Santa Clara Valley
Urban Runoff
Pollution Prevention Program

Watershed Monitoring and Assessment Program

Urban Creeks Monitoring Report

Part C: Pesticides and Toxicity Monitoring Status Report

Water Year 2023 (October 2022 – September 2023)

Submitted in compliance with provision C.8.h.iii.(3) of NPDES Permit No. CAS612008, Order No. R2-2022-018

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EOA inc.

This report is submitted by the agencies participating in the

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

City of Campbell	City of Milpitas	City of Santa Clara
City of Cupertino	City of Monte Sereno	City of Saratoga
City of Los Altos	City of Mountain View	City of Sunnyvale
Town of Los Altos Hills	City of Palo Alto	County of Santa Clara
Town of Los Gatos	City of San José	Valley Water

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ATTACHMENTS

LIST OF ACRONYMS

ACCWP	Alameda Countywide Clean Water Program
BAMSC	Bay Area Municipal Stormwater Collaborative
BASMAA	Bay Area Stormwater Management Agency Association
CCCWP	Contra Costa Clean Water Program
CEDEN	California Environmental Data Exchange Network
DF	Detection Frequency
DPR	(California) Department of Pesticide Regulation
FY	Fiscal Year
IMR	Integrated Monitoring Report
IPM	Integrated Pest Management
LID	Low Impact Development
MDL	Method Detection Limit
MPC	Monitoring and Pollutants of Concern
MRP	Municipal Regional Permit
NPDES	National Pollutant Discharge Elimination System
PAHs	Polycyclic Aromatic Hydrocarbons
PEC	Probable Effects Concentrations
PUR	(California) Pesticide Use Reporting (Program)
QAPP	Quality Assurance Project Plan
QAPrP	Quality Assurance Program Plan
QA/QC	Quality Assurance/Quality Control
RMC	Regional Monitoring Coalition
SCCWRP	Southern California Coastal Water Research Project
SCVURPPP	Santa Clara Valley Urban Runoff Pollution Prevention Program
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board
SMCWPPP	San Mateo Countywide Water Pollution Prevention Program
SOP	Standard Operating Procedure
SPoT	Stream Pollution Trends
SURF	Surface Water Database
SWAMP	Surface Water Ambient Monitoring Program
SWPP	Surface Water Protection Program
TEC	Threshold Effects Concentrations
TOC	Total Organic Carbon
TST	Test of Significant Toxicity
TU	Toxicity Unit
UCMR	Urban Creeks Monitoring Report
UPA	Urban Pesticides Amendments
USEPA	United States Environmental Protection Agency
WQO	Water Quality Objective
WY	Water Year

INTRODUCTION

This *Urban Creeks Monitoring Report (UCMR) Part C: Pesticides & Toxicity Monitoring Status*, *Water Year*[1] *(WY) 2023* was prepared by the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP or Program), on behalf of its 15 member agencies (13 cities/towns, the County of Santa Clara, and Valley Water), which are subject to the National Pollutant Discharge Elimination System (NPDES) stormwater permit for Bay Area municipalities referred to as the Municipal Regional Permit (MRP).

The MRP was first adopted by the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB or Regional Water Board) on October 14, 2009 as Order R2-2009-0074 (SFBRWQCB 2009; referred to as MRP 1.0). On November 19, 2015, the Regional Water Board updated and reissued the MRP as Order R2-2015-0049 (SFBRWQCB 2015; referred to as MRP 2.0). The current, and third, version of the MRP (i.e., MRP 3.0, SFBRWQCB 2022) was issued by the Regional Water Board as Order R2-2022-0018 and became effective July 1, 2022. The monitoring requirements in MRP 3.0 (SFBRWQCB 2022) are similar to those within MRP 2.0 (SFBRWQCB 2009), with minor differences in analytes and reporting structure.

This report fulfills the requirements of provision C.8.h.iii.(3) of MRP 3.0 for interpreting and reporting all Pesticides & Toxicity monitoring data collected during WY 2023 by SCVURPPP. This report builds on the interpretation and reporting on Pesticides & Toxicity monitoring data that were provided in the March 2020 Integrated Monitoring Report (IMR) (SCVURPPP 2020) and UCMRs from WYs 2016 through 2022 (SCVURPPP 2017 through 2023).[2]

Data presented in this report were collected pursuant to water quality monitoring requirements in provision C.8.g (Pesticides & Toxicity Monitoring) of the MRP.[3] Data presented in this report were submitted electronically to the Regional Water Board by SCVURPPP and may be obtained via the California Environmental Data Exchange Network (CEDEN).

1.1 Report Organization

This report is organized into the following sections:

- **Section 1.0** provides the relevant background information and regulatory requirements for Pesticides & Toxicity monitoring pursuant to the MRP.
- **Section 2.0** presents the methodology of Pesticides & Toxicity monitoring conducted by the Program in WY 2023, including brief descriptions of sampling protocols and analytical methods and a statement of data quality.
- **Section 3.0** discusses the results based on WY 2023 monitoring data.
- **Section 4.0** discusses conclusions and recommendations based on all Pesticide and Toxicity monitoring for SCVURPPP since WY 2016.
- **Section 5.0** provides all references used in citations for this report.

[1] Most hydrologic monitoring occurs for a period defined as a Water Year, which begins on October 1 and ends on September 30 of the named year. For example, Water Year 2023 (WY 2023) began on October 1, 2022 and concluded on September 30, 2023.

[2] Prior monitoring reports prepared by SCVURPPP are available at scvurppp.org

[3] Monitoring data collected pursuant to other C.8 provisions (e.g., Pollutants of Concern Monitoring, Low Impact Development (LID) Monitoring, and Trash Monitoring) are reported in other Reports of the SCVURPPP Urban Creeks Monitoring Reporting series (UCMR) for WY 2023.

1.2 Monitoring Requirements

Toxicity testing provides a tool for assessing the toxic effects (acute and chronic) of all chemicals in samples of receiving waters or sediments and allows the cumulative effect of the pollutant present in the sample to be evaluated. Because different test organisms are sensitive to different classes of chemicals and pollutants, several different organisms are monitored. Sediment and water chemistry monitoring for a variety of potential pollutants is conducted synoptically with toxicity monitoring to provide preliminary insight into the possible causes of toxicity should it be observed.

Provision C.8.g of the MRP requires Permittees to conduct wet and dry weather monitoring of pesticides and toxicity in urban creeks.

1.2.1 Dry Weather

Provision C.8.g.ii of MRP 3.0 requires the Program to collect two samples each year during dry weather for toxicity and sediment chemistry analysis. The permit provides examples of possible monitoring location types, including sites with suspected or past toxicity results and sites where bioassessment surveys have been conducted. MRP 3.0 dry weather monitoring includes:

- Toxicity testing in water using five species: *Ceriodaphnia* dubia (chronic survival and reproduction), *Pimephales promelas* (larval survival and growth), *Selenastrum capricornutum* (growth), *Hyalella azteca* (survival) and *Chironomus dilutus* (survival).
- Toxicity testing in sediment using two species: *Hyalella azteca* (survival) and *Chironomus dilutus* (survival).
- Sediment chemistry analysis for pyrethroids (bifenthrin, cyfluthrin, cypermethrin, deltamethrin, esfenvalerate, lambda-cyhalothrin, permethrin), fipronil and its degradates (fipronil-sulfone, fipronil-desulfinyl, fipronil sulfide), total polycyclic aromatic hydrocarbons (PAHs), metals (arsenic, cadmium, chromium, copper, lead, nickel, zinc), total organic carbon (TOC), and sediment grain size.

1.2.2 Wet Weather

Provision C.8.g.iii of MRP 3.0 requires Permittees to collect samples from the water column during storm events for toxicity and pesticide analysis. Sample locations must be representative of urban watersheds (i.e., bottom of watershed locations). Wet weather monitoring includes:

- Toxicity testing in water using five species: *Ceriodaphnia* dubia (chronic survival and reproduction), *Pimephales promelas* (larval survival and growth), *Selenastrum capricornutum* (growth), *Hyalella azteca* (survival) and *Chironomus dilutus* (survival).
- Water chemistry analysis for pyrethroids (bifenthrin, cyfluthrin, cypermethrin, deltamethrin, esfenvalerate, lambda-cyhalothrin, permethrin), fipronil and its degradates (fipronil-sulfone, fipronil-desulfinyl, fipronil sulfide)[4], and imidacloprid[5].

Provision C.8.g.iii provides two options to the determine the number of wet weather samples required. If provision C.8.g.iii sampling is conducted by the Bay Area Municipal Stormwater

[4] Fipronil amide is optional.

[5] Imidacloprid must be analyzed using a method that achieves a reporting level of 0.01 ppb.

Collaborative (BAMSC)[6] Regional Monitoring Coalition (RMC) on behalf of all MRP Permittees, a collective total of ten wet weather samples is required, with a minimum of six samples collected by the end of the third water year of the permit term (i.e., WY 2024). If provision C.8.g.iii sampling is conducted by individual countywide stormwater programs, SCVURPPP must collect at least two wet weather samples per year.

Members of the RMC have completed wet weather Pesticides & Toxicity monitoring in WY 2023. The SCVURPPP collected three of the ten regional samples.

1.2.3 Follow-up

Provision C.8.g.iv of the MRP requires Permittees to provide notification in the next UCMR when analytical results indicate any of the following:

- A toxicity test of growth, reproduction, or survival of any test organism that is reported as "fail" in both the initial sampling and a second, follow-up sampling, and both have ≥ 50% Percent Effect;
- A pollutant is present at a concentration exceeding its water quality objective (WQO) in the Basin Plan; or
- For pollutants without WQOs, results exceed Probable Effects Concentrations (PECs) or Threshold Effects Concentrations (TECs) as defined in MacDonald et al. (2000).

1.3 Regional Monitoring Coalition

Provision C.8.a. (Compliance Options) of the MRP allows Permittees to address monitoring requirements through a regional collaborative effort, their Stormwater Program, and/or individually.[7] The RMC was originally formed in early 2010 as a collaboration among several Bay Area Stormwater Management Agencies Association (BASMAA) members and MRP Permittees[8] to develop and implement regionally coordinated water quality monitoring programs that improve stormwater management in the region and address water quality monitoring required by the MRP. The BAMSC took over coordination of the RMC in 2020 and the collaboration allows Permittees and the Regional Water Board to improve their ability to collectively answer core management questions in a cost-effective and scientifically rigorous way. Participation in the RMC is facilitated through the BAMSC Monitoring and Pollutants of Concern (MPC) Subcommittee.

The goals of the RMC are to:

1. Assist Permittees in complying with requirements in provision C.8 (Water Quality Monitoring) of the MRP;
2. Develop and implement regionally consistent monitoring approaches and designs in the Bay Area, through the improved coordination among RMC participants and other agencies (e.g., Regional Water Board) that share common goals; and
3. Stabilize the costs of creek monitoring by reducing duplication of effort and streamlining reporting.

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[6] The BAMSC was organized by the Bay Area Stormwater Management Agencies Association (BASMAA) Board of Directors to continue the information sharing and permittee advocacy functions of BASMAA in an informal manner after BASMAA's dissolution in 2021.

[7] Provision C.8.g of MRP 3.0 also encourages Permittees to collaborate with the California Department of Pesticide Regulation for data collection and analysis.

[8] BAMSC RMC partners include SCVURPPP, Alameda Countywide Clean Water Program (ACCWP), Contra Costa Clean Water Program (CCCWP), San Mateo Countywide Water Pollution Prevention Program SMCWPPP, and the Solano Stormwater Alliance (SSA).

2.0 METHODS

Water quality data were collected and reviewed in accordance with California Surface Water Ambient Monitoring Program (SWAMP) comparable methods and procedures described in the RMC Standard Operating Procedures (SOPs; BASMAA 2016) and the associated Quality Assurance Project Plan (QAPP; BASMAA 2020). These documents are updated as needed to optimize applicability. Where applicable, monitoring data were collected using methods comparable to those specified by the SWAMP Quality Assurance Program Plan (QAPrP)[9], and were submitted in SWAMP-compatible format to the Regional Water Board. The SOPs were developed using a standard format that describes health and safety cautions and considerations, relevant training, site selection, and sampling methods/procedures, including pre-fieldwork mobilization activities to prepare equipment, sample collection, and de-mobilization activities to preserve and transport samples.

2.1 Monitoring Methods

Water and sediment samples for pesticides and toxicity monitoring were collected in accordance with SWAMP-comparable methods and procedures described in the RMC SOPs (BASMAA 2016) and the associated QAPP (BASMAA 2020). Before sampling, field personnel conduct a qualitative assessment of the proposed sampling site to identify appropriate sampling locations. This is particularly necessary for sediment sampling, which requires the presence of fine-sediment depositional areas that can support at least five sub-sites within a 100-meter reach.

Water samples were collected using standard grab sampling methods. The required number of labeled bottles were filled and placed on ice to cool to < 6˚C. The laboratories were notified of the impending sampling delivery to meet sample hold times. Procedures used for sampling and transporting water samples are described in SOP FS-2 (BASMAA 2016).

Sediment samples were collected after water sample collection. Sediment samples were collected from the top 2 cm at each sub-site beginning at the downstream-most location and continuing upstream. Field staff walk in an upstream direction, carefully avoiding disturbance of sediment at collection sub-sites. Sediment samples were placed in a compositing container, thoroughly homogenized, and then aliquoted into separate jars for chemical or toxicological analysis using standard clean sampling techniques (see SOP FS-6, BASMAA 2016).

Samples were submitted to respective laboratories under RMC SOP FS-9 Chain of Custody procedures and field data sheets were reviewed per SOP FS-13 (BASMAA 2016).

2.2 Laboratory Analysis Methods

RMC participants, including SCVURPPP, agreed to use the same laboratories for individual parameters, developed standards for contracting with the labs, and coordinated shared quality assurance samples. All samples collected by RMC participants that were sent to laboratories for analysis were analyzed and reported per SWAMP-comparable methods as described in the QAPP (BASMAA 2020). Analytical laboratory methods, reporting limits, and holding times for chemical water quality parameters are also described in the QAPP (2020). Analytical laboratory contractors in WY 2023 included CalTest, Inc. (sediment chemistry) and Pacific EcoRisk, Inc. (water and sediment toxicity).

[9]The current SWAMP QAPrP is available at: https://www.waterboards.ca.gov/water_issues/programs/swamp/docs/swamp-qaprp-2022.pdf

2.3 Data Evaluation

2.3.1 Water and Sediment Toxicity

Toxicity data evaluation required by the MRP involves first assessing 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, reproduction, growth) to the laboratory control endpoints. Both the statistical comparison (e.g., TST) and the comparison of the sample results to the laboratory control (e.g., Percent Effect) are determined by the laboratory. If both the initial and follow-up sample are reported as "fail" with ≥ 50% Percent Effect, the Regional Water Board is notified in the next UCMR.

2.3.2 Sediment Chemistry

In compliance with MRP provision C.8.g.iv, sediment sample results are compared 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 are reported in the next UCMR.

PECs and TECs are listed in MacDonald et al. (2000) for total PAHs, rather than the individual PAHs that are reported by the laboratory. Total PAH concentrations were calculated by summing the concentrations of the 24 individual PAHs that were measured by SCVURPPP. Concentrations equal to one-half of the respective laboratory method detection limits (MDLs) were substituted for non-detect data so that calculations and statistics could be computed. Therefore, some of the TEC and PEC quotients may be artificially elevated due to the method used to account for filling in non-detect data.

The TECs for bedded sediments are very conservative values that do not consider site specific background conditions and therefore may not be very useful in identifying real water quality concerns in receiving waters. 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 local ultramafic geologic formations (i.e., serpentinite) and soils. These conditions are considered when making decisions about follow-up investigations.

MRP 3.0 does not specify follow-up actions for pyrethroid or fipronil sediment chemistry data, perhaps because pyrethroids are ubiquitous in the urban environment and little is known about fipronil distribution. However, SCVURPPP computed toxic unit (TU) equivalents for individual pyrethroid results based on available literature values for pyrethroids in sediment LC50 values.[10] Because organic carbon mitigates the toxicity of pyrethroid pesticides in sediments, the LC50 values were derived on the basis of TOC-normalized concentrations. Therefore, the pesticide concentrations as reported by the lab were divided by the measured TOC concentration at each site, and the TOC-normalized concentrations were then used to compute TU equivalents for each constituent. Concentrations equal to one-half of the respective laboratory MDLs were substituted for non-detect data so that these statistics could be computed, potentially resulting in artificially elevated results.

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

2.3.3 Water Chemistry

Provision C.8.g.iv of the MRP requires that chemical pollutant data from water and sediment monitoring be compared to the corresponding WQOs in the Basin Plan for each analyte sampled. If concentrations in the samples exceed their WQOs, then the Regional Water Board is notified in the next UCMR. However, the Basin Plan does not contain numeric WQOs for the chemical analytes encompassed within the wet weather pesticide monitoring.

2.3.4 Statement of Data Quality

A comprehensive Quality Assurance/Quality Control (QA/QC) program was implemented by SCVURPPP covering all aspects of Pesticides & Toxicity monitoring. In general, QA/QC procedures were implemented as specified in the RMC QAPP (BASMAA, 2020) and monitoring was performed according to protocols specified in the RMC SOPs (BASMAA 2016). Both documents were adapted from the methods detailed in the SWAMP QAPrP.

Overall, the results of the QA/QC review suggest that the Pesticides & Toxicity Monitoring data generated during WY 2023 were of sufficient quality in comparison to objectives outlined in the QAPP. However, some data were flagged in accordance with QA/QC protocols. A detailed QA/QC report for WY 2023 data is included as Attachment 1.

3.0 RESULTS AND DISCUSSION

This section describes the results of toxicity testing, sediment chemistry, and pesticide monitoring (collectively referred to as pesticides and toxicity monitoring) conducted during WY 2023 in compliance with provision C.8.g of the MRP. Historical data from the WY 2023 stations and pesticides and toxicity monitoring results from projects external to SCVURPPP are also discussed. External programs' monitoring sites can provide SCVURPPP with valuable data to inform management efforts for Santa Clara Basin urban creeks with respect to achievement of WQOs and support of beneficial uses.

From WY 2016 through WY 2023, dry weather water and sediment toxicity and sediment chemistry monitoring was conducted by SCVURPPP at two sites: Stevens Creek (37.4098, -122.0691) in the City of Mountain View and San Tomas Aquino Creek (37.3886, -121.9685) in the City of Santa Clara (Figure 3.1).

In WY 2023, collection of wet weather water samples was conducted in coordination with the RMC during a storm event on November 8, 2022. Samples were collected from three stations, the Stevens and San Tomas Aquino Creek dry weather stations and the Guadalupe River. The Guadalupe River station (205GUATRM) was selected in coordination with the California Department of Pesticide Regulation's (DPR) Surface Water Protection Program (SWPP). This station is part of DPR's FY 2020-21 *Surface Water Monitoring for Pesticides in Urban Areas of Northern California Program* (Smith 2021). SCVURPPP collected extra sample volume from this station and shipped it to the California Department of Food and Agriculture Center for Analytical Chemistry in Sacramento, California for DPR analysis of a larger suite of pesticides analytes than those targeted by the MRP. Coordination with DPR provided DPR with expanded storm monitoring capabilities and will provide SCVURPPP with additional analytical results when published.

Wet weather sample results from WY 2018, collected in compliance with MRP 2.0, are included in this section for context. All monitoring stations are mapped in Figure 3.1.

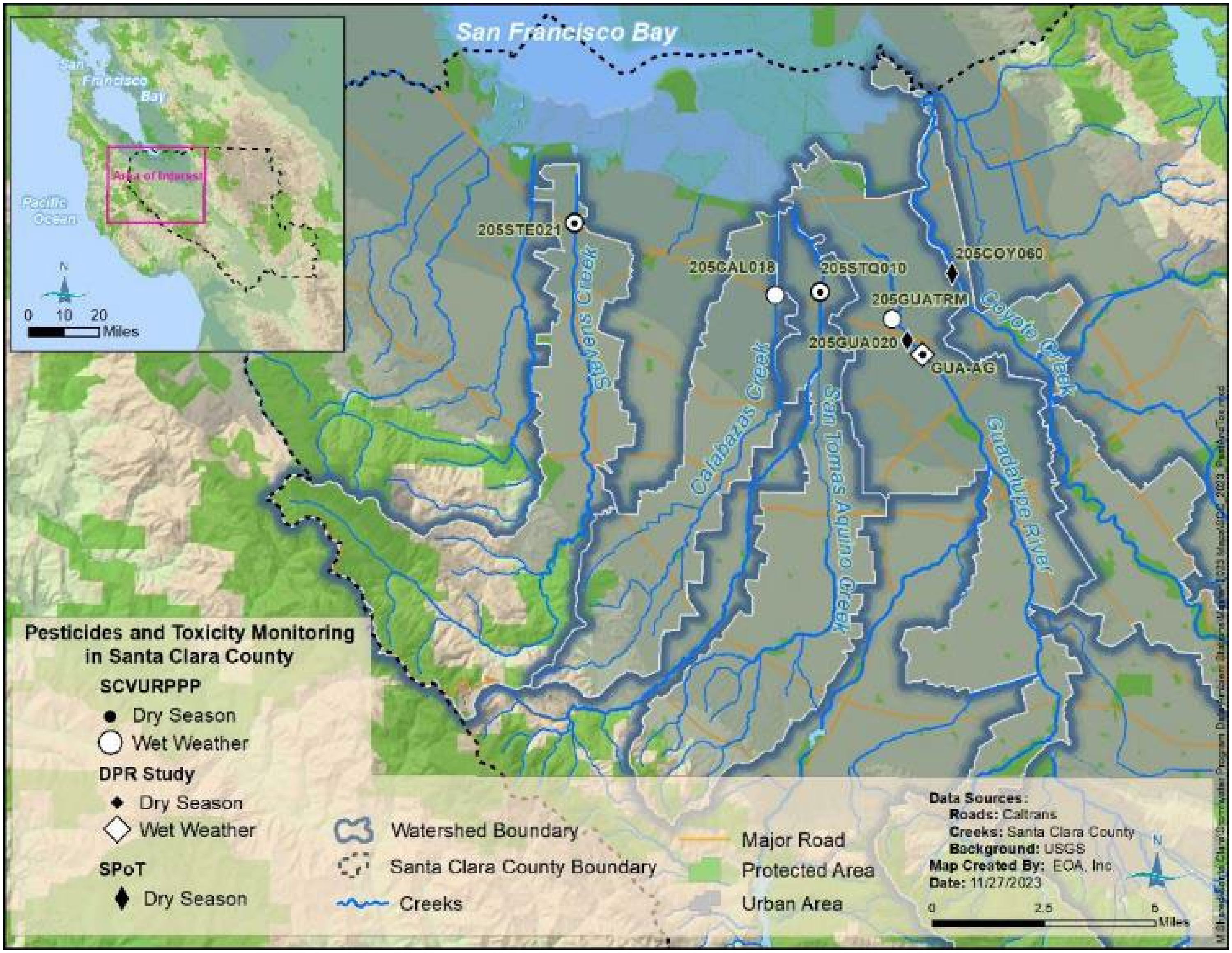

Figure 3.1. Pesticides and toxicity sampling stations in the Santa Clara Basin during WY 2016 through WY 2023..

3.1 Toxicity

3.1.1 WY 2023 Dry Weather Results

Table 3.1 provides a summary of toxicity testing results for water and sediment samples collected during dry weather on July 18, 2023.

- **San Tomas Aquino Creek (205STQ010).** Of the seven water toxicity endpoints, there was just one observation of significant toxicity (*C. dubia* reproduction in water); however, the Percent Effect was less than 50% and no resample was required. The sediment sample was significantly toxic to both test organisms (*C. dilutus* and *H. azteca*); however, the Percent Effect did not exceed the 50% threshold required for resampling for either organism. Sample collection occurred underneath a bridge where there was creek flow (Figure 3.2).

- **Stevens Creek (205STE021).** The sediment sample at this site was not significantly toxic to either *C. dilutus* or *H. azteca*. The water sample was significantly toxic to two of the five test organisms (*C. dubia,* reproduction and *C. dilutus*, survival), with a Percent Effect for *C. dubia* exceeding the 50% threshold for resampling. The *C. dubia* (reproduction) resampling event was conducted on September 11, 2023 (Figure 3.3). The second water sample was also significantly toxic to *C. dubia* reproduction with a Percent Effect exceeding the 50% MRP trigger. The cause of the toxicity in the water sample collected from Stevens Creek is unknown. However, chronic (reproduction) toxicity to *C. dubia* has been observed in some prior samples collected by SCVURPPP (Table 3.3). See below for further discussion of *C. dubia* toxicity. In 2010, Stevens Creek was added to the Clean Water Act (CWA) Section 303(d) list of impaired waterbodies due to toxicity in the water column, including toxicity to *H. azteca.* Although no data have been published, Water Board staff has recently conducted sampling of the creek to examine the current status of the impairment in preparation for development of a Total Maximum Daily Load (TMDL).[11]

Figure 3.2. San Tomas Aquino Creek (205STQ010), upstream view (left) and downstream view (right), July 18, 2023. (Photo credit: Kinnetic Environmental, Inc.).

11 https://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/stevenscktoxicity.html#:~:text=Stevens%20Creek%20was%20identified%20in,survival%2C%20growth%2C%20or%20reproduction

Figure 3.3. Stevens Creek (205STE021), upstream view (left) and downstream view (right), September 11, 2023. (Photo credit: Kinnetic Environmental, Inc.).

Table 3.1. Summary of SCVURPPP dry weather toxicity results for WY 2023. Shaded cells indicate significant toxicity; bold cells indicate a Percent Effect ≥50%.

Site	Organism	Test Type	Unit	Results: Lab Control	Results: Organism Test	% Effect	TST Value	Follow up needed (TST "Fail" and ≥50%)
205STQ010 San Tomas Aquino Creek July 18, 2023	**Water**							
	Ceriodaphnia dubia	Survival	%	90	90	0%	NA[1] (Pass)	No
		Reproduction	Num/Rep	32	18	44%	Fail	No
	Pimephales promelas	Survival	%	95	95	0%	Pass	No
		Growth	mg/ind	0.82	0.65	21%	Pass	No
	Chironomus dilutus	Survival	%	98	90	8%	Fail	No
	Hyalella azteca	Survival	%	98	98	0%	Pass	No
	Selenastrum capricornutum	Growth	cells/ml	2503000	3678000	-47%	Pass	No
	Sediment							
	Chironomus dilutus	Survival	%	73	39	47%	Fail	No
	Hyalella azteca	Survival	%	94	55	41%	Fail	No
205STE021 Stevens Creek July 18, 2023	**Water**							
	Ceriodaphnia dubia	Survival	%	90	70	22%	NA[1] (Pass)	No
		Reproduction	Num/Rep	32	14	**57%**	**Fail**	**Yes**
	Pimephales promelas	Survival	%	95	98	-3%	Pass	No
		Growth	mg/ind	0.82	0.66	20%	Pass	No
	Chironomus dilutus	Survival	%	98	85	13%	Fail	No
	Hyalella azteca	Survival	%	98	100	-2%	Pass	No
	Selenastrum capricornutum	Growth	cells/ml	2503000	4305000	-72%	Pass	No
	Sediment							
	Chironomus dilutus	Survival	%	73	70	3%	Pass	No
	Hyalella azteca	Survival	%	94	94	0%	Pass	No
205STE021 Stevens Creek September 11, 2023	**Water**							
	Ceriodaphnia dubia	Reproduction	Num/Rep	29	13	**54%**	**Fail**	**NA**

[1] TST analysis is not performed for survival endpoint - a percent effect <25% is considered a "Pass", and a percent effect ≥25% is considered a "Fail"

3.1.2 WY 2023 Wet Weather Results

The MRP 3.0 provision for wet weather toxicity and pesticide analysis was satisfied with a regional sampling event on November 8, 2022. The SCVURPPP was responsible for three of the ten regional sites with results detailed below. Table 3.2 shows all WY 2023 wet weather SCVURPPP toxicity sample results. A photo of the Guadalupe River station (205GUATRM) is shown in Figure 3.4.

Figure 3.4. Wet weather sampling at Guadalupe River on November 8, 2022 (Photo credit: Kinnetic Environmental, Inc.).

- **San Tomas Aquino Creek (205STQ010)**

  No samples were found to be significantly toxic.

- **Stevens Creek (205STE021)**

  No samples were found to be significantly toxic

- **Guadalupe River (205GUATRM)**

  Sample water from the Guadalupe River at Trimble Road in San Jose ((Figure 3.4) was significantly toxic to *H. azteca* and had a Percent Effect greater than 50% (Table 3.2). A follow-up sampling event was conducted approximately two months later at the same site with similar weather conditions, which resulted in a significantly toxic sample with a Percent Effect less than 50% for *H. Azteca* (Table 3.2).

Table 3.2. Summary of SCVURPPP wet weather water toxicity results for WY 2023. Shaded cells indicate significant toxicity; bold cells indicate a Percent Effect ≥50%.

Site	Organism	Test Type	Unit	Results: Lab Control	Results: Organism Test	% Effect	TST Value	Follow up needed (TST "Fail" and ≥50%)
205GUATRM Guadalupe River November 8, 2022	*Ceriodaphnia dubia*	Survival	%	100	100	0%	NA [1] (Pass)	No
		Reproduction	Num/Rep	42	42	0%	Pass	No
	Pimephales promelas	Survival	%	100	95	5%	Pass	No
		Growth	mg/ind	0.80	0.79	1%	Pass	No
	Chironomus dilutus	Survival	%	95	90	5%	Pass	No
	Hyalella azteca	Survival	%	100	37	**63%**	**Fail**	**Yes**
	Selenastrum capricornutum	Growth	cells/ml	2943000	6140000	-109%	Pass	No
205GUATRM Guadalupe River January 10, 2023	*Hyalella azteca*	Survival	%	100	60	40%	Fail	No
205STQ010 San Tomas Aquino Creek November 8, 2022	*Ceriodaphnia dubia*	Survival	%	100	100	0%	NA [1] (Pass)	No
		Reproduction	Num/Rep	42	37	11%	Pass	No
	Pimephales promelas	Survival	%	100	85	15%	Pass	No
		Growth	mg/ind	0.80	0.70	13%	Pass	No
	Chironomus dilutus	Survival	%	95	98	-3%	Pass	No
	Hyalella azteca	Survival	%	100	84	16%	Pass	No
	Selenastrum capricornutum	Growth	cells/ml	2943000	5660000	-92%	Pass	No
205STE021 Stevens Creek November 8, 2022	*Ceriodaphnia dubia*	Survival	%	100	100	0%	NA [1] (Pass)	No
		Reproduction	Num/Rep	42	40	5%	Pass	No
	Pimephales promelas	Survival	%	100	90	10%	Pass	No
		Growth	mg/ind	0.80	0.73	9%	Pass	No
	Chironomus dilutus	Survival	%	95	97	-2%	Pass	No
	Hyalella azteca	Survival	%	100	92	8%	Pass	No
	Selenastrum capricornutum	Growth	cells/ml	2943000	5728000	-95%	Pass	No

[1] TST analysis is not performed for survival endpoint - a percent effect <25% is considered a "Pass", and a percent effect ≥25% is considered a "Fail"

3.1.3 WY 2016 – WY 2023 Results Summary

Toxicity results from water and sediment samples collected in San Tomas Aquino and Stevens Creek from WY 2016 through WY 2023 are summarized in Table 3.3. These data include the annual dry season samples, as well as six wet weather samples (and three follow-up samples) collected in WY 2018 and WY 2023 in compliance with MRP 2.0 and MRP 3.0. Details of the toxicity tests conducted can be found in the UCMR for each associated year (SCVURPPP 2023, 2022, 2021, 2020, 2019a, 2018, 2017). Details of WY 2019 toxicity test results are compiled with prior years in the Program's MRP 2.0 IMR (SCVURPPP 2020).

From WY 2016 through WY 2023, three sediment samples and seven dry season water samples had observed toxicity relative to the laboratory control *and* a Percent Effect exceeding the MRP evaluation criteria of 50% (see Section 2.3.1 for an explanation of toxicity data evaluation). The September 11, 2023, resample was also found to be significantly toxic with a Percent Effect greater than 50%. There were an additional 19 dry season test results where significant toxicity was observed, but the Percent Effect did not exceed the Percent Effect threshold. There were three wet weather samples with toxicity results exceeding the MRP evaluation criteria and three with toxicity but a Percent Effect below 50%. None of the wet weather follow-up tests exceeded the Percent Effect threshold.

A review of the eight-year toxicity summary in Table 3.3 reveals several findings:

- ***H. azteca*.** Toxicity to *H. azteca*, a test organism known to be sensitive to pyrethroid pesticides, was observed in WY 2022 and WY 2023 dry season sediment samples and was also observed in the wet weather water samples collected in WY 2018 and WY 2023. Pyrethroid pesticides tend to accumulate in sediment and pyrethroids in sediment samples collected synoptic with the dry season toxicity samples (summarized for WY 2016 – WY 2023 in Table 3.7) sometimes approach or exceed levels of concern (i.e., TU equivalent of 1.0). However, long-term monitoring of local creeks by the Stream Pollution Trends (SPoT) monitoring program suggests that pyrethroid concentrations in sediment have decreased since 2011/2012 (SCVURPPP 2019b). It is unknown whether the toxicity to *H. azteca* observed in WY 2022 and WY 2023 dry season sediment and WY 2018 and WY 2023 wet weather water samples is directly related to pyrethroids or some other toxic substance present in the creeks.
- ***C. dilutus.*** Toxicity to *C. dilutus*, a test organism known to be sensitive to neonicotinoids (e.g., imidacloprid) and fipronil, was observed in sediment and water samples collected during the dry season, include three sediment samples from San Tomas Aquino Creek that resulted in a Percent Effect exceeding the MRP threshold for resampling. The most recent retest was done in WY 2022, which resulted in a significantly toxic sample with a Percent Effect less than the MRP threshold (Table 3.2). Toxicity to *C. dilutus* was also observed in a WY 2023 sediment sample from San Tomas Aquino creek, but the Percent Effect was below 50%. Toxicity to *C. dilutus* was not observed in any of the six wet weather samples collected in WY 2018 and WY 2023. Although fipronil and its degradates are rarely detected in synoptic sediment samples, it appears plausible that the water quality impacts associated with pyrethroid pesticides may be decreasing, while impacts associated with their replacements (i.e., neonicotinoids) may be increasing as these types of pesticides have gained market share.
- ***C. dubia* (reproduction).** Of the 29 dry season samples where significant toxicity was observed, nearly half (n=13) were water samples with *C. dubia* reproduction toxicity. WY 2023 had significantly toxic samples from Stevens Creek with a Percent Effect higher

than 50% for both the initial and follow-up samples. *Ceriodaphnia dubia* is a water flea that is sensitive to a broad range of aquatic contaminants. However, the specific cause of the chronic *C. dubia* toxicity in San Tomas Aquino and Stevens Creeks is unknown, not seemingly explained by the synoptic sediment chemistry results.

In preparation for reissuance of the SWAMP QAPrP in 2013, the SWAMP Toxicity Work Group examined conductivity tolerance in freshwater toxicity test species with respect to the relationship between sample water conductivity and observed toxicity. It was determined that *C. dubia* survival and reproduction are negatively affected at high and low conductivities (SWAMP 2013). The SWAMP Toxicity Work Group (2013) recommended “appropriate controls” when sample water has high (>1900 µS/cm) or low (<100 µS/cm) conductivities because the *C. dubia* test organisms cultivated in the laboratory under standard laboratory conditions (e.g., 310 to 360 µS/cm) may perish or experience reduced reproduction when exposed to the sample water. Considering these findings, SCVURPPP compiled the results of conductivity measurements taken from sample water associated with toxicity monitoring from WY 2012 through WY 2020 to compare with the laboratory water used in these toxicity tests and the results of the tests themselves. In almost all cases, it was found that the sample water conductivity was higher or lower by several hundred µS/cm compared to the laboratory control samples (a mean difference of approximately 433 µS/cm). However, no correlation was found between *C. dubia* toxicity and sample water/laboratory control water conductivity differences.

Statewide, there have been other reports of unexplained chronic *C. dubia* toxicity, within and between laboratory variability in the magnitude of toxicity, and suspicion of false positives. An analysis by SWAMP in conjunction with the Statewide Toxicity Provisions adopted by the State Water Board on December 1, 2020 indicates that *C. dubia* toxicity variability could arise from inconsistencies in QA procedures used by laboratories. A final report of a nearly three-year special study requested by the State Water Board and completed by the Southern California Coastal Water Research Project (SCCWRP) was released in September 2023 (Brent et al. 2023). The SCCWRP report investigates levels and sources of variability in lab testing for *C. dubia* toxicity testing. The study also provides recommendations for regulators, regulated parties, and testing laboratories that will enhance the data quality for *C. dubia* toxicity tests and affect stormwater toxicity provisions.

There are many factors that may influence *C. dubia* toxicity test results. The *Ceriodaphnia dubia* Quality Assurance Guidance Recommendations (Study; Brent et al. 2023) investigated laboratory techniques and historical data to better understand how variabilities in test results can be explained and reduced. Laboratory visits and interlaboratory comparisons were also conducted, which found that no two laboratories performed *C. dubia* toxicity testing in the same manner (Brent et al. 2023). Inconsistencies between lab processes on many factors were observed (e.g. recipes for dilution water, food sources, feeding methods, test chambers, volumes, light intensities, health assessments). The Study recommended guidance for laboratory best practices, accreditation, and training. A list of constraints were also provided by the Study that limit the conclusions and recommendations of the Study. Overall, the main concern that was identified in the Study was lab performance, not test methods.

Table 3.3. Toxicity test result summary, WY 2016 – WY 2023. The Percent Effect is indicated for test results with toxicity relative to the lab control. Test results with toxicity exceeding the MRP threshold of 50 Percent Effect are highlighted.

Station ID	Creek	Date	Water Year	Season	Sediment		Water						
					C. dilutus	*H. azteca*	*C. dubia*		*P. promelas*		*C. dilutus*	*H. azteca*	*S. capricornutum*
					Survival	Survival	Survival	Reproduction	Survival	Growth	Survival	Survival	Growth
San Tomas Aquino Creek Dry Season Samples													
205STQ010	San Tomas Aquino Cr	7/11/2016	WY 2016	Dry	**Yes** (18%)	No	No	No	No	No	No	No	No
205STQ010	San Tomas Aquino Cr	7/13/2017	WY 2017	Dry	No	No	No	**Yes** (30%)	No	No	**Yes** (11%)	No	No
205STQ010	San Tomas Aquino Cr	7/17/2018	WY 2018	Dry	No	No	No	No	No	No	No	No	No
205STQ010	San Tomas Aquino Cr	7/23/2019	WY 2019	Dry	**Yes** (56%)	No	No	**Yes** (31%)	No	No	No	No	No
205STQ010	San Tomas Aquino Cr	8/28/2019	WY 2019	Dry [a]	No	--	No	--	--	--	--	--	--
205STQ010	San Tomas Aquino Cr	7/22/2020	WY 2020	Dry	No	No	No	**Yes** (67%)	No	No	**Yes** (31%)	No	No
205STQ010	San Tomas Aquino Cr	9/9/2020	WY 2020	Dry [a]	--	--	--	No	--	--	--	--	--
205STQ010	San Tomas Aquino Cr	6/23/2021	WY 2021	Dry	**Yes** (57%)	No	No	**Yes** (45%)	No	No	No	No	No
205STQ010	San Tomas Aquino Cr	8/18/2021	WY 2021	Dry [a]	--	--	No	No	--	--	--	--	--
205STQ010	San Tomas Aquino Cr	7/12/2022	WY 2022	Dry	**Yes** (100%)	**Yes** (47.4%)	No	No	No	No	No	No	No
205STQ010	San Tomas Aquino Cr	9/6/2022	WY 2022	Dry [a]	**Yes** (25%)	--	--	--	--	--	--	--	--
205STQ010	San Tomas Aquino Cr	7/18/2023	WY 2023	Dry	**Yes** (47%)	**Yes** (41%)	No	**Yes** (44%)	No	No	No	No	No
Stevens Creek Dry Season Samples													
205STE021	Stevens Cr	7/11/2016	WY 2016	Dry	No	No	No	No	**Yes** (27%)	No	No	No	No
205STE021	Stevens Cr	7/13/2017	WY 2017	Dry	No	No	No	**Yes** (80%)	No	No	No	No	No
205STE021	Stevens Cr	8/15/2017	WY 2017	Dry [a]	--	--	No	No	--	--	--	--	--
205STE021	Stevens Cr	7/17/2018	WY 2018	Dry	No	No	No	No	No	No	**Yes** (24%)	No	No
205STE021	Stevens Cr	7/23/2019	WY 2019	Dry	No	No	No	**Yes** (73%)	No	No	**Yes** (18%)	No	No
205STE021	Stevens Cr	9/18/2019	WY 2019	Dry [a]	--	--	No	**Yes** (47%)	--	--	--	--	--
205STE021	Stevens Cr	7/22/2020	WY 2020	Dry	No	No	**Yes** (30%)	**Yes** (79%)	No	No	No	No	No
205STE021	Stevens Cr	9/9/2020	WY 2020	Dry [a]	--	--	--	No	--	--	--	--	--
205STE021	Stevens Cr	6/23/2021	WY 2021	Dry	No	No	**Yes** (40%)	**Yes** (57%)	No	No	No	No	No
205STE021	Stevens Cr	8/18/2021	WY 2021	Dry [a]	No	--	--	--	--	--	--	--	--
205STE021	Stevens Cr	7/12/2022	WY 2022	Dry	No	No	No	**Yes** (24%)	No	No	No	No	No
205STE021	Stevens Cr	7/18/2023	WY 2023	Dry	No	No	No	**Yes** (57%)	No	No	**Yes** (13%)	No	No
205STE021	Stevens Cr	9/11/2023	WY 2023	Dry [a]	--	--	--	**Yes** (54%)	--	--	--	--	--
Wet Weather Samples													
205STQ010	San Tomas Aquino Cr	1/8/2018	WY 2018	Wet	--	--	No	No	No	No	No	**Yes** (56%)	No
205STQ010	San Tomas Aquino Cr	3/1/2018	WY 2018	Wet [a]	--	--	No	--	--	--	--	No	--
205STE021	Stevens Cr	1/8/2018	WY 2018	Wet	--	--	No	No	No	No	No	**Yes** (28%)	No
205CAL018	Calabazas Cr	1/8/2018	WY 2018	Wet	--	--	No	No	No	No	No	**Yes** (60%)	No
205CAL018	Calabazas Cr	3/1/2018	WY 2018	Wet [a]	--	--	No	--	--	--	--	**Yes** (12%)	--
205GUATRM	Guadalupe River	11/8/2022	WY 2023	Wet	--	--	No	No	No	No	No	**Yes** (63%)	No
205GUATRM	Guadalupe River	1/10/2023	WY 2023	Wet [a]	--	--	--	--	--	--	--	**Yes** (40%)	--
205STE021	Stevens Cr	11/8/2022	WY 2023	Wet	--	--	No	No	No	No	No	No	No
205STQ010	San Tomas Aquino Cr	11/8/2022	WY 2023	Wet	--	--	No	No	No	No	No	No	No

[a] Resample.

3.2 Sediment Chemistry

3.2.1 WY 2023 Results

Sediment chemistry results from WY 2023 were evaluated as potential stressors based on TEC and PEC quotients (see Section 2.3.2). The Program also evaluated TU equivalents of pyrethroids and fipronil to inform stormwater management.

Table 3.4 lists concentrations and TEC quotients for sediment chemistry constituents (metals and total PAHs) collected in WY 2023 from Stevens Creek and San Tomas Aquino Creek. TEC quotients are calculated as the measured concentration divided by the highly conservative TEC value, per MacDonald et al. (2000).[12] TECs are extremely conservative and are intended to identify concentrations below which harmful effects on sediment-dwelling organisms are unlikely to be observed. Both sites had at least one result with a TEC quotient greater than 1.0 (Table 3.4). These included chromium, copper, lead, and nickel in Stevens Creek, and nickel in San Tomas Aquino Creek. Nickel and chromium are expected in watersheds draining hillsides underlain by serpentine formations, which is a common geological feature in Santa Clara County. Thus, it is not surprising that nickel TEC quotients were greater than 1.0 at both sites and that the chromium TEC quotient was greater than 1.0 in Stevens Creek. Previous years demonstrated similar chromium and nickel concentrations for the two sites (SCVURPPP 2023). Copper concentrations and TEC quotients in WY 2023 samples were also similar to prior years, with the copper TEC quotient greater than 1.0 in the Stevens Creek sample in WY 2023. However, lead concentrations in the Stevens Creek sediment sample were found at levels higher than previously seen at the two SCVURPPP sites.

Table 3.4. Threshold Effect Concentration (TEC) quotients for WY 2023 sediment chemistry constituents. Bolded and shaded values indicate TEC quotient ≥ 1.0.

	TEC	205STE021		205STQ010	
		Stevens Creek		San Tomas Aquino Creek	
Metals (mg/kg DW)		**Concentration**	**Quotient**	**Concentration**	**Quotient**
Arsenic	9.79	3.0	0.31	2.7	0.28
Cadmium	0.99	0.32	0.32	0.15	0.15
Chromium	43.4	78	**1.80**	34	0.78
Copper	31.6	37	**1.17**	21	0.66
Lead	35.8	40	**1.12**	10	0.28
Nickel	22.7	70	**3.08**	34	**1.50**
Zinc	121	94	0.78	94	0.78
PAHs (ug/kg DW)					
Total PAHs	1,610	44.2	0.02745 ab	54.30	0.033727 ab
# Constituents with TEC quotient ≥ 1.0		**4**		**1**	

a. Concentration was below the method detection limit (MDL) for most PAHs. TEC quotient equivalents calculated using 1/2 MDL.

b. TEC quotient calculated from some concentrations below the reporting limit but the above the MDL (J-flagged).

Table 3.5 lists concentrations and PEC quotients for sediment chemistry constituents (metals and total PAHs) collected in WY 2023. PECs are intended to identify concentrations above which toxicity to benthic-dwelling organisms are predicted to be probable. There was one PEC

[12] MacDonald et al. (2000) does not provide TEC or PEC values for pyrethroids or fipronil. Pesticides are compared to LC50 values in Table 3.6.

quotient that was found to be greater than 1.0 in Stevens Creek. The PEC quotient for nickel, an abundant metal in local serpentine soils, was calculated to be 1.44 (Table 3.5).

Table 3.5. Probable Effect Concentration (PEC) quotients for WY 2023 sediment chemistry constituents. Bolded and shaded values indicate PEC quotient ≥ 1.0.

	PEC	205STE021		205STQ010	
		Stevens Creek		San Tomas Aquino Creek	
Metals (mg/kg DW)		**Concentration**	**Quotient**	**Concentration**	**Quotient**
Arsenic	33.0	3.00	0.09	2.70	0.08
Cadmium	4.98	0.32	0.06	0.15	0.03
Chromium	111	78	0.70	34	0.31
Copper	149	37	0.25	21	0.14
Lead	128	40	0.31	10	0.08
Nickel	48.6	70	**1.44**	34	0.70
Zinc	459	94	0.20	94	0.20
PAHs (ug/kg DW)					
Total PAHs	22,800	0.93	0.00004 [ab]	0.26	0.0000 [ab]
# Constituents with PEC quotient ≥ 1.0		**1**		**0**	

a. Concentration was below the method detection limit (MDL) for some PAHs. PEC quotient equivalents calculated using 1/2 MDL.

b. PEC quotient calculated from concentration below the reporting limit but above the MDL (J-flagged).

Table 3.6 lists the concentrations of pesticides measured in sediment samples collected in WY 2023, TOC-normalized concentrations, and TU equivalents for the pesticides for which there are published LC50 values in the literature. Many of the pesticides measured were below MDLs and the TU equivalents were calculated using ½ the MDL concentration. No individual constituent had a TU equivalent exceeding 1.0. The sum of all measured pyrethroid TUs was 0.3 for Stevens Creek and 0.5 for San Tomas Aquino Creek. The highest TU equivalent was bifenthrin (0.14) in Stevens Creek and deltamethrin/tralomethrin (0.20) in San Tomas Aquino Creek. Both bifenthrin and deltamethrin/tralomethrin pesticides have been observed as some of the largest contributors to overall pyrethroid-related toxicity in SCVURPPP samples. Bifenthrin is considered the leading cause of pyrethroid-related toxicity in urban areas (Ruby 2013) and the most-commonly detected insecticide monitored by the DPR's SWPP (Ensminger 2017).

Table 3.6. Pesticide concentrations and calculated toxic unit (TU) equivalents, July 18, 2023.

	Unit	LC50	205STE021 Stevens Creek			205STQ010 San Tomas Aquino Creek		
			Concentration	Normalized to TOC	TU Equivalent	Concentration	Normalized to TOC	TU Equivalent
Total Organic Carbon	%	NA	1.7	NA	NA	1.8	NA	NA
Pyrethroid								
Bifenthrin	µg/g dw	0.52	0.0012	0.0706	0.1357	0.0013	0.0722	0.1389
Cyfluthrin, total	µg/g dw	1.08	0.0007	0.0412	0.0381	0.0006	0.0339	0.0314
Cypermethrin, total	µg/g dw	0.38	0.0002 [b]	0.0141	0.0372	0.0004 [b]	0.0211	0.0556
Deltamethrin/Tralomethrin	µg/g dw	0.79	0.0001 [a]	0.0062	0.0078	0.0028	0.1556	0.1969
Esfenvalerate/Fenvalerate, total	µg/g dw	1.54	0.0002 [a]	0.0097	0.0063	0.0002 [a]	0.0092	0.0060
Cyhalothrin, Total lambda-	µg/g dw	0.45	0.0003 [b]	0.0153	0.0340	0.0004 [b]	0.0206	0.0457
Permethrin, Total	µg/g dw	10.83	0.0014	0.0824	0.0076	0.0014	0.0778	0.0072
				Sum of TU Equivalents	0.3		Sum of TU Equivalents	0.5
Other MRP Pesticides of Concern								
Fipronil	ng/g dw	306	0.0600 [a]	3.5294	0.0115	0.0600 [a]	3.3333	0.0109
Fipronil Desulfinyl	ng/g dw	NA [c]	0.0850 [a]	5.0000	NA	0.0850 [a]	4.7222	NA
Fipronil Sulfide	ng/g dw	435	0.0850 [a]	5.0000	0.0115	0.0850 [a]	4.7222	0.0109
Fipronil Sulfone	ng/g dw	158	0.2050 [a]	12.0588	0.0763	0.2050 [a]	11.3889	0.0721

a. Concentration was below the method detection limit (MDL). TU equivalents calculated using 1/2 MDL.

b. TU equivalent calculated from concentration below the reporting limit but above the MDL (J-flagged).

c. No available LC50 value for Fipronil Desulfinyl.

In compliance with the MRP, a grain size analysis was conducted on both WY 2023 sediment samples (Table 3.6). The Stevens Creek (205STE021) sample was 33.3% fines (i.e., 12.5% clay and 20.8% silt) and the San Tomas Aquino Creek (205STQ010) sample was 33.7% fines (i.e., 9.8% clay and 23.9% silt).

Table 3.7. Summary of grain size for the two locations sampled in Santa Clara County during WY 2023.

Grain Size (%)		205STE021 Stevens Creek	205STQ010 San Tomas Aquino Creek
Clay	<0.0039 mm	12.5%	9.8%
Silt	0.0039 to <0.0625 mm	20.8%	23.9%
Sand	V. Fine 0.0625 to <0.125 mm	10.7%	12.2%
	Fine 0.125 to <0.25 mm	25.4%	19.2%
	Medium 0.25 to <0.5 mm	22.5%	17.7%
	Coarse 0.5 to <1.0 mm	5.7%	6.7%
	V. Coarse 1.0 to <2.0 mm	2.4%	10.6%
Granule	2.0 to <4.0 mm	0.9%	13.5%
Pebble	Small 4 to <8 mm	0%	4.4%
	Medium 8 to <16 mm	0%	4.5%
	Large 16 to <32 mm	0%	0%
	V. Large 32 to <64 mm	0%	0%

Note: Sum of grain size values for both sites is greater than 100% due to the laboratory analytical methods used.

3.2.2 WY 2016 – WY 2023 Summary

From WY 2016 to WY 2023, no sediment samples had PEC quotients that exceeded 1.0 for any analytes other than chromium and nickel. Chromium and nickel are excluded from this PEC/TEC analysis because they are contributed primarily by serpentine formations naturally present in the watersheds where monitoring occurred. Excluding chromium and nickel, there were seven samples in the WY 2016 through WY 2023 dataset with TEC quotients ≥ 1.0, the more conservative of the two sediment chemistry evaluation criteria. The constituents and locations with TEC quotients ≥ 1.0 included:

- Total PAHs from Stevens Creek in WYs 2017 and 2018;
- Zinc from Stevens Creek and San Tomas Aquino Creek in WY 2020;
- Copper from Stevens Creek and San Tomas Aquino Creek in WYs 2020 and 2022; and
- Lead and copper from Stevens Creek in WY 2023.

Table 3.8 lists TU equivalents for pesticides with LC50s available in the literature and concentrations for pesticides without LC50s for sediment samples collected in WY 2016 - WY 2023. Carbaryl has not been detected in any sample.[13] Fipronil and its degradates[14] (desulfinyl, sulfide, sulfone) have been detected at TOC-normalized concentrations below the LC50 in three samples, both WY 2016 samples and the WY 2020 sample from San Tomas Aquino Creek. The sum-of-pyrethroids TU equivalents ranged from 0.11 (Stevens Creek in WY 2017) to 1.3 (Stevens Creek in WY 2020). Since WY 2016, two samples collected from Stevens Creek in 2016 and 2020 have had a sum-of-pyrethroids TU equivalent ≥ 1.0. The sum-of-pyrethroids TU equivalent ≥ 1.0 for San Tomas Aquino Creek has not been observed, except for WY 2022, which found a sum of 1.7 TU equivalents (Table 3.8). Water Year 2023 had no TU equivalents (individual or summed) greater than 1.0 at either sites. There are no apparent trends in TU equivalents for pesticides in San Tomas Aquino Creek or Stevens Creek between WY 2016 and WY 2023.

[13] Carbaryl was eliminated from the list of required analytes in MRP 3.0.

[14] Fipronil degrades via UV exposure, oxidation, and hydrolysis to form four principal degradates: fipronil desulfinyl, fipronil sulfide, fipronil sulfone, and fipronil amide. The degradates tend to be more stable and persistent than the parent compound; therefore, SCVURPPP added the first three of the degradates to the monitoring program in WY 2017.

Table 3.8. Toxicity Unit (TU) equivalent summary for Santa Clara County sediment samples, WY 2016 – WY 2023. See Table 3.5 for WY 2023 concentration data. Bolded values indicate Sum of pyrethroids.

Analyte			Pyrethroids								Other MRP Pesticides of Concern				
			Bifenthrin	Cyfluthrin	Cypermethrin	Deltamethrin	Esfenvalerate	Lambda-cyhalothrin	Permethrin	**Sum Pyrethroids**	Carbaryl	Fipronil	Fipronil desulfinyl	Fipronil sulfide	Fipronil sulfone
		LC50 [c]	0.52 (µg/g dw)	1.08 (µg/g dw)	0.38 (µg/g dw)	0.79 (µg/g dw)	1.54 (µg/g dw)	0.45 (µg/g dw)	10.83 (µg/g dw)	-	NA [d]	306 (ng/g dw)	NA [d]	435 (ng/g dw)	158 (ng/g dw)
Station ID	**Creek**	**Date**													
205STQ010	San Tomas Aquino	7/11/2016	0.39	0.15	0.15 [b]	0.11 [b]	<MDL	<MDL	0.03	**0.88** [a]	<MDL	0.01 [b]	-	-	-
205STQ010	San Tomas Aquino	7/13/2017	0.07 [b]	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	**0.22** [a]	<MDL	<MDL	<MDL	<MDL	<MDL
205STQ010	San Tomas Aquino	7/17/2018	0.39	0.15	0.15 [b]	0.11 [b]	<MDL	<MDL	0.03	**0.88** [a]	<MDL	<MDL	<MDL	<MDL	<MDL
205STQ010	San Tomas Aquino	7/23/2019	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	**0.43** [a]	<MDL	<MDL	<MDL	<MDL	<MDL
205STQ010	San Tomas Aquino	7/22/2020	0.54	0.08	0.07	<MDL	<MDL	0.06	0.01	**0.77** [a]	<MDL	<MDL	<MDL	<MDL	0.12
205STQ010	San Tomas Aquino	6/23/2021	0.49	0.08	<MDL	<MDL	<MDL	0.04 [b]	<MDL	**0.69** [a]	<MDL	<MDL	<MDL	<MDL	<MDL
205STQ010	San Tomas Aquino	7/12/2022	0.83	0.15	0.28	0.30	<MDL	0.06 [b]	0.03	**1.7** [a]	<MDL	<MDL	<MDL	<MDL	<MDL
205STQ010	San Tomas Aquino	7/18/2023	0.14	0.03	0.06 [b]	0.20	<MDL	0.05 [b]	0.01	**0.5** [a]	NA	<MDL	<MDL	<MDL	<MDL
205STE021	Stevens Creek	7/11/2016	0.78	0.13	0.03 [b]	0.19	<MDL	<MDL	0.03	**1.21** [a]	<MDL	0.01 [b]	-	-	-
205STE021	Stevens Creek	7/13/2017	0.07	<MDL	0.02 [b]	<MDL	<MDL	<MDL	0.002	**0.11** [a]	<MDL	<MDL	<MDL	<MDL	<MDL
205STE021	Stevens Creek	7/17/2018	0.12 [b]	<MDL	0.03 [b]	0.10	<MDL	<MDL	<MDL	**0.29** [a]	<MDL	<MDL	<MDL	<MDL	<MDL
205STE021	Stevens Creek	7/23/2019	0.15 [b]	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	**0.40** [a]	<MDL	<MDL	<MDL	<MDL	<MDL
205STE021	Stevens Creek	7/22/2020	0.59	0.14	0.31	<MDL	<MDL	0.26	<MDL	**1.3** [a]	<MDL	<MDL	<MDL	<MDL	<MDL
205STE021	Stevens Creek	6/23/2021	0.27	0.07	<MDL	0.09	<MDL	<MDL	<MDL	**0.51** [a]	<MDL	<MDL	<MDL	<MDL	<MDL
205STE021	Stevens Creek	7/12/2022	0.37 [b]	0.04 [b]	0.14 [b]	0.32 [b]	<MDL	<MDL	0.03	**0.9** [a]	<MDL	<MDL	<MDL	<MDL	<MDL
205STE021	Stevens Creek	7/18/2023	0.14	0.04	0.04 [b]	<MDL	<MDL	0.03 [b]	0.01	**0.3** [a]	NA	<MDL	<MDL	<MDL	<MDL

dw = dry weight
a. Total calculated using 1/2 MDLs for some individual pyrethroids.
b. TU equivalents calculated from concentration below the reporting limit (J-flagged).
c. Sources: Amweg et al. 2005 and Maund et al. 2002 for pyrethroids; Maul et al. 2008 for fipronil compounds
d. No available LC50 value for Carbaryl or Fipronil Desulfinyl.

3.3 Pesticides in Wet Weather Water Samples

Wet weather water samples were collected during WY 2023 at three locations in San Tomas Aquino Creek, Stevens Creek, and the Guadalupe River, which was a site selected in coordination with DPR staff. In addition to toxicity testing which did not return any significantly toxic results (see Section 3.1.2), the MRP requires analysis of water samples for pesticide concentrations. The concentrations of many pesticides analyzed were below the MDL, meaning that these analytes were reported as non-detects (Table 3.9). There are no WQOs specified in the San Francisco Bay Basin Plan for water column pesticide analytes. As a result, no WQO or MRP trigger threshold exceedance analysis was performed on the wet weather pesticide data. However, comparative United States Environmental Protection Agency (USEPA) benchmarks are provided as reference points for chronic effects of freshwater invertebrates (Table 3.9). Overall, concentrations of most constituents were highest in the Guadalupe River sample.

Table 3.9. Summary of water column pesticide concentrations sampled during a WY 2023 storm event.

	Unit	205STE021 Stevens Creek	205STQ010 San Tomas Aquino Creek	205GUATRM Guadalupe River	Lowest USEPA Benchmark [d]
		Concentration	Concentration [a]	Concentration	Concentration
Pyrethroid					
Bifenthrin	µg/L	0.0013	0.0035	0.03	0.00005
Cyfluthrin, total		0.0004 [b]	0.0007	0.003	0.00012
Cypermethrin, total		< 0.0003 [c]	0.0009	0.0045	< 0.00005
Deltamethrin/Tralomethrin		< 0.0006 [c]	0.0007 [b]	0.0023	0.000026
Esfenvalerate/Fenvalerate, total		< 0.0004 [c]	< 0.0005 [c]	< 0.0004 [c]	0.0000309
Cyhalothrin, Total lambda-		0.0004 [b]	< 0.0003 [c]	0.0004 [b]	0.00022
Permethrin, Total		< 0.0020 [c]	< 0.0023 [c]	0.0043 [b]	0.0042
Other MRP Pesticides of Concern					
Fipronil	µg/L	0.0047	0.0045	0.0051	0.01
Fipronil Desulfinyl		0.0017	0.0014	0.0021	41
Fipronil Sulfide		0.0004 [b]	0.0003 [b]	0.0004 [b]	5.16
Fipronil Sulfone		0.0047	0.0038	0.0046	< 0.22
Imidacloprid		< 0.0040 [c]	< 0.0040 [c]	< 0.0040 [c]	0.01

a. Elevated Reporting Limits due to limited sample volume
b. Concentration is below the reporting limit but above the MDL (J-flagged).
c. Concentration is below Method Detection Limit (MDL); values are displayed as "< MDL".
d. Lowest concentration leading to chronic effects for freshwater invertebrates accessed January 2024 (https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/aquatic-life-benchmarks-and-ecological-risk#aquatic-benchmarks)

3.4 Third-Party Monitoring Efforts

Throughout the monitoring period associated with the results described in this report, several programs external to SCVURPPP conducted similar pesticides and toxicity monitoring studies within the region. These studies provide valuable data for comparison against SCVURPPP findings to view water quality in a broader spatial and temporal context.

3.4.1 DPR Surface Water Protection Program (SWPP) Monitoring

The DPR SWPP is one of the largest pesticide monitoring and management efforts currently being undertaken in California. Pesticide studies conducted by the DPR SWPP evaluate the frequency of pesticide detections at any concentration and make use of USEPA aquatic benchmarks for many pesticide compounds (USEPA 2016). DPR provides web access to their monitoring reports which contain detailed analyses of USEPA aquatic benchmark exceedance rates. DPR also maintains the Surface Water Database (SURF) to provide public access to quantitative pesticide data from a wide array of surface water monitoring studies. This database could be queried in the future to allow for the leverage of DPR monitoring data in more complex analyses of MRP pesticide data. The following paragraphs summarize recent DPR studies in urban areas of California.

WY 2017: The DPR conducted two studies in Northern and Southern California that involved pesticides and toxicity monitoring at urban sites in Alameda, Contra Costa, Placer, Sacramento, Santa Clara (Guadalupe River – see Figure 6.1), Los Angeles, Orange, and San Diego Counties. Both water and sediment samples were collected and analyzed for a wide range of pesticide compounds. In both the Northern and Southern California studies, bifenthrin and fipronil were found to be among the most frequently detected pesticides. Additionally, pyrethroid concentrations were found to be above their USEPA minimum benchmarks for toxicity to aquatic life for most samples with the exception of cyfluthrin. The studies also state that the detection frequencies of most pyrethroids have remained consistent over recent years (Budd 2018 and Ensminger 2017).

WY 2018: The DPR conducted two urban monitoring studies in Northern and Southern California that collected water and sediment samples in the same counties sampled during WY 2017. Similar to WY 2017, bifenthrin was among the most frequently detected insecticides in water samples from both the Northern and Southern California WY 2018 studies. In the Northern California study, bifenthrin was the most frequently detected insecticide and second most frequently detected compound in water samples with a detection frequency (DF) of 76%. In the Southern California study, bifenthrin was the most frequently detected pyrethroid insecticide and the fifth most frequently detected compound in water samples with a DF of 72%. Fipronil and its degradates were also detected at high rates in water samples from the Northern and Southern California studies. While fipronil itself only had a DF of 48% in the Northern California study, fipronil and its degradates collectively had a DF of 72%. Out of these compounds, fipronil sulfone was found at the highest rate with a DF of 70%. Fipronil was also found at a high rate during the Southern California study with a DF of 76%. Its degradates were also found in a large portion of samples, with fipronil sulfone again being the most found with a DF of 67%. Sediment samples from Northern and Southern California were collected and analyzed for bifenthrin and eight other pyrethroids, but concentrations of fipronil and its degradates were not measured. In both studies, bifenthrin was detected in all samples and was also responsible for the greatest magnitude of TU equivalents (Budd 2019 and Ensminger 2019).

WY 2019: The DPR collected water and sediment samples in the same Northern Californian counties targeted during WY 2018. Bifenthrin and fipronil were the most detected insecticides with 41% DF and 37% DF, respectively. Three of fipronil's five degradates were observed and collectively accounted for 61% DF; when combined with the fipronil DF, fipronil and its degradates had an aggregate 98% DF. Bifenthrin and fipronil both exceeded their lowest USEPA aquatic benchmarks in 34% of all detections. There were no benchmark exceedances for fipronil degradates, yet fipronil sulfone had a 32% DF. Perhaps the biggest conclusion from this DPR study was the observed differences between outfall and stream monitoring and between wet and dry weather monitoring. Bifenthrin and fipronil detections at storm drain outfalls had 73-91% DFs compared to 23-37% in waterways. There was little observed difference between dry and wet events in storm drain outfalls for bifenthrin and fipronil, yet waterways that lacked bifenthrin detections during dry events demonstrated a large increase in bifenthrin (up to 70% DF) during rain events. Likewise, fipronil had 10% DF in waterways during dry events but increased to 50% DF during rain events. Fipronil degradates also exhibited differences in dry weather and storm event monitoring concentrations. While fipronil desulfinyl had equal detection during dry and wet monitoring events, fipronil amide and sulfone had a 36 and 34 percentage point increase in DF, respectively (Ensminger 2020).

WY 2020: The DPR collected water and sediment samples in the same Northern Californian counties targeted during WY 2019. Bifenthrin was the second most detected insecticide at 60% DF and fipronil with a 33% DF. Both bifenthrin and fipronil were observed to exceed their USEPA aquatic benchmarks in 53% and 27% of all detections, respectively. Three of fipronil's degradates were measured: fipronil sulfone had a 29% DF and exceeded its benchmark 2% of the time; fipronil amide was measured at 11% DF and fipronil desulfinyl had 7% DF. Fipronil degradates collectively amounted to 47% DF and when combined with fipronil reflect an aggregate 80% DF (Ensminger 2021).

WY 2021: The DPR collected and analyzed water samples for toxicity and pesticide concentrations, and sediment samples for analysis of pyrethroid concentrations. All samples were from Northern Californian urban areas and were collected throughout the water year. Similar to previous years' findings, imidacloprid had the highest DF (68%) while bifenthrin (59%) and fipronil (39%) were the second and third most detected pesticides, respectively. Storm events increased detection frequencies in the top three most detected pesticides by 2-4 times their dry weather detection frequencies. Both imidacloprid and bifenthrin were detected more often in waterways than storm drain systems. However, fipronil was detected slightly more frequently in storm drains compared to waterways. Imidacloprid, bifenthrin, and deltamethrin concentrations were all found to be above their respective lowest USEPA aquatic life benchmark (BM). Some fipronil concentrations were also found to be above the BM. Three of the five fipronil degradates were detected, with sulfone having the highest detections (39%) and amide/desulfinyl both having the second highest (14%). Desulfinyl was detected in one sample at a concentration above the BM. All seven pyrethroids were detected in the eight sediment samples. All pyrethroid concentrations in sediment samples exceeded their BM's. Toxicity testing using *H. azteca* and *C. dilutus* was conducted on water samples collected from Sacramento storm drains during four events: two storm events and two dry season events. All samples were found to be toxic to both test organisms. Samples collected during wet weather were more toxic to *H. azteca* than *C. dilutus*, and overall, wet weather samples were found to be more toxic than dry weather samples (Alvarado, 2023).

WY 2017-WY 2021: Findings from the DPR studies generally corroborate SCVURPPP pesticide monitoring results. For example, bifenthrin has been the most frequently detected pesticide in samples collected by SCVURPPP from WY 2016 through WY 2023 and is the second most detected insecticide in DPR samples. Wet weather and dry weather water samples collected by SCVURPPP and DPR have both found some pyrethroids to be above their respective USEPA benchmarks. Toxicity to the pyrethroid-sensitive *H. azteca* has been observed in water column samples for both programs. Fipronil appears to have increasing concentrations and detection frequencies in both programs.

3.4.2 SPoT Monitoring Program

The SPoT Monitoring Program conducts annual dry season monitoring (subject to funding constraints) of sediments collected from a statewide network of large rivers. The goal of the SPoT Program is to investigate long-term trends in water quality. Sites are targeted in bottom-of-the-watershed locations with slow water flow and appropriate micromorphology to allow deposition and accumulation of sediments, including stations near the mouth of Coyote Creek and the Guadalupe River (Phillips et al. 2014) (Figure 3.1). In most years, sediments are analyzed for toxicity, with metals, PCBs, mercury, organic pollutants, and pesticides (including pyrethroids and fipronil and its degradates) analyzed on a less frequent schedule. The most recent technical report prepared by SPoT program staff was published in 2020 and describes ten-year trends from the initiation of the program in 2008 through 2017 (Phillips et al. 2020).

Toxicity testing of sediment was conducted by SPoT in Santa Clara County watersheds using indicator organisms *H. azteca*, which is sensitive to pyrethroids, and *C. dilutus*, added in 2015 to assess neonicotinoid and fipronil impacts. Toxicity samples were evaluated using the TST statistical approach (Phillips et al. 2020).

- ***H. azteca***. In Guadalupe River, chronic *H. azteca* toxicity has not been observed in the entire dataset and acute *H. azteca* has not been observed since 2014. In Coyote Creek, both acute and chronic *H. azteca* toxicity have been observed but there is a trend of decreasing toxicity.

- ***C. dilutus***. In Guadalupe River, neither acute nor chronic *C. dilutus* toxicity have been observed since monitoring for this organism began in 2015. In Coyote Creek, *acute C. dilutus* toxicity has not been observed, but moderate chronic *C. dilutus* was observed in at least one sample.

The SpoT toxicity results contrast with SCVURPPP monitoring results from Stevens Creek and San Tomas Aquino Creek. SCVURPPP has not detected acute *H. azteca* toxicity in sediment samples from these creeks but has observed acute *C. dilutus* toxicity in two of six samples from San Tomas Aquino Creek. The MRP does not require analysis of chronic toxicity endpoints for sediment samples.

The SPoT sediment chemistry results from Guadalupe River and Coyote Creek do not show statistically significant trends in sum-of-pyrethroid concentrations or sum-of-fipronil-and-its-degradates concentrations over the 2008 – 2017 dataset reviewed by Philips et al. (2020). A review of SPoT data from 2008 to 2020 downloaded from CEDEN suggests the following findings that are in line with SCVURPPP data from Stevens Creek and San Tomas Aquino:

- **Coyote Creek.** Dry season pyrethroid concentrations in Coyote Creek peaked in July 2012 (674 ng/g). This concentration was largely driven by cyfluthrin, which was measured at 539 ng/g, a concentration 26 times higher than the next highest cyfluthrin measurement (20.2 ng/g in September 2012) and 90 times higher than the average cyfluthrin concentration in the dataset sans July 2012. In most other years, the individual pyrethroid with the highest concentration in Coyote Creek is bifenthrin. Although fipronil has only been detected twice in Coyote Creek during the years it was monitored by SPoT (2013 – 2020), its degradates (fipronil desulfinyl, fipronil sulfide, fipronil sulfone) are usually found at measurable concentrations, with no obvious long-term trends.

- **Guadalupe River.** Similar to Coyote Creek, sum-of-pyrethroid concentrations in Guadalupe River peaked in 2012 (165 ng/g) but was driven by a high permethrin concentration that year (76 ng/g) rather than cyfluthrin (21.7 ng/g). In most other years, the individual pyrethroid with the highest concentration in Guadalupe River is bifenthrin. Fipronil has never been detected in Guadalupe River but its degradates (fipronil sulfone, fipronil sulfide, and fipronil desulfinyl) have been detected. More recent samples have detections of at least two degradates. A significant decrease in PAHs has also been observed in the Guadalupe River SPoT samples.

4.0 CONCLUSIONS AND RECOMMENDATIONS

This section presents conclusions and recommendations from review of the WY 2023 Pesticides & Toxicity Monitoring data that were generated in compliance with provision C.8.g of the MRP and which are presented in the previous sections of this report.

All monitoring and data validation were conducted using methods consistent with the BASMAA RMC QAPP (BASMAA 2020) and SOPs (BASMAA 2016). Recommendations for future monitoring are described in Section 4.2.

4.1 Conclusions

Toxicity testing of water and sediment samples and sediment chemistry monitoring, collectively referred to as pesticides and toxicity monitoring, was conducted during WY 2023 in compliance with provision C.8.g of the MRP. Dry season samples were collected from Stevens Creek and San Tomas Aquino Creek at the same stations that were monitored for pesticides and toxicity during WY 2016 to WY 2022 under MRP 2.0 and MRP 3.0. A dry weather water resample was required for the *C. dubia* chronic test in Stevens Creek. Wet weather water samples were collected from the water columns of Stevens Creek, San Tomas Aquino Creek, and the Guadalupe River to satisfy provision C.8.g.iii of the MRP. A water resample was required for the *H. azteca* acute test in the Guadalupe River. Data summaries for the results of both wet and dry monitoring requirements are in the subsequent sections.

4.1.1 Data Evaluation Summary

Dry weather monitoring requirements include five toxicity test species that are analyzed in water samples and two test species in sediment samples. The test organism *H. azteca*, required for water and sediment samples, is known to be sensitive to pyrethroid pesticides and the test organism *C. dilutus*, is known to be sensitive to neonicotinoids. A two-tiered approach is applied to assess toxicity. First, organism responses from ambient samples are compared to responses from appropriate laboratory control samples using a statistical comparison (i.e., TST). This is followed by a comparison to a “threshold value” or “Percent Effect” that indicates the magnitude of the difference in response. If the MRP threshold of 50 Percent Effect is exceeded, a follow-up sample is collected.

Sediment chemistry data for metals and PAHs are compared to Threshold Effect Concentrations (TECs) and Probable Effect Concentrations (PECs) published by MacDonald et al. (2000). Most samples in Santa Clara County have chromium and nickel concentrations that exceed the more conservative TEC and many exceed the PEC. These metals are naturally occurring in the serpentine formations that underly mountains and hills in the region, and therefore are not prioritized for follow-up management actions. Sediment chemistry data for pyrethroid and fipronil pesticides are compared to TOC-normalized LC50s, calculated as TU equivalents.

Wet weather monitoring requirements include an analysis of water samples for toxicity, like the dry weather requirements listed above and an analysis of water samples for pesticides (pyrethroids, fipronil and its degradates, and imidacloprid). Due to a lack of numeric thresholds for pesticides in water samples, data collected during the WY 2023 wet weather pesticide monitoring efforts cannot be assessed for individual exceedances of their respective sample sites. However, pesticide concentration results with parallel data collected across the state. Furthermore, SCVURPPP wet weather pesticide concentrations can be compared to USEPA pesticide concentration benchmarks for a reference of potential effects to key aquatic biological indicators. DPR also maintains SURF to provide public access to quantitative pesticide data from a wide array of surface water monitoring studies. This database could be queried in the future to allow the leverage of DPR monitoring data in more complex analyses of MRP pesticide data.

4.1.2 WY 2023 Results

In WY 2023, SCVURPPP conducted dry weather pesticides and toxicity monitoring at two stations (Stevens Creek and San Tomas Aquino Creek).

- Statistically significant toxicity to *C. dubia* (reproduction) was observed in the San Tomas Aquino and Stevens Creek water samples. The Stevens Creek *C. dubia* water sample's magnitude of toxic effects exceeded the MRP threshold of 50 Percent Effect, but the threshold was not exceeded for the San Tomas Aquino Creek sample. A follow-up sample was conducted for *C. dubia* in Stevens Creek, which found more evidence of significant toxicity with a Percent Effect exceeding the threshold. Statistically significant toxicity to C. dilutus (survival) was also observed in the Stevens Creek water sample, but with a Percent Effect below the follow-up threshold of 50%.

- Sediment samples in San Tomas Aquino Creek were found to be significantly toxic to both *C. dilutus* and *H.* azteca but with Percent Effects less than the threshold.

- Pesticide concentrations in the WY 2023 sediment samples were low, with no TOC-normalized concentrations of an individual pyrethroid found to be over 1 TU equivalent. The sum of pyrethroids for both sites were also found to be well below 1 TU equivalent.

- Similar to prior years, common serpentine derived metals (chromium and nickel) were found in concentrations exceeding the TEC and/or PEC thresholds at both sites. In addition, the TEC quotients for copper and lead were greater than 1.0 in the Stevens Creek sediment sample.

- The WY 2023 wet weather regional sampling effort included SCVURPPP collecting samples from three sites. Two of the sites were from the Program's long-term sampling of Stevens and San Tomas Aquino Creeks while the third (Guadalupe River) site was selected from the DPR's SWPP program. A water sample from the Guadalupe River exhibited significant acute toxicity to *H. azteca* with a Percent Effect greater than 50%. The follow-up sample was also significantly toxic, but with a Percent Effect less than the threshold.

- Pesticide concentration results from the wet weather water samples showed evidence that USEPA benchmarks leading to chronic effects in freshwater invertebrates were exceeded for many pyrethroid pesticides at all three monitoring locations. Imidacloprid, fipronil, and its degradates had no exceedances of the benchmarks. It is worth noting that some pyrethroids which appeared to exceed the benchmarks were also either detected below the laboratory's detection or reporting limits. Pesticide concentrations that were detected below the detection limit were estimated using one half of the MDL.

4.1.3 WY 2016 – WY 2023 Data Summary

The results of pesticides and toxicity monitoring conducted in San Tomas Aquino and Stevens Creek during WY 2016 through WY 2023 were analyzed to identify trends.

- Acute toxicity to *H. azteca*, a test organism known to be sensitive to pyrethroid pesticides, was observed for the second consecutive year in the WY 2023 dry season sediment sample for San Tomas Aquino Creek; however, the Percent Effect was below the threshold for resampling. The cause of this toxicity finding is unknown as the sum of pyrethroid TU equivalents was 0.5 in the corresponding sediment chemistry sample.
- Toxicity to *H. azteca* (survival) has been found in six of nine wet weather water samples collected throughout the Santa Clara Valley in WY 2018 and WY 2023. In WY 2023 significant toxicity to *H. azteca* was found in the Guadalupe River sample, with a Percent Effect greater than 50%. The resample at this site was also found to be significantly toxic, but with a Percent Effect less than the threshold.
- Five of the 22 dry (n=16) and wet (n=6) weather water samples were significantly toxic to *C. dilutus*, a test organism known to be sensitive to neonicotinoids (e.g., imidacloprid) and fipronil, including the WY 2023 dry weather sample collected from Stevens Creek. All of the significantly toxic samples were from the dry weather data set; however, none had a Percent Effect greater than 50%.
- Of the 29 dry season samples where significant toxicity was observed, 13 were water samples with *C. dubia* reproduction toxicity. *C. dubia* is a water flea that is sensitive to a broad range of aquatic contaminants. However, the specific cause of the chronic *C. dubia* toxicity in San Tomas Aquino and Stevens Creek is unknown, and not seemingly explained by the synoptic sediment chemistry results. It is possible that the chronic *C. dubia* toxicity observed in water samples are false positives resulting from inconsistencies in laboratory QA procedures. Statewide, there have been other reports of unexplained chronic *C. dubia* toxicity. SCCWRP recently examined this issue and recommended guidance for laboratory best practices, accreditation, and training to reduce variability and inconsistency between lab processes (Brent et al. 2023).
- Between WY 2016 and WY 2023, no sediment samples in San Tomas Aquino or Stevens Creek had PEC quotients greater than 1.0 for analytes other than chromium and nickel. When chromium and nickel (present in local native soils) are excluded, seven samples in the WY 2016 through WY 2023 dataset had TEC quotients ≥ 1.0, the more conservative of the two sediment chemistry evaluation criteria. These include total PAHs from Stevens Creek in WY 2017 and WY 2018, zinc from Stevens Creek and San Tomas Aquino Creek in WY 2020, and copper from Stevens Creek and San Tomas Aquino Creek in WY 2020 and 2022. Stevens Creek was found to have copper and lead exceeding the TEC threshold during WY 2023.
- Overall, detection frequencies for bifenthrin and fipronil were on par with results from the DPR Northern California study (Ensminger 2021) and *H. azteca* toxicity responses were similar to SPoT monitoring in Coyote Creek and Guadalupe River (Phillips et al. 2020).

The pesticides and toxicity data collected from WYs 2016 through 2023 provide a reference to inform management decisions regarding water quality improvement in Santa Clara County watersheds and guide the planning of future monitoring in the area.

4.2 Recommendations

The following recommendations are based on findings from eight years (WY 2016 through WY 2023) of Pesticides &Toxicity monitoring conducted by SCVURPPP, as well as reflections on other monitoring, data analysis, and policy development projects being conducted in the region and statewide.

- Pesticides & Toxicity Monitoring will continue to be conducted during the dry season at the same two stations targeted in WYs 2016 through 2023: Stevens Creek and San Tomas Aquino Creek.
- External studies and their results will be closely followed as reports become available to compare with SCVURPPP pesticide and toxicity data. The DPR's SWPP studies are essential to understanding a long-term regional and statewide assessment of pesticide concentrations and their effects on aquatic environments. Study 329 of SWPP is particularly relevant to SCVURPPP's pesticide and toxicity program since some of their monitoring sites are located in Santa Clara County. The SCVURPPP will continue to search for opportunities to share data, monitoring locations, and information with other agencies, like how WY 2023 wet weather monitoring was conducted at DPR's Guadalupe River site. Additionally, SWPP will be implementing monitoring and reporting changes with the most recent (WY 2023) update to Study 329 to facilitate data collection and communication with other outside organizations in the bay area, such as the San Francisco Estuary Institute. A summary report of Study 329 is expected during the first quarter of 2024, as described in the protocol update for WY2023 (Alvarado and McClanahan 2023).

In compliance with provision C.9 of the MRP, the Program and Co-permittees are implementing pesticide toxicity control programs that focus on source control and pollution prevention measures. The control measure programs include the implementation of integrated pest management (IPM) policies/ordinances, public education and outreach programs, pesticide disposal programs, and sustainable landscaping requirements for new and redevelopment projects. California's Pesticide Use Reporting Program (PUR) contains extensive data for nearly all types of registered pesticides and their associated applications. Ongoing evaluations of pesticides and their uses through PUR inform DPR, Permittees, and the public about potential emerging trends with registered pesticide usage. These efforts will eventually be supplemented by the statewide Urban Pesticides Amendments (UPAs) which will seek to improve considerations of surface water quality during the registration process overseen by state and federal pesticide regulatory authorities such as DPR and USEPA. The anticipated result of the UPAs will be reduction in pyrethroids and other pesticides in urban stormwater runoff and the eventual elimination of pesticide-related toxicity in local urban creeks. The UPAs would also likely establish a statewide monitoring program that may substitute for pesticides and toxicity monitoring requirements in MS4 permits, such as the MRP. The goal of this statewide coordinated monitoring program is to generate useful data at minimal cost and standardize information at the statewide level to support the objectives of the UPAs. At this time, the mechanism for implementing the statewide monitoring program is uncertain, but will likely be developed over the next few years.

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ATTACHMENTS

Attachment 1

QA/QC Report

Pesticides and Toxicity Monitoring Quality Assurance/Quality Control Report, WY 2023

1.0 Introduction

The Santa Clara Valley Urban Runoff Pollution Protection Program (SCVURPPP) conducted Pesticides and Toxicity monitoring in Water Year (WY) 2023 to comply with Provision C.8.g (Pesticides and Toxicity Monitoring) of the National Pollutant Discharge Elimination System Program (NPDES) Municipal Regional Permit for the San Francisco Bay Area (i.e., MRP 3.0; Permit No. CAS612008, Order No. R2-2022-0018). In WY 2023, sediment and stormwater monitoring included analysis for:

- Water toxicity (dry weather, MRP Provision C.8.g.i);
- Sediment toxicity (dry weather, MRP Provision C.8.g.ii);
- Sediment chemistry (dry weather, MRP Provision C.8.g.ii);
- Water toxicity (wet weather, MRP Provision C.8.g.iii); and
- Water chemistry (wet weather, MRP Provision C.8.g.iii).

Kinnetic Environmental, Inc. (KEI) of Santa Cruz, California collected the samples. Caltest Analytical Laboratory (Caltest) of Napa, California, and Pacific EcoRisk, Inc. of Fairfield, California performed the analyses described in Table 1.

Table 1. Pesticides and toxicity monitoring analyses conducted in WY 2023

Laboratory	Analysis	Matrix	Method Reference
CalTest	Water Chemistry	Water	EPA 625.1_NCI EPA 632
	Sediment Chemistry	Sediment	EPA 6020 EPA 8270C EPA 8270M_NCI EPA 9060M Plumb, 1981, GS
Pacific EcoRisk	Toxicity	Sediment/Water	EPA 600/R-99-064 EPA 821/R-02-012 EPA 821/R-02-013

This report summarizes the Quality Assurance/Quality Control (QA/QC) procedures and results for this monitoring effort for the analyses performed by Pacific EcoRisk in the reports from December 2022, September 2023, and February 2023. The analyses performed by CalTest can be found in reports X110572 and Y070662. Samples are listed in Table 2.

Table 2. Pesticides and toxicity monitoring samples analyzed in WY 2023.

Note, 205GUA_TRM = 205GUATRM

Caltest Report X110572	Caltest Report Y070661	Pacific EcoRisk Report December 2022	Pacific EcoRisk Report February 2023	Pacific EcoRisk Report September 1, 2023	Pacific EcoRisk Report September 27, 2023
205STE021	205STE-S-09	205STE021	205GUA_TRM	205STE021-W-09	205STE021-W-09b
205STQ010	205STQ010-S-09	205STQ010		205STQ010-W-09	
205GUA_TRM		205GUA_TRM			

SCVURPPP utilizes the BASMAA RMC Quality Assurance Project Plan (QAPP; BASMAA 2020) and BASMAA RMC Standard Operating Procedures (SOP; BASMAA 2016), SOP FS-13 (Standard Operating Procedures for QA/QC Data Review) as a basis for QA/QC procedures. Data were assessed for seven data quality attributes: (1) Representativeness, (2) Comparability, (3) Completeness, (4) Sensitivity, (5) Contamination, (6) Accuracy, and (7) Precision. These seven attributes are compared to Data Quality Objectives (DQOs), which were established to ensure that data collected are of adequate quality and sufficient for the intended uses. DQOs address both quantitative and qualitative assessment of the acceptability of data – representativeness and comparability are qualitative while completeness, sensitivity, precision, accuracy, and contamination are quantitative assessments. Specific DQOs are based on Measurement Quality Objectives (MQOs) for each analyte. The MQOs for each analyte are summarized in Table 3. Target Method Reporting Limits (MRLs) and actual monitoring Reporting Limits (RLs) are summarized in Tables 4 and 5.

Table 3. Measurement quality objectives for analytes from the RMC QAPP (BASMAA, 2020).

Sample	Sediment					Water		
	Inorganics	Synthetic Organic Compounds (Non pyrethroids)	Pyrethroids	Conventional Analytes	Toxicity	Synthetic Organic Compounds (Non pyrethroids)	Pyrethroids	Toxicity
Laboratory Blank (Method Blank, Field Filter Blank, Equipment Rinsate Blank, Trip Blank)	<RL	<RL	<RL	80-120%	The sediment control must meet all test acceptability criteria for the species of interest. Laboratory overlying water must be of uniform quality for the species of interest (USEPA method manual 600/R-99/064)	<RL	<RL	Laboratory control water must meet all test acceptability criteria for the species of interest
Reference Material Recovery (Laboratory Control Sample)	75-125%	50-150% (70-130% if certified)	50-150%	RPD<25%	The last plotted data point (LC50 or EC50) should be within 2 standard deviations of the cumulative mean (n=20). Reference toxicant tests that fall outside of recommended control chart limits are evaluated to determine the validity of associated tests. A reference toxicant test outside of the 2 standard deviations does not invalidate the associated test results.	50-150% (70-130% if certified) 35-135% for fipronil	50-150%	The last plotted data point (LC50 or EC50) should be within 2 standard deviations of the cumulative mean (n=20). Reference toxicant tests that fall outside of recommended control chart limits are evaluated to determine the validity of associated tests. A reference toxicant test outside of the 2 standard deviations does not invalidate the associated test results.
Matrix Spike Recovery	75-125%	50-150%	50-150%	NA	NA	50-150%	50-150%	NA
Duplicates (Matrix Spike, Field, and Laboratory)	75-125%; RPD<25 %	50-150%; RPD<25% (Fipronil RPD<35%)	50-150%; RPD≤ 35%	80-120%; RPD<25%	NA	50-150%; RPD<25% (Fipronil 1-130%; RPD<35%)	50-150%; RPD≤ 35%	NA

Table 4. Comparison of target and actual reporting limits (dry weight) (205STE021/205STQ010, respectively) for sediment analytes.

Analyte	Target RL	Actual RL	Unit
Arsenic	0.3	0.52	mg/Kg
Cadmium	0.01	0.042/0.041	mg/Kg
Chromium	0.1	0.52	mg/Kg
Copper	0.01	0.21	mg/Kg
Lead	0.01	0.042/0.041	mg/Kg
Nickel	0.02	0.083	mg/Kg
Zinc	0.1	0.83 [b]	mg/Kg
PAHs (Individual)	20	18 [b]	ng/g
Bifenthrin	0.33 [a]	1 [b]	ng/g
Cyfluthrin	0.33 [a]	1 [b]	ng/g
Total Lambda-cyhalothrin	0.33 [a]	1 [b]	ng/g
Total Cypermethrin	0.33 [a]	1 [b]	ng/g
Total Deltamethrin	0.33 [a]	1 [b]	ng/g
Total Esfenvalerate/Fenvalerate	0.33 [a]	1 [b]	ng/g
Permethrin	0.33 [a]	1 [b]	ng/g
Fipronil	0.33 [a]	1 [b]	ng/g
Fipronil Desulfinyl	0.33 [a]	1 [b]	ng/g
Fipronil Sulfide	0.33 [a]	1 [b]	ng/g
Fipronil Sulfone	0.33 [a]	1 [b]	ng/g
Total Organic Carbon	0.01	0.047/0.057	% dw

[a] There are no appropriate SWAMP targets for pyrethroids or for fipronil and its degradates. For these analytes, the RMC target RLs are based on current lab capabilities.

[b] These samples were diluted, which raised the RL.

Table 5. Comparison of target and actual reporting limits (205STE021/205STQ010/205GUA_TRM, respectively) for water analytes.

Analyte	Target RL [a]	Actual RL [b]	Unit
Bifenthrin	2	0.5/0.6/0.5	ng/L
Cyfluthrin	5	0.5/0.6/0.5	ng/L
Total Lambda-cyhalothrin	0.5	0.5/0.6/0.5	ng/L
Total Cypermethrin	5	0.5/0.6/0.5	ng/L
Total Deltamethrin	5	1.0/1.2/1.0	ng/L
Total Esfenvalerate/Fenvalerate	2	1.0/1.2/1.0	ng/L
Permethrin	10	5.0/5.8/5.0	ng/L
Fipronil	1	0.001/0.0012/0.0010	µg/L
Fipronil Desulfinyl	1	0.001/0.0012/0.0010	µg/L
Fipronil Sulfide	1	0.001/0.0012/0.0010	µg/L
Fipronil Sulfone	1	0.0030/0.0035/0.0030	µg/L
Imidacloprid	0.02	0.0050	µg/L

[a] There are no appropriate SWAMP targets for pyrethroids or for fipronil and its degradates. For these analytes, the RMC target RLs are based on current lab capabilities.

[b] 205STQ010 had a limited sample volume, which raised RLs.

Overall, the results of the QA/QC review suggest that the data generated during WY 2023 pesticides and toxicity monitoring were of sufficient quality for the purposes of this program. A sample with limited volume was collected at 205STQ010 during the November 8, 2022 wet weather sampling event, which caused RLs to become slightly elevated. A sample for the wet weather toxicity resample for 205GUA_TRM had two replicates that exhibited complete mortality, resulting in a significantly toxic sample that was less than 50 Percent Effect when compared to control samples. All other ambient water replicates of the resample had no reductions in *H. azteca* survival rates, leading to the conclusion that the sample homogenization process was not thorough enough. Some external programs' sediment and water data were also flagged because of not satisfying minor MQOs and DQOs identified in the QAPP. However, none of the data were rejected. Further details regarding the QA/QC review are provided in the sections below.

2.0 Sediment and Water Chemistry

2.1. Representativeness

Data representativeness assesses whether the data were collected in a manner that represents actual conditions at each monitoring location. For this project, all samples were assumed to be representative if they were collected and analyzed according to protocols specified in the QAPP. Field and laboratory personnel received and reviewed the QAPP and followed prescribed protocols including laboratory methods, holding times, preservation, and storage.

The dry season sediment chemistry sample was collected by KEI on July 18, 2023. Caltest analyzed samples for inorganic compounds, synthetic organic compounds, and grain size distribution. KEI also collected water column samples on November 8, 2022, which were analyzed for pesticides by CalTest. The laboratory conducted all QA/QC requirements as specified in the RMC QAPP and reported their findings to the RMC.

2.2. Hold Times

Extractions and analyses were performed within the recommended holding time criteria and no additional data flags were assigned by the QA officer (QAO).

2.3. Preservation and Sample Storage

The samples were preserved and stored appropriately as ascribed by the respective methods and no additional data flags were assigned by the QAO.

2.4. Comparability

The QAO ensures that the data may be reasonably compared to data from other programs producing similar types of data. For POC monitoring, individual stormwater programs strive to maintain comparability within the Regional Monitoring Coalition (RMC). The key measure of comparability for all RMC data is the California Surface Water Ambient Monitoring Program (SWAMP).

Electronic data deliverables (EDDs) were submitted to the San Francisco Bay Regional Water Quality Control Board (SFRWQCB) in Microsoft Excel templates developed by the California Environmental Data Exchange Network (CEDEN) which are comparable to SWAMP. In addition, data entry followed SWAMP documentation specific to each data type, including the exclusion of qualitative values that do not appear on CEDEN's look up lists[1]. Completed templates were reviewed using CEDEN's online data checker[2], further ensuring SWAMP-comparability. There was no POC monitoring data collected in WY 2023 that is required to be reported to CEDEN via the CEDEN data portal.[3]

All WY 2023 data were considered comparable to SWAMP data and other RMC data.

2.5. Completeness

Completeness is the degree to which all data were produced as planned; this covers both sample collection and analysis. An overall completeness of greater than 90% is considered acceptable for RMC chemical data and field measurements.

During WY 2023, SCVURPPP collected and analyzed 100% of the planned chemical analytes and field measurements.

2.6. Sensitivity

Sensitivity analysis determines whether the methods can identify and/or quantify results at low enough levels. This data quality attribute is evaluated via the assessment of RLs.

The RLs for many of the analytes in sediment samples exceeded the MRLs specified in the QAPP. All pesticide concentration's RLs were diluted, which raised the RL. However, pesticide RLs would have been under the MRL if dilution had not occurred. Zinc concentrations were also measured from a diluted sample. Individual PAHs were also measured from diluted samples but were still less than the MRL. The inorganic analysis revealed elevated RLs that were above MRLs and were not from diluted samples. These samples could have had a high amount of other solids present, which could raise the RL. Overall, the data was deemed acceptable by the QAO with no changes or rejections.

2.7. Contamination

For chemical data, contamination is assessed as the presence of analytical constituents in blank samples. Laboratory method blank analyses were performed at the required frequencies specified by the QAPP (a minimum of one laboratory blank must be prepared and analyzed in every analytical batch). For purposes of data qualification, the laboratory method blanks were associated with all samples prepared in the analytical batch.

All laboratory method blank results were non-detect to the MDLs for all target analytes, indicating that there was no contamination present.

2.8. Accuracy

Accuracy is assessed as the percent recovery of samples spiked with a known amount of a specific chemical constituent. The analytical laboratory evaluated and reported the Percent Recovery of Laboratory Control Samples (LCS; in lieu of reference materials) and Matrix Spikes (MS), which were reported by the laboratory as well as recalculated by the QAO and compared to the target ranges in the QAPP. If a QA sample did not meet MQOs, all samples in that batch for that analyte were flagged.

All sediment and water analytes' LCS and MS samples met their corresponding MQOs and frequency (one LCS and matrix spike per 20 samples or per analytical batch, whichever is more frequent per analyte) and

[1] Look up lists available online at https://swamp.waterboards.ca.gov/swamp_checker/LookUpLists.aspx
[2] Checker available online at https://swamp.waterboards.ca.gov/swamp_checker/SWAMPUpload.aspx
[3] Convertor available at: http://www.ceden.org/docs/2015_templates/swamp_to_ceden_converter_042115.xlsm

the data were deemed acceptable by the QAO with no changes. Some regional monitoring results external to SCVURPPP had flagged data due to minor inconsistencies relative to MQOs. No data were rejected.

2.9. Precision

Precision is the repeatability of a measurement and is quantified by the Relative Percent Difference (RPD) of two duplicate samples. Three measures of precision were used for this project, laboratory duplicates (LCSDs), MSDs, and field duplicates (FDs). The MQO for RPDs specified by the QAPP is <25% for most analytes and <35% for pyrethroids.

All water and sediment LCSD and MSD samples met their corresponding MQO RPDs (RPD<25% or <35% for pyrethroids) when compared with their respective paired LCS and MS samples as well as frequency (One LCSD and MSD per 20 samples or per analytical batch, whichever is more frequent).

A sediment sample field duplicate was collected in Contra Costa County on July 18, 2023 and a water sample field duplicate was collected on November 8, 2022. The sediment field duplicate sample and corresponding RPDs were analyzed for precision and values are shown in Table 6. Table 7 displays field duplicate values for water column RPDs. Due to the variability in reporting limits, values less than the RL (J-flagged) should not be evaluated for RPD. The measured concentrations of many of the analytes from the original and duplicate samples were below the method detection limit and therefore reported as non-detect (ND).

The analysis of precision for the sediment sample revealed that a total of eight analytes had RPDs over the MQO (medium sand and granule grain distribution, cyfluthrin, benz(a)anthracene, chrysene, fluoranthene, phenanthrene, and pyrene). However, cyfluthrin, benz(a)anthracene, and chrysene should not be considered for exceeding MQOs due to samples being J-flagged. Qualifying data exceeding MQOs were flagged. Wet weather water samples analyzed for precision found no exceedances of MQOs for pyrethroid pesticides. This list is comparable to past years' results.

Table 6. Summary of qualifiers assigned as a result of field duplicates exceeding the measurement quality objective for relative percent difference.

Analyte		Unit	Original	Duplicate	RPD (%)	Exceeds MQO? (<25%)[a]
Grain Size Distribution	Clay: <0.0039 mm	%	9.3	8.4	10	No
	Silt: 0.0039 to <0.0625 mm	%	11.1	11.8	6.1	No
	Sand: V. Fine 0.0625 to <0.125 mm	%	21.4	18.9	12	No
	Sand: Fine 0.125 to <0.25 mm	%	51.6	52.1	1.0	No
	Sand: Medium 0.25 to <0.5 mm	%	5.8	8	32	Yes
	Sand: Coarse 0.5 to <1.0 mm	%	0.5	0.6	18	No
	Sand: V. Coarse 1.0 to <2.0 mm	%	0.3	0.2	40	No
	Granule: 2.0 to <4.0 mm	%	0.3	0.2	40	Yes
	Pebble: Small 4 to <8 mm	%	0	0	NA	NA
	Pebble: Medium 8 to <16 mm	%	0	0	NA	NA
	Pebble: Large 16 to <32 mm	%	0	0	NA	NA
	Pebble: V. Large 32 to <64 mm	%	0	0	NA	NA
Metals	Arsenic	mg/Kg dw	3.4	3.2	6.1	No
	Cadmium	mg/Kg dw	0.30	0.30	0	No
	Chromium	mg/Kg dw	26	24	8.0	No
	Copper	mg/Kg dw	20	17	16.2	No

	Lead	mg/Kg dw	11	9.4	15.7	No
	Nickel	mg/Kg dw	31	29	6.7	No
	Zinc	mg/Kg dw	73	73	0	No
	Total Organic Carbon	% dw	0.99	1.1	10.5	No
Pyrethroids (MQO <35%)	Bifenthrin	ng/g dw	1.6	1.6	0	No
	Cyfluthrin	ng/g dw	J 0.16	J 0.29	58	Yes
	Lambda-Cyhalothrin	ng/g dw	J 0.22	J 0.28	24	No
	Cypermethrin	ng/g dw	J 0.25	J 0.24	4.1	No
	Deltamethrin/Tralomethrin	ng/g dw	J 0.46	J 0.47	2.2	No
	Esfenvalerate/Fenvalerate	ng/g dw	ND	ND	NA	NA
	Permethrin, Total	ng/g dw	ND	ND	NA	NA
Fipronil	Fipronil	ng/g dw	ND	ND	NA	NA
	Fipronil Desulfinyl	ng/g dw	ND	ND	NA	NA
	Fipronil Sulfide	ng/g dw	ND	ND	NA	NA
	Fipronil Sulfone	ng/g dw	ND	ND	NA	NA
Polycyclic Aromatic Hydrocarbons	Acenaphthene	ng/g dw	ND	ND	NA	NA
	Acenaphthylene	ng/g dw	ND	ND	NA	NA
	Anthracene	ng/g dw	ND	ND	NA	NA
	Benz(a)anthracene	ng/g dw	J 7.9	27	110	Yes
	Benzo(a)pyrene	ng/g dw	ND	32	NA	NA
	Benzo(b)fluoranthene	ng/g dw	ND	52	NA	NA
	Benzo(e)pyrene	ng/g dw	ND	31	NA	NA
	Benzo(g,h,i)perylene	ng/g dw	ND	ND	NA	NA
	Benzo(k)fluoranthene	ng/g dw	ND	20	NA	NA
	Biphenyl	ng/g dw	ND	ND	NA	NA
	Chrysene	ng/g dw	J 18	54	100	Yes
	Dibenz(a,h)anthracene	ng/g dw	ND	ND	NA	NA
	Dibenzothiophene	ng/g dw	ND	ND	NA	NA
	Dimethylnaphthalene, 2,6-	ng/g dw	ND	ND	NA	NA
	Fluoranthene	ng/g dw	22	65	99	Yes
	Fluorene	ng/g dw	ND	ND	NA	NA
	Indeno(1,2,3-c,d)pyrene	ng/g dw	ND	30	NA	NA
	Methylnaphthalene, 1-	ng/g dw	ND	ND	NA	NA
	Methylnaphthalene, 2-	ng/g dw	ND	ND	NA	NA
	Methylphenanthrene, 1-	ng/g dw	ND	ND	NA	NA
	Naphthalene	ng/g dw	ND	ND	NA	NA
	Perylene	ng/g dw	ND	J12	NA	NA
	Phenanthrene	ng/g dw	21	33	44	Yes
	Pyrene	ng/g dw	22	64	98	Yes
	Trimethylnaphthalene, 2,3,5-	ng/g dw	ND	ND	NA	NA

a. MQO for precision of J-flagged data does not apply

Table 7. Summary of sample water data RPDs.

	Analyte	Unit	Original	Duplicate	RPD (%)	Exceeds MQO? (<35%)[a,b]
	Imidacloprid	ug/L	ND	ND	NA	NA
Pyrethroids	Bifenthrin	ug/L	0.0053	0.0049	8	No
	Cyfluthrin	ug/L	0.0006	0.0007	15	No
	Lambda-Cyhalothrin	ug/L	0.0006	J 0.00048	NA	NA
	Cypermethrin, total	ug/L	J 0.0004	ND	NA	NA
	Deltamethrin/Tralomethrin	ug/L	J 0.0009	ND	NA	NA
	Esfenvalerate/Fenvalerate	ug/L	ND	ND	NA	NA
	Fipronil	ug/L	0.0077	0.0072	6.7	No
	Fipronil Desulfinyl	ug/L	0.0028	0.0028	0	No
	Fipronil Sulfide	ug/L	J 0.0006	J 0.0006	NA	NA
	Fipronil Sulfone	ug/L	0.0059	0.0072	20	No
	Permethrin	ug/L	ND	ND	NA	NA

a. MQO for precision of J-flagged data does not apply
b. MQO for imidacloprid not to exceed 25%

3.0 Toxicity Testing

3.1. Representativeness

Data representativeness assesses whether the data were collected in a manner that represents actual conditions at each monitoring location. For this project, all samples were assumed to be representative if they were collected and analyzed according to protocols specified in the QAPP. Field and laboratory personnel received and reviewed the QAPP and followed prescribed protocols including laboratory methods, holding times, preservation, and storage.

Dry weather water and sediment toxicity samples were collected by KEI concurrently with dry season sediment chemistry samples at two Santa Clara County sites on July 18, 2023. Wet weather water toxicity samples were also collected by KEI for WY 2023 alongside water chemistry samples at three sites in Santa Clara County on November 8, 2022. All toxicity tests were performed by Pacific EcoRisk. In accordance with the MRP, the water samples were analyzed for toxicity to five organisms (*Selenastrum capricornutum*, *Ceriodaphnia dubia*, *Pimephales promelas*, *Hyalella azteca*, and *Chironomus dilutus*) and the dry season sediment samples were analyzed for toxicity to *Hyalella azteca* and *Chironomus dilutus*.

3.2. Hold Times

Extractions and analyses were performed within the recommended holding time criteria and no additional data flags were assigned by the QAO.

3.3. Preservation and Sample Storage

The samples were preserved and stored appropriately as ascribed by the respective methods and no additional data flags were assigned by the QAO.

3.4. Comparability

The QAO ensures that the data may be reasonably compared to data from other programs producing similar types of data. For pesticides and toxicity monitoring, individual stormwater programs strive to maintain comparability within the Regional Monitoring Coalition (RMC). The key measure of comparability for all RMC data is the California Surface Water Ambient Monitoring Program (SWAMP).

Electronic data deliverables (EDDs) were submitted to the San Francisco Bay Regional Water Quality Control Board (SFRWQCB) in Microsoft Excel templates developed by the California Environmental Data Exchange Network (CEDEN) which are comparable to SWAMP. In addition, data entry followed SWAMP documentation specific to each data type, including the exclusion of qualitative values that do not appear on CEDEN's look up lists. Completed templates were reviewed using CEDEN's online data checker, further ensuring SWAMP-comparability. Pesticides and toxicity monitoring data collected in WY 2023 is required to be reported to CEDEN via the CEDEN data portal.

All WY 2023 data were considered comparable to SWAMP data and other RMC data.

3.5. Completeness

Completeness is the degree to which all data were produced as planned; this covers both sample collection and analysis. An overall completeness of greater than 90% is considered acceptable for RMC chemical data and field measurements.

The MRP requires the collection of dry weather water and sediment toxicity samples at two sites per year in Santa Clara County. Three wet weather water toxicity samples were collected at two sites in Santa Clara County. Pacific EcoRisk tested the required organisms for toxicity, and 100% of results were reported. During WY 2023, SCVURPPP collected and analyzed 100% of the planned toxicity analytes and field measurements.

3.6. Sensitivity and Accuracy

Internal laboratory procedures that align with the RMC QAPP were performed and submitted to SCVURPPP. Four measures of quality control are assessed, including maintenance of acceptable test conditions, negative control testing, positive control (i.e., reference toxicant testing), and Concentration Response Relationship assessment. The laboratory data QC checks found that all conditions and responses were acceptable. A copy of the laboratory QC report is available upon request.

3.7. Contamination

There are no QA/QC procedures for contamination of toxicity samples, but staff followed applicable RMC SOPs to limit possible contamination of samples. Although there were no pathogen related mortalities observed in ambient samples, two of the replicates from January 10, 2023 resampled water at 205GUA_TRM had complete mortality while the remaining replicates had no changes in mortality. Control water also had no observed mortality. There were no water quality issues (e.g., dissolved oxygen, pH, and conductivity) in the affected replicates, suggesting that sample homogenization prior to testing was not as thorough as it should have been. Poorly homogenized sample water could then lead to drastic differences in the contaminant distribution between the replicates.

3.8. Precision

Field duplicates for water and sediment toxicity are not required by the RMC QAPP. Subsequently, precision could not be evaluated.

4.0 References

Bay Area Stormwater Management Agency Association (BASMAA). 2013. Quality Assurance Project Plan. Clean Watersheds for a Clean Bay – Implementing the San Francisco Bay's PCB and Mercury TMDL with a Focus on Urban Runoff. Revision Number 1. EPA San Francisco Bay Water Quality Improvement Fund Grant # CFDA 66.202. Prepared for Bay Area Stormwater Management Agencies Association (BASMAA) by Applied Marine Sciences (AMS). August.

BASMAA (Bay Area Stormwater Management Agency Association) Regional Monitoring Coalition (RMC). 2016. Creek Status and Pesticides & Toxicity Monitoring Standard Operating Procedures, 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. 190 pp.

BASMAA (Bay Area Stormwater Management Agency Association) Regional Monitoring Coalition (RMC). 2020. Creek Status and Pesticides & Toxicity Monitoring Quality Assurance Project Plan, Final Version 4. 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. 79 pp plus appendices.

SFBRWQCB (San Francisco Bay Regional Water Quality Control Board). 2022. Municipal Regional Stormwater NPDES Permit. Order R2-2022-0018, NPDES Permit No. CAS612008. May. 724 pp.

Surface Water Ambient Monitoring Program (SWAMP). 2022. Surface Water Ambient Monitoring Program Quality Assurance Program Plan. Version 2.0. January. 152 pp.