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Environmental Monitoring Branch
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Study 304: Surface Water Monitoring for Pesticides in Agricultural Areas in Central Coast and Southern California, 2016

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(Yellow-highlighted entries updated on May 25, 2016)

1. INTRODUCTION

Surface water monitoring for pesticides in agricultural areas of California is one of the California Department of Pesticide Regulation's (CDPR's) key environmental monitoring projects. This project was initiated in 2008 with a long-term goal of collecting data to better assess potential impacts of pesticides from agricultural runoff on California aquatic environments. Project findings help guide CDPR in development and implementation of regulatory and non-regulatory mitigation activities. In the last eight years, the monitoring activities had focused on areas in Central Coast and Southern California where pesticide uses were heavy and croplands were dominant with irrigation practices of high runoff potentials. The monitoring areas include major watershed drainages in Monterey, Santa Barbara, San Luis Obispo and Imperial Counties (Starner 2010, 2013; Deng 2014, 2015).

Preliminary monitoring results in Central Coast and Southern California in recent years had been summarized in short reports (Deng 2014, 2015a&b). Over 24 pesticides in 8 chemical groups were monitored each year. Chlorpyrifos, malathion, methomyl, bifenthrin, permethrin and imidacloprid were the insecticides detected at high frequencies (22-84%) and at concentrations frequently exceeding the lowest US EPA aquatic life benchmark values (14-42%). Those insecticides are highly toxic to aquatic organisms. Many of them were commonly detected in single or multiple samples from the same watershed. Their frequent concurrent occurrences in a given watershed and frequent exceedances to their benchmarks indicate that the insecticide uses in the monitored watershed drainages could cause significant adverse impacts to non-targeted aquatic organisms and aquatic communities. Bensulide, oxyfluorfen, pendimethalin, trifluralin, azoxystrobin and pyraclostrobin were the herbicides and fungicides detected at high frequencies (18-64%). However, the benchmark exceedances for herbicides and fungicides were at low frequencies.

Study 304 is a continuation of CDPR's agricultural monitoring efforts in Central Coast and Southern California. Monitoring sites were selected from those established in previous years with changes based on analyses of recent years' monitoring data (analyses not included in the protocol and will be summarized in a separate report). In general, nearby sites that provided similar monitoring results in detected chemical numbers and frequencies were presented by one site. Sites that resulted in low detections in chemical numbers and frequencies will not be sampled in 2016. Priority lists of pesticides recommended for monitoring in each watershed were identified using CDPR's Prioritization Model (Luo et al. 2013, 2014, 2015). The watershed-based prioritization approach was applied to help refine the pesticide priority list for monitoring in 2016.

2. OBJECTIVE

The goal of the project is to assess short-term changes and long-term trends of pesticide contamination in agricultural runoff and the potential impacts of the runoff to aquatic environments. Results of the assessment will provide information to managers to make mitigation responses to potential risks of pesticide contamination in aquatic environments. Objectives of the project are as follows:

1) Determine sampling sites in watersheds of high pesticide uses based on monitoring results and watershed hydrology;
2) Prioritize pesticide monitoring candidates based on the current pesticide use report at watershed level;
3) Determine occurrences and measure chemical concentrations of high priority pesticides in runoff samples;
4) Analyze chemistry data to evaluate potential impacts on aquatic environments.

3. PERSONNEL

The study will be conducted by staff from the Environmental Monitoring Branch, Surface Water Protection Program, under the general direction of Kean S. Goh Ph.D., Environmental Program Manager I. Key personnel are listed below:

Project Leader:	Xin Deng, Ph.D.
Field Coordinator:	Kevin Kelley
Review Scientist:	Yuzhou Luo, Ph.D.
Statistician:	Dan Wang, Ph.D.
Laboratory Liaison:	Sue Peoples
Analytical Chemistry:	Center for Analytical Chemistry, California Department of Food and Agriculture (CDFA)

Questions concerning this monitoring project should be directed to Xin Deng, Senior Environmental Scientist, at (916) 445-2506 or by email at xdeng@cdpr.ca.gov.

4. SELECTION OF PESTICIDES FOR MONITORING

The pesticides were prioritized following the procedures described in the Monitoring Prioritization Model (Luo et al. 2013, 2014, 2015). The watershed-based prioritization model uses 12-digit hydrologic units on the USGS Watershed Boundary Database (http://viewer.nationalmap.gov/viewer/nhd.html?p=nhd) to define the watershed boundary. It then aggregates the total use of each pesticide within the watershed and adjusts the total use by factoring in its dissipation as a function of travel time. The model was applied to generate ranked lists of pesticides for each major watershed. Pesticides were then screened to produce final monitoring lists following the general criteria below:

1) Pesticides with final ranking scores ≥ 9 were reported in the priority lists for the major watersheds for further consideration (Table 3-6). Pesticides with a final ranking score < 9 were considered to be low priority due to their low use (use score <2) and/or low toxicity (toxicity scores <3, acute benchmark values >100 ppb). Therefore, they were excluded from the priority lists.
2) Pesticides with use scores ≥ 2 in the priority lists would be considered for monitoring. The use criterion would include the top 30% pesticides with the highest use amounts among all the pesticides reported to PUR in 2011-2013 for a watershed of interest. Pesticides that were not in the priority lists or had use scores < 2 may be monitored because they will be concurrently analyzed with analytical groups that contain pesticides in the final monitoring list.
3) Pesticides that were not recommended for monitoring by the Prioritization Model were not included in the final lists that were reported in the protocol. Historical monitoring data and availability of analytical methods were additional factors to help decide a final list for monitoring. Reasons for excluding specific pesticides that were in the priority lists were explained briefly in the footnotes of Tables 3-6.

5. STUDY PLAN

5.1. Imperial County

Ambient monitoring will be conducted in Imperial County in March and October. Five sites that had been monitored within the watersheds of Alamo and New Rivers since 2008 were selected for monitoring in 2016 (Figure 2, Table 1). One new site at the mainstream of the lower New River near Lack Road (Imp-Lack) will be added. Four sites that are located on the beach of the Salton Sea (Imp_Butte), Vail Drain (Imp_Young, an isolated field), and Verde Drain (Imp_Verde) and Malva Drain (Imp_Malva) of Alamo River will not be sampled because of the overall lower detection frequencies of pesticides from those sites compared to the sites selected (Table 2). Detailed information for the locations of current and previous sites is listed in Tables 1 and 2. Water samples in the watershed of the Palo Verde Outfall Drain will not be collected because monitoring results from 2013-2015 indicated low detection frequencies of only two pesticides (dimethoate and pendimethalin) with no exceedances to their acute and chronic aquatic life benchmarks.

The priority lists for monitoring in New and Alamo Riveres in March and October were generated using the average use data from January to March and from August to October in 2011-2013, respectively (Table 3 and 4). The chemical lists recommended by the model are similar to those in 2015. All the chemicals on the lists will be monitored except paraquat dichloride and indoxacarb due to a low detection frequency (<1%) statewide for paraquat dichloride in surface water, and the unavailability of analytical method for indoxacarb.

5.2. Monterey County

Ambient monitoring will be conducted in Monterey County monthly from April to September. Six sites that had been established within the watersheds of Salinas River and Tembladero Slough since 2008 were selected for monitoring in 2016 (Figure 3, Table 1). The two sites at Reclamation Ditch (Sal_Rec3) and Molera Road (Sal_Molera) on Tembladero Slough are within 3 - 5 miles away from the adjacent sites (Sal_Hartnell and Sal_Haro) with no major runoff inputs between the nearby sites. Preliminary analyses on monitoring results from 2010 to 2015 indicate that the detection frequencies and median concentrations of all the pesticides monitored at Sal_Rec3 and Sal_Molera were insignificantly different from those at Sal_Hartnell and Sal_Haro. Sites Sal_Monte and Sal_Blanco on Salinas River had fewer pesticides detected at much lower frequencies compared to other sites. Therefore, runoff samples will not be collected from the four sites in 2016. The site at Monterey Dunes Way (Sal_Dunes) is located on the outlet of Old Salinas River that collects runoff from a small isolated area. Several pesticides had been detected at this site with much lower frequencies from 2010 to 2015, thus, samples will not be collected from this site in 2016. Detailed information for locations of previous and current sampling sites is listed in Tables 1 and 2.

The priority lists for monitoring in each watershed were generated using the average pesticide use data from April to September in 2011-2013 (Table 5). The chemical lists recommended by the model are similar to those in 2015 with changes on rankings of a few chemicals due to changes of their use scores in recent years. Paraquat dichloride herbicide, cyprodinil and fenamidone fungicides made on the priority list in the Salinas River watershed but will not be monitored in 2016 due to either the low detection frequency statewide in previous years or unavailability of analytical methods (Table 5).

5.3. Santa Barbara and San Luis Obispo County

Ambient monitoring will be conducted in Santa Barbara and San Luis Obispo Counties in May, July and September. Three monitoring sites that had been monitored within the watersheds of Orcutt Creek and Oso Flaco Creek in recent years were selected for monitoring in 2016 (Figure 4). A new site at the outlet of the ditch on Bradley Channel (SM_Bradley) will be added to replace the site at the main ditch near HWY166 (SM_MainDitch). Detailed information for the locations of current and previous sites is listed in Tables 1 and 2.

The priority lists for monitoring in each watershed were generated using the average use data from April to September in 2010-13 (Table 6). The chemicals recommended by the model for monitoring in the Orcutt Creek watershed are similar to those in 2015 with changes on the ranking of chlorpyrifos due to its reduced use scores in recent years. Prometryn herbicide is a new chemical on the list and will be monitored in 2016. In Oso Flaco Creek, chlorpyrifos dropped out of the list but will be monitored in concurrence with malathion. Imidacloprid, bifenthrin and permethrin that were not on the list in 2015 made on the 2016 list and will be monitored. Cyprodinil will not be monitored in 2016 because the analytical method is not currently available for this chemical (Table 6).

6. SAMPLING METHOD

6.1. Water Sampling and Sample Transport

Water samples will be collected as grab samples directly into 1-liter amber glass bottles sealed with Teflon-lined lids. Samples will be transported and stored on wet ice or refrigerated at $4^{o}C$ until extraction for chemical analysis. CDPR staff will transport samples following the procedures outlined in CDPR SOP QAQC004.01 (Jones, 1999). A chain-of-custody record will be completed and accompany each sample.

6.2. Field Measurements

Dissolved oxygen, pH, specific conductivity, turbidity and water temperature will be measured *in situ* during each sampling event with an YSI EXO1 multi-parameter water quality Sonde (Doo and He 2008).

7. CHEMICAL ANALYSES

Chemical analyses will be performed by the Center for Analytical Chemistry, California Department of Food and Agriculture, Sacramento, CA. Nine analyte groups with 31 chemicals will be analyzed. Method detection limits and reporting limits for each chemical are given in Table 8. Quality control will be conducted in accordance with the Standard Operating Procedure QAQC001.00 (Segawa 1995). Laboratory QA/QC will follow CDPR guidelines and will consist of laboratory blanks, matrix spikes, matrix spike duplicates, surrogate spikes, and blind spikes (Segawa 1995). Laboratory blanks and matrix spikes will be included in each extraction set.

8. DATA ANALYSIS

All data generated by this project will be entered to 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 CDPR Surface Water Database (SURF) (http://cdpr.ca.gov/docs/emon/surfwtr/surfdata.htm).

Resulting data will be analyzed and reported as appropriate, potentially including the following: Comparison of pesticide concentrations to aquatic toxicity benchmarks, water quality limits and other toxicity data (CCVRWQCB 2012, US EPA 2015); spatial analysis of data in order to identify correlations between observed pesticide concentrations and region-specific pesticide uses and geographical features; assessment of multiple years of data to characterize patterns and trends in detection frequencies; assessment of results to determine potential additional monitoring in regions with similar pesticide use patterns.

9. TIMETABLE

Field Sampling:	March 2016 — October 2016
Chemical Analysis:	March 2016 — December 2016
Draft Report:	March 2017
Data Entry into SURF:	April 2017

10. BUDGET

The estimated total cost for chemical analyses is $ 225,240 (Table 9).

11. REFERENCES

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US EPA 2016. Aquatic Life Benchmark Table. http://www.epa.gov/oppefed1/ecorisk_ders/aquatic_life_benchmark.htm

Table 1. Sampling Site Information for Study 304 in 2016

Site ID	Site Location	County	Watershed	Latitude	Longitude	Site Type
Imp_NewRiv27	New River at HWY S27/Keystone Road	Imperial	New River	32.9136	-115.60646	Main Stream
Imp_Lack	New River at Lack Road			33.0999	-115.64876	Main Stream
Imp_Rice3	Rice Drain III at Weinert Road			32.8691	-115.651	Ag Drain
Imp_Rutherford	Alamo River at Rutherford Rd (upstream of Imperial State Wildlife Area)		Alamo River	33.0447	-115.48829	Main Stream
Imp_Garst	Alamo River at Garst Road			33.199	-115.59696	Main stream
Imp_Holtville	Holtville Main Drain at HWY115			32.9309	-115.40611	Ag Drain
Sal_Quail	Quail Creek at HWY 101, btwn Spence and Potter Roads	Monterey	Salinas River	36.6092	-121.56269	Tributary
Sal_Chualar	Chualar Creek at Chualar River Rd., ca. 1.2 mi. from HWY 101			36.5584	-121.52964	Tributary
Sal_Davis	Salinas River at Davis Road			36.647	-121.70219	Main Stream
Sal_Hartnell	Alisal Creek at Hartnell Rd		Tembladero Slough	36.6435	-121.57836	Tributary
Sal_SanJon	Rec Ditch at San Jon Road			36.7049	-121.70506	Tributary
Sal_Haro	Tembladero Slough at Haro Street			36.7596	-121.75433	Main Stream
SM_OFC	Oso Flaco Creek @ OFL Road	San Luis Obispo	Oso Flaco Creek	35.0164	-120.58755	Tributary
SM_Solomon	Solomon Creek @ HWY 1	Santa Barbara	Orcutt Creek	34.9414	-120.5742	Main Stream
SM_Orcutt	Orcutt Creek @ Main Street			34.9576	-120.63244	Main Stream
SM_Bradley	Bradley Channel @ River Oaks		Bradley Channel	34.9743	-120.4247	Ag drain

Table 2. Sampling sites monitored in 2015 but not in 2016.

Site ID	**Site Location**	**County**	**Watershed**	**Justification**
Imp_Malva	Malva Drain near Park Avenue	Imperial	Alamo River	Overall lower detection frequencies compared to the sites on the main stream
Imp_Verde	Verde Drain at Bonds Corner Road		Alamo River	
Imp_Young	Vail Drain near Young Road		New River	Less representative site that collects runoff from smaller agricultural fields
Imp_Butte	Salton Sea at Obsidian Butte		Salton Sea	Limited detections with few pesticides
Imp_Clark	Palo Verde Outfall Drain (PVOD2)	Imperial	Palo Verde Drain	Monitoring results from 2013-2015 indicated detections of two pesticides (dimethoate and pendimethalin) with no aquatic life benchmark exceedances.
Imp_OFD78	Outfall Drain at HWY78			
Riv_LG	Palo Verde Lagoon (LG1)	Riverside		
Riv_PVL	Palo Verde Lagoon @ 35th Avenue			
Riv_South	South End Drain @Palo Verde Lagoon			
Sal_Blanco	Blanco Drain at Cooper Rd	Monterey	Salinas River	Overall lower detection frequencies compared to other sites
Sal_Monte	Salinas River at Del Monte Road			
Sal_Dunes	Old Salinas R. at Monterey Dunes Way		Old Salinas River	Less representative site that collects runoff from smaller agricultural fields and had overall lower detection frequencies compared to other sites near the watershed
Sal_Rec3	Reclamation Ditch Site		Tembladero Slough	Overall lower or similar detection frequencies compared to the sites nearby on the slough
Sal_Molera	Tembladero Sl. at Molera Road			
SM_Brown	Orcutt Creek @ Brown Road	Santa Barbara	Orcutt Creek	Sites either being dry or having overall lower detection frequencies compared to the sites on the main stream
SM_Simas	Green Valley Creek @ Simas Road			
SM_MainDitch	Main St. Ditch @ HWY166		Santa Maria River	To be moved to a site downstream at Bradley Channel

Table 3. Pesticide Prioritization for Surface Water Monitoring in Alamo River and New River in Imperial County. Ranking of Pesticides Based on Average Use Data from January to March in 2011-2013

Alamo River, Drainage Area = 1264 km^2				
Chemical	**Use score**	**Tox score**	**Final score**	**Monitoring inclusion**
Atrazine	3	8	24	Yes
Chlorpyrifos	4	6	24	Yes
Malathion	4	5	20	Yes
Pendimethalin	5	4	20	Yes
Trifluralin	5	4	20	Yes
λ-cyhalothrin	2	7	14	Yes
Permethrin	2	6	12	Yes
Methomyl	3	4	12	Yes
Dimethoate	4	3	12	Yes
Cypermethrin	2	5	10	Yes
Oxyfluorfen	2	5	10	Yes
New River, Drainage Area = 1729 km^2				
Chemical	**Use score**	**Tox score**	**Final score**	**Monitoring inclusion**
Atrazine	3	8	24	Yes
Chlorpyrifos	4	6	24	Yes
Malathion	4	5	20	Yes
Pendimethalin	5	4	20	Yes
Trifluralin	5	4	20	Yes
λ-cyhalothrin	2	7	14	Yes
Permethrin	2	6	12	Yes
Methomyl	3	4	12	Yes
Dimethoate	4	3	12	Yes
Cypermethrin	2	5	10	Yes
Oxyfluorfen	2	5	10	Yes
Paraquat dichloride	2	5	10	No[1]
Indoxacarb	3	3	9	No[2]

Notes for exclusion:

1) Low detection frequencies statewide (less than 1 % in 1828 samples; SURF database, 2016) in previous monitoring results.
2) Analytical method not currently available.

Table 4. Pesticide Prioritization for Surface Water Monitoring in Palo Verde Drain, Alamo River and New River in Imperial and Riverside Counties. Ranking of Pesticides Based on Average Use Data from August to October in 2011-2013

Alamo River, Drainage Area = 1264 km^2				
Pesticide	**Use score**	**Tox score**	**Final score**	**Monitoring inclusion**
Chlorpyrifos	5	6	30	Yes
Atrazine	2	8	16	Yes
Pendimethalin	4	4	16	Yes
Permethrin	2	6	12	Yes
Esfenvalerate	2	6	12	Yes
Methomyl	3	4	12	Yes
Cypermethrin	2	5	10	Yes
Oxyfluorfen	2	5	10	Yes
Malathion	2	5	10	Yes
Bensulide	5	2	10	Yes
Methoxyfenozide	3	3	9	Yes
Imidacloprid	3	3	9	Yes
Benfluralin	3	3	9	Yes
New River, Drainage Area = 1729 km^2				
Pesticide	**Use score**	**Tox score**	**Final score**	**Monitoring inclusion**
Chlorpryrifos	4	6	24	Yes
Permethrin	2	6	12	Yes
Methomyl	3	4	12	Yes
Pendimethalin	3	4	12	Yes
Trifluralin	3	4	12	Yes
Cypermethrin	2	5	10	Yes
Malathion	2	5	10	Yes
Paraquat dichloride	2	5	10	No[1]
Bensulide	5	2	10	Yes
Imidacloprid	3	3	9	Yes

Notes for exclusion:

1) Low detection frequencies statewide (less than 1 % detection in 1828 samples; SURF database, 2016) from monitoring results in previous years.

Table 5. Pesticide Prioritization for Surface Water Monitoring in Salinas River and Tembladero Slough in Monterey County. Ranking of Pesticides Based on Average Use Data from April to September in 2011-2013.

Salinas River, Drainage Area = 11082 km^2				
Pesticide	**Use score**	**Tox score**	**Final score**	**Monitoring inclusion**
Permethrin	3	6	18	Yes
Chlorpyrifos	3	6	18	Yes
Methomyl	4	4	16	Yes
Malathion	3	5	15	Yes
Paraquat dichloride	3	5	15	No[1]
λ-cyhalothrin	2	7	14	Yes
Diazinon	2	5	10	Yes
Oxyfluorfen	2	5	10	Yes
Bensulide	5	2	10	Yes
Cyprodinil	3	3	9	No[2]
Fenamidone	3	3	9	No[2]
Imidacloprid	3	3	9	Yes
Tembladero Slough, Drainage Area = 291 km^2				
Pesticide	**Use score**	**Tox score**	**Final score**	**Monitoring inclusion**
Malathion	5	5	25	Yes
Permethrin	3	6	18	Yes
Bifenthrin	2	6	12	Yes
Methomyl	4	4	16	Yes
Diazinon	2	5	10	Yes

Notes for exclusion:

1) Low detection frequencies statewide (less than 1 % detection in 1828 samples; SURF database, 2016) from monitoring results in previous years.
2) Analytical method not currently available.

Table 6. Pesticide Prioritization for Surface Water Monitoring in Orcutt Creek and Oso Flaco Creek in Santa Barbara and San Luis Obispo Counties. Ranking of Pesticides Based on Average Use Data from April to September in 2010-2012.

Orcutt Creek, Drainage Area = 301 km^2				
Pesticide	**Use score**	**Tox score**	**Final score**	**Monitoring inclusion**
Malathion	5	5	25	Yes
Oxyfluorfen	3	5	15	Yes
Permethrin	2	6	12	Yes
Chlorpyrifos	2	6	12	Yes
Prometryn	3	4	12	Yes
Pyraclostrobin	3	4	12	Yes
Trifluralin	3	4	12	Yes
Imidacloprid	4	3	12	Yes
Fenpropathrin	2	5	10	Yes
Oso Flaco Creek, Drainage Area = 51 km^2				
Pesticide	**Use score**	**Tox score**	**Final score**	**Monitoring inclusion**
Malathion	5	5	25	Yes
Oxyfluorfen	3	5	15	Yes
Permethrin	2	6	12	Yes
Bifenthrin	2	6	12	Yes
Fenpropathrin	2	6	12	Yes
Cyprodinil	3	4	12	No[1]
Imidacloprid	3	3	9	Yes

Notes for exclusion:

1) Analytical method not currently available.

Table 7. Final Monitoring Lists for Analytes or Analyte Groups in Imperial, Monterey, Santa Barbara and San Luis Obispo Counties from March to October, 2016.

Screen Group*	March	April-September	May, July, September	October
	Imperial	Monterey	Santa Barbara San Luis Obispo	Imperial
TR	X		X	X
DA		X		X
DN/OX	X	X	X	X
DZ		X		
IMD/BEN		X	X	X
ME	X	X		X
OP	X	X	X	X
PY	X	X	X	X
STR		X	X	

* TR = Atrizine + Degradates + Prometryn; DA = Diacylhydrazines; DN/OX = Dinitroanilines & Oxyfluorfen; DZ = Diazinon; IMD/BEN = Imidacloprid & Bensulide; ME = Methomyl; OP = Organophosphates; PY = Pyrethroids; STR = Strobilurins

Table 8. Reporting Limit and Method Detection Limit for Pesticides Monitored in 2016.

Analytic Screen	Pesticide	Method Detection Limit (µg/L)	Reporting Limit (µg/L)
Photosynthetic Inhibitor Herbicides	Atrazine	0.015	0.05
	Prometryn	0.0135	0.05
Dinitroanilines and Oxyfluorfen (DN/OX)	Benfluralin	0.015	0.05
	Ethalfluralin	0.017	0.05
	Oryzalin	0.021	0.05
	Oxyfluorfen	0.023	0.05
	Pendimethalin	0.19	0.05
	Prodiamine	0.02	0.05
	Trifluralin	0.015	0.05
Diacylhydrazines (DA)	Methoxyfenozide	0.00641	0.05
	Tebufenozide	0.00573	0.05
Imidacloprid and Bensulide (IMD/BEN)	Imidacloprid	0.0101	0.05
	Bensulide	0.0198	0.04
Methomyl (ME)	Methomyl	0.0011	0.05
Organophosphates (OP)	Chlorpyrifos	0.01024	0.01
	Diazinon	0.01093	0.01
	Dimethoate	0.01202	0.04
	Malathion	0.00935	0.02
	Methidathion	0.01136	0.05
	Phorate	0.00959	0.05
Pyrethroids (PY)	Bifenthrin	0.00091	0.001
	Lambda-cyhalothrin	0.00174	0.002
	Permethirn (cis)	0.00105	0.002
	Permethrin (trans)	0.00105	0.005
	Cyfluthrin	0.00146	0.002
	Cypermethrin	0.00154	0.005
	Fenopropathrin	0.00132	0.005
	Fenvalerate/esfenvalerate	0.00166	0.005
Strobilurins (STR)	Azoxystrobin	0.0225	0.05
	Kresoxim-methyl	0.0190	0.05
	Pyraclostrobin	0.0207	0.05
	Trifloxystrobin	0.0172	0.05

Table 9. Monitoring Schedules and Budget in Imperial, Riverside, Monterey, Santa Barbara (SB) and San Luis Obispo (SLO) Counties from March to October, 2016.

Analyte Group*	March	April	May	June	July	August	September	October	Total Number of Samples	QC Samples	Cost per sample	Total Cost per Analyte Group
	Imperial	Monterey	Monterey SB and SLO	Monterey	Monterey SB and SLO	Monterey	Monterey SB and SLO	Imperial				
TR	4	–	2	–	2	–	2	4	14	2	540	8640
DA	–	–	–	6	–	6	–	4	16	2	720	12960
DN/OX	4	6	4	6	4	6	4	4	38	4	840	35280
DZ	–	6	–	6	–	6	–	–	18	2	510	10200
IMD/BEN	–	6	10	6	10	6	10	4	52	5	720	41040
ME	4	6	–	6	–	6	–	4	26	3	480	13920
OP	4	6	10	6	10	6	10	4	56	6	600	37200
PY	6	6	4	6	4	6	4	6	42	4	960	44160
STR	–	–	10	–	4	–	10	–	24	2	840	21840
Grand Total	**22**	**36**	**40**	**42**	**34**	**42**	**40**	**30**	**286**	**30**	**6210**	**225,240**

* TR = Atrizine + Degradates + Prometryn; DA = Diacylhydrazines; DN/OX = Dinitroanilines & Oxyfluorfen; DZ = Diazinon; IMD/BEN = Imidacloprid & Bensulide; ME = Methomyl; OP = Organophosphates; PY = Pyrethroids; STR = Strobilurin

Figure 1. Monitoring Sites in Alamo River and New River in Imperial County

Figure 2. Monitoring Sites in Salinas River and Tembladero Slough in Monterey County

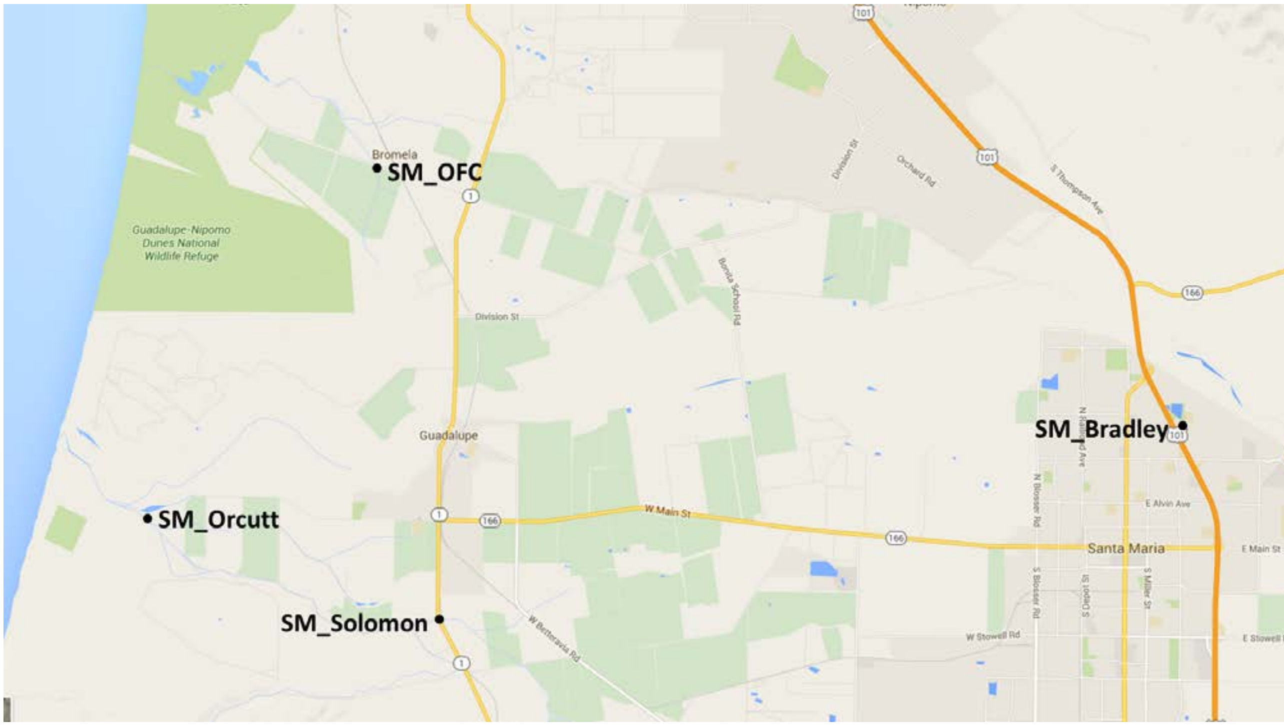

Figure 3. Monitoring Sites in Orcutt Creek and Oso Flaco Creek in Santa Barbara and San Luis Obispo Counties