Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Watershed Monitoring and Assessment Program

Coyote Creek Toxicity
Stressor Source Identification Project
Work Plan - Water Year 2018

March 31, 2017

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1.0 INTRODUCTION

The purpose of this work plan is to describe the design of and tasks that will be completed for a Stressor/Source Identification (SSID) project, which is required by Provision C.8.e.iii of the San Francisco Bay Region Municipal Regional Stormwater National Pollutant Discharge Elimination System (NPDES) Stormwater Permit (MRP) (Order No. R2-2015-0049). The Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP or Program) is working with the Bay Area Stormwater Management Agencies Association (BASMAA) Regional Monitoring Coalition (RMC) to collectively initiate eight new SSID projects during the five-year term of the MRP (i.e., 2016 – 2020). SSID projects typically follow-up on monitoring conducted in compliance with MRP Provision C.8 (or monitoring conducted through other programs) with results that exceed trigger thresholds identified in the MRP. Trigger thresholds are not necessarily equivalent to Water Quality Objectives (WQOs) established in the San Francisco Bay Basin (Region 2) Water Quality Control Plan (Basin Plan, SFRWQCB 2017) by the San Francisco Bay Regional Water Quality Control Board (Regional Water Board); however, sites where triggers are exceeded may indicate potential impacts to aquatic life or other Beneficial Uses.

This SSID work plan describes the steps that will be taken during WY 2018 to investigate sources of toxicity in **Coyote Creek, San Jose, California**. The Regional Water Board recently recommended listing Coyote Creek for toxicity in sediment in the 2016 Integrated Report (303(d) List/305(b) Report) for the San Francisco Bay Region. The recommendation has been submitted to the State Water Resources Control Board (State Board) and will be compiled into a statewide 303(d) list, which is subject to the approval of both the State Water Board and the USEPA.

1.1 SSID Regulatory Background

SSID projects are intended to be oriented toward taking action(s) to alleviate stressors and reduce sources of pollutants. MRP Provision C.8.e.iii requires that SSID projects are conducted in a stepwise process:

Step 1: Develop a work plan. The work plan must:

- Define the problem (e.g., magnitude and temporal and geographic extent) to the extent known;
- Describe the SSID project objectives, including the management context within which the results of the investigation will be used;
- Consider the problem within a watershed context and look at multiple types of related indicators, where possible (e.g., basic water quality data and biological assessment results);
- List candidate causes of the problem (e.g., biological stressors, pollutant sources, and physical stressors);
- Establish a schedule for investigating the cause(s) of the trigger stressor/source to begin upon completion of the work plan. Investigations may include evaluation of existing data and/or collection of new data.
- Conduct a site specific study (or non-site specific if the problem is wide-spread) in a stepwise process to identify and isolate the cause(s) of the trigger stressor/source. Study approaches are listed depending on the stressor being investigated.
    - For toxicity studies, a Toxicity Identification Evaluation (TIE) should be conducted when no chemical pollutant is present in the sample that exhibited toxicity. In the case where samples exhibiting toxicity contain pollutant at concentrations that might produce adverse effects, it is not necessary to conduct a TIE, and the SSID project would be considered complete.

Step 2: Conduct SSID investigations according to the schedule in the work plan and report on the status of the SSID investigation annually in the Urban Creeks Monitoring Report (UCMR) that is submitted to the Regional Water Board on March 31 of each year.

Step 3: Follow-up actions:

- If it is determined that discharges to the municipal separate storm sewer system (MS4) contribute to an exceedance of a water quality standard (WQS) or an exceedance of a trigger threshold such that the water body's beneficial uses are not supported, submit a report in the UCMR that describes Best Management Practices (BMPs) that are currently being implemented and additional BMPs that will be implemented to prevent or reduce the discharge of pollutants that are causing or contributing to the exceedance of WQS. The report must include an implementation schedule.
- If it is determined that MS4 discharges are not contributing to an exceedance of a WQS, the SSID project may end. The Executive Officer must concur in writing before an SSID project is determined to be completed.
- If the SSID investigation is inconclusive (e.g. the trigger threshold exceedance is episodic or reasonable methods do not reveal a stressor/source), the Permittee may request that the Executive Officer consider the SSID project complete.

1.2 SSID Work Plan Organization

This work plan fulfills **Step 1** of the SSID process described above in Section 1.1. It describes the steps that will be conducted to investigate sources of toxicity observed in Coyote Creek. The work plan is organized according to the required work plan elements described in Step 1.

Section 2.0 Problem Definition and Study Objectives

Section 3.0 Study Area, Existing Data, and Candidate Causes

Section 4.0 Monitoring Approach and Schedule

Section 5.0 References

2.0 PROBLEM DEFINITION AND STUDY OBJECTIVES

2.1 Problem Definition

This Coyote Creek Sediment Toxicity SSID Project (Project) was triggered by the recommended listing of Coyote Creek for toxicity in sediment in the 2016 Integrated Report (303(d) List/305(b) Report) for the San Francisco Bay Region (Integrated Report). The revised Integrated Report (dated April 2017) was approved by the Regional Water Board on April 12, 2017. The Regional Water Board identified Coyote Creek for toxicity as a Category 5 listing group; which is defined as listing "when at least one beneficial use is not supported and a TMDL is needed." The recommendation has been submitted to the State Water Resources Control Board (State Board) and will be compiled into a statewide 303(d) list subject to the approval of the State Water Board and the USEPA.

The Water Board evaluated toxicity data that were collected prior to 2010 for determination of the recommended listing. Four lines of evidence were evaluated showing significant toxicity from sediment and/or water samples collected in 2007 and 2008 at two locations in the lower reaches of the Coyote Creek mainstem and one location in Coyote Slough. The locations, sampling date, monitoring program and number of samples used as evidence are shown in Table 1. Only the sediment toxicity data collected from two sites in Coyote Creek were determined to exceed the 303(d) listing evaluation guidelines. The sediment toxicity test included survival and growth of *Hyalella azteca*. Toxicity was defined as a statistically significant effect in the sample exposure compared to the control using EPA-recommended hypothesis testing.

Table 1. The sampling locations, date, monitoring program and number of samples used as evidence for listing sediment toxicity in Coyote Creek.

Station ID	Location	Sample Date	Program	Sample Type	Number of Samples	Number of Exceedences of WQOs[1]	Exceeded Evaluation Guidelines[2]
205COY240 (205SUP022)	Coyote Creek at Williams Park	January 2007	Urban Pyrethroid Status Monitoring	Sediment	1	1	Yes
205COY060	Coyote Creek at Montague Exp	June 2008	Stream Pollution Trends Study	Sediment	2	1	Yes
C-3-0	Coyote Slough	1997 - 2002	Regional Monitoring Program (RMP)	Sediment	7	2	No
C-3-0[1]	Coyote Slough	1997 - 2001	Regional Monitoring Program (RMP)	Water	16	1	No

[1] WQO for Toxicity: All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in, human, plant, animal, or aquatic life. (Region 2 Basin Plan 2007).
[2] Toxicity is defined as a significant reduction of test organism relative to the control (alpha < 0.05) and test organism survival is 80% or less than the control survival (at least 20% effect).

In response to the proposed 303(d) listing, the Program developed a comment letter to the Regional Water Board, dated March 13, 2017. The comments were primarily associated with the data evaluation process used by the Water Board to derive the proposed listing. The Program's comments are summarized below:

- The water quality data used by the Water Board to evaluate potential exceedences of water quality objectives were collected 10 – 20 years prior to the data evaluation. With regards to water and sediment toxicity, these data were collected prior to initiation of the pesticide control program mandated by the San Francisco Bay Regional Water Board's Water Quality Attainment Strategy for Pesticide-related Toxicity for Urban Creeks and implemented under the MRP, and thus should not be considered representative of current water quality conditions in Coyote Creek or the San Francisco Bay. Recent sediment toxicity data collected in Coyote Creek since 2010 show a decline in incidences of toxicity.

- Receiving water monitoring data collected through 2010 under NPDES permits were not used for the 303(d) listing process. The Program collected water quality data from 2002 – 2008 in Santa Clara Valley Creeks during implementation of the SCVURPPP Multi-Year Receiving Waters Monitoring Plan. These data include total and dissolved metal concentrations and aquatic and sediment toxicity results from hundreds of samples collected at roughly 70 sites in Santa Clara Valley. Specifically, the Program conducted a sediment toxicity study in the Coyote Creek watershed in 2007-2008 (see Section 3.2.1 below). Not including data collected via NPDES permits potentially contributes to the mischaracterization of water quality conditions in local receiving water bodies. Without conducting such an evaluation and review as part of the 303(d) list data analysis process, a scientifically defensible conclusion regarding water quality conditions and the need for additional control measures should not be made.

- Instead of using a robust data analysis process, it appears that data evaluations to support listing recommendations in 2016 have been reduced to simplistic "black box" approaches where all data (in addition to incomplete datasets noted above) that are housed in the California Environmental Data Exchange Network (CEDEN) for a specific analyte are considered equal, regardless of the context of when, where, how and for what reason they were collected. Data are run through binomial tests with no interpretation in the context of the receiving water bodies or monitoring program goals and objectives.

2.2 Study Objectives

The objective of this Project is to focus on potential causes and sources of toxicity in Coyote Creek. The study is designed to:

1. Identify the magnitude and extent of toxicity in a reach of the Coyote Creek mainstem where previous data were collected; and
2. Identify potential causes of sediment toxicity (if observed).

Depending on results of the investigation, management actions to control toxicity in Coyote Creek will be identified in the project report.

3.0 STUDY AREA, EXISTING DATA, PROBABLE CAUSES

3.1 Study Area

The Coyote Creek watershed covers approximately 320 square miles and drains most of the west-facing slope of the Diablo Range (SCVURPPP 2003). The watershed extends 45 miles from the creek's headwaters (approximately 3,000-foot elevation) to the tidal sloughs entering San Francisco Bay. Coyote Creek has two reservoirs in the middle reaches, Coyote and Anderson Reservoirs. The creek flows for approximately 22 miles between the lowermost reservoir (i.e., Anderson Reservoir) and its confluence with San Francisco South Bay at Alviso Slough.

Coyote Creek flows through unincorporated land with predominantly agricultural land and recent urbanization in the reach between the Cities of Morgan Hill and San Jose. The upper section of Coyote Creek is buffered by Santa Clara County Park land, with densely vegetated flood prone areas. The middle reaches of Coyote Creek are a relatively incised channel that flow through dense urban areas of San Jose. The lower reaches of Coyote have been partially modified for flood protection with setback levees and high-flow bypass channels.

Stream flow in Coyote Creek is extensively regulated by Anderson Dam. The creek also has a small dam that creates Metcalf Percolation Pond. Downstream of the ponds, the stream channel often runs dry, or flows intermittently during the dry season (SCVURPPP 2003). The lower reaches of Coyote Creek are fed by groundwater and urban runoff, as well as tributary flow. Upper Penitencia Creek, Lower Silver - Thompson Creek, and Upper Silver Creek are the largest tributaries that empty into the lower reaches of Coyote Creek below Anderson Dam.

3.2 Existing Sediment Toxicity Data

<u>3.2.1 Sediment Quality Triad Pilot Study (WY 2007 – WY 2008)</u>

During Water Year (WY) 2007 and WY 2008, the Program conducted the Sediment Quality Triad (SQT) Pilot Study as part of the Program's Multi-Year Receiving Waters Monitoring Plan (SCVURPPP 2008). The SQT Study used a weight of evidence (WOE) approach to evaluate bedded sediment chemistry, sediment toxicity, benthic macroinvertebrate (BMI) community and physical habitat data. The SQT approach was implemented to better evaluate relationships between BMIs and stressor variables, and to identify potential causes of aquatic life use impacts in creeks within the Santa Clara Valley.

In WY 2007, the Program collected bedded sediments for toxicity testing at six locations along the mainstem of Coyote Creek during two sampling events: September 2006 and May 2007. In WY 2008, sediment samples were collected for toxicity testing at four locations on Coyote Creek mainstem during two sampling events: October 2007 and April 2008. During the April 2008 sampling event, sediment samples were also collected for toxicity testing from two major tributaries to Coyote Creek, with two sites in Upper Penitencia Creek and two sites in Lower Silver-Thompson Creek. Station locations (latitude and longitude) and sample periods are listed in Table 2. Stations are mapped in Figure 2.

The toxicity of sediments collected over the two years from the ten monitoring locations were evaluated by exposing the amphipod, *Hyalella azteca,* to the collected sediments in a standard ten-day survival test (EPA method 600-R-99/064). In WY 2007, significant toxicity was observed in sediments collected at 5 of the 6 sites during the fall 2006 sampling event. Toxicity was not observed at any of the sites during the spring 2007 sampling event (Figure 1). In WY 2008, significant toxicity was observed in sediments collected at 4 of 8 sites during the fall 2007 and/or spring 2008 sampling events. Sediment samples from the two lowest elevation sites on the Coyote Creek mainstem (COY080 and COY240) had significant toxicity during both water years (Figure 1).

Sediment samples were also analyzed for total recoverable metals and a suite of pyrethroid pesticides. The PECs[1] for metals and LC50s[2] for pyrethroids were used to assess sediment contamination. Metal concentrations were consistently below PECs for all samples, with the exception of nickel, which occurs naturally in Bay Area soils. The co-occurrence of pyrethroid concentrations above LC50s and sediment toxicity in samples collected during spring 2008 sampling event suggests that pyrethroids may have caused (at least partially) the toxicity at those sites. In particular, either Bifenthrin or Cypermethrin concentrations were above levels that one would expect to observe a significant toxic response (i.e., LC50s) at three sites (Table 3).

Table 2. Sampling locations and date of sediment collected for toxicity testing for SCVURPPP Sediment Quality Triad Study.

Station ID	Sampling Location	Latitude	Longitude	Sediment Toxicity Sampling Event			
				9/2006	5/2007	10/2007	4/2008
205COY060	Coyote Creek at Montague Exp	37.39540	-121.91485	x	x		
205COY080	Coyote Creek at Oakland Ave	37.37778	121.89455	x	x	x	x
205COY240	Coyote Creek at Williams Park	37.33575	121.86707	x	x	x	x
205COY330	Coyote Creek at Hellyer Park	37.29000	121.81801	x	x	x	x
205COY400	Coyote Creek at Metcalf Rd	37.22429	121.74741	x	x	x	x
205COY460	Coyote Creek at Osier Ponds	37.17705	121.68516	x	x		
205COY090	Upper Penitencia Cr at Flea Market	37.37080	121.87660				x
205COY130	Upper Penitencia Cr at Quail Hollow	37.39420	121.81250				x
205COY180	Lower Silver Cr at Wooster Ave.	37.35548	121.87052				x
205COY200	Thompson Cr at Quimby Road	37.32423	121.80757				x

[1] The Probable Effects Concentrations (PEC) represent concentrations of metals above which one would expect to observe some degree of toxic response (MacDonald et al. 2000)

[2] A concentration of a chemical that is lethal to 50% of test organisms exposed

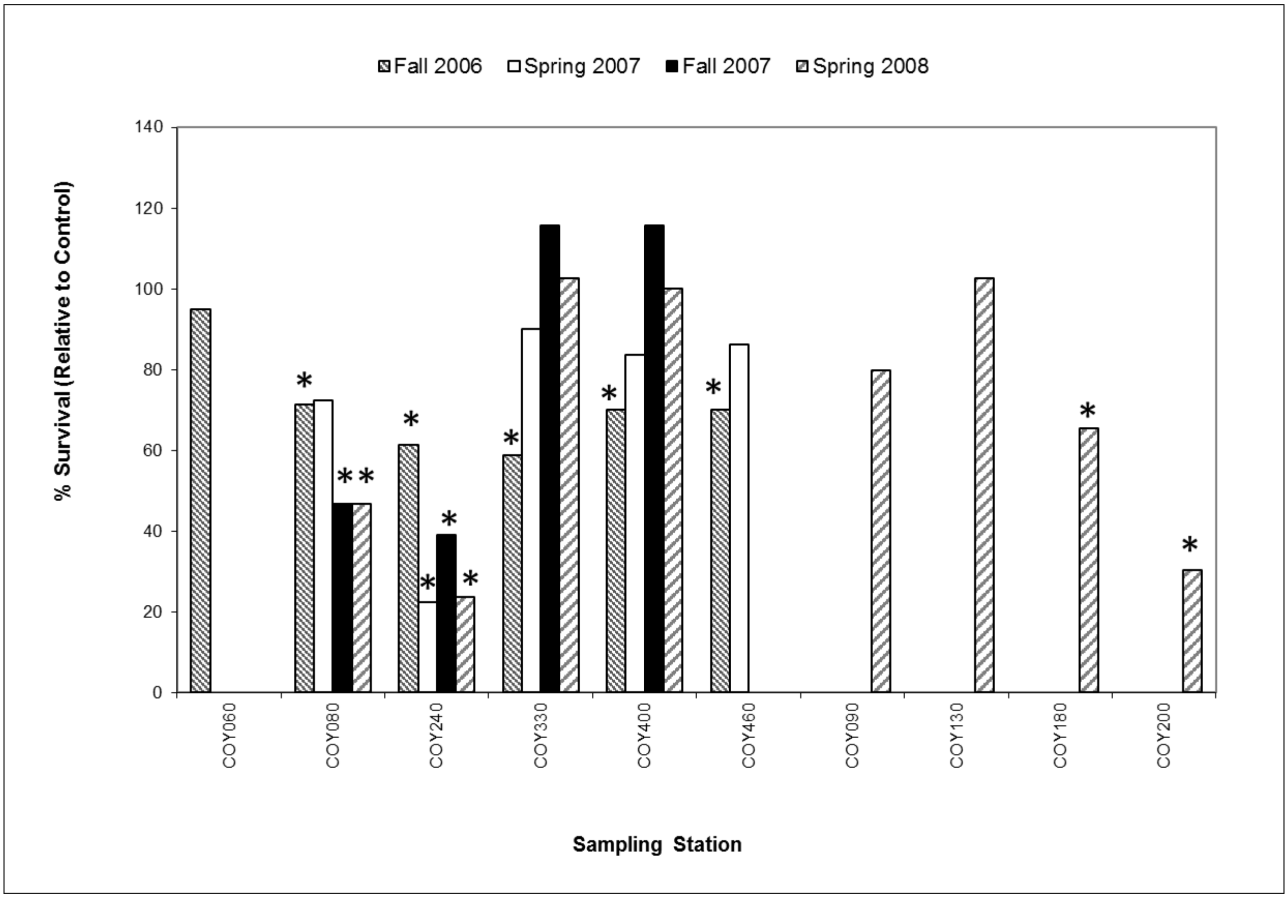

Figure 1. *Hyalella azteca* 10 day survival bioassay results. Star indicates significantly reduced survival compared to lab control.

Table 3. A comparison of sediment toxicity occurrences and pyrethroid pesticide detections in bedded sediment samples collected in Coyote Creek and Lower Penitencia Creek watersheds in spring 2008.

Sampling Site	Sediment Toxicity (% Survival Relative to Control)	Pyrethroid Concentration Greater than LC50[1]			
		Bifenthrin	Cyfluthrin	Cypermethrin	L-Cyhalothrin
Coyote Creek					
COY080	Yes (47%)	Yes (1.22)	-	-	-
COY240	Yes (24%)	Yes (1.25)	No (0.29)	Yes (1.21)	No (0.03)
COY330	No	-	-	-	-
COY400	No	-	-	-	-
Coyote Creek Tributaries					
COY090	Yes (80%)	No (0.61)	-	-	-
COY130	No	-	-	-	-
COY180	Yes (65%)	-	-	Yes (1.25)	-
COY200	Yes (30%)	No (0.96)	-	No (0.33)	-

[1]Dash (-) = pyrethroid not detected.

3.2.2 Stream Pollution Trends Monitoring (SPoT) (WY 2008 - WY 2015)

The Stream Pollution Trends Program (SPoT) is a core component of the Surface Water Ambient Monitoring Program (SWAMP) that conducts statewide monitoring to provide information on the health of California waterways with respect to sediment toxicity and contamination (Phillips et al. 2015). SPoT data is used by the California Water Boards to assess the levels to which aquatic life beneficial uses are supported in California streams and rivers.

The SPoT Program has annually conducted monitoring of sediment chemistry and toxicity testing at site 205COY060 (Coyote Creek at Montague Expressway) since 2008. The toxicity of sediments are evaluated by exposing the amphipod, *Hyalella azteca,* to the collected sediments in a standard ten-day survival test (EPA method 600-R-99/064). Between 2011 and 2013, SPoT conducted two sampling events each year, typically during the month of July and again during September/October. Only ten percent (one of ten) of the sediment samples collected since 2010 were significantly toxic AND the percent effect was greater than 20% reduction in *Hyalella azteca* growth compared to the Lab Control (Table 4). None of the sediment samples collected since 2010 met this criteria for *Hyalella azteca* survival.

Between 2011 and 2013, SPoT conducted sediment toxicity tests using two different temperature treatments. For five sampling events, toxicity tests were conducted at the standard temperature defined in the EPA protocol (23°C) and at a lower temperature (15°C) to better evaluate potential toxic effects on *Hyalella azteca* from pyrethroids. Sediment toxicity tests run at the lower temperature exhibited significant toxicity and exceeded the percent effect threshold (< 20% relative to control sample) for all five sampling events conducted at 205COY060.

Over the past eight years (2008-2014), there has been a significant trend of increasing amphipod (*H. azteca*) survival in toxicity tests at site 205COY060 (Phillips et al 2016). In addition, there was no significant increase in pyrethroid concentrations over the eight-year review period. It is not clear if the overall decline in toxicity at the Coyote site (using the EPA method) reflects a decrease in pyrethroid concentrations in the sediment over time. Recent monitoring results in SPoT monitoring stations in California (including Coyote Creek) have detected other contaminants of emerging concern (i.e., fipronil). In 2015, SPoT initiated use of a new test organism (i.e., *Chironomus dilutus*) to assess potential toxic effects associated with fipronil.

Table 4. Toxicity testing results for 12 sediment samples collected between 2008 and 2016 by the SPoT Program at Coyote Creek site 205COY060.

Year	Date	Significant Toxicity and > 20% Effect Threshold	
		Growth	Survival
2008	6/17/2008	X	
2009	6/16/2009	X	X
2010	6/30/2010		
2011	7/21/11		
2011	10/21/11		
2012	7/5/2012		
2012	9/19/2012		
2013	1/3/2013		
2013	7/2/2013		
2014	6/25/2014		
2015	7/1/2015	X	
2016	7/19/2016		

3.2.3 Creek Status Monitoring for MRP (WY 2012 – WY 2014)

The Program conducted sediment sampling and toxicity testing as part of the Creek Status Monitoring project in compliance with the MRP (1.0) requirements. Sampling was conducted at three sites on the Coyote Creek mainstem, one site in Upper Penitencia Creek, and one site in Lower Silver-Thompson Creek (Table 4). Sites are mapped in Figure 2. Significant toxicity combined with percent effect that was greater than 20% reduction in survival (compared to Lab Control) was reported for sediment samples collected at two sites on Coyote Creek during WY 2013 (SCVURPPP 2014).

The PECs for metals and LC50s for pyrethroids were used to assess sediment contamination. Metal concentrations were consistently below PECs for all samples, with the exception of nickel and cadmium, both of which occur naturally in Bay Area soils. None of the pyrethroid concentrations were above the LC50 threshold for toxic effects.

Table 5. Toxicity testing results for 5 sediment samples collected in Coyote Creek Watershed between 2012 and 2014 by SCVURPPP as part of the Creek Status Monitoring Program. Two of the five samples exhibited significant toxicity and were more than 20% less than control sample.

Station Code	Creek	Date	Significant Toxicity and > 20% Effect Threshold	
			Growth	Survival
205R00035	Upper Penitencia Cr	7/25/2012		
205R00042	Coyote Creek	7/25/2012		
205R00451	Coyote Creek	7/9/2013		X
205R00474	Coyote Creek	7/9/2013		X
205R00979	Lower Silver Cr	6/4/2014		

3.2.4 Upper Penitencia Creek SSID Project (WY 2016)

The Program collected sediment samples on May 2016 at two locations (205COY114 and 205COY121) in Upper Penitencia Creek as part of the Upper Penitencia Creek SSID Project. Samples were tested for sediment toxicity and analyzed for pyrethroid pesticides. Sediment toxicity testing was performed on two species, *Hyalella azteca* and *Chironomus dilutus* using acute endpoints (i.e., survival). No significant toxicity was observed from samples collected at either site. All pyrethroid pesticides detected in the sediment samples were well below the LC50 threshold concentrations (SCVURPPP 2017).

The location of all sediment toxicity monitoring stations in the Coyote Creek watershed that have been sampled by SPoT and SCVURPPP between 2008 and 2016 are shown in Figure 2.

3.3 Probable Cause

Over the past ten years, pyrethroid pesticides have become the predominant group of chemicals deployed for insect control in urban areas in California, and are the primary cause of toxicity in urban water bodies in the state. Ruby (2013) compiled and summarized chemistry data from monitoring performed in urban areas of California for pyrethroid and fipronil pesticides, as well as related toxicity testing results, covering the ten year period from 2003-2012. These studies showed that pyrethroids are linked to toxicity to the amphipod *Hyalella azteca* in water and sediment samples from urban creeks in all of California's major urban areas. Bifenthrin was the most frequently detected pyrethroid (64% of water samples, 69% of sediment samples) and the greatest contributor to toxic potency in both water and sediment samples collected from urban creeks (Ruby 2013). Average concentrations for seven pyrethroids that were reported in the study were substantially greater than the published LC50 values.

The study also showed that Fipronil, a common pyrethroid replacement pesticide, is also found in substantial numbers of water and sediment samples (Ruby 2013). The maximum reported concentrations for fipronil and its degradates in water samples are well above the USEPA benchmarks. Similarly, the maximum reported concentrations of fipronil and its degradates in sediment samples are well above published toxicity (LC50) values.

Linkage between toxicity and pyrethroids have also been observed in studies conducted in San Francisco Bay urban streams. Toxicity was observed to the test species Hyalella azteca synoptically with adverse effects levels of pyrethroids in both water and sediment samples collected in two urban streams in Contra Costa County (CCCWP 2014). Similar association between sediment toxicity and pyrethroids was observed in a toxicity study conducted by SCVURPPP in Stevens Creek, Santa Clara County (SCVURPPP 2008). Summary results from toxicity data in Coyote Creek (presented in Section 3.2) also indicate pesticide related toxicity.

The Coyote Toxicity SSID Project will focus on evaluating if sediment toxicity is present in Coyote Creek and if so, evaluate pesticides as the stressor that may be causing the toxicity.

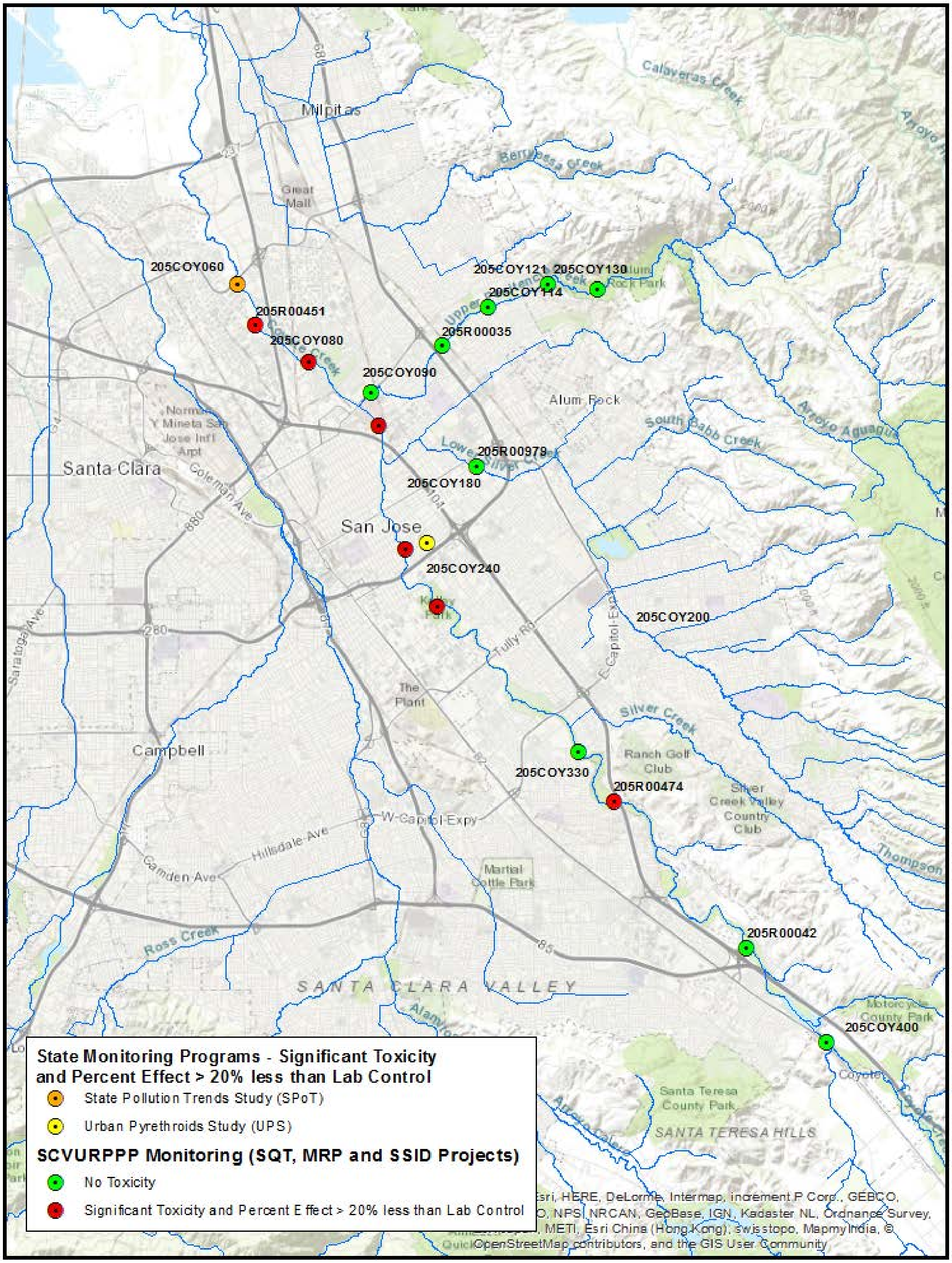

Figure 2. Monitoring locations for sediment toxicity data collected by SWAMP and SCVURPPP between 2008 and 2015.

4.0 SSID MONITORING APPROACH AND SCHEDULE

The Program will implement an adaptive monitoring approach to further investigate potential sources and causes of sediment toxicity in Coyote Creek. The approach is described below and illustrated as a flow diagram in Figure 3 . The approach is consistent with Section C.8.e.iii.(1)(f) of the MRP, which states:

"*Conduct a site specific study (or non-site specific if the problem is wide-spread) in a stepwise process to identify and isolate the cause(s) of the trigger stressor/source…..for toxicity studies where there is no chemical pollutant associated with the creek status monitoring sample exhibiting toxicity, a TIE should be conducted. Where chemical data indicate a pollutant, such as fipronil or a pyrethroid, is present at adverse effects levels in the sample location, it is not necessary to conduct a TIE, and the SSID project would be considered complete*."

The Coyote Toxicity SSID monitoring design includes an initial evaluation of sediment chemistry and toxicity testing during the dry season of WY 2018. Toxicity testing will be conducted using *Hyallela azteca* and *Chironomus dilutes* for acute toxicity. Sediment chemistry will be analyzed for metals and pesticides, including fipronil and pyrethroids. The Program will evaluate sediment chemistry results for adverse effects using analytical methods described in Section 4.4 below. In summary, if results indicate the following, the described next steps will be implemented.

- If toxicity tests exhibit **significant toxicity** and percent effect is greater than 20% reduction in survival (compared to the Lab Control) **AND** sediment chemistry results indicate the presence of pyrethroid or fipronil **pesticide at adverse effects levels** (i.e., greater than LC50 threshold), then the **SSID project will be considered complete**.

- If toxicity tests exhibit **significant toxicity**, **BUT the sediment chemistry results are inconclusive**, the Program will implement a **Toxicity Identification Evaluation** (TIE) consistent with guidance provided in the EPA sediment TIE manual (EPA/600/R-08/080). The TIE will consist of a series of treatments designed to identify the type of chemicals that may be causing toxicity (Anderson 2009). The Program will implement a TIE that includes three targeted tests: 1) Baseline sample (i.e., re-test of sample); 2) Activated Carbon (i.e., general organic contaminants); and 3) Cationic Resin (metals). The TIE will confirm toxicity is present (or not), and the type of contaminant (i.e., metal and/or organic) that may be causing the toxicity. TIEs are more effective when there is sufficient toxicity in the sample. Thus, a TIE will only be conducted for samples that exhibit toxicity with percent effect that is greater than 50% reduction in survival (compared to Lab Control). A maximum of one TIE will be conducted at two sites (total of two TIEs) for the SSID Project, providing all sites meet the 50% reduction in survival criterion. The TIE(s) will be conducted immediately following receipt of the sediment chemistry laboratory.

All toxicity testing, sediment chemistry results and TIE results from WY 2018 will be evaluated prior to any additional monitoring is considered for WY 2019.

Potential for Near-term Delisting

The potential for delisting Coyote Creek for toxicity even if no toxicity were observed during the study, appears to be challenging. Using the Water Board's 303(d) listing policy binomial distribution, a large number of samples with no toxicity would be required to effectively de-list Coyote Creek for sediment toxicity, considering the number of toxicity observations that have been documented over the course of the last decade. The Water Board 303(d) listing policy identifies 28-36 samples with no toxicity would be needed to de-list a waterbody that has two observations of toxicity (SWQCB 2015). This number would be larger due to additional exceedences that have occurred in Coyote Creek since the listing was made in 2008.

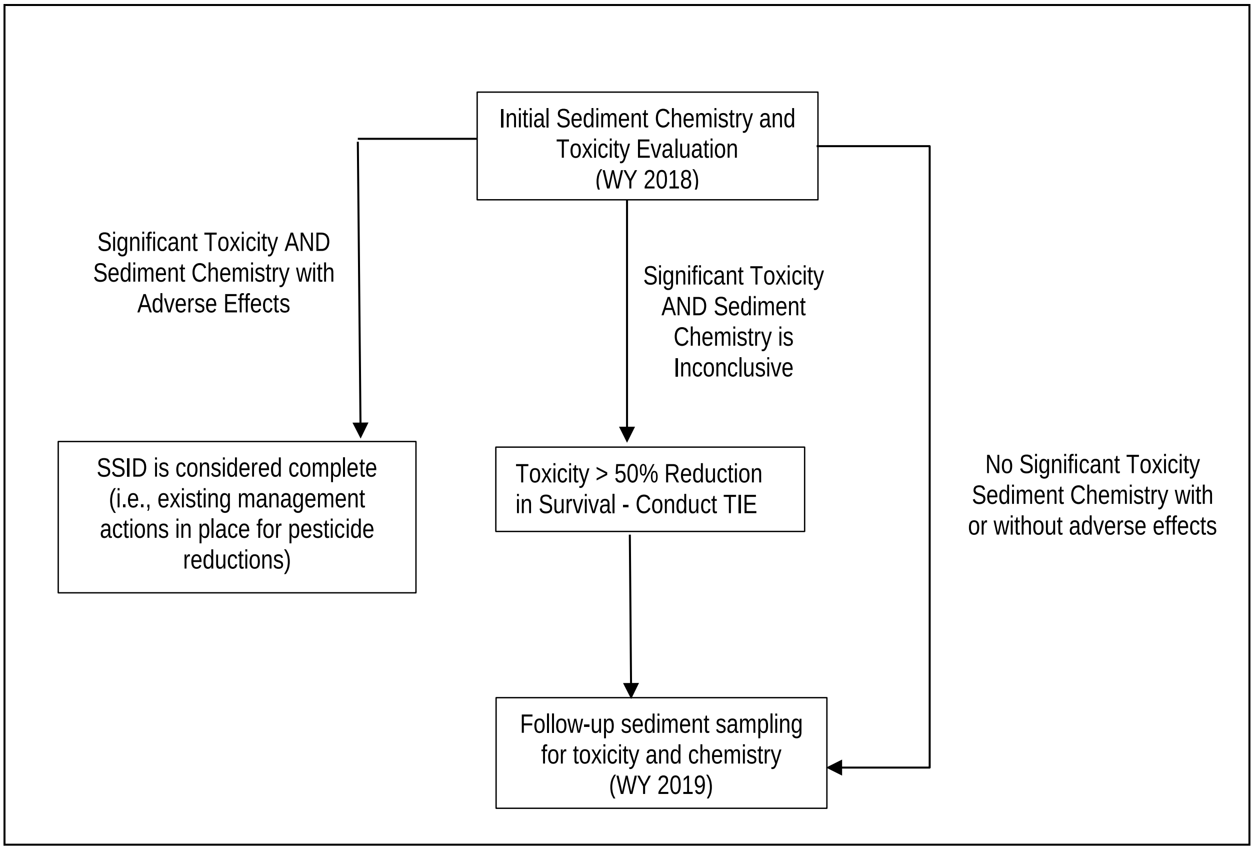

Figure 3. Adaptive monitoring approach used for the Coyote Toxicity SSID Project.

4.1 Sampling Locations

In WY 2018, bedded sediments will be collected at **five stations** that are located within the reach of the Coyote Creek mainstem that extends from Montague Expressway upstream to Kelley Park (south of Story Road). Samples will be collected at three stations that previously exhibited sediment toxicity in 2008. Sediment toxicity data that were used to determine the recommended 303(d) listing were collected at two of these stations. Sediment samples will also be collected at two stations with no previous toxicity data, but are within the reach of interest. Sampling location information is provided in Table 6 and illustrated in Figure 4.

Table 6. Sampling locations in WY 2018 for sediment chemistry and toxicity testing in Coyote Creek mainstem as part of the Coyote Toxicity SSID Project.

Station ID	Sampling Location	Lat	Long	Sampling History
205COY060	Coyote Creek at Montague Exp	37.39540	121.91485	SPoT monitoring site (2008 to present); tox data from 2008 used for 303(d) listing
205COY080	Coyote Creek at Oakland Ave	37.37778	121.89455	SCVURPPP SQT Study monitoring site; tox data collected in 2007 and 2008
205COY165	Coyote Creek at Maybury	37.36341	121.87445	New site located below confluence of Lower Silver Creek; (note:two sites on Lower Silver were toxic in SQT Study)
205COY240	Coyote Creek at Williams Park	37.33575	121.86707	Urban Pyrethroid Study monitoring site; tox data from 2007 used for 303(d) listing; SCVURPPP SQT Study monitoring site; tox data collected in 2007 and 2008
205COY250	Coyote Creek at Kelley Park	37.32444	-121.85983	New site; upstream extent of SSID Study Reach

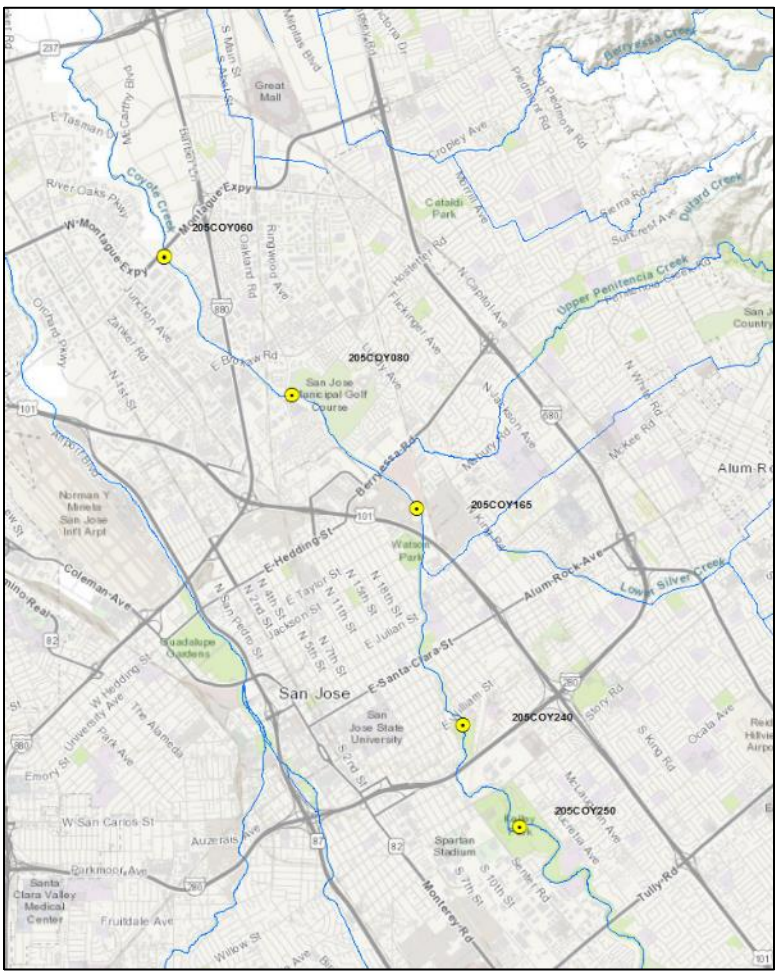

Figure 4. Sampling locations in WY 2018 for sediment chemistry and toxicity testing in Coyote Creek mainstem as part of the Coyote Toxicity SSID Project.

4.2 Schedule

One sampling event will occur during the dry season of WY 2018 (May-September 2018). The sampling event will be coordinated with a sediment sampling event that is planned for SCVURPPP's Pesticide and Toxicity Monitoring Project for WY 2018. The need for additional sampling events will be assessed following analyses of data collected in WY 2018. Additional monitoring activities, if deemed necessary, will be described in a revised Coyote Toxicity SSID Work Plan.

4.3 Field Monitoring Methods

Field sampling procedures will be conducted by Kinnetic Laboratories Inc. from Santa Cruz. Bedded sediment samples will be collected at each of the five sites for sediment chemistry and toxicity testing during the dry season of WY 2018. Sample collection will follow protocols described in RMC Quality Assurance Project Plan (QAPP; BASMAA 2016a) and RMC Standard Operating Procedures (BASMAA 2016b). A summary of the field methods is described below.

Water quality measurements will be collected at each site using a multi-parameter probe to measure temperature, pH, dissolved oxygen (DO) and specific conductance. Water quality measurements, field observations of water quality (e.g., odor, clarity, color, etc.), and site information (e.g., GPS coordinates, stream width and depth) will be recorded on a SWAMP field data sheet for each sampling event.

Prior to sediment sampling, field personnel will survey the proposed sampling area for appropriate fine-sediment depositional areas. Personnel will carefully enter the stream to avoid disturbing sediment at collection sub-sites. Sediment samples are collected from the top 2 cm at each sub-site beginning at the downstream-most location and continuing upstream. Sediment samples will be placed in a compositing container, thoroughly homogenized, and then aliquoted into separate jars for chemical or toxicological analysis using standard clean sampling techniques.

The sediment sample volumes and containers required for each analyte and/or test are listed in Table 7. All samples will be placed on ice, and delivery of samples to the analytical laboratory will be under chain-of-custody (COC) within specified hold time requirements. Sediment samples will be submitted to Caltest Analytical Laboratory in Napa for chemical analyses and to Pacific EcoRisk in Fairfield for toxicity testing.

Table 7. Containers and handling requirements for bedded sediment samples.

Analyte	Container	Hold Times	Handling Requirements
Sediment Toxicity	4L wide mouth glass	14 days	Preserved with ice, stored at 4°C
Pyrethroids and Fipronil	8 oz. amber glass jar	14 days	
Metals			
% Solids			
Total Organic Carbon	8 oz. amber glass jar	28 days	
Sediment Grain size			

4.4 Testing and Analytical Methods

Sediment samples will be analyzed using methods and reporting limits shown in Table 8. Sediment will be analyzed for pyrethroid and fipronil pesticides and metals. Sediment toxicity testing will be performed on *Hyalella azteca* and *Chironomus dilutus* using 10-Day acute endpoints (i.e., survival).

Data evaluation involves first determining whether the samples are toxic to the test organisms relative to the laboratory control treatment via statistical comparison using the Test of Significant Toxicity (TST) statistical approach. For samples with toxicity (i.e., those that "failed" the TST), the Percent Effect is evaluated. The Percent Effect compares sample endpoints (survival) to the laboratory control endpoints. A Percent Effect that is > 20 % survival (compared to Lab Control) is the threshold used to determine adverse effects. Both the TST result and the Percent Effect are determined by the laboratory.

Table 8. Analytical constituents, methods and reporting limits used for sediment samples collected for the Coyote Toxicity SSID Project.

Analyte	Analytical Method	Reporting Limit	Contracting Lab
TOTAL RECOVERABLE METALS (µg/kg)			
Arsenic	EPA 6020	500	*Caltest*
Cadmium		40	
Chromium		100	
Copper		200	
Lead		100	
Nickel		100	
Zinc		1000	
Total Organic Carbon* (%)	EPA 9060	0.1	
Sediment Grain Analysis* (%)	ASTM D422M/PSEP	1	
Percent Solids	EPA 160.3	NA	
Pyrethroid Pesticides, including fipronil (ug/kg)	SW846 8270 Mod (GCMS-NCI-SIM)	0.33	
TOXICITY TESTING			
10-Day *Hyalella azteca* acute	EPA-600-R-99-064 2nd Edition	NA	*Pacific EcoRisk*
10-day *Chrironomus dilutus* acute	EPA-600-R-99-064 2nd Edition	NA	

* *Analysis done by subcontracting lab*

Consistent with MRP Provision C.8.g.iv, sediment sample results will be compared to Probable Effects Concentrations (PECs) and Threshold Effects Concentrations (TECs) as defined by MacDonald et al. (2000). PEC and TEC quotients are calculated as the ratio of the measured concentration to the respective PEC and TEC values from MacDonald et al. (2000). All results where a PEC or TEC quotient is equal to or greater than 1.0 will be identified.

The TECs for bedded sediments are very conservative values that do not consider site specific background conditions, and are therefore not very useful in identifying real water quality concerns in receiving waters in the Santa Clara Valley. All sites in Santa Clara County are likely to have at least one TEC quotient equal to or greater than 1.0. This is due to high levels of naturally-occurring chromium and nickel in geologic formations (i.e., serpentinite) and soils that contribute to TEC and PEC quotients. These conditions should be considered when interpreting the data.

Toxicity unit (TU) equivalents for individual pyrethroid and fipronil results are based on available literature values for the LC50 values for these pesticides.[3] Because organic carbon mitigates the toxicity of pyrethroid pesticides in sediments, the LC50 values were derived on the basis of total organic carbon (TOC)-normalized concentrations. Therefore, the pesticide concentrations as reported by the lab will be divided by the measured TOC concentration at each site, and the TOC-normalized concentrations will be used to compute TU equivalents for each constituent.

[3] The LC50 is the concentration of a given chemical that is lethal on average to 50% of test organisms.

4.5 Quality Assurance

Quality Assurance/Quality Control (QA/QC) analyses include levels of precision and accuracy, and tolerable levels of error as presented in detail in the RMC QAPP (BASMAA et al., 2016a). Caltest Laboratories will perform all chemical analyses and Pacific EcoRisk (PER) will perform all toxicology analyses in accordance with the RMC QAPP and their respective quality assurance programs.

The sediment toxicity sampling event for the Coyote Toxicity SSID Project will be coordinated with sediment sampling associated with the Pesticide and Toxicity Monitoring (PTM) Project. As a result, the Coyote Toxicity SSID Project will not require the collection of field QA/QC samples. Since the samples collected for the Coyote Toxicity SSID Project will be in the same batch as the PTM Project, the same Reference Toxicant Test will be used.

4.6 Reporting

If the monitoring results from WY 2018 suggest further sampling and investigation is warranted, the Program will develop a revised Work Plan that will summarize results from WY 2018 and describe additional monitoring work to be conducted. If monitoring results suggest that Coyote Toxicity SSID project is complete, the Program will prepare a Final Report with data results and interpretation and will submit the Final Report to the Water Board on March 31, 2019 with the WY 2019 Urban Creeks Monitoring Report.

5.0 REFERENCES

Bay Area Stormwater Management Agency Association (BASMAA) Regional Monitoring Coalition (RMC). 2016a. Creek Status and Pesticides & Toxicity Monitoring Quality Assurance Project Plan, Final Version 3. Prepared for BASMAA by EOA, Inc. on behalf of the Santa Clara Urban Runoff Pollution Prevention Program and the San Mateo Countywide Water Pollution Prevention Program, Applied Marine Sciences on behalf of the Alameda Countywide Clean Water Program, and Armand Ruby Consulting on behalf of the Contra Costa Clean Water Program. 83 pp plus appendices.

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