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Study 321. Surface Water Monitoring for Pesticides in Agricultural Areas in the Central Coast and Southern California in 2026 and 2027

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1. INTRODUCTION

Surface water monitoring in agricultural areas is a priority for the California Department of Pesticide Regulation (DPR) to assess potential impacts of pesticides from agricultural runoff on California's aquatic environments. Initiated in 2008, collection of agricultural runoff within the Central Coast and southern regions of California represents one of DPR's long-term environmental monitoring efforts. Annual surface water monitoring data help guide DPR in the development and implementation of regulatory and non-regulatory mitigation activities. This project's current monitoring efforts are focused on two major agricultural regions of California: the Central Coast and the Imperial Valley (Southern California).

The Central Coast (CC) monitoring areas include major watersheds in Monterey, Santa Barbara, and San Luis Obispo counties (Main, 2019, 2020; Deng, 2021, 2022, Lima, 2023, 2024, 2025). In 2023, Monterey was the fourth largest county in total value of production that contributed most to California's agricultural economy, with Santa Barbara and San Luis Obispo also being within the top fifteen state counties (CDFA, 2024). Notable for its broad diversity of crops, many of which are grown year-round, CC leading commodities include strawberry, leaf and head lettuce, broccoli, cauliflower, celery, spinach, grapes, among other vegetables and fruit crops (CDFA, 2024; Monterey County Farm Bureau, 2025). Such heavy and diverse agricultural production is linked to a wide range of pesticide active ingredients (AIs) that are applied annually. The Pesticide Use Reporting (PUR) database estimated permethrin, imidacloprid, and thiamethoxam among the most applied pesticides in the CC agricultural area with over 17 million pounds of agricultural pesticides applied in 2023 (DPR, 2025).

Similarly, the Imperial Valley (IMP) in Southern California is known for growing a wide variety of crops. In 2023, Imperial was the eighth largest county in total value of production that contributed most to California's agricultural economy (CDFA, 2024). Its top crops included alfalfa, leaf and head lettuce, Bermuda grass hay, among other vegetables and fruit and nut crops (Imperial County, 2023). The region is extremely dry with a hot desert climate characterized by daily temperature extremes. Thus, intensive irrigation is required to achieve its high crop production. The extensive use of pesticides on top of heavy use of irrigation and diverse planting substantiate both the CC and IMP areas with greater potential for pesticide transport into surface waters via agricultural runoff.

Study 321 is a continuation of DPR's agricultural monitoring efforts in CC and IMP regions (*see Study 304*). The current monitoring sites were established in previous years (Deng, 2017, 2022) and proposed exploratory sites will be sampled to address identified research gaps. The watershed-based prioritization approach was applied to help refine the pesticide priority list for monitoring using DPR's Surface Water Monitoring Prioritization model (SWMP; Luo et al., 2013, 2014, 2015). The prioritized lists of pesticides identified by SWMP were used to inform regional sampling efforts and to identify AIs needing analytical method development. Each year, monitoring frequency in the CC will include three sampling events during the irrigation season from May to September, and two sampling events in the winter from November to February to capture storm runoff. Monitoring in IMP will be conducted twice a year in March and October.

2. OBJECTIVES

The goals of the project are to assess emerging issues and long-term trends of pesticide occurrence in surface water resulting from agricultural runoff and their potential impact to the surrounding aquatic environments. Monitoring results can be used to assess the efficacy of mitigation efforts and provide information to DPR management to determine whether additional mitigations are necessary. The objectives of this study are as follows:

- Determine occurrences and measure chemical concentrations of high-priority pesticides in aqueous and sediment samples;
- Determine toxicity of water samples using lab surrogate species (*Hyalella azteca*, *Chironomus dilutus, Ceriodaphnia dubia*);
- Evaluate potential impacts on aquatic environments by comparing environmental concentrations with current toxicity thresholds;
- Evaluate storm runoff on pesticide transport from agricultural fields;
- Analyze spatial correlations between observed pesticide concentrations and detection frequencies with region-specific pesticide use;
- Assess trends in pesticide concentrations at long-term monitoring stations to evaluate efficacy of mitigation efforts and future needs;
- Publish raw data sets on Surface Water Monitoring Database (SURF) and annual monitoring results in a summary report. Share aforementioned evaluation reports on DPR Surface Water Protection Program website once they become available.

3. PERSONNEL

This study will be conducted by staff from the Environmental Monitoring Branch, Surface Water Protection Program, under the general direction of Dr. Anson Main, Environmental Program Manager I (Supervisory). Key personnel are listed below:

Project Leader:	Pedro Lima, Ph.D.
Field Coordinator:	Rose Sherman
Reviewing Scientist:	Robert Budd, Ph.D.
Statistician:	Xuyang Zhang Ph.D.
Laboratory Liaison:	Joshua Alvarado
Analytical Chemistry:	Center for Analytical Chemistry, California Department of Food and Agriculture (CDFA)
Toxicity Test:	Aquatic Health Program Laboratory (AHPL), University of California at Davis

Questions concerning this monitoring project should be directed to Dr. Pedro Lima, Sr. Environmental Scientist (Specialist), at (916) 324-4186 or by email at pedro.lima@cdpr.ca.gov.

4. STUDY PLAN

4.1 Pesticides for Monitoring

Pesticides of potential concern were prioritized following the procedures described in the SWMP model memos (Luo et al., 2013, 2014, 2015). Watershed boundaries were delineated using 12-digit Hydrologic Unit Codes (HUC12) from the U.S. Geological Survey's Watershed Boundary Database (NHD, 2025) and used as spatial inputs to the SWMP model. The watershed boundary defines the areas that contribute to the specific HUC12 where the monitoring site is located. The SWMP model aggregates the total use of each pesticide upstream and within each HUC12 by utilizing their use amounts reported in the PUR database. To account for environmental fate, the model adjusted the total pesticide use by factoring in aquatic dissipation as a function of travel time between each upstream HUC12 and the HUC12 where the monitoring site is located. Pesticide aquatic dissipation was calculated based on water-sediment DT_{50} (half-life) of each pesticide of interest. This study applied the SWMP model to generate a ranked list of pesticides for each sampling site. The final *rank score* of a pesticide is the product of the rank in use amount and the relative toxicity of that pesticide among all pesticides used upstream. Pesticides were then analyzed to produce final monitoring lists for individual watersheds following the general procedure below:

1) Pesticides with a use score ≥ 2 and a final ranking score > 8 in a priority list for a watershed of interest will be monitored;

2) Pesticides with a use score < 2 and/or final scores ≤ 8 in a priority list are considered low priority but may be included as part of a larger analytical screen;
3) Pesticides that may not have high potential to cause surface water toxicity due to their physicochemical properties (e.g. short persistence in water) are excluded from monitoring, despite their use amount and aquatic toxicity being relatively high as indicated by the final score;
4) Historical monitoring data and/or current availability of analytical methods at the Center for Analytical Chemistry (CDFA) lab are additional factors to consider in deciding a final list for monitoring recommendations;
5) Pesticides that are identified as high priority for monitoring that are not included in current analytical screens will be noted for requiring analytical method development.

4.2. Selection of Monitoring Sites

Monitoring will be conducted in Monterey, Santa Barbara, and San Luis Obispo counties in the CC and Imperial County in Southern California. Most sites described in this protocol have been previously sampled by DPR (Main, 2019, 2020; Deng, 2021, 2022, Lima, 2023, 2024, 2025). These sites were selected using the watershed prioritization component of the SWMP model, which identifies HUC12s based on reported pesticide use and toxicity data. Using the SWMP model and its aggregation tool (Luo et al., 2017), the top eight priority HUC12s for the IMP (Table A14, Figure 1) and the top ten priority HUC12s for the CC (Table A15, Figures 2 and 3) were identified. Factors such as sampling being conducted concurrently at downstream sites, budgetary constraints, and other monitoring agency representation direct site selection in the HUCs. A more detailed justification is provided in both Tables A14 and A15.

Monitoring plans for each county are described below. The chemical lists for monitoring were generated by the SWMP model using the average yearly pesticide use from 2021 to 2023.

4.2.1. Imperial County

Ambient monitoring will be conducted in Imperial County twice a year at six established sites. Whole water samples will be collected during two sampling events at each site, and at a subset of sites for toxicity testing. Sediment samples will be collected once a year in October. Sediment samples will be analyzed for eight pyrethroids (bifenthrin, λ-cyhalothrin, permethrin, cyfluthrin, cypermethrin, fenpropathrin, esfenvalerate, and deltamethrin). Monitoring locations are located at the Alamo River and New River watersheds (Table 1, Figure 1). Monitoring will be conducted in March and October to capture the runoff during the periods of higher pesticide uses coinciding with spring and fall in Imperial County.

The chemicals recommended by the prioritization model for monitoring in the New River and Alamo River are similar to those in 2025 (Tables A1, A2). The AIs 4-(2,4-DB), dimethylamine salt, ametoctradin, hexythiazox, and linuron are recommended for monitoring, however they will not be monitored in 2026 and 2027 because an analytical method for the four AIs has not yet been developed.

4.2.2. Monterey County

Ambient monitoring will be conducted in Monterey County five times a year at seven sites including three times during the growing season (May, July, and September), and two times during storm events in the fall and winter. Storm sampling will target the first significant runoff flush event (fall storm), followed by a subsequent sampling event to assess residual concentrations (winter storm). Whole water samples will be collected during each sampling event for chemical analysis, and a subset of water samples will be collected during each sampling event for toxicity testing. Sediment samples from all seven sites will be collected only in September of each year for pyrethroid analysis. Monitoring sites are located at the Salinas River and Tembladero Slough watersheds (Table 1, Figure 2).

The chemicals recommended by the prioritization model are similar to those in 2025. Ametoctradin, cyantraniliprole, linuron, propyzamide, and spinetoram are recommended for monitoring (Tables A3, A4), however they will not be monitored in 2026 and 2027 because an analytical method for the five AIs has not yet been developed.

4.2.3. Santa Barbara and San Luis Obispo Counties

Ambient monitoring will be conducted in Santa Barbara and San Luis Obispo counties three times a year in May, July, and September at four established sites (Table 1). Whole water samples will be collected during each sampling event for chemical analysis and a subset of water samples from the four sites will be collected during each sampling period for toxicity testing. Sediment samples will only be collected in September of each year for pyrethroid analysis. Monitoring sites are located at Orcutt Creek and Oso Flaco Creek watersheds (Table 1, Figure 3).

The chemicals recommended by the prioritization model for monitoring in the Orcutt Creek Watershed are similar to those in 2025. Ametoctradin, cyflumetofen, linuron, novaluron, and propyzamide appear on the priority list for monitoring (Tables A5, A6). However, they will not be included for monitoring as analytical methods have not been developed for the five AIs.

4.3. Modifications from 2025

The following key modifications to the monitoring program will be implemented in the upcoming sampling schedule. Moving forward, the monitoring protocol will be developed on a biennial basis, with the next cycle covering the 2026–2027 period. This shift to a two-year planning setup is intended to optimize sampling effectiveness and support more consistent long-term data collection.

Monterey County's Quail Creek site, previously designated as an established sampling location, will be removed from the monitoring schedule due to the absence of surface water runoff observed over recent years.

During the 2026 and 2027 monitoring years, sampling may include the collection of water samples from exploratory sites located within the previously mentioned counties, though additional counties may also be considered as warranted. Exploratory sites are used to increase spatial representation within prioritized watersheds and to help verify land use contributions by minimizing upstream sources. These efforts are intended to address existing research gaps—such as characterizing surface water runoff in under-monitored areas—through the use of exploratory sites that target regions with emerging pesticide use and elevated runoff potential.

5. SAMPLING METHOD

5.1. Water and Sediment Sampling

Whole water samples will be collected as grab samples directly into 1-liter amber glass bottles by hand or using a pole and then sealed with Teflon-lined lids (Deng and Ensminger, 2021). Auto samplers (Teledyne Isco, Inc., Lincoln, NE) will be used to collect storm runoff over the course of a storm event (time-weighted) where possible. Sediment samples will be collected into half-pint Mason jars using stainless steel scoops from the top 2-cm bed layer. Sediments will be sieved through a 2-mm sieve to remove gravel and plant materials and homogenized (Deng and Ensminger, 2021; Ensminger, 2017). Samples will be stored and transported on wet ice or refrigerated at 4°C until analyzed.

5.2. Sample Transport

The SWPP staff will transport water and sediment samples to the Center for Analytical Chemistry at CDFA for chemical analysis and to the UC Davis Aquatic Health Program Laboratory (AHPL) following the procedures outlined in DPR Standard Operating Procedure (SOP) QAQC004.01 (Jones, 1999). A chain-of-custody record will be completed and will accompany each sample.

5.3. Field Measurements

Dissolved oxygen, pH, specific conductivity, total dissolved solids (TDS), salinity and water temperature will be measured *in situ* during each sampling event (Mecredy, 2024) with an Aqua Troll 400 multi-parameter water quality sonde (In Situ Inc., Fort Collins, CO).

6. LABORATORY ANALYSES

6.1. Chemical Analysis

Chemical analyses will be performed by the Center for Analytical Chemistry at CDFA. A total of 82 pesticides will be analyzed in the water samples collected from the sampling sites in 2026 and 2027. Of these, 58 pesticides will be measured using a single multi-analyte liquid chromatography screen (LC-screen), as detailed in Table A7 along with their associated method reporting limits and method detection limits. Additional screens (and number of AIs) including dinitroanilines (6), phenoxies (4), neonicotinoids (3), pyrethroids (8), and glyphosate (3), will also be analyzed (Tables A8 - A12). Sediment samples will be analyzed for eight pyrethroids (Table A13). Quality Assurance/Quality Control (QA/QC) will be conducted in accordance with the SOP QAQC001.01 (Peoples, 2019). Approximately 10% of all samples collected during the 2026 to 2027 monitoring years will be included for QC. Laboratory QA/QC will follow DPR guidelines and will consist of laboratory blanks, matrix spikes, surrogate spikes, field matrix spikes, and field matrix spikes duplicates (Peoples, 2019). Laboratory blanks and matrix spikes will be included in each extraction set. All pesticides identified as high priority by the SWMP model are included in current analytical screens except for the following nine pesticides: 4-(2,4-DB), dimethylamine salt, ametoctradin, cyantraniliprole, cyflumetofen, hexythiazox, linuron, novaluron, propyzamide, and spinetoram. Analytical methods will need to be developed for the aforementioned pesticides before their inclusion for monitoring.

6.2. Organic Carbon and Suspended Solid Analyses

Total organic carbon (TOC) and dissolved organic carbon (DOC) in water samples will be analyzed by DPR staff using a Vario TOC Cube TOC/TNb Analyzer (Elementar Analysensysteme GmbH, Langenselbold, Germany) following a procedure similar to that outlined in Elementar (2009). Before analysis of each sample set, lab blanks and calibration standards will be run to ensure the quality of the TOC and DOC data. Water samples will also be analyzed for suspended sediment (Ensminger, 2016). Similarly, sediment samples collected during September (Central Coast) and October (Imperial Valley) will be analyzed for TOC using the TOC Cube TOC/TNb Analyzer.

6.3. Toxicity Analysis

Toxicity analyses will be conducted in collaboration with the UC Davis AHPL. Grab whole water samples collected from a set of selected sampling sites in the CC and IMP regions will be tested for mortality using *Hyalella azteca*, *Chironomus dilutus, and Ceriodaphnia dubia* as surrogate species.

7. DATA ANALYSIS

All data generated by this project will be entered into a Microsoft Office Access database that holds field information, field measurements, and laboratory analytical data. All ambient monitoring analytical data will also be uploaded into the DPR SURF database (DPR 2025).

Periodic assessments of monitoring data can include the following:

- Comparison of pesticide concentrations to aquatic toxicity benchmarks, water quality objectives, and other toxicity thresholds.
- Spatial analysis of data to identify correlations between observed pesticide concentrations and pesticide uses, rainfall, and geographical features.
- Assessment of multiple years of data to characterize patterns and trends in detection frequencies and exceedances of toxicity thresholds.
- Assessment of SWMP model results to determine potential needs of additional monitoring in regions with similar pesticide use patterns.

8. ESTIMATED TIMETABLE

Field Sampling:	January 2026–December 2027
Chemical Analysis:	January 2026–February 2028
Draft Report:	May 2027 and May 2028
Data Entry into SURF:	May 2027 and May 2028

9. SAMPLING EVENTS

The sampling schedule for each county is provided in Table 2.

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11. TABLES

Table 1. Sampling site information for Study 321 in 2026 and 2027.

County	Site ID	SURF ID	Location	Watershed	Latitude	Longitude	Waterbody Type	Site Type
Imperial	Imp_NewRiv27	13_71	New River at HWY S27/Keystone Rd	New River	32.9136	-115.60646	Waterway	Main Stem
Imperial	Imp_Lack	13_60	New River at Lack Road	New River	33.0999	-115.64876	Waterway	Main Stem
Imperial	Imp_Rice3	13_69	Rice Drain III at Weinert Rd	New River	32.8691	-115.651	Engineered Conveyance	Ag Ditch
Imperial	Imp_Rutherford	13_56	Alamo River at Rutherford Rd	Alamo River	33.0447	-115.48829	Waterway	Main Stem
Imperial	Imp_Garst	13_10	Alamo River at Garst Road	Alamo River	33.199	-115.59696	Waterway	Main Stem
Imperial	Imp_Holtville	13_22	Holtville Main Drain at HWY 115	Alamo River	32.9309	-115.40611	Engineered Conveyance	Ag Ditch
Monterey	Sal_Chualar	27_8	Chualar Creek at Chualar River Rd	Salinas River	36.5584	-121.52964	Engineered Conveyance	Ag Ditch
Monterey	Sal_Davis	27_13	Salinas River at Davis Rd	Salinas River	36.647	-121.70219	Waterway	Main Stem
Monterey	Sal_Blanco	27_9	Blanco Drain at Cooper Rd	Salinas River	36.6987	-121.73516	Engineered Conveyance	Ag Ditch
Monterey	Sal_Hartnell	27_70	Alisal Creek at Hartnell Rd	Tembladero Slough	36.6435	-121.57836	Engineered Conveyance	Ag Ditch
Monterey	Sal_SanJon	27_12	Rec Ditch at San Jon Rd	Tembladero Slough	36.7049	-121.70506	Engineered Conveyance	Ag Ditch
Monterey	Sal_Tembl	27_57	Tembladero Slough at HWY 183	Tembladero Slough	36.75166	-121.74186	Waterway	Tributary Stream
Monterey	Sal_Haro	27_66	Tembladero Slough at Haro St.	Tembladero Slough	36.7596	-121.75433	Waterway	Main Stem
San Luis Obispo	SM_OFC	40_13	Oso Flaco Creek at Oso Flaco Creek Road	Oso Flaco Creek	35.0164	-120.58755	Waterway	Main Stem
Santa Barbara	SM_Solomon	42_48	Solomon Creek at HWY 1	Orcutt Creek	34.9414	-120.5742	Waterway	Tributary Stream
Santa Barbara	SM_Orcutt	42_50	Orcutt Creek at West Main St	Orcutt Creek	34.9576	-120.63244	Waterway	Main Stem
Santa Barbara	SM_Main	42_49	Main Ditch at HWY 166	Main Ditch	34.95474	-120.48501	Engineered Conveyance	Ag Ditch

Table 2. Annual sample count by analytical screen and region in 2026 and 2027*.

Analyte Group**	Location[1]	Mar	May	July	Sept	Oct	Fall Storm	Winter Storm***	Total samples[2]
LC-Full	IMP	6				6			12
DN/OX	IMP	6				6			12
Phenoxy	IMP	6				6			12
Neonics	IMP	6				6			12
PY-Water	IMP	6				6			12
PY-Sediment	IMP					6			6
LC-Full	CC****		14	14	14		10	10	62
DN/OX	CC****		14	14	14		10	10	62
Neonics	CC****		14	14	14		10	10	62
PY-Water	CC****		14	14	14		10	10	62
GL	CC****		14	14	14		10	10	62
PY-Sediment	CC****				14				14
Overall		**30**	**70**	**70**	**84**	**36**	**50**	**50**	**390**

*Numbers under each month represent the total number of samples collected for each analyte or analyte group. One whole water grab sample for each analyte or analyte group will be collected from one site.

**LC = Liquid chromatograph multi-analyte screen (54 AIs); DN/OX = Dinitroaniline & Oxyfluorfen; Neonics = Neonicotinoids; PY = Pyrethroid; GL = Glyphosate.

***Winter storm could possibly occur in the following year (2027 and 2028).

****Eleven established sites (7 in Salinas Valley and 4 in Santa Maria Valley) and three tentative exploratory sites will be sampled during the dry and storm seasons in the Central Coast trips.

[1]CC = Central Coast = Monterey, Santa Barbara and San Luis Obispo counties.

[2]10% of the equivalent total samples collected will be used for QA/QC.

12. APPENDIX

Table A1. Pesticide prioritization for surface water monitoring in Alamo River in Imperial County.

Chemical	Use Score	Use (lbs)	Tox Score	Lowest USEPA benchmark (BM) (µg/L)	Final Score	Monitoring Inclusion
Permethrin	3	6,152	7	0.0033	21	Yes
Pendimethalin	5	183,815	4	5.2	20	Yes
Trifluralin	5	65,444	4	9.25	20	Yes
Malathion	3	6,402	6	0.04	18	Yes
Methomyl	4	16,219	4	4.4	16	Yes
λ-cyhalothrin	2	3,484	8	0.00004	16	Yes
Esfenvalerate	2	1,368	8	0.0004	16	Yes
Imidacloprid	3	6,494	5	0.38	15	Yes
Atrazine	3	8,354	5	1	15	Yes
4-(2,4-DB), dimethylamine salt	4	26,377	3	83	12	No[1]
Chlorothalonil	3	11,737	4	9	12	No[2]
Bromoxynil Octanoate	3	10,744	4	5.5	12	No[2]
Cyfluthrin	2	1,313	6	0.01	12	Yes
Bensulide	5	46,292	2	140	10	Yes
Carbaryl	2	3,814	5	0.85	10	Yes
Oxyfluorfen	2	3,040	5	0.33	10	Yes
Mancozeb	3	15,411	3	47	9	No[2]
Dimethoate	3	7,810	3	21.5	9	Yes
Hexythiazox	3	7,108	3	60	9	No[1]
Methoxyfenozide	3	6,967	3	28.5	9	Yes
2,4-D	4	16,505	2	299.2	8	Yes
Linuron	2	3,473	4	2.5	8	No[1]
Chlorantraniliprole	2	2,406	4	8.3	8	Yes
Ametoctradin	2	1,317	4	7.8	8	No[1]
Cypermethrin	1	843	8	0.00028	8	Yes
Bifenthrin	1	283	8	0.00025	8	Yes

Alamo River drainage area = 1,264 km^2

[1]Analytical method not currently available. [2]Pesticides with low potential to cause surface water toxicity due to their physicochemical properties.

Table A2. Pesticide prioritization for surface water monitoring in New River in Imperial County.

Chemical	Use Score	Use (lbs)	Tox Score	Lowest USEPA benchmark (BM) (µg/L)	Final Score	Monitoring Inclusion
Pendimethalin	5	69,412	4	5.2	20	Yes
Trifluralin	5	20,586	4	9.25	20	Yes
Malathion	3	3,207	6	0.04	18	Yes
λ-cyhalothrin	2	1,473	8	0.00004	16	Yes
Atrazine	3	3,048	5	1	15	Yes
Imidacloprid	3	2,260	5	0.38	15	Yes
Permethrin	2	1,819	7	0.0033	14	Yes
4-(2,4-DB), dimethylamine salt	4	10,704	3	83	12	No[1]
Bromoxynil Octanoate	3	5,197	4	5.5	12	No[2]
Methomyl	3	5,000	4	4.4	12	Yes
Chlorothalonil	3	3,638	4	9	12	No[2]
Linuron	3	1,976	4	2.5	12	No[1]
Bensulide	5	22,948	2	140	10	Yes
Carbaryl	2	1,650	5	0.85	10	Yes
Oxyfluorfen	2	1,665	5	0.33	10	Yes
Diquat Dibromide	2	870	5	0.75	10	No[2]
Mancozeb	3	5,784	3	47	9	No[2]
Dimethoate	3	3,611	3	21.5	9	Yes
Methoxyfenozide	3	2,319	3	28.5	9	Yes
2,4-D	4	9,585	2	299.2	8	Yes
Chlorantraniliprole	2	924	4	8.3	8	Yes
Esfenvalerate	1	551	8	0.0004	8	Yes
Cypermethrin	1	344	8	0.0003	8	Yes
Bifenthrin	1	118	8	0.0002	8	Yes

New River drainage area = 1,729 km^2

[1]Analytical method not currently available. [2]Pesticides with low potential to cause surface water toxicity due to their physicochemical properties.

Table A3. Pesticide monitoring prioritization in Salinas River in Monterey County.

Chemical	Use Score	Use (lbs)	Tox Score	Lowest USEPA benchmark (BM) (µg/L)	Final Score	Monitoring Inclusion
Permethrin	3	20,673	7	0.0033	21	Yes
Methomyl	5	102,796	4	4.4	20	Yes
Malathion	3	17,675	6	0.04	18	Yes
Pendimethalin	4	30,439	4	5.2	16	Yes
λ-cyhalothrin	2	5,649	8	0.00004	16	Yes
Mancozeb	5	147,282	3	47	9	No[2]
Oxyfluorfen	3	20,490	5	0.33	15	Yes
Imidacloprid	3	18,453	5	0.38	15	Yes
Glufosinate-ammonium	4	59,803	3	72	12	Yes
Chlorothalonil	3	20,712	4	9	12	No[2]
Pyraclostrobin	3	10,670	4	1.5	12	Yes
Prometryn	3	10,176	4	1.04	12	Yes
Naled	2	9,953	6	0.05	12	No[2]
Bensulide	5	158,654	2	140	10	Yes
Fosetyl_Al	5	74,718	2	780	10	No[2]
Flumioxazin	2	5,388	5	0.49	10	No[2]
Cycloate	3	23,709	3	61	9	No[2]
Spinetoram	3	10,502	3	77.9	9	No[1]
Propyzamide	4	58,336	2	760	8	No[1]
Trifloxystrobin	2	4,924	4	7.15	8	Yes
Linuron	2	4,475	4	2.5	8	No[1]
Ametoctradin	2	4,230	4	7.8	8	No[1]
S-Metolachlor	2	2,982	4	8	8	Yes
Bifenthrin	1	2,827	8	0.0002	8	Yes
Cypermethrin	1	1,041	8	0.0003	8	Yes
Esfenvalerate	1	688	8	0.0004	8	Yes

Salinas River drainage area = 11,082 km^2

[1]Analytical method not currently available. [2]Pesticides with low potential to cause surface water toxicity due to their physicochemical properties.

Table A4. Pesticide monitoring prioritization in Tembladero Slough in Monterey County.

Chemical	Use Score	Use (lbs)	Tox Score	Lowest USEPA benchmark (BM) (µg/L)	Final Score	Monitoring Inclusion
Malathion	4	10,907	6	0.04	24	Yes
Naled	4	7,560	6	0.05	24	No[2]
Permethrin	3	3,187	7	0.0033	21	Yes
Methomyl	5	13,286	4	4.4	20	Yes
Novaluron	4	5,840	6	0.07	18	No[2]
Bifenthrin	2	1,046	8	0.00025	16	Yes
λ-cyhalothrin	2	1,034	8	0.00004	16	Yes
Mancozeb	5	18,098	3	47	15	No[2]
Captan	4	11,328	3	24	12	No[2]
Chlorothalonil	3	2,474	4	9	12	No[2]
Fosetyl_Al	5	12,673	2	780	10	No[2]
Oxyfluorfen	2	1,159	5	0.33	10	Yes
Imidacloprid	2	1,084	5	0.38	10	Yes
Thiram	3	5,914	3	21	9	No[2]
Cyantraniliprole	3	2,143	3	10.2	9	No[1]
Propyzamide	4	6,942	2	760	8	No[1]
Prometryn	2	1,248	4	1.04	8	Yes
Pyraclostrobin	2	1,845	4	1.5	8	Yes
Trifloxystrobin	2	1,200	4	7.15	8	Yes
Ametoctradin	2	1,018	4	7.8	8	No[1]
Acequinocyl	2	955	4	2.6	8	No[2]
Cypermethrin	1	116	8	0.0003	8	Yes
Esfenvalerate	1	196	8	0.0004	8	Yes

Tembladero Slough drainage area = 291 km^2

[1]Analytical method not currently available. [2]Pesticides with low potential to cause surface water toxicity due to their physicochemical properties.

Table A5. Pesticide monitoring prioritization in Orcutt Creek in Santa Barbara County.

Chemical	Use Score	Use (lbs)	Tox Score	Lowest USEPA benchmark (BM) (µg/L)	Final Score	Monitoring Inclusion
Malathion	5	28,383	6	0.04	30	Yes
Naled	4	11,140	6	0.05	24	No[2]
Permethrin	3	2,980	7	0.0033	21	Yes
Imidacloprid	4	7,685	5	0.38	20	Yes
Bifenthrin	2	1,238	8	0.0002	16	Yes
Captan	5	67,656	3	24	15	No[2]
Thiram	5	27,242	3	21	15	No[2]
Oxyfluorfen	3	4,804	5	0.33	15	Yes
Fenpropathrin	2	1,468	7	0.0015	14	Yes
Mancozeb	4	9,535	3	47	12	No[2]
Prometryn	3	4,659	4	1.04	12	Yes
Chlorothalonil	3	4,438	4	9	12	No[2]
Pendimethalin	3	4,157	4	5.2	12	Yes
Methomyl	3	2,951	4	4.4	12	Yes
Novaluron	2	1,118	6	0.07	12	No[1]
Propyzamide	4	7,507	2	760	8	No[1]
Acequinocyl	2	2,373	4	2.6	8	No[2]
Pyraclostrobin	2	2,207	4	1.5	8	Yes
Linuron	2	1,591	4	2.5	8	No[1]
Cyflumetofen	2	1,550	4	8.6	8	No[1]
Trifloxystrobin	2	1,495	4	7.15	8	Yes
Chlorantraniliprole	2	1,195	4	8.3	8	Yes
Ametoctradin	2	1,185	4	7.8	8	No[1]
Cypermethrin	1	54	8	0.00028	8	Yes
Esfenvalerate	1	11	8	0.00042	8	Yes
λ-cyhalothrin	1	443	8	0.00004	8	Yes

Orcutt Creek drainage area = 301 km^2

[1]Analytical method not currently available. [2]Pesticides with low potential to cause surface water toxicity due to their physicochemical properties.

Table A6. Pesticide monitoring prioritization in Oso Flaco Creek in San Luis Obispo County.

Chemical	Use Score	Use (lbs)	Tox Score	Lowest USEPA benchmark (BM) (µg/L)	Final Score	Monitoring Inclusion
Malathion	5	9,853	6	0.04	30	Yes
Naled	4	3,851	6	0.05	24	No[2]
Permethrin	3	1,192	7	0.0033	21	Yes
Imidacloprid	4	2,774	5	0.38	20	Yes
Bifenthrin	2	564	8	0.0002	16	Yes
Captan	5	29,723	3	24	15	No[2]
Thiram	5	8,890	3	21	15	No[2]
Oxyfluorfen	3	1,800	5	0.33	15	Yes
Mancozeb	4	4,207	3	47	12	No[2]
Pendimethalin	3	1,100	4	5.2	12	Yes
Cyprodinil	3	1,847	3	16	9	Yes
Pyraclostrobin	2	872	4	1.5	8	Yes
Trifloxystrobin	2	769	4	7.15	8	Yes
Ametoctradin	2	645	4	7.8	8	No[1]
Cyflumetofen	2	628	4	8.6	8	No[1]
Acequinocyl	2	604	4	2.6	8	No[2]
Chlorantraniliprole	2	462	4	8.3	8	Yes
Prometryn	2	481	4	1.04	8	Yes
Cypermethrin	1	6	8	0.00028	8	Yes
Esfenvalerate	1	0.2	8	0.00042	8	Yes
λ-cyhalothrin	1	73	8	0.00004	8	Yes

Oso Flaco Creek drainage area = 51 km^2

[1]Analytical method not currently available. [2]Pesticides with low potential to cause surface water toxicity due to their physicochemical properties.

Table A7. Reporting Limits and Method Detection Limits for Pesticides in LC* Multi-Analyte Screen (EMON-SM-05-037).

Pesticide	Method Detection Limit (ng/L)	Reporting Limit (ng/L)	Pesticide	Method Detection Limit (ng/L)	Reporting Limit (ng/L)
Abamectin	4	20	**Methoxyfenozide**	4	20
Acetamiprid	4	20	**Metribuzin**	4	20
Atrazine	4	20	**Norflurazon**	4	20
Azoxystrobin	4	20	**Oryzalin**	4	20
Bensulide	4	20	**Oxadiazon**	4	20
Boscalid	4	20	**Prometon**	4	20
Bromacil	4	20	**Prometryn**	4	20
Carbaryl	4	20	**Propanil**	4	20
Chlorantraniliprole	4	20	**Propargite**	4	20
Chlorpyrifos	4	20	**Propiconazole**	4	20
Cyprodinil	4	20	**Pyraclostrobin**	4	20
Diazinon	4	20	**Pyriproxyfen**	4	15
Diflubenzuron	4	20	**Quinoxyfen**	4	20
Dimethoate	4	20	**Simazine**	4	20
Diuron	4	20	**S-Metolachlor**	4	20
Ethoprop	4	20	**Tebuconazole**	4	20
Etofenprox	4	20	**Tebufenozide**	4	20
Fenamidone	4	20	**Tebuthiuron**	4	20
Fenhexamid	5	20	**Thiabendazole**	4	20
Fludioxonil	4	20	**Thiacloprid**	4	20
Hexazinone	4	20	**Thiamethoxam**	4	20
Imidacloprid	4	10	**Thiobencarb**	4	20
Indoxacarb	4	20	**Trifloxystrobin**	4	20
Isoxaben	4	20	**Fipronil**	4	10
Kresoxim-methyl	4	20	**Fipronil Amide**	4	10
Malathion	4	20	**Fipronil Sulfide**	4	10
Mefenoxam	4	20	**Fipronil Sulfone**	4	10
Methidathion	4	20	**Desulfinyl Fipronil**	4	10
Methomyl	4	20	**Desulfinyl Fipronil Amide**	4	10

*LC = Liquid chromatograph multi-analyte screen (54 AIs).

Table A8. Reporting Limits and Method Detection Limits for Dinitroanilines and Oxyfluorfen (DN/OX*) in whole water (EMON-SM-05-006).

Analytic Screen	Pesticide	Method Detection Limit (ng/L)	Reporting Limit (ng/L)
DN/OX	**Benfluralin (*Benefin*)**	14	50
DN/OX	**Ethalfluralin**	15	50
DN/OX	**Oxyfluorfen**	10	50
DN/OX	**Pendimethalin**	12	50
DN/OX	**Prodiamine**	12	50
DN/OX	**Trifluralin**	14	50

*DN/OX = dinitroanilines and oxyfluorfen.

Table A9. Reporting Limits and Method Detection Limits for Phenoxy in whole water (EMON-SM-05-012).

Analytic Screen	Pesticide	Method Detection Limit (ng/L)	Reporting Limit (ng/L)
Phenoxy	**2,4-D**	15	50
Phenoxy	**Dicamba**	17	50
Phenoxy	**MCPA**	22	50
Phenoxy	**Triclopyr**	20	50

Table A10. Reporting Limits and Method Detection Limits for Neonicotinoids in whole water (EMON-SM-05-052).

Analytic Screen	Pesticide	Method Detection Limit (ng/L)	Reporting Limit (ng/L)
Neonics	**Clothianidin**	4	20
Neonics	**Dinotefuran**	4	20
Neonics	**Sulfoxaflor**	4	20

Table A11. Reporting Limits and Method Detection Limits for Pyrethroids in whole water (EMON-SM-05-022).

Analytic Screen	Pesticide	Method Detection Limit (ng/L)	Reporting Limit (ng/L)
Pyrethroid	**Bifenthrin**	0.91	1
Pyrethroid	**λ-cyhalothrin**	1.74	2
Pyrethroid	**Permethrin**	1.05	2
Pyrethroid	**Cyfluthrin**	1.46	2
Pyrethroid	**Cypermethrin**	1.54	5
Pyrethroid	**Fenpropathrin**	1.32	5
Pyrethroid	**Esfenvalerate**	1.66	5
Pyrethroid	**Deltamethrin**	2.78	4

Table A12. Reporting Limits and Method Detection Limits for Glyphosate in whole water (EM-SM-05-046).

Analytic Screen	Pesticide	Method Detection Limit (ng/L)	Reporting Limit (ng/L)
Glyphosate	**Glyphosate**	4.95	70
Glyphosate	**Glufosinate-ammonium**	11.54	70
Glyphosate	**Aminomethylphosphonic Acid (AMPA)**	27.86	200

Table A13. Reporting Limits and Method Detection Limits for Pyrethroids in sediment (EMON-SM-52-9).

Analytic Screen	Pesticide	Method Detection Limit (ng/g dry wt)	Reporting Limit (ng/g dry wt)
Pyrethroid	**Bifenthrin**	0.1083	1
Pyrethroid	**λ-cyhalothrin**	0.1154	1
Pyrethroid	**Permethrin**	0.1159	1
Pyrethroid	**Cyfluthrin**	0.1830	1
Pyrethroid	**Cypermethrin**	0.1070	1
Pyrethroid	**Fenpropathrin**	0.1094	1
Pyrethroid	**Esfenvalerate**	0.1430	1
Pyrethroid	**Deltamethrin**	0.0661	1

Table A14. Top eight HUC12's identified for agricultural monitoring in Imperial Valley, ordered by the ranking process.

HUC12 Code	HUC12 Name	DPR Monitoring Location	Comments
181002040803	Town of Fuller-Alamo River	Imp_Holtville	
181002040804	Gieselmann Lake-Alamo River		Drains into Ramer Lake-Alamo River and Obsidian Butte-Frontal Salton Sea HUC12 waterways
181002041101	Upper New River		Drains into Middle New River and Lower New River HUC12 waterways
181002040805	Ramer Lake-Alamo River	Imp_Rutherford	
181002040807	Town of Calipatria-Alamo River		Drains into Obsidian Butte-Frontal Salton Sea HUC12 waterways
181002041104	Lower New River	Imp_NewRiver27	
181002041103	Middle New River	Imp_Rice3	
181002041402	Obsidian Butte-Frontal Salton Sea	Imp_Garst, Imp_Lack	

Table A15. Top ten HUC12's identified for agricultural monitoring in Central Coast, ordered by the ranking process.

HUC12 Code	HUC12 Name	DPR Monitoring Location	Comments
180600080503	Corralitons Canyon	SM_Orcutt, SM_Main, SM_Solomon	
180600080502	Lower Orcutt Creek		Drains into Corralitos Canyon HUC12 waterways
180600080404	Santa Maria Canyon-Sisquoc River		Drains into Corralitos Canyon HUC12 waterways
180600080603	Lower Santa Maria River		Drains into Corralitos Canyon HUC12 waterways
180600150103	Alisal Slough-Tembladero Slough	Sal_Haro, Sal_Tembl, Sal_SanJon	
180600150102	Nativdad Creek-Gabilan Creek		Drains into Alisal Slough-Tembladero Slough HUC12 waterways
180600051505	Johnson Creek	Sal_Chualar	
180600051311	Paraiso Springs-Arroyo Seco		Drains into Salinas River which is sampled downstream at Alisal Creek-Salinas River and Johnson Creek HUC12 sites
180600051004	Lower San Lorenzo Creek		Drains into Salinas River which is sampled downstream at Alisal Creek-Salinas River and Johnson Creek HUC12 sites
180600051509	Alisal Creek-Salinas River	Sal_Blanco, Sal_Davis, Sal_Hartnell	
180600060704	Oso Flaco Creek	SM_OFC	

13. FIGURES

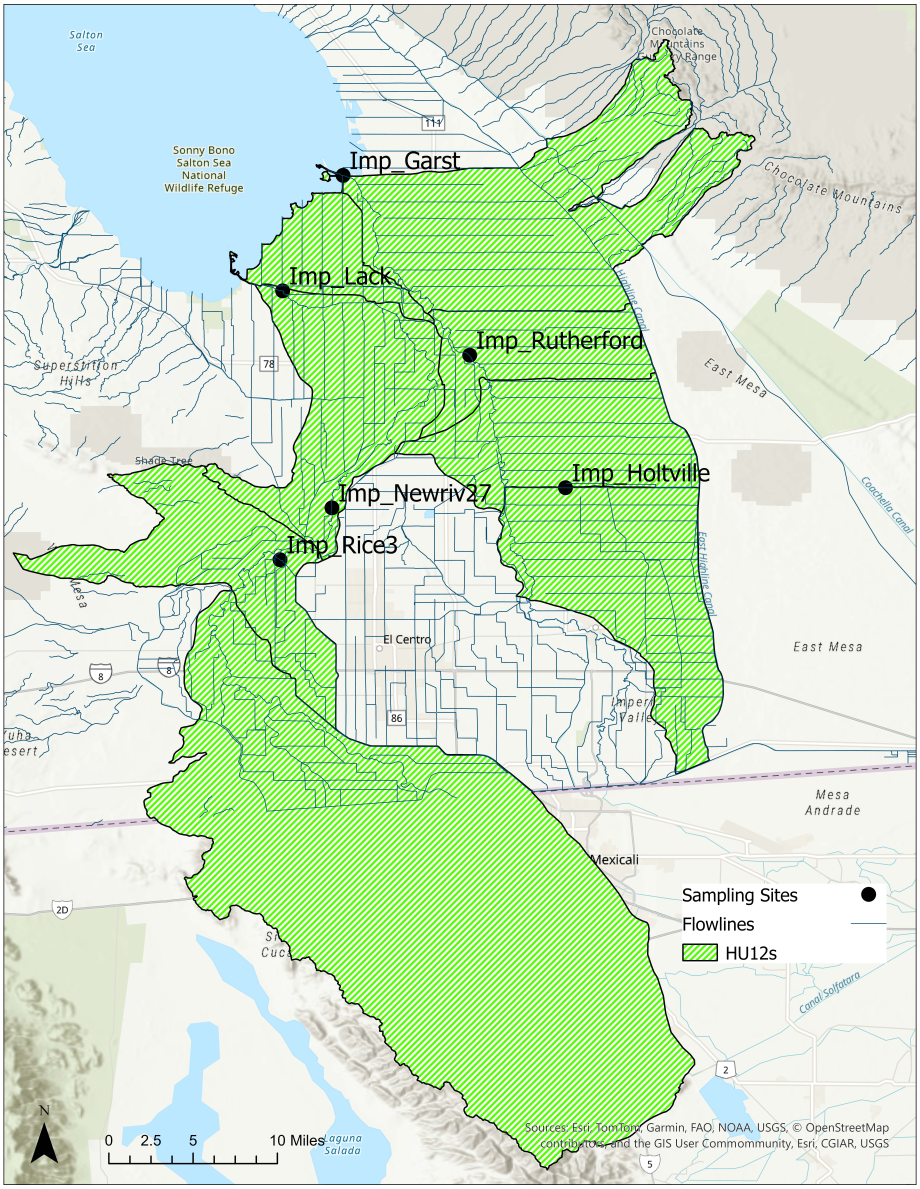

Figure 1. Monitoring sites in Alamo River and New River, and top eight HUC12's identified for agricultural monitoring in Imperial County.

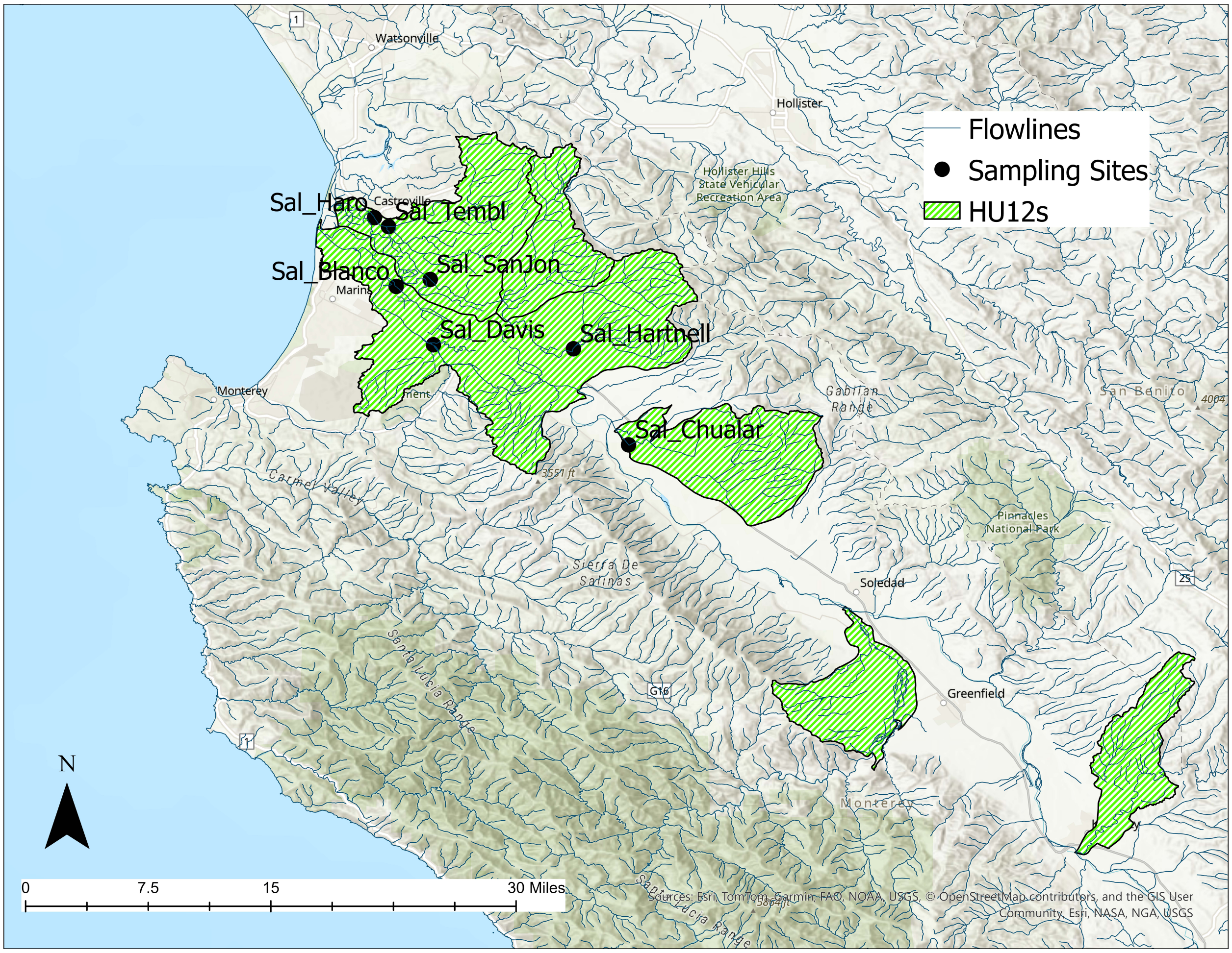

Figure 2. Monitoring sites in Salinas River and Tembladero Slough, and top six HUC12's identified for agricultural monitoring in Monterey County.

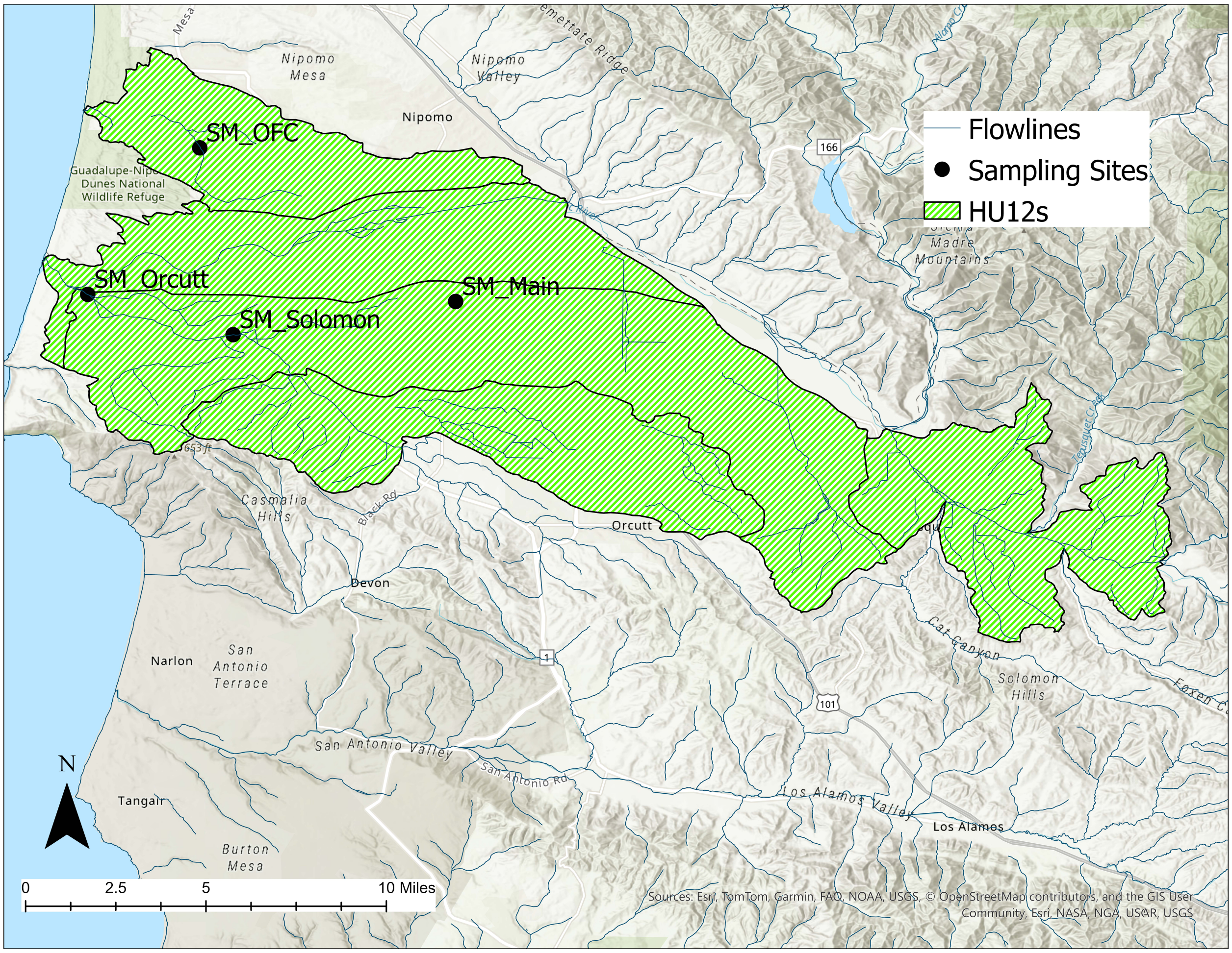

Figure 3. Monitoring sites in Orcutt Creek and Oso Flaco Creek, and top five HUC12's identified for agricultural monitoring in San Luis Obispo and Santa Barbara counties.