS NCI-SIM.

RESULTS

Study Equipment Blanks

The 2018 equipment blank analysis detected a small amount of TOC and a detected not quantifiable (DNQ) amount of the pyrethroids bifenthrin and cypermethrin (Table 1). These amounts are similar to those seen in equipment blank samples in previous years of the Study (Table 2) and are insignificant in relation to expected environmental concentrations so a second equipment blank was not submitted for 2018. Several non-pyrethroid constituents were also analyzed by this method but were not detected.

Table 1. Equipment Blank Results 2018

Analyte	2018 Trowel Blank (µg/L, MDL varies)
Allethrin	ND (<0.00085)
Bifenthrin	**0.00085 (DNQ)**
Cyfluthrin	ND (<0.00083)
Cypermethrin	**0.00087 (DNQ)**
Deltamethrin/Tralomethrin	ND (<0.0019)
Dichloran	ND (<0.00080)
Esfenvalerate	ND (<0.00098)
Fenpropathrin (Danitol)	ND (<0.0020)
Fenvalerate	ND (<0.00098)
L-Cyhalothrin	ND (<0.0012)
Pendimethalin	ND (<0.00050)
Permethrin	ND (<0.0050)
Prallethrin	ND (<0.00092)
Sumithrin	ND (<0.0024)
Tefluthrin	ND (<0.00093)
TOC	**0.23 mg/L**

Analyte listed in Permit
Detections
ND = Not Detected
DNQ = Detected Not Quantified

Table 2. Equipment Blank Results 2012 - 2015

Analyte	2015 Initial Trowel Blank (µg/L, MDL varies)	2015 2nd Trowel Blank (µg/L, MDL varies)	2012 Initial Trowel Blank (µg/L, MDL varies)	2012 2nd Trowel Blank (µg/L, MDL varies)
Allethrin	ND (<0.00085)	ND (<0.00085)	ND (<0.00085)	ND (<0.00085)
Bifenthrin	**0.0026**	**0.00091 (DNQ)**	**0.0041**	ND (<0.00079)
Cyfluthrin	ND (<0.00083)	ND (<0.00083)	ND (<0.00083)	ND (<0.00083)
Cypermethrin	ND (<0.00066)	ND (<0.00066)	**0.0026**	ND (<0.00066)
Deltamethrin/Tralomethrin	ND (<0.0019)	ND (<0.0019)	ND (<0.0019)	ND (<0.0019)
Dichloran	ND (<0.00080)	ND (<0.00080)	ND (<0.00080)	ND (<0.00080)
Esfenvalerate	ND (<0.00098)	ND (<0.00098)	ND (<0.00098)	ND (<0.00098)
Fenpropathrin (Danitol)	ND (<0.0020)	ND (<0.0020)		
Fenvalerate	ND (<0.00098)	ND (<0.00098)	ND (<0.00098)	ND (<0.00098)
L-Cyhalothrin	ND (<0.0012)	ND (<0.0012)	ND (<0.0012)	ND (<0.0012)
Pendimethalin	ND (<0.00050)	ND (<0.00050)	**0.0025**	ND (<0.00050)
Permethrin	ND (<0.0050)	ND (<0.0050)	ND (<0.0050)	ND (<0.0050)
Prallethrin	ND (<0.00092)	ND (<0.00092)	ND (<0.00092)	ND (<0.00092)
Sumithrin	ND (<0.0024)	ND (<0.0024)	ND (<0.0024)	ND (<0.0024)
Tefluthrin	ND (<0.00093)	ND (<0.00093)	ND (<0.00093)	ND (<0.00093)
TOC	**0.18 mg/L (DNQ)**	**0.23 mg (DNQ)**	**0.17 mg/L (DNQ)**	N/A

Analyte listed in Permit
Detections
ND = Not Detected
DNQ = Detected Not Quantified

2018 Study

The 2017/18 water year started out very dry, with the first storm of the season occurring in January 2018, followed by a series of storms in March 2018 that dropped 4 – 8 inches of rain across the county. Sampling was conducted on May 8 and 9, 2018, approximately 6 weeks after the March storms. VR Up (Figure 2), VR Down (Figure 3), SCR Up (Figure 4), and CC Down (Figure 7) were flowing, however SCR Down (Figure 5) was damp with small remnant ponds and CC Up (Figure 6) was dry (although there were some sediment deposits from earlier flows).

Figure 2. VR Up

Figure 3. VR Down

Figure 4. SCR Up

Figure 5. SCR Down

Figure 6. CC Up

Figure 7. CC Down

No pyrethroids were detected in the 2018 sediment samples, including the eight pyrethroids specified by the Permit for analysis (bifenthrin, cyfluthrin, cypermethrin, deltamethrin, esfenvalerate, l-cyhalothrin,

permethrin, and tralomethrin). Dichloran, a non-pyrethroid pesticide, was detected at one site (SCR Down). A field duplicate sample was collected at VR Down and the results agreed with the original sample, with no pyrethroid detections and TOC within allowed limits for relative percent difference.

All samples were subjected to a 10-day survival and growth sediment bioassay using *Hyalella azteca*. The laboratory inadvertently discarded the organisms before collecting the growth data at the end of the initial test period, so the samples were set up and run a second time within hold time for both growth and survival. All samples were non-toxic for both tests, and all samples outperformed the control in measurements of growth.

TOC amounts ranged from 1.43 g/kg in the upstream Calleguas Creek sample (CC Up 2018) to 31.4 g/kg in the downstream Ventura River field duplicate (VR Down 2018 Dup) and this range is similar to previous years, although it varies between sites.

2012-2018 Combined Results

Data from the Calleguas Creek Watershed (CCW) Toxicity Total Maximum Daily Load (TMDL) monitoring program was used to meet the requirements for that watershed in 2012, as allowed by the Permit. However, TMDL site 04_WOOD (WOOD) is not co-located with CC Up, and although TMDL site 03_UNIV (UNIV) is co-located with CC Down, the sample collection methods and protocols for the TMDL are different to this Study. To increase comparability between samples and watersheds, two sites in the Calleguas Creek Watershed were added in 2015 to avoid issues with different detection levels, sampling strategies, and reporting cycles. TMDL data (except for 2012) is not included in this report.

The 2012-2018 laboratory results are grouped by watershed in Table 3, Table 4, and Table 5. Pyrethroids that were detected during the three Study periods (2012, 2015, and 2018) are also grouped by watershed and shown in Figure 8, Figure 9, and Figure 10. Similarly, detected non-pyrethroids for the same period are shown in Figure 11 and Figure 12 (non-pyrethroid pesticides were not detected in any of the Study samples from the Ventura River Watershed, therefore a chart for this data is not included in this report.)

Three pyrethroids were detected during the Study, bifenthrin and permethrin, which were required analytes in the Permit, and fenpropathrin (danitol) which was not required by the Permit but was included in the analytical method. Two non-pyrethroid pesticides, dichloran and pendimethalin, were also detected but were not required by the Permit. These non-pyrethroid analytes were not part of the TMDL analytical method so data is not available for the 2012 TMDL sites.

Table 3. Laboratory Results 2012-2018 – Calleguas Creek Watershed

Analyte	WOOD	CC Up		UNIV (co-located with CC Down)		CC Down			Units
	2012	2015	2018	2012	2012 Dup	2015	2015 Dup	2018	
Allethrin	<0.5	<0.93	<0.85	<0.5	<0.5	<0.93	<0.92	<0.93	ng/g
Bifenthrin	2.7	<0.93	<0.85	1^	0.9^	3.3	5.9	<0.93	ng/g
Cyfluthrin	<0.5	<0.93	<0.85	<0.5	<0.5	<0.93	<0.92	<0.93	ng/g
Cypermethrin	<0.5	<0.93	<0.85	<0.5	<0.5	<0.93	<0.92	<0.93	ng/g
Deltamethrin	<0.5	<0.93	<0.85	<0.5	<0.5	<0.93	<0.92	<0.93	ng/g
Dichloran	NS	<0.93	<0.85	NS	NS	<0.93	<0.92	<0.93	ng/g
Esfenvalerate	<0.5	<0.93	<0.85	<0.5	<0.5	<0.93	<0.92	<0.93	ng/g
Fenpropathrin (Danitol)	<0.5	<0.93	<0.85	<0.5	<0.5	<0.93	<0.92	<0.93	ng/g
Fenvalerate	<0.5	<0.93	<0.85	<0.5	<0.5	<0.93	<0.92	<0.93	ng/g
L-Cyhalothrin	<0.5	<0.93	<0.85	<0.5	<0.5	<0.93	<0.92	<0.93	ng/g
Pendimethalin	NS	<0.93	<0.85	NS	NS	3.8	2.5	<0.93	ng/g
Permethrin	<5	<0.93	<0.85	<5	<5	3.3	5.4	<0.93	ng/g
Prallethrin	<0.5	<0.93	<0.85	<0.5	<0.5	<0.93	<0.92	<0.93	ng/g
Sumithrin	NS	<0.93	<0.85	NS	NS	<0.93	<0.92	<0.93	ng/g
Tefluthrin	NS	<0.93	<0.85	NS	NS	<0.93	<0.92	<0.93	ng/g
Tralomethrin	NS	<0.93	<0.85	NS	NS	<0.93	<0.92	<0.93	ng/g
TOC	5.6	12.2	1.43	4.4	3.3	12.3	8.27	7.01	g/kg
Toxicity to *H. azteca*, Survival	66.3 SG	95.0	100 100*	75.0 SG	NS	82.5	87.5	95 100*	% Survival
Toxicity to *H. azteca*, Mortality	33.7 SG	5.0	0 0*	25.0 SG	NS	17.5	12.5	5.0 0*	% Mortality
Toxicity to *H. azteca,* Growth	69.4 SG	-565	-304	-7.71	NS	-216	-161	-189	% Effect

TMDL = Samples collected at TMDL sites using TMDL methods. Only applicable to 2012 results.

Analyte listed in Permit

< Not detected at method detection limit

^ Detected not quantified

* Samples re-run to include growth

- Sample performed better than control

Detected

Dup = Duplicate

NS = Not sampled

SG = Significant effect compared to control

Table 4. Laboratory Results 2012-2018 – Santa Clara River Watershed

Analyte	SCR Up			SCR Down			Units
	2012	2015	2018	2012	2015	2018	
Allethrin	<0.5	<0.92	<0.88	<0.5	<0.94	<0.93	ng/g
Bifenthrin	0.78	<0.92	<0.88	0.74	2.6	<0.93	ng/g
Cyfluthrin	<0.5	<0.92	<0.88	<0.5	<0.94	<0.93	ng/g
Cypermethrin	<0.5	<0.92	<0.88	<0.5	<0.94	<0.93	ng/g
Deltamethrin	<0.5	<0.92	<0.88	<0.5	<0.94	<0.93	ng/g
Dichloran	<0.5	<0.92	<0.88	0.54	1.1	2.1	ng/g
Esfenvalerate	<0.5	<0.92	<0.88	<0.5	<0.94	<0.93	ng/g
Fenpropathrin (Danitol)	<0.5	<0.92	<0.88	<0.5	<0.94	<0.93	ng/g
Fenvalerate	<0.5	<0.92	<0.88	<0.5	<0.94	<0.93	ng/g
L-Cyhalothrin	<0.5	<0.92	<0.88	<0.5	<0.94	<0.93	ng/g
Pendimethalin	0.69	1.4	<0.88	5.4	8.8	<0.93	ng/g
Permethrin	<0.5	<0.92	<0.88	<0.5	<0.94	<0.93	ng/g
Prallethrin	<0.5	<0.92	<0.88	<0.5	<0.94	<0.93	ng/g
Sumithrin	<0.5	<0.92	<0.88	<0.5	<0.94	<0.93	ng/g
Tefluthrin	<0.5	<0.92	<0.88	<0.5	<0.94	<0.93	ng/g
Tralomethrin	<0.5	<0.92	<0.88	<0.5	<0.94	<0.93	ng/g
TOC	5.4	17	13.3	11	11.4	14.6	g/kg
Toxicity to H. azteca, Survival	98.75	55.0 SG	95.0 100*	96.25	90.0	100 97.5*	% Survival
Toxicity to H. azteca, Mortality	1.25	45.0 SG	5.0 0*	3.75	10.0	0 2.50*	% Mortality
Toxicity to *H. azteca,* Growth	NS	58.06	-226.35	NS	-387.10	-292.00	% Effect

Analyte listed in Permit

Detected

< Not detected at method detection limit

NS = Not sampled

* Samples re-run to include growth

SG = Significant effect compared to control

- Sample performed better than control

Table 5. Laboratory Results 2012-2018 – Ventura River Watershed

Analyte	VR Up			VR Down				Units
	2012	2015	2018	2012	2015	2018	2018 Dup	
Allethrin	<0.5	<0.83	<0.90	<0.5	<0.82	<0.99	<0.93	ng/g
Bifenthrin	<0.5	<0.83	<0.90	1.2	2.8	<0.99	<0.93	ng/g
Cyfluthrin	<0.5	<0.83	<0.90	<0.5	<0.82	<0.99	<0.93	ng/g
Cypermethrin	<0.5	<0.83	<0.90	<0.5	<0.82	<0.99	<0.93	ng/g
Deltamethrin	<0.5	<0.83	<0.90	<0.5	<0.82	<0.99	<0.93	ng/g
Dichloran	<0.5	<0.83	<0.90	<0.5	<0.82	<0.99	<0.93	ng/g
Esfenvalerate	<0.5	<0.83	<0.90	<0.5	<0.82	<0.99	<0.93	ng/g
Fenpropathrin (Danitol)	<0.5	<0.83	<0.90	<0.5	1.4	<0.99	<0.93	ng/g
Fenvalerate	<0.5	<0.83	<0.90	<0.5	<0.82	<0.99	<0.93	ng/g
L-Cyhalothrin	<0.5	<0.83	<0.90	<0.5	<0.82	<0.99	<0.93	ng/g
Pendimethalin	<0.5	<0.83	<0.90	<0.5	<0.82	<0.99	<0.93	ng/g
Permethrin	5.3	<0.83	<0.90	<0.5	<0.82	<0.99	<0.93	ng/g
Prallethrin	<0.5	<0.83	<0.90	<0.5	<0.82	<0.99	<0.93	ng/g
Sumithrin	<0.5	<0.83	<0.90	<0.5	<0.82	<0.99	<0.93	ng/g
Tefluthrin	<0.5	<0.83	<0.90	<0.5	<0.82	<0.99	<0.93	ng/g
Tralomethrin	<0.5	<0.83	<0.90	<0.5	<0.82	<0.99	<0.93	ng/g
TOC	22	33.8	13	26	18.8	27.1	31.4	g/kg
Toxicity to H. azteca, Survival	83.75	95.0	100 100*	88.75	20.0 SG	97.5 97.5*	NS	% Survival
Toxicity to H. azteca, Mortality	16.25	5.0	0 0*	11.25	80.0 SG	2.5 2.5*	NS	% Mortality
Toxicity to *H. azteca,* Growth	NS	5.00	-147.58	NS	54.84	-162.08	NS	% Effect

Analyte listed in Permit

Detected

< Not detected at method detection limit

Dup = Duplicate

* Samples re-run to include growth

NS = Not sampled

- Sample performed better than control

SG = Significant effect compared to control

Figure 8. 2012-2018 Detected Pyrethroids - Calleguas Creek Watershed

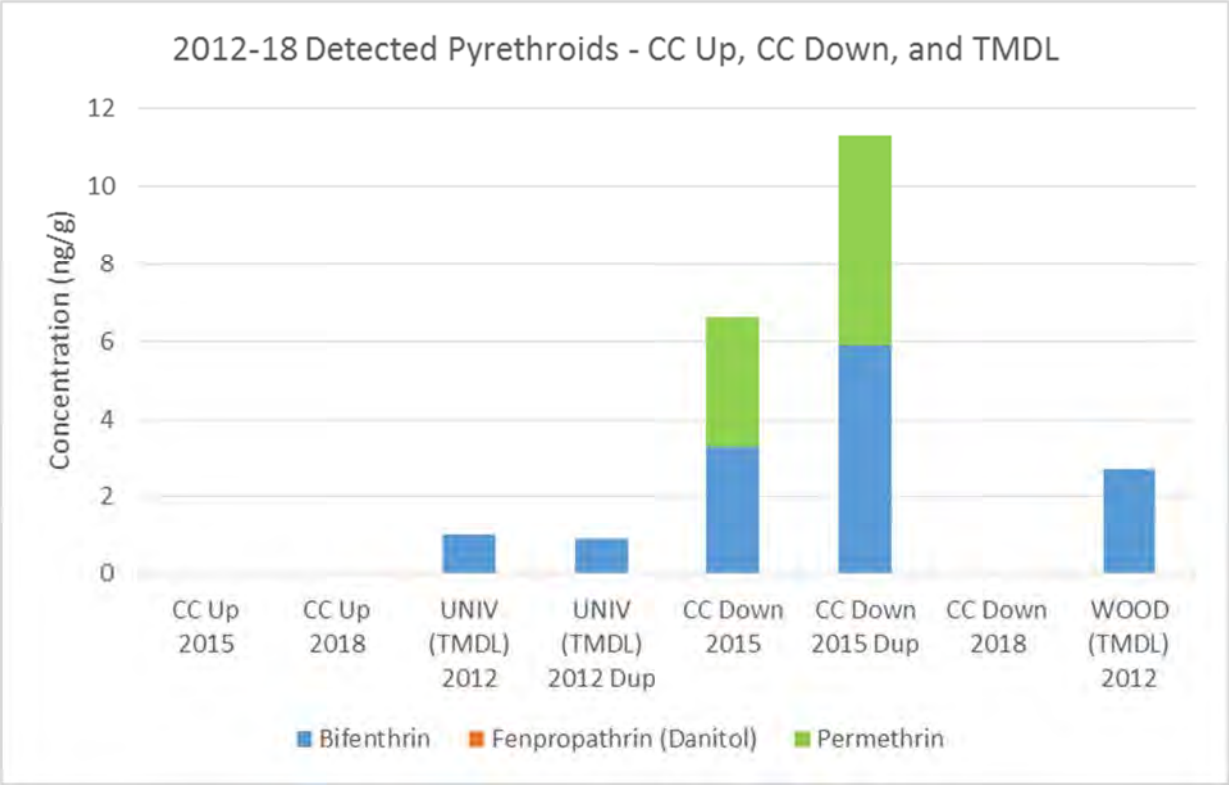


Figure 9. 2012-2018 Detected Pyrethroids - Santa Clara River Watershed

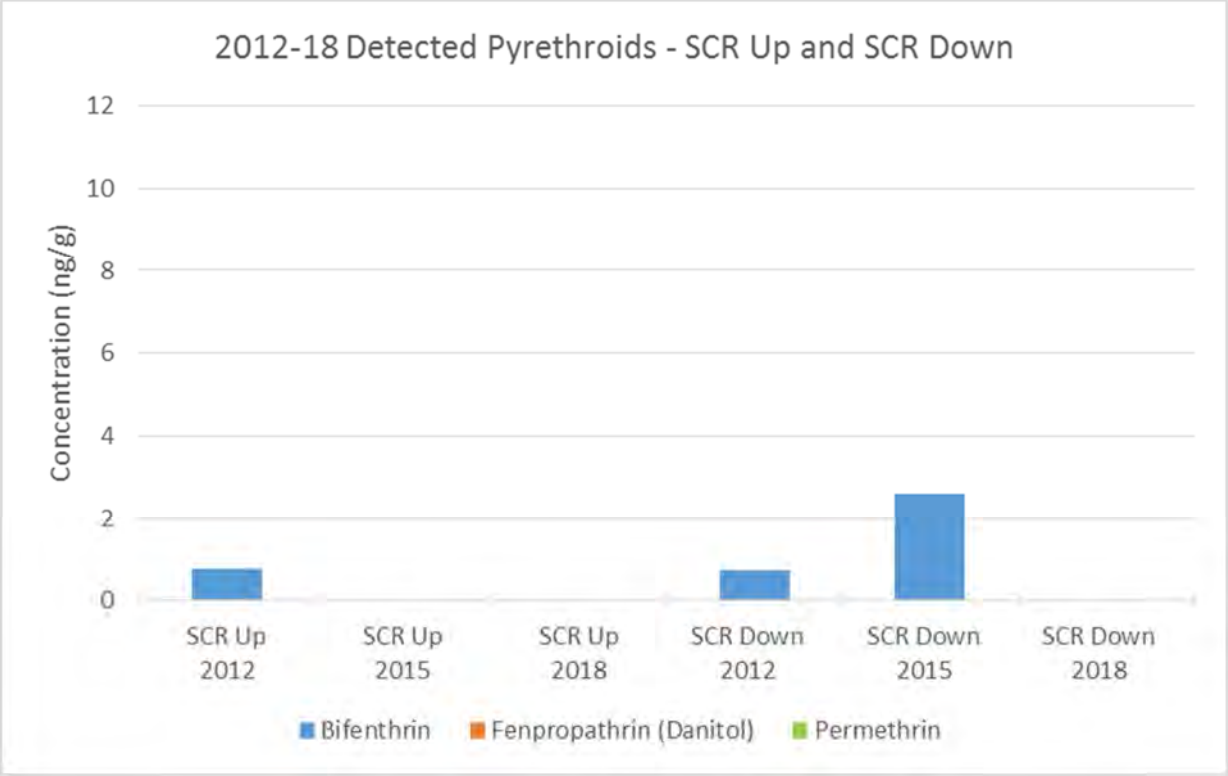


Figure 10. 2012-2018 Detected Pyrethroids - Ventura River Watershed

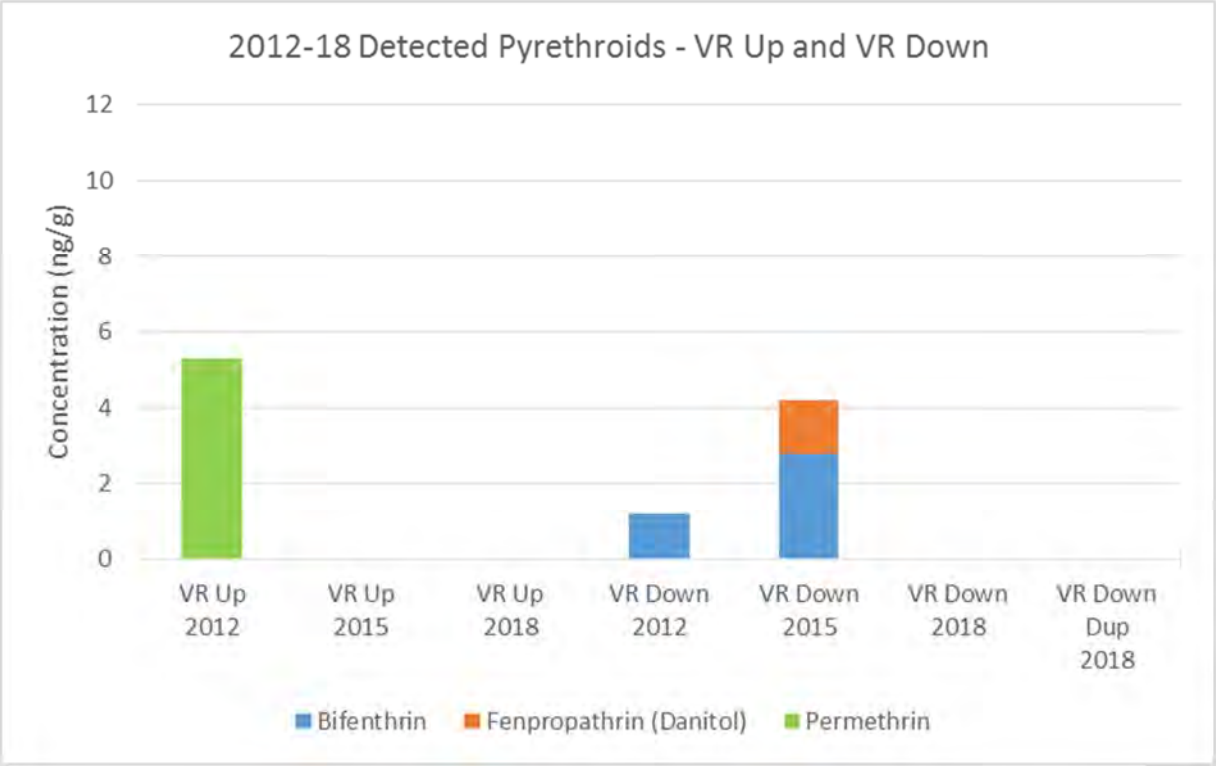


Figure 11. 2012-2018 Detected Non-Pyrethroid Pesticides - Calleguas Creek Watershed

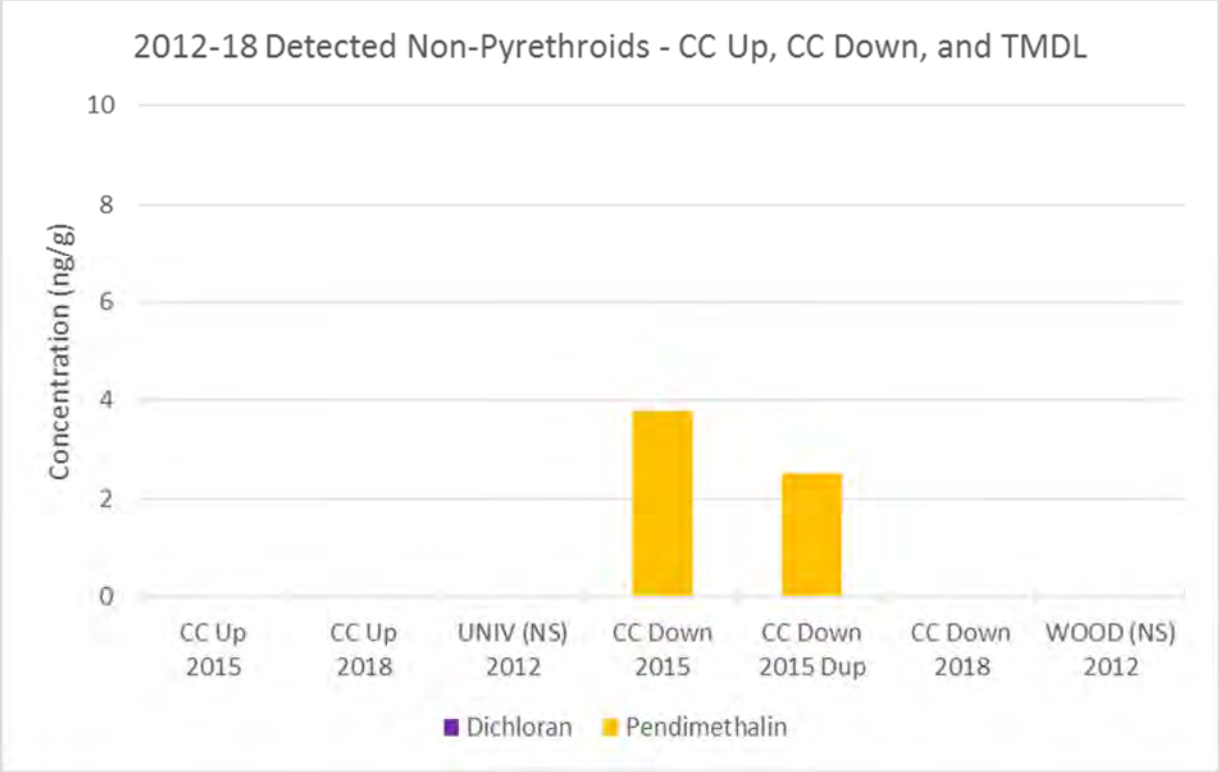
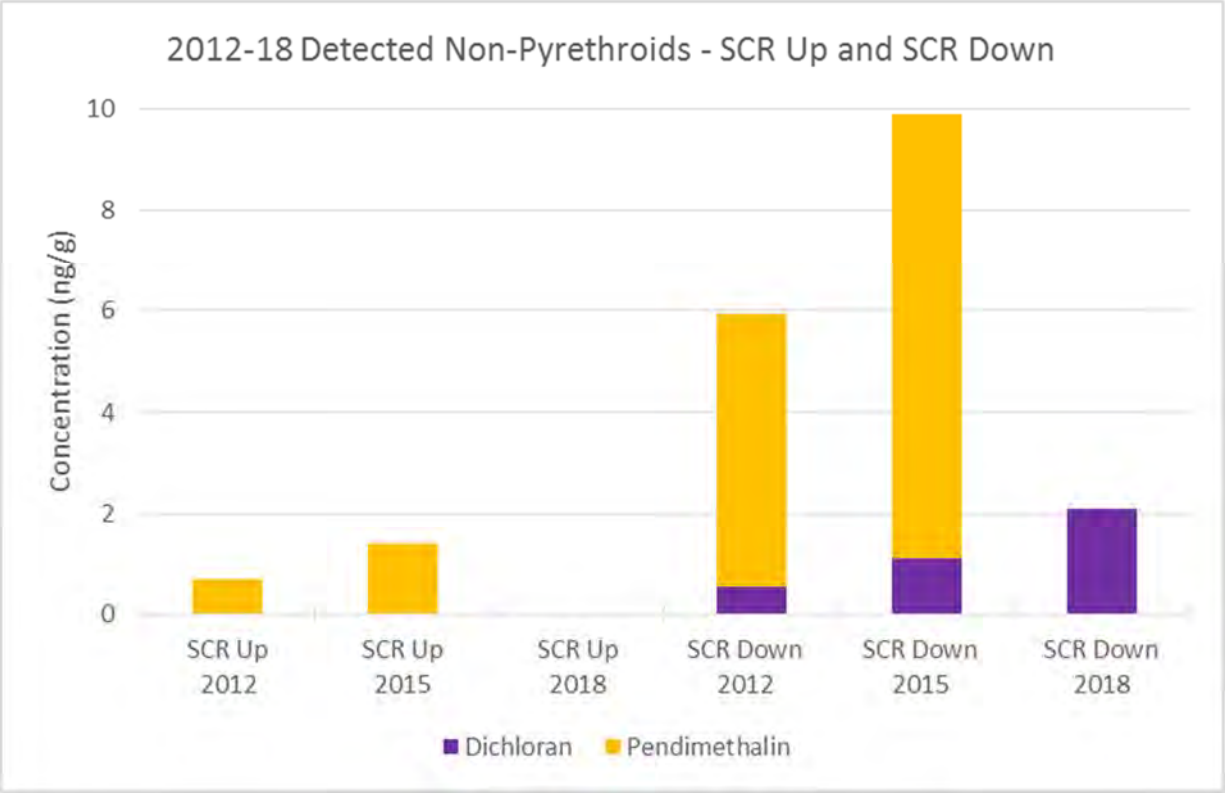


Figure 12. 2012-2018 Detected Non-Pyrethroid Pesticides - Santa Clara River Watershed



Non-pyrethroids were not detected at VR Up or VR Down.

DISCUSSION OF RESULTS

The 2017/18 water year started out very dry, with the first storm of the season occurring in January 2018, followed by a series of storms in March 2018 that dropped 4 – 8 inches of rain across the county. Sampling was conducted on May 8 and 9, 2018, approximately 6 weeks after the March storms. VR Up, VR Down, SCR Up, and CC Down were flowing, however SCR Down was damp with small remnant ponds and CC Up was dry (although there were some sediment deposits from earlier flows)

Equipment Blank

The source of the detected but not quantified (DNQ) amounts of bifenthrin and cypermethrin in the Study's 2018 equipment blank is unknown, but the amounts are similar to those seen in equipment blank samples in previous years of the study, including 2012 when the trowels were new. The laboratory QC was within limits for the equipment blank batches, i.e. bifenthrin and cypermethrin were not detected above the reporting limit of 0.0020 µg/L in the laboratory method blank, and the laboratory control samples and duplicates were all within acceptance limits. The trowels were washed twice since they were last used, once with Citranox after the 2015 sampling, and once with Alconox prior to the 2018 sampling. The source of the contamination is unknown but potential sources could be from air drying, during rinsate collection and/or during analysis at the laboratory. Alconox appears to have worked as well or better than Citranox for bifenthrin removal, and similarly or better than Citranox for cypermethrin removal. The equipment blank is collected by rinsing the trowel with one liter of laboratory grade deionized water and collecting the rinsate for analysis. One liter is used as it is the volume required for the analytical method and collecting extra for a potential re-analysis may dilute the sample, so a replicate is not feasible. The trowels did not contaminate the environmental samples as pyrethroids were not detected at all 2018 sites.

A detectable amount of TOC was measured in the equipment blank at 0.23 mg/L, which is above the reporting limit of 0.10 mg/L. A small DNQ amount of TOC was seen in the method blank (0.0182 mg/L) but these amounts are significantly less than seen in the environmental samples (≥ 1.43 g/kg, equal to 1430 mg/kg) so is not considered to be enough to significantly impact the sediment results (i.e. TOC measured in the equipment blank was at least four orders of magnitude below the environmental samples).

Toxicity

Toxicity levels vary between pyrethroids. Hypothetical toxicity units (TU_H) can be calculated to compare the expected relative toxicity of different samples and pyrethroids. This is done by normalizing the sediment pyrethroid concentrations to TOC concentration to account for hydrophobicity (Table 6 and Figure 13) and then dividing by the *Hyalella azteca* ten day median lethal concentration (LC50[3]) for each detected pyrethroid, if available (Table 7). LC50s for the detected analytes bifenthrin and permethrin were obtained from the study referenced in the Permit, "Aquatic Toxicity Due to Residential Use of Pyrethroid Insecticides (2005) by Weston *et al*. The Study did not include an LC50 for the pyrethroid fenpropathrin

[3] LC50 is the lethal concentration required to kill 50% of the population.

or the non-pyrethroids dichloran and pendimethalin. To complete this Pyrethroid Study, an LC50 for fenpropathrin was obtained from the Los Angeles Regional Water Quality Control Boards study, "Occurrence and Toxicity of Three Classes of Insecticides in Water and Sediment in Two Southern California Coastal Watersheds (2011) by Delgado-Moreno et al. The overall hypothetical pyrethroid toxicity of a sample can be calculated by summing all the pyrethroid TU_H for that sample. TU_H greater than one indicates significant hypothetical toxicity. The non-pyrethroids were also normalized to TOC (Table 6 and Figure 13) but TU_H were not calculated since they are not pyrethroids and do not have LC50s in the Permit-referenced study.

Table 6. Detected Analytes Normalized to TOC – By Watershed

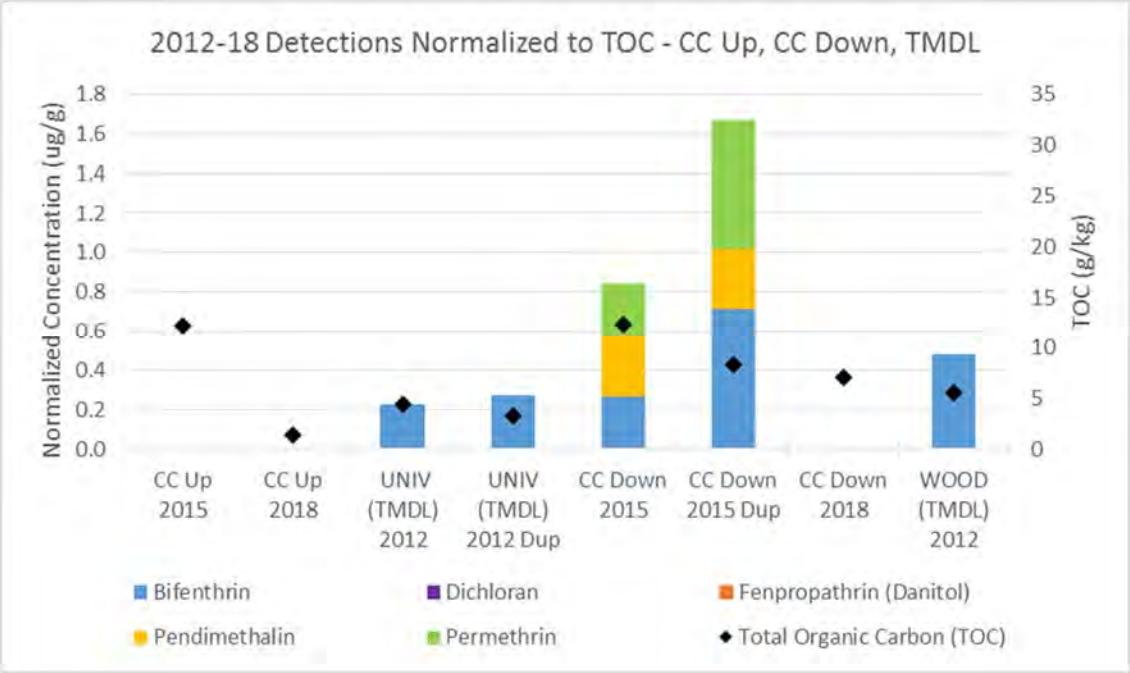
Calleguas Creek Watershed									
Analyte	**WOOD**	**CC Up**		**UNIV (co-located with CC Down)**		**CC Down**			**Units**
	2012	**2015**	**2018**	**2012**	**2012 Dup**	**2015**	**2015 Dup**	**2018**	
Bifenthrin	0.48			0.23^	0.27^	0.27	0.71		ng/g
Pendimethalin	NS			NS	NS	0.31	0.30		ng/g
Permethrin						0.27	0.65		ng/g
TOC	5.6	12.2	1.43	4.4	3.3	12.3	8.27	7.01	g/kg

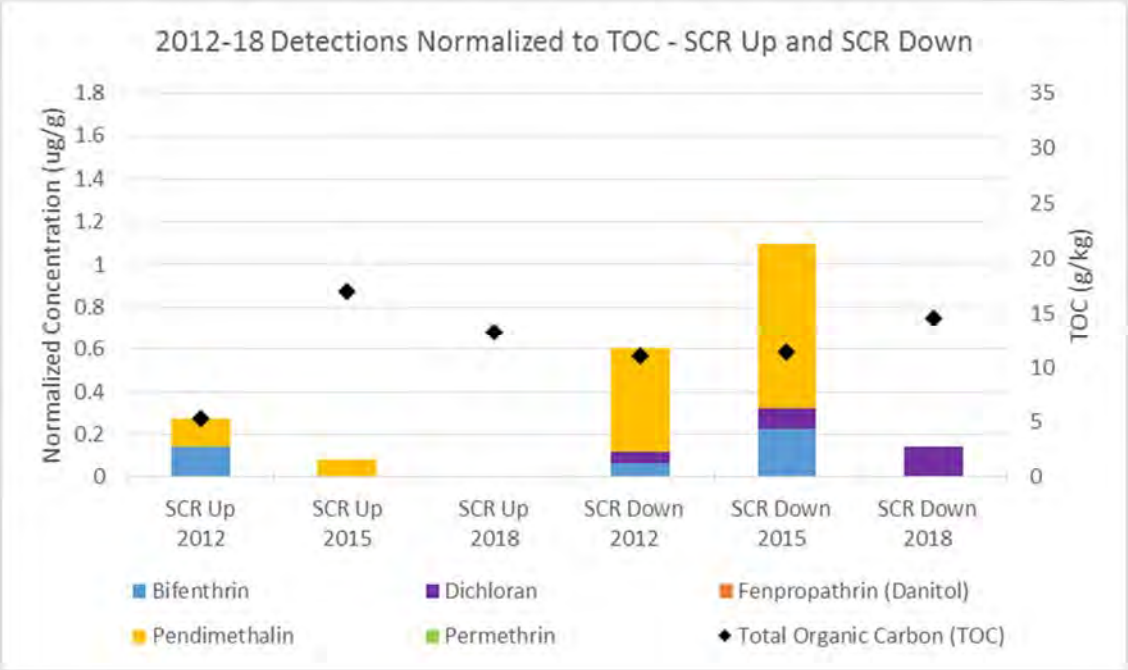
^ DNQ

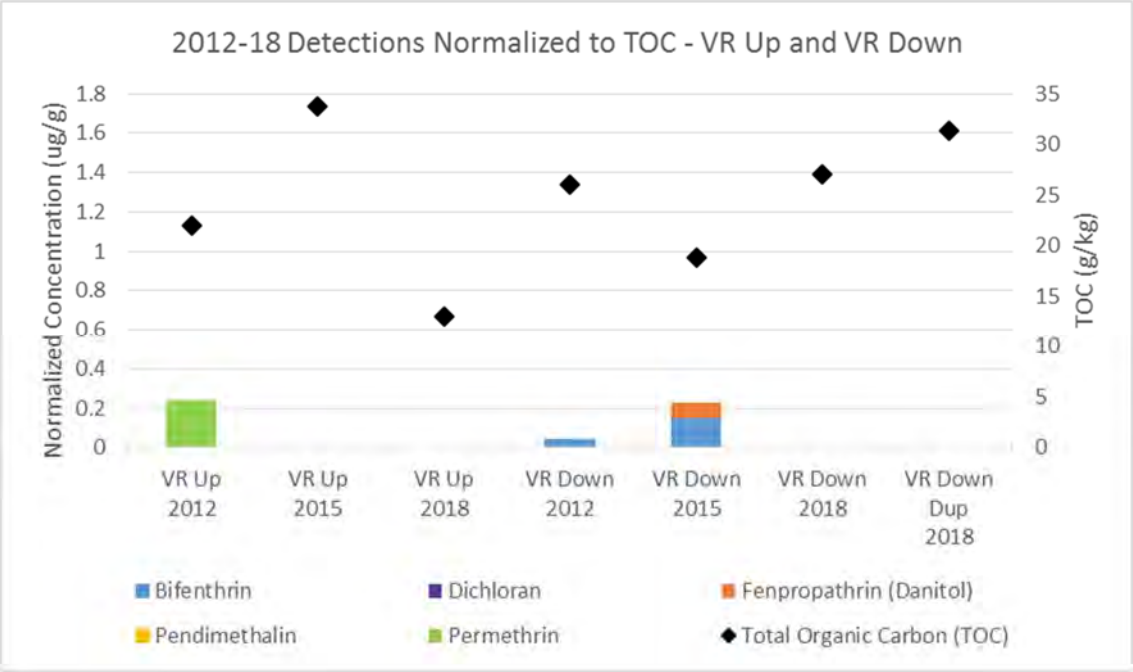
Santa Clara River Watershed							
Analyte	**SCR Up**			**SCR Down**			**Units**
	2012	**2015**	**2018**	**2012**	**2015**	**2018**	
Bifenthrin	0.14			0.07	0.23		ng/g
Dichloran				0.05	0.10	0.14	ng/g
Pendimethalin	0.13	0.08		0.49	0.77		ng/g
TOC	5.4	17	13.3	11	11.4	14.6	g/kg

Ventura River Watershed								
Analyte	**VR Up**			**VR Down**				**Units**
	2012	**2015**	**2018**	**2012**	**2015**	**2018**	**2018 Dup**	
Bifenthrin				0.05	0.15			ng/g
Fenpropathrin (Danitol)					0.07			ng/g
Permethrin	0.24							ng/g
TOC	22	33.8	13	26	18.8	27.1	31.4	g/kg

Figure 13. Detected Analytes Normalized to TOC – By Watershed







Dichloran, fenpropathrin, and pendimethalin not required by Permit. Dichloran and pendimethalin not analyzed for TMDL samples.

Table 7. Hypothetical Toxicity Units Vs. Observed Toxicity – By Watershed

Calleguas Creek Watershed									
Analyte	**LC50 (ug/g TOC)**	**Units**	**WOOD**	**CC Up**		**UNIV**	**CC Down**		
			2012	**2015**	**2018**	**2012**	**2015**	**2015 Dup**	**2018**
Bifenthrin	0.52	TU_H	0.927			0.437^	0.516	1.372	
Fenpropathrin (Danitol)	1.1	TU_H							
Permethrin	10.83	TU_H					0.025	0.060	
Summed Hypothetical TU_H		TU_H	0.927			0.437^	0.541	1.432	
Significant Observed Toxicity			Yes	No	No	Yes	No	No	No

^ DNQ

Santa Clara River Watershed								
Analyte	**LC50 (ug/g TOC)**	**Units**	**SCR Up**			**SCR Down**		
			2012	**2015**	**2018**	**2012**	**2015**	**2018**
Bifenthrin	0.52	TU_H	0.278			0.129	0.439	
Fenpropathrin (Danitol)	1.1	TU_H						
Permethrin	10.83	TU_H						
Summed Hypothetical TU_H		TU_H	0.278			0.129	0.439	
Significant Observed Toxicity			No	Yes	No	No	No	No

Ventura River Watershed									
Analyte	**LC50 (ug/g TOC)**	**Units**	**VR Up**			**VR Down**		
			2012	**2015**	**2018**	**2012**	**2015**	**2018**
Bifenthrin	0.52	TU_H				0.089	0.286	
Fenpropathrin (Danitol)	1.1	TU_H					0.068	
Permethrin	10.83	TU_H	0.022					
Summed Hypothetical TU_H		TU_H	0.022			0.089	0.354	
Significant Observed Toxicity			No	No	No	No	Yes	No

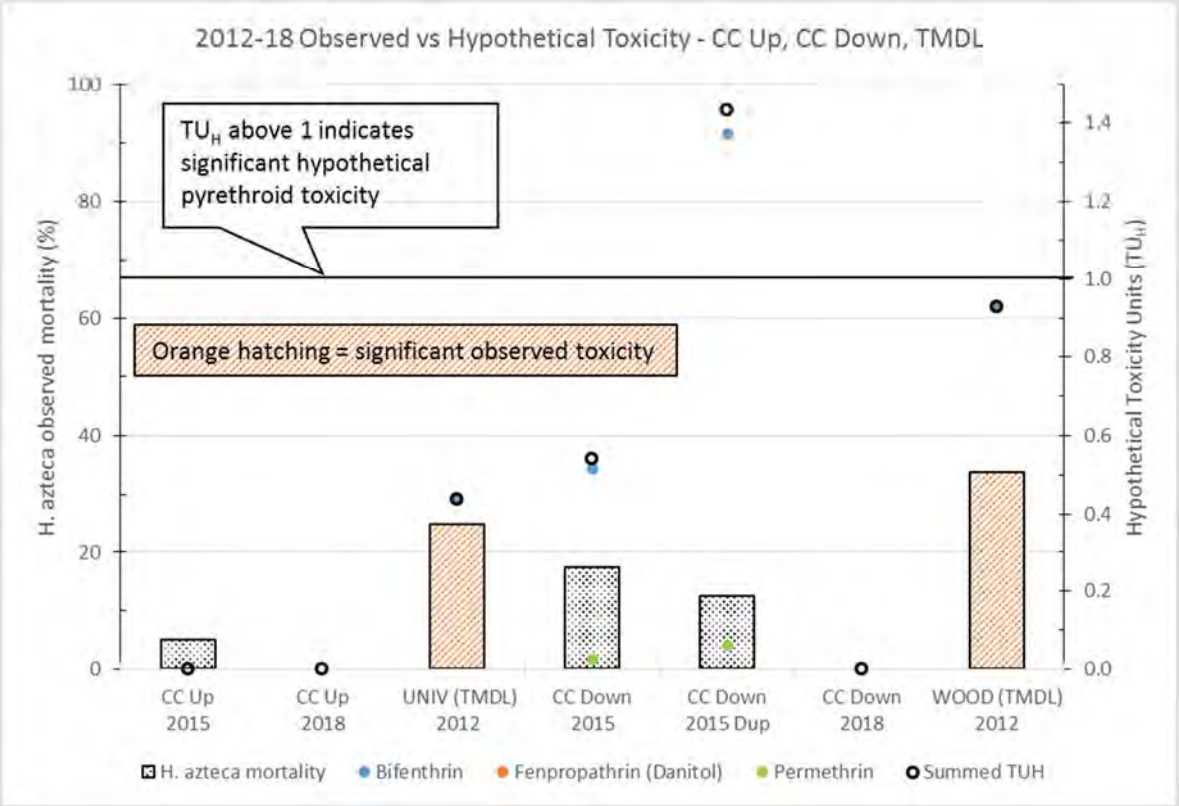
No pyrethroids were detected in the 2018 Study samples, so all TU_H for 2018 are equal to zero and toxicity due to pyrethroids is not expected. This was supported by the lack of toxicity observed in the sediment samples for both survival and growth.

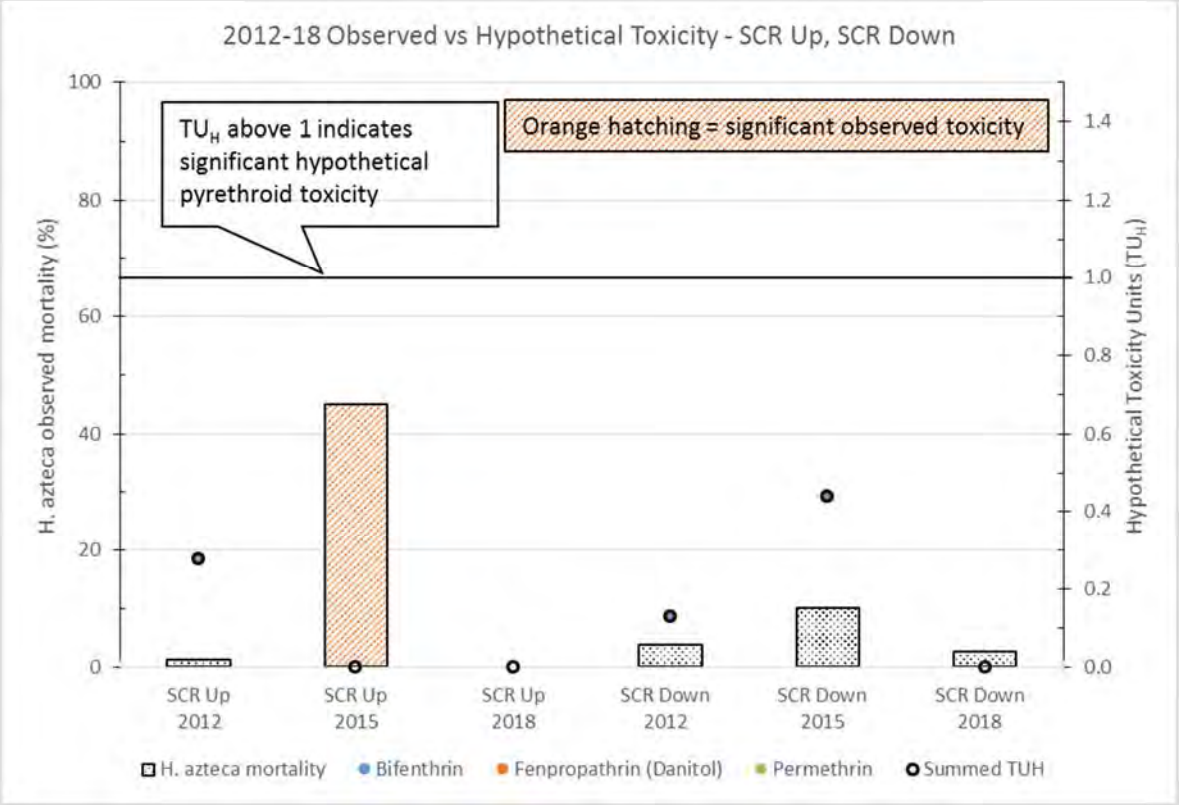
The 2012-2018 results are summarized by watershed in the figures below, showing their measured toxicity (% mortality) as compared to their hypothetical pyrethroid toxicity units. In some cases, e.g. UNIV (2012), SCR Up (2015), and VR Down (2015), significant toxicity was observed but the TU_H were low, in which case a different contaminant is likely the cause of the observed toxicity. At WOOD (2012), pyrethroids may have contributed to or been the cause of the toxicity observed in the sample, since the pyrethroid TU_H is close to 1. For CC Down Dup (2015), the TU_H were high but the observed toxicity was not, which may be due to other factors such as antagonistic effects with other components in the sample or subsample differences (e.g. differences in concentrations of TOC and pyrethroids). Subsample differences seem a likely cause since CC Down (2015) had a similar observed toxicity but a lower TU_H mostly due to higher TOC and lower bifenthrin concentrations.

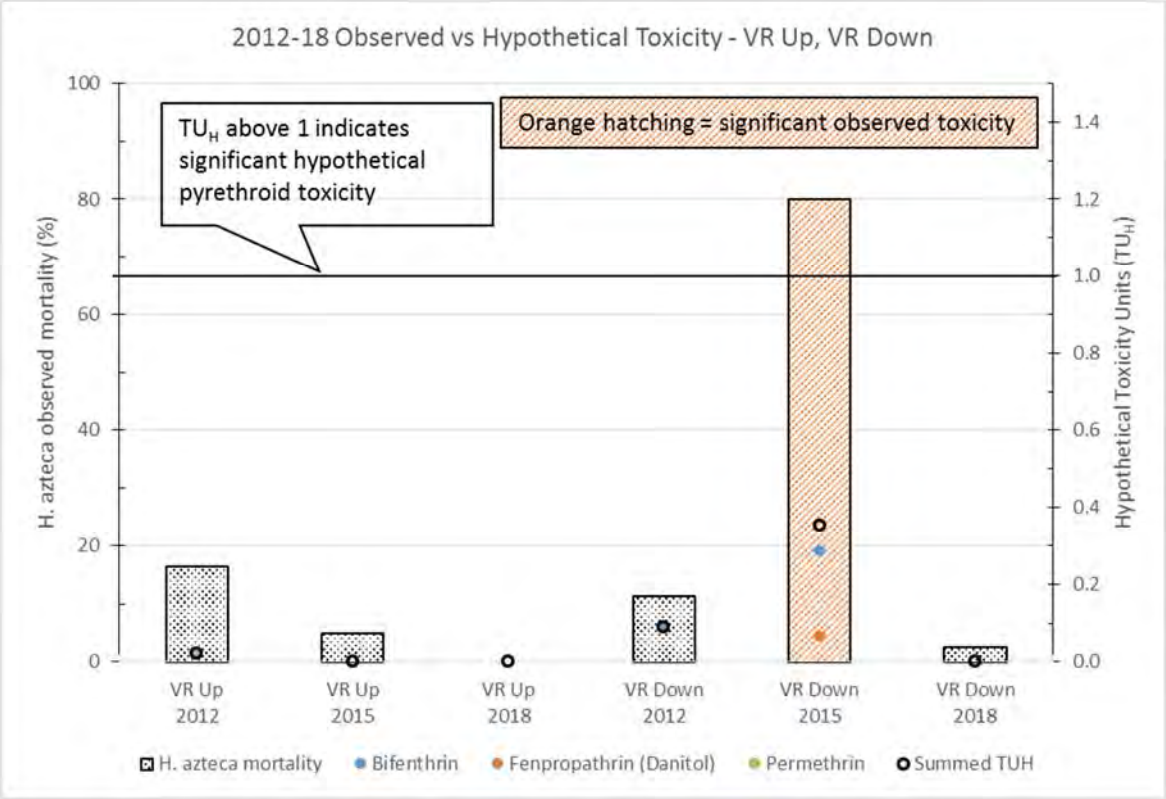
Except for the CC Down Dup (2015), the TU_H for the Study samples were all less than one (Table 7) and so pyrethroid toxicity is not expected to be an issue for these samples according to this evaluation method. For the CC Down Duplicate, even though the TU_H was greater than one, the measured toxicity units were not above one, which means that significant toxicity was not observed in the *H. azteca* test.

The study referenced in the Permit does not contain an LC50 for dichloran or pendimethalin, however the lack of toxicity in the environmental sample infers a TU_H of less than one for these analytes. The TU_H were not correlated with the observed toxicity, possibly due to the presence of unanalyzed constituents in the samples.

Figure 14. Hypothetical Toxicity Units Vs. Observed Toxicity – By Watershed







Pyrethroid pesticides were more prevalent in the downstream samples for most analytes/watersheds.

POTENTIAL PESTICIDE SOURCES

The application of pesticides for residential, industrial, and commercial use is not tracked, except for structural pest control by certified applicators. Many pesticides have both general use (lower concentrations and/or small areas) and restricted use (higher concentrations and/or large-scale applications) formulations. General use pesticides can be applied by anyone however restricted use pesticides applications require California Department of Pesticide Regulation (CDPR) Certified Pesticide Applicators.

The pounds of pesticides applied annually for agriculture and structural pest control is tracked by the CDPR. The *Annual Pesticide Use Report Indexed by Chemical* (PUR) for Ventura County summarizes the annual reported pesticide use for regulated applications, including agriculture (e.g. food and ornamental), structural pest control, and other purposes (e.g. animal premise, golf course turf, landscape maintenance, public health, regulatory pest control, rights of way, vertebrate control, etc.). These reports typically become available two years after the year referenced, so 2017 and 2018 were unavailable for this Study report. The pounds used for regulated uses of the detected pesticides in this Study are summarized in Table 8.

Table 8. Ventura County Pesticide Use (Pounds) Reported to California Department of Pesticide Regulation (DPR)

	2011					2012				
Pesticide	**Total Pounds**	**Agriculture**	**Structural**	**Other**	**Major crop - pounds**	**Total Pounds**	**Agriculture**	**Structural**	**Other**	**Major crop - pounds**
Bifenthrin	2771.79	1732.74	1005.79	33.26	Strawberry 1499	2911.63	1673.06	1211.49	27.08	Strawberry 1364
Permethrin	4742.67	3635.45	1059.45	47.77	Celery 2162	4625.02	2060.4	2515.73	48.89	Celery 873
Fenpropathrin (Danitol)**	969.21	969.21	0	0	Strawberry 849	788.71	788.08	0	0.63	Strawberry 595
Dichloran*,**	22733.97	22733.97	0	0	Celery 21916	15545.81	15545.81	0	0	Celery 14854
Pendimethalin*,**	2788.84	2627.32	0	161.52	Strawberry 2515	5983.35	5739.14	0	244.21	Strawberry 5140

	2013					2014				
Pesticide	**Total Pounds**	**Agriculture**	**Structural**	**Other**	**Major crop - pounds**	**Total Pounds**	**Agriculture**	**Structural**	**Other**	**Major crop - pounds**
Bifenthrin	3350.01	1635.33	1684.09	30.59	Strawberry 1253	4699.88	2453.05	2133.09	113.74	Strawberry 1413
Permethrin	4678.32	2408.77	2201.2	68.35	Celery 1142	3807.76	2755.71	933.95	118.1	Celery 945
Fenpropathrin (Danitol)**	1668.9	1668.9	0	0	Strawberry 1307	1820.92	1820.92	0	0	Strawberry 1215
Dichloran*,**	19557.51	19557.51	0	0	Celery 18984	19983.11	19983.11	0	0	Celery 19347
Pendimethalin*,**	11899.69	11862.37	0	37.32	Strawberry 10855	12617.4	12557.56	0	59.84	Strawberry 11255

	2015					2016				
Pesticide	**Total Pounds**	**Agriculture**	**Structural**	**Other**	**Major crop - pounds**	**Total Pounds**	**Agriculture**	**Structural**	**Other**	**Major crop - pounds**
Bifenthrin	6048.4	2657.4	3362.52	28.48	Strawberry 1615	3239.03	2003.42	1123.58	112.03	Strawberry 1068
Permethrin	3222.6	2503.93	660.79	57.88	Container plants 906, Celery 657	2865.9	2193.48	612.48	59.94	Celery 721
Fenpropathrin (Danitol)**	2131.63	2130.85	0	0.78	Strawberry 1852	1831.09	1831.09	0	0	Strawberry 1250
Dichloran*,**	18702.35	18702.35	0	0	Celery 18146	17521.95	17521.95	0	0	Celery 17400
Pendimethalin*,**	11350.8	11296.26	0	54.54	Strawberry 8854	12068.51	11978.68	0	89.83	Strawberry 10089

* Not analyzed by TMDL ** Analytes not required by Permit

Other - Includes animal premise, golf course turf, landscape maintenance, public health, regulatory pest control, rights of way, vertebrate control, unknown

Data from Pesticide Use Annual Summary Reports at https://www.cdpr.ca.gov/docs/pur/purmain.htm, indexed by Chemical and restricted to Ventura County

E.g "Department of Pesticide Regulation 2015 Annual Pesticide Use Report Indexed by Chemical - Ventura County"

There is approximately a two-year delay for the California Department of Pesticide Regulation Annual Pesticide Use Reports (PUR) to become available online. This means that 2011 and 2012 PUR were unavailable for the 2012 Study report, 2014 and 2015 PUR were unavailable for the 2015 Study report, and 2017 and 2018 PUR were unavailable for the 2018 Study Report.

Five pesticides (three pyrethroids and two non-pyrethroids) were detected by the laboratory's pyrethroid analytical method during the Study. Bifenthrin and permethrin are pyrethroid insecticides that have both agricultural and urban and general and restricted use applications. Bifenthrin and permethrin are both used in significant quantities for regulated applications for structural and agricultural pest control in Ventura County but are also known to have unregulated applications for residential and industrial uses, which are not tracked. The pyrethroid insecticide fenpropathrin and the non-pyrethroid fungicide dichloran are agricultural pesticides without urban uses. The non-pyrethroid herbicide pendimethalin is used for agricultural and urban uses. Fenpropathrin, dichloran, and pendimethalin are not used for structural pest control in Ventura County.

Bifenthrin is used as a restricted use pesticide in orchards, nurseries, and buildings (e.g. structural pest control). Some products with lower concentrations are available for unrestricted residential use for indoor and outdoor insect control. Bifenthrin was detected at all Study sites except CC Up and VR Up at least once from 2012-2018. All the sites at which bifenthrin was detected (TMDL sites in 2012, CC Down in 2015, VR Down in 2012 and 2015, SCR Up in 2012, and SCR Down in 2012 and 2015) have both urban and agricultural influences but are in predominantly agricultural areas. In contrast, CC Up doesn't have urban or agricultural influences and VR Up has a small amount of agriculture and low-density housing. WOOD 2012 is a predominantly agricultural site and given its location within the Oxnard Plain, an area notable for its large crops of strawberries, peppers, and leafy green vegetables, the source of the bifenthrin is likely agricultural, however there are upstream discharges from urban areas.

Permethrin is a restricted use pesticide for crop and wide area applications (e.g. nurseries, sod farms) but is also a general use pesticide for residential (e.g. indoor and outdoor spaces, pets) and industrial applications. According to the United States Environmental Protections Agency's "Reregistration Eligibility Decision (RED) for Permethrin (December 2007)", approximately 70% of permethrin is used in non-agricultural settings and approximately 30% is used on food/feed crops in agricultural settings. The RED states that approximately 55% of the non-agricultural applications are made by professionals, 41% by homeowners on residential areas, and 4% on mosquito abatement areas. Permethrin was only detected at VR Up in 2012, which is downstream of a small amount of agriculture and low-density housing, and at ME-CC in 2015, which has both urban and agricultural influences. The TMDL permethrin detection limit of 5 ng/g is above/near the quantities measured in the 2015 CC Down samples, so the higher TMDL detection limit may have obscured the presence of similar concentrations of permethrin in the TMDL samples. The CDPR reports show that the regulated use of permethrin in Ventura County is predominantly for row crops and structural pest control, however according to the Environmental Health Tracking Program (www.cehtp.org/pesticidetool), which uses CDPR data, there were no applications near VR Up, so the source may be from unregistered residential users but the data is inconclusive at this time.

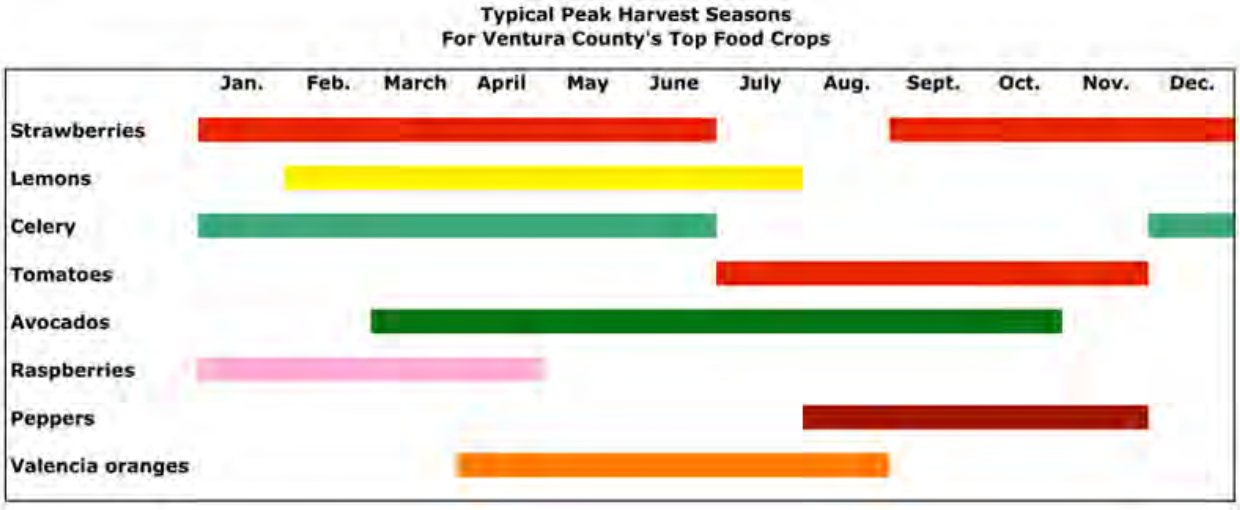
Fenpropathrin is a pyrethroid insecticide that is registered for multiple crops but its restricted use designation makes it unlikely to have an urban source, however it can be used to treat Asian citrus psyllid infestations (as can cyfluthrin, which was not detected), which have become a problem in Ventura County. It was only detected once during the Study, at VR Down in 2015.

Dichloran is a (non-pyrethroid) general use fungicide with no residential uses [DCNA (Dicloran) Reregistration Eligibility Decision (RED) Fact Sheet (EPA 738-F-06-013, July 2006)], therefore the detected dichloran is not from an urban source. Dichloran was only detected at one site, SCR Down, and was detected during all three study years (2015, 2015, and 2018).

Pendimethalin is a (non-pyrethroid) general use selective herbicide used to control broadleaf weeds and grassy seed species in agricultural and non-agricultural settings. Pendimethalin was predominantly detected in the Santa Clara River Watershed at SCR Up and SCR Down in 2012 and 2015, but it was also detected at CC Down in 2015. It is unknown if the detection of this non-pyrethroid is related to an urban source, but its concentrations tended to be higher at the downstream sites, where agriculture is a more direct influence.

The PUR are summarized by calendar year, however samples for this Study were collected in April/May so the previous year's applications are also relevant. Strawberry and celery are among the top 10 crops grown in Ventura County, and are also the major crops on which the five detected pesticides (3 pyrethroids and 2 non-pyrethroids) are applied. Additionally, as seen in Figure 15, the strawberry and celery growing seasons lead into the sampling period. This suggests that the pesticides could have an agricultural source, however it does not exclude an urban source for those pesticides which have urban uses.

Figure 15. Peak Harvest Seasons



(Chart obtained from http://www.farmbureauvc.com/new/images/typical-peak.jpg)

PESTICIDE USE TRENDS

According to the CDPR website (https://www.cdpr.ca.gov/docs/pur/pur16rep/16sum.htm#trends), "Since 1990, the reported pounds of pesticides applied and acres treated have fluctuated from year to year. These fluctuations can be attributed to a variety of factors, including changes in planted acreage,

crop plantings, pest pressures, and weather conditions. An increase or decrease in use from one year to the next or in the span of a few years may not necessarily indicate a general trend in use, but rather variations related to changes in weather, pricing, supply of raw ingredients, or regulations. Regression analyses on use over the last twenty years do not indicate a significant trend of either increase or decrease in total pesticide use." These factors, combined with differences in rainfall and runoff intensities and amounts could all contribute to the variations in concentrations seen in the Study.

The 2017 and 2018 PUR data were not released by CDPR in time for inclusion in this report, so the comparison of analytical data to pesticide application amounts to look for trends are limited to the 2011-2016 period. The multiple factors that can affect fluctuations and the lack of PUR data for 2017 and 2018, combine to prevent drawing conclusions from any apparent trends. However, some possible trends from the current available data are visible in Figure 16, Figure 17, Figure 18, Figure 19, and Figure 20, and are described below.

Figure 16. 2011-2016 Bifenthrin Use in Ventura County (CDPR)

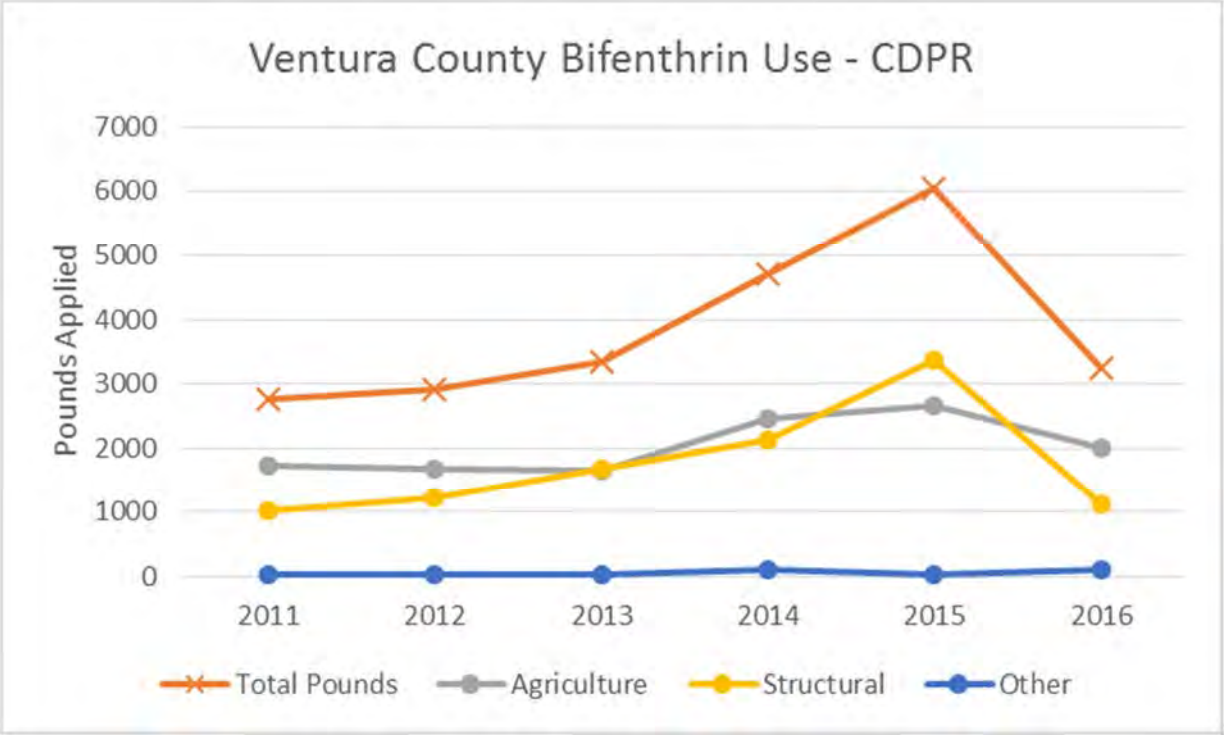


Figure 17. 2011-2016 Permethrin Use in Ventura County (CDPR)

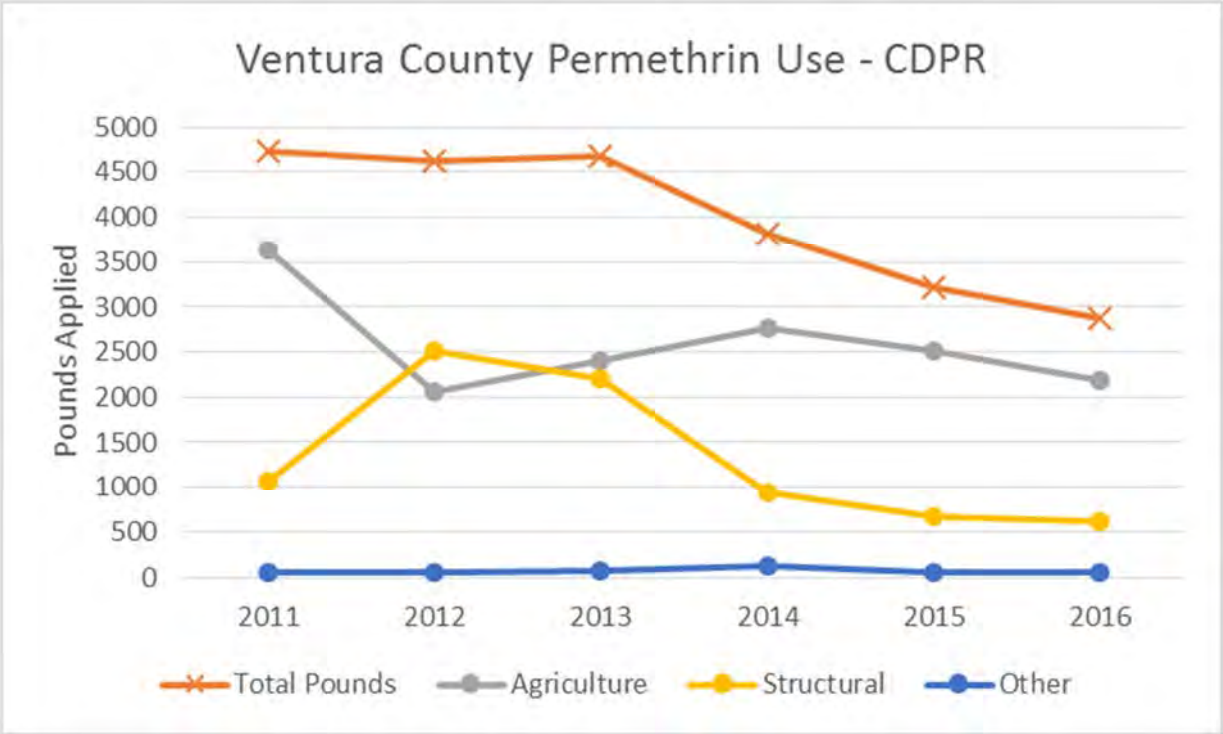


Figure 18. 2011-2016 Fenpropathrin (Danitol) Use in Ventura County (CDPR)

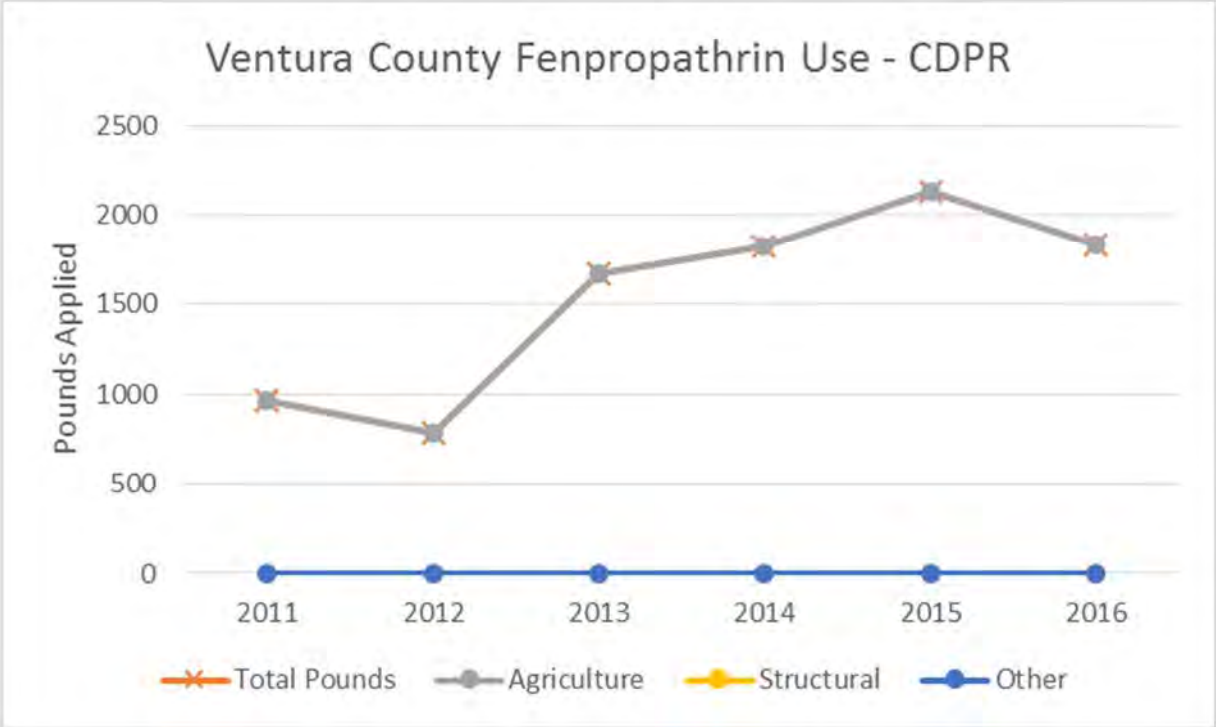


Figure 19. 2011-2016 Dichloran Use in Ventura County (CDPR)

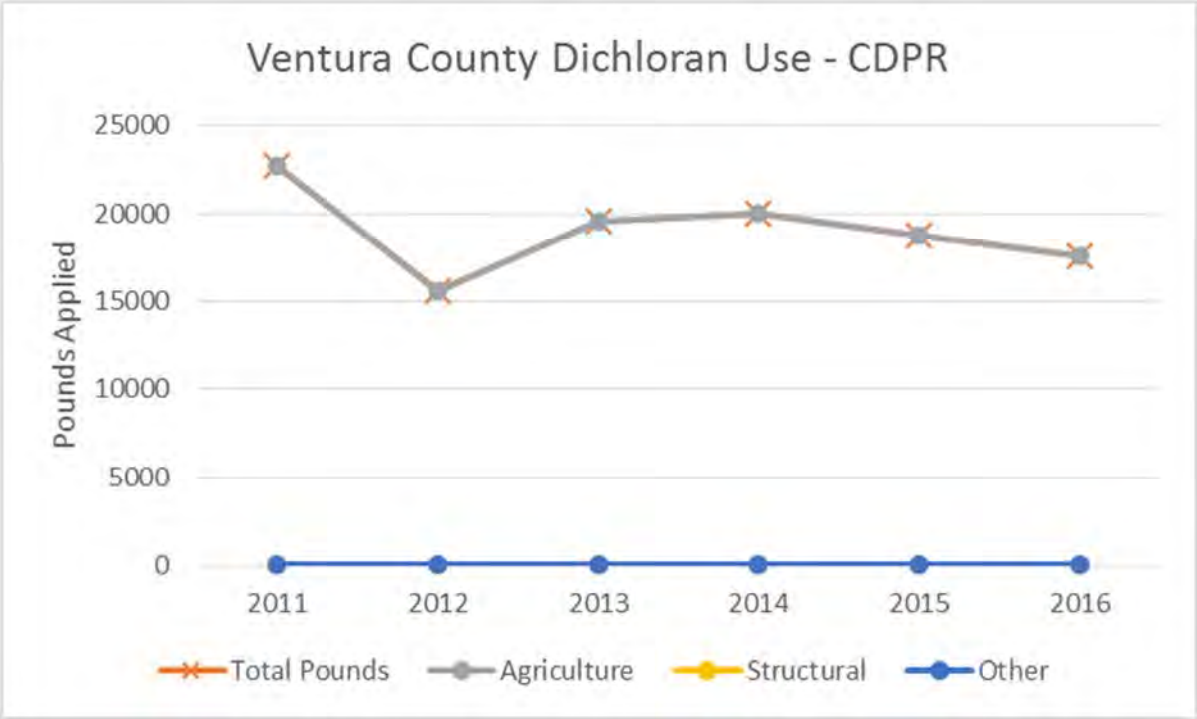
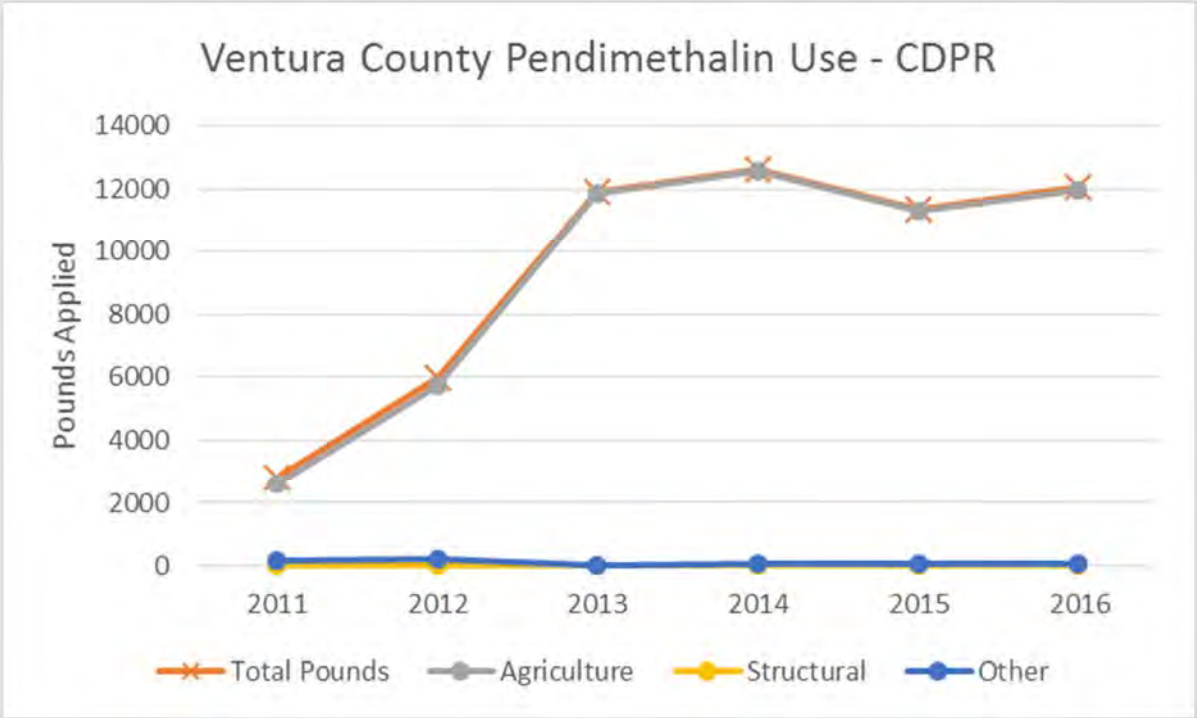


Figure 20. 2011-2016 Pendimethalin Use in Ventura County (CDPR)



The 2011-2016 PUR show dichloran and pendimethalin (non-pyrethroids) are used in larger quantities (pounds) for regulated applications (primarily agriculture) in the County than the pyrethroids bifenthrin,

permethrin, and fenpropathrin, however this was not typically reflected in the monitoring data (i.e. quantities and frequencies of detection). These five pesticides are all applied to strawberry or celery as their major crop, and these are among the top ten crops in Ventura County and are mainly grown in the lower regions of each watershed.

According to the 2011-2016 PUR, bifenthrin, fenpropathrin, and pendimethalin use appear to be trending upward since 2011 (although bifenthrin use decreased in 2016). Bifenthrin use (according to CDPR) was highest in 2015, which correlates with the concentrations measured at downstream sites. Bifenthrin structural use increased in the county between 2012 and 2015, and briefly exceeded agricultural use in 2015. Permethrin use appears to be decreasing (largely due to decreased use for structural pest control use) and dichloran use appears to be staying relatively stable over the 2011-2016 period. The 2017 and 2018 data are unavailable to see if the trend continues.

PESTICIDE REDUCTION EFFORTS

Integrated Pest Management Programs

A model integrated pest management (IPM) program was drafted through the Public Agencies Activities Subcommittee and used as a template by the Permittees to develop their own plans by November 2009. This standardized protocol was amended in February 2014 at the amended version is posted on Program's website at: http://www.vcstormwater.org/index.php/publications/manuals/pesticide-application-protocol.

The prevention of pesticides from harming non-target organisms is the primary goal of the Permittees IPM program. The intent is to focus on preventing pesticides, fertilizers, and herbicides from entering the storm drain system and discharging to receiving waters. This protocol is applicable to 1) the outdoor use of pesticides, herbicides, and fertilizers; 2) the use of pesticides and fertilizers where the materials may come into contact with precipitation; 3) the use of pesticides, herbicides, and fertilizers where these materials may come into contact with runoff (natural or induced); and 4) the use of pesticides, herbicides, or fertilizers anywhere where they may be directly or indirectly discharged to a storm drainage system.
An effective IPM program includes the following elements:

- Pesticides are used only if monitoring indicates they are needed according to established guidelines.
- Treatment is made with the goal of removing only the target organism.
- Pest controls are selected and applied in a manner that minimizes risks to human health, beneficial, non-target organisms, and the environment.
- The use of pesticides, including organophosphates and pyrethroids do not threaten water quality.
- Partner with other agencies and organizations to encourage the use of IPM.

- Adopt and verifiably implement policies, procedures, and/or ordinances requiring the minimization of pesticide use and encouraging the use of IPM techniques (including beneficial insects) in the Permittees' overall operations and on municipal property.

- Policies, procedures, and ordinances shall include commitments and timelines to reduce the use of pesticides that cause impairment of surface waters by implementing the following procedures:

    - Quantify pesticide use by its staff and hired contractors.

    - Prepare and annually update an inventory of pesticides used by all internal departments, divisions, and other operational units.

    - Demonstrate reductions in pesticide use.

The protocol is applicable to any Permittee staff and contracted services that apply pesticides, fertilizers, or herbicides. Such staff commonly include, park, public works, purchasing, building/grounds maintenance, hazardous materials, and pesticide application staff. It is not applicable to the indoor use of pesticides, herbicides or fertilizers, but is applicable to the consequential outdoor handling, mixing, transport, or disposal of materials related to indoor use. This protocol also does not apply when another NPDES permit and/or abatement orders are in effect at the selected site. Furthermore, this protocol is not intended to replace federal or state requirements or provide complete directions for applying, handling, transporting, mixing, or storing pesticides, fertilizers, or herbicides.

Spanish Language Pesticide Outreach

Public Outreach and Education on Pesticide Use

Ventura County's Community for a Clean Watershed (CCW) is the Program's public outreach effort, and it regularly targets pesticide use in its campaigns. CCW has developed creative materials to promote the safe and correct use of outdoor pesticides. The animated "More, Better" television commercial graphically demonstrates how using too much pesticide results in runoff into the storm drains, eventually making it into the Watershed where it adversely affects plants and animals. The radio spot was a humorous adaptation of the television ad, featuring the two animated characters as they defend their house against garden pests and inadvertently poison the watershed. An animated web banner corresponded with both broadcast media while the transit shelters took a more direct approach showing a snail and telling residents "Don't kill an ocean just to keep pests out of your garden."

Newspaper Advertisement

In 2010, coinciding with the spring planting season, CCW ran a five-week campaign on television and radio, as well as animated web banners and transit shelter posters. A similar campaign was run in spring 2016 for four weeks, utilizing the thirty second radio spot, digital web banner, and six transit shelters showing the snail poster. The radio spot was also run for four weeks on Pandora in January – February 2017.

In February 2016, April 2016, and twice in January 2017, CCW sent out e-blasts targeting 100,000 homeowners in Ventura County each time. The e-blast promoted the Program's rain barrel and compost bin truckload sale and included links to the Program's "Yard Care Watershed Protection Tips" brochure and "Pesticides, Herbicides, & Fertilizer Application Best Practices" BMP sheet.

Retail Partnership Brochures: Nurseries and Gardeners

"Watershed Protection Tips for Gardeners" pamphlets were created in 2010 to encourage residents to follow best practices in their homes and yards when gardening and dealing with pests. These brochures were distributed to targeted retail stores and numerous outreach events across the county to reach the population that is likely involved in the activities. The colorful pamphlet defines the Watershed, explains the storm drain system, how and why polluted water is damaging, and gives both overall and topic-specific tips for how to keep the Watershed clean. The pamphlet covers plant selection, irrigation, fertilizer and pesticide practices, integrated pest management, and proper yard maintenance. The pamphlet was updated in 2016 to include pictures of drought tolerant plants and an updated link to Integrated Pest Management resources.

The Program also created a best management practices fact sheet covering commercial pesticide, herbicide, & fertilizer application and a poster covering best management practices for nurseries. These were distributed during stormwater business inspections. All the materials are also posted on the CCW website www.cleanwatershed.org.

2010 Gardening Retail Partnership Brochure

2016 Gardening Retail Partnership Brochure

RECOMMENDATIONS

Urban use of pesticides remains one of the priority pollutants for the Program. Through maintaining a strong public outreach effort to educate the public on the use and handling of pesticides coupled with household hazardous waste collections providing proper disposal of unwanted products, the Program expects to reduce the pesticide contamination in stormwater discharge. The results of this study, and the previous studies in 2012 and 2015, do not directly show a link between pyrethroids and significant toxicity in the samples, therefore the instances of measured toxicity could be from other pesticides or other pollutants. The Program is committed to reducing all pollutants in MS4 runoff and through the continued implementation of the Program, these other potential causes of toxicity will be addressed.

BIBLIOGRAPHY

WORKS CITED

Delgado-Moreno, L., Lin, K., Veiga-Nascimiento, R., & Gan, J. (2011). Occurrence and Toxicity of Three Classes of Insecticides in Water and Sediment in Two Southern California Coastal Watersheds. *Journall of Agricultural and Food Chemistry* , (59) 9448-9456.

Weston, D., Holmes, R., You, J., & Lydy, M. (2005). Aquatic Toxicity Due to Residential Use of Pyrethroid Insecticides. *Environmental Science & Technology* , 39(24); 9780 pp.

California Environmental Health Tracking Program, California Department of Public Health. Agricultural Pesticide Mapping Tool. Data from California Department of Pesticide Regulation Pesticide Use Report Database, 1991-2015. 2017. Online at www.cehtp.org/pesticidetool.