OCTOBER 10, 2011
[Revision 1]

VENTURA COUNTY AGRICULTURAL
IRRIGATED LANDS GROUP (VCAILG)

Quality Assurance Project Plan (QAPP)

submitted to:
LOS ANGELES REGIONAL WATER QUALITY CONTROL BOARD

prepared by:
LARRY WALKER ASSOCIATES

On behalf of the
VENTURA COUNTY AGRICULTURAL IRRIGATED LANDS GROUP (VCAILG)

LARRY WALKER ASSOCIATES

A. PROJECT MANAGEMENT

1. Title and Approval Sheets

Ventura County Agricultural Irrigated Lands Group (VCAILG)
Quality Assurance Project Plan (QAPP)

VCAILG Contract Manager	John Krist, Farm Bureau of Ventura County	Date
Project Manager	Amy Storm, Larry Walker Associates	Date
Project QA Manager	Michael Marson, Larry Walker Associates	Date
Lab QA Officer	Stephen Clark, Pacific EcoRisk (Toxicity Lab)	Date
Lab QA Officer	David Terz, FGL Environmental, Inc. (Chemistry Lab)	Date
Lab QA Officer	Rich Gossett, Physis Environmental Labs (Chemistry Lab)	Date
LARWQCB Project Manager	Jenny Newman	Date
LARWQCB QA Officer	Yanjie Chu	Date

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3. Distribution List

Name	Agency	Contact Number	E-mail
Jenny Newman	Los Angeles Regional Water Quality Control Board	(213) 576-6691	jnewman@waterboards.ca.gov
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Edgar Terry	VCAILG Steering Committee Chair	(805) 656-0310	edgar.terry@terryfarmsinc.com
John Krist	Farm Bureau of Ventura County	(805) 289-0155	john@farmbureauvc.com
Amy Storm	Larry Walker Associates (LWA) Ventura Office	(805) 585-1835	amys@lwa.com
Michael Marson	Larry Walker Associates (LWA) Ventura Office	(805) 585-1835	michaelm@lwa.com
Stephen Clark	Pacific EcoRisk	(707) 207-7766	slclark@pacificecorisk.com
David Terz	Fruit Growers Laboratory, Inc.	(805) 392-2000	davidt@fglinc.com
Rich Gossett	Physis Environmental Laboratories	(714) 602-5320	richgossett@physislabs.com
George Trouw	Fruit Growers Laboratory, Inc.	(805) 392-2000	georget@fglinc.com

4. Project Organization

The Ventura County Agricultural Irrigated Lands Group (VCAILG) was formed in 2006 to act as one unified "Discharger Group" in Ventura County for the purpose of compliance with the *Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands* (Order No. R4-2005-0080), which was adopted by the Los Angeles Regional Water Quality Control Board on November 3, 2005. On October 7, 2010, a new *Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands within the Los Angeles Region* (Order No. R4-2010-0186) was adopted. This Quality Assurance Project Plan (QAPP) fulfills requirements of the 2010 Conditional Waiver. VCAILG oversight is provided by an 18-member Steering Committee and a 7-member Executive Committee (also members of the Steering Committee). Steering Committee membership consists of agricultural organization representatives, agricultural water district representatives, and landowners and growers from the three primary watersheds in Ventura County (Calleguas Creek, Santa Clara River and Ventura River). Steering Committee membership also represents the major agricultural commodities grown in Ventura County (berries, nursery stock, citrus, vegetables, and avocados).

Group management and decision-making for administrative and technical issues occur through quarterly Steering Committee meetings. The Steering Committee advises and provides input to the Executive Committee and VCAILG consultants on a number of issues pertaining to VCAILG membership and development of reports required by the *Conditional Ag Waiver*. The Steering Committee also reviews fee assessments and consultant selections. The Executive Committee meets on an as needed basis. The VCAILG Steering Committee/Executive Committee member roster is included in Section 3 of the Notice of Intent.

Because the VCAILG is an unincorporated organization, the Farm Bureau of Ventura County acts as the responsible entity for the collection of funds, contracting with consultants, and other fiscal and/or business matters that require an organization with some form of tax status; the Farm Bureau is a non-profit 501(c)(5) organization.

Larry Walker Associates (LWA) has been selected to assist the VCAILG with development and implementation of a program that meets the requirements of the *Conditional Ag Waiver* for a Discharger group. Program responsibilities are as follows:

- VCAILG Contract Manager: John Krist (Farm Bureau of Ventura County)
- Project Manager: Amy Storm (LWA)
- Project Quality Assurance Manager: Michael Marson (LWA). Michael will conduct quality assurance oversight for the project independent of both project management and the project's monitoring program.
- Laboratory Quality Assurance Officer, Toxicity Testing: Stephen Clark (Pacific EcoRisk)
- Laboratory Quality Assurance Officer, Chemistry Testing: David Terz (FGL)
- Laboratory Quality Assurance Officer, Chemistry Testing: Rich Gossett (Physis Environmental Laboratories)
- Sample Collection: LWA and FGL field personnel
- QAPP changes / updates: Project Manager. Changes to the QAPP may be made upon concurrent approval of necessary changes by the Project Manager, Project Quality Assurance Manager and the Regional Board's Quality Assurance Officer. The Project Manager will be responsible for making the changes, submitting drafts for review, preparing a final copy, and submitting the final revision for signature and distribution.

This Quality Assurance Project Plan (QAPP) describes the quality assurance requirements for the VCAILG Monitoring Program (VCAILGMP) developed to comply with the Los Angeles Regional Board's *Conditional Ag Waiver*. All contractors selected to perform the sampling and laboratory analyses must meet the quality control criteria necessary to satisfy the data quality objectives of this program, including those for precision, accuracy, detection and reporting. This QAPP is based on the State Water Resources Control Board's SWAMP QAPP Template (SWRCB, 2008b) and the SWAMP QA Checklist (SWRCB, 2008c). A general organizational structure for the VCAILGMP is illustrated in Figure 1.

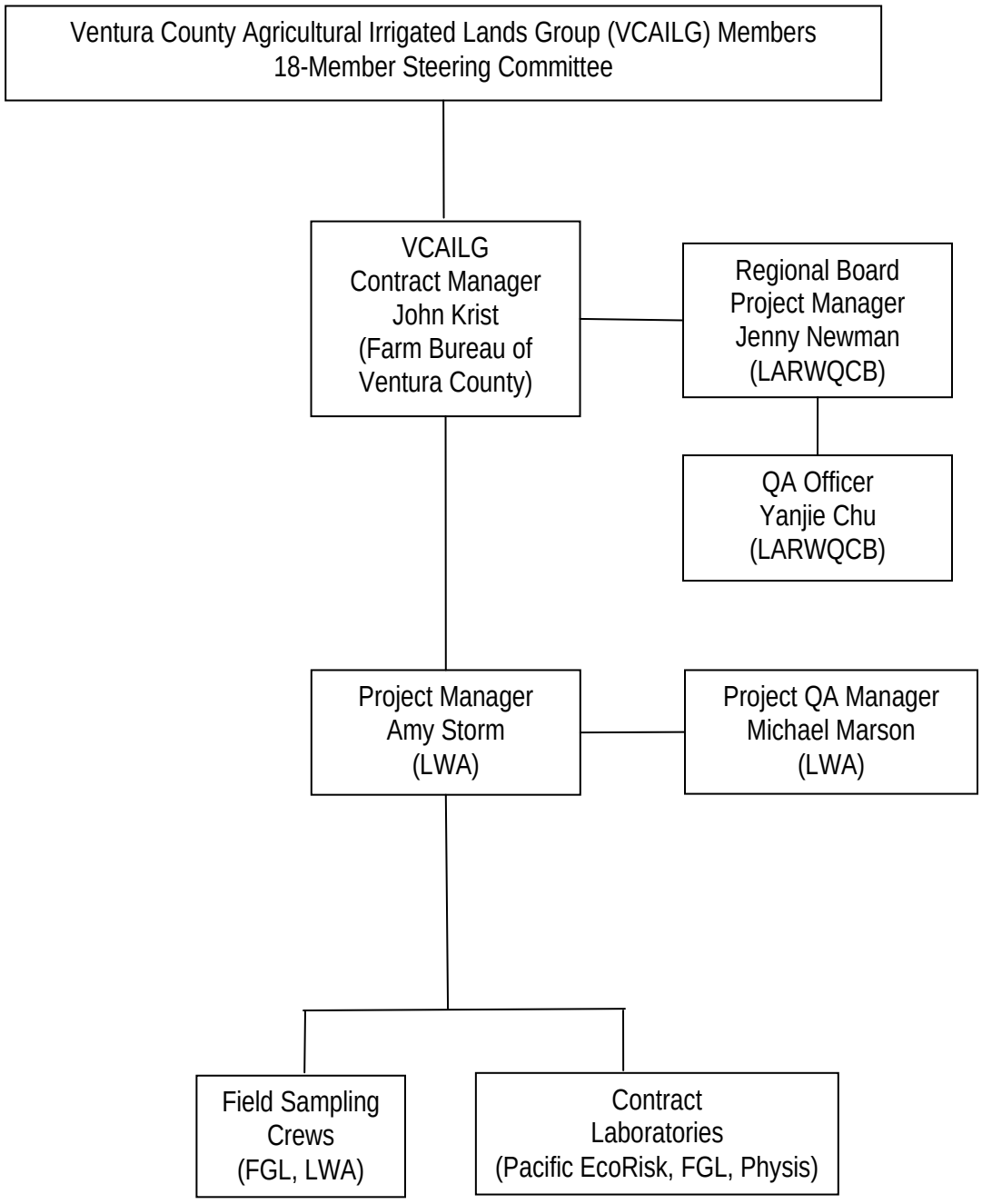

Figure 1. VCAILG Monitoring Program Management Structure

5. Problem Definition/Background

On October 7, 2010, the Los Angeles Regional Water Quality Control Board adopted the *Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands within the Los Angeles Region* (Order No. R4-2010-0186). The Order states that the intent of the *Conditional Ag Waiver* is "to establish a regulatory program for irrigated agricultural lands that requires Dischargers to attain Water Quality Benchmarks through a process that quantitatively assesses the in-stream water quality impacts of discharges and, when necessary to attain Water Quality Benchmarks, requires Dischargers to implement effective management practices." In order to comply with the *Conditional Ag Waiver*, water quality monitoring must be conducted and the monitoring results compared to water quality benchmarks and applicable TMDL load allocations. Exceedances of these benchmarks indicate that management practices are in need of implementation or improvement to better protect water quality, triggering the requirement to develop a Water Quality Management Plan (WQMP). The WQMP outlines specific steps that will be taken to reduce pollutant loading to receiving waters and ultimately attain water quality objectives through the use of best management practices.

The VCAILG was initially formed to comply with the 2005 *Conditional Ag Waiver* and is continuing for 2010 *Conditional Ag Waiver* compliance. The VCAILG is a county-wide Discharger Group. Group members represent irrigated acreage located throughout Ventura County watersheds, including the Calleguas Creek, Santa Clara River, Ventura River and coastal watersheds. A map of the main Ventura County watersheds is presented in Figure 2.

Ventura County Agriculture

Ventura County covers 1,843 square miles (approximately 1.2 million acres) with 43 miles of coastline. The Pacific Ocean forms its southwestern boundary, with Los Angeles County to the southeast, Kern County to the north and Santa Barbara County to the west. The Los Padres National Forest accounts for the northern half of the county, with residential, agricultural and business uses in the southern portion. Of the estimated 259,055 acres of agricultural land in the county, there are approximately 93,000 acres of irrigated land.[1] The Calleguas Creek Watershed contains the highest number of irrigated acres (roughly 46,000), followed by the Santa Clara River Watershed (approximately 32,000), Ventura River Watershed (approximately 6,400), and finally the Oxnard Plain/Coastal Watershed (approximately 5,400).[2]

Agriculture is a major industry in Ventura County, generating over $1.62 billion in gross sales for 2009, placing the county 8th in a statewide ranking of California's 58 counties. Ventura County was ranked as one of the top five counties in California for eleven agricultural commodities in 2009. [3]

Various monitoring programs and the Annual Monitoring Reports, submitted by VCAILG during the 2005 *Conditional Ag Waiver* period have documented exceedances of water quality benchmarks that could cause or contribute to water quality impairments. The 2008 Federal Clean Water Act Section 303(d) list of impaired water bodies in the Los Angeles Region identifies agriculture as a potential source of pollutants; most commonly, pesticides and nutrients. The implementation of the 2005 *Conditional Ag Waiver* by the members of VCAILG has resulted in extensive water quality monitoring, grower education and outreach,

[1] The estimates of acreage of agricultural and irrigated agricultural land in the county: U.S. Department of Agriculture-National Agricultural Statistics Service, *2007 Census of Agriculture*. Washington D.C.: Updated September 2009.
[2] Estimates of irrigated agricultural acreage by watershed are based on the VCAILG membership database and also includes estimated irrigated acreage for parcels not enrolled in VCAILG.
[3] Ventura County Agricultural Commissioner. *Ventura County Crop Report 2009*. July 27, 2010.

and implementation of numerous new and/or improved management practices to improve and protect water quality in Ventura County. The 2010 *Conditional Ag Waiver* was adopted as a continuation of the original program to leverage past successes and continue improving water quality through education, monitoring, and the use of a targeted, iterative BMP implementation process.

Monitoring Program Objectives

The objectives of the monitoring program required under the *Conditional Ag Waiver* include the following:

- Monitor the discharge of wastes in irrigation return flows, tile drains, stormwater, and waters of the state and identify waste sources;
- Where discharges of waste cause or contribute to exceedances of water quality benchmarks or cause pollution or nuisance, submit a Water Quality Management Plan (WQMP) to implement targeted management practices to reduce or eliminate discharges of waste;
- Report results and other required information on an annual basis;and
- Coordinate monitoring efforts with existing and future monitoring programs so that data generated are complementary and not duplicative (*e.g.*, coordinate monitoring sites and sampling events with the TMDL Monitoring Programs within Ventura County).

Water samples will be collected from surface waterbodies influenced primarily by irrigated agriculture throughout Ventura County and analyzed for constituents typically associated with agricultural activities, including suspended sediment, nutrients, and pesticides. Data collected at each site will be compared with water quality benchmarks to determine whether these benchmarks are being met. A benchmark exceedance will trigger development of a Water Quality Management Plan (WQMP), which will outline specific steps that will be taken to reduce pollutant loading to receiving waters and ultimately attain water quality objectives through the use of best management practices. VCAILGMP data will be used to determine monitoring program effectiveness at meeting program objectives.

VCAILGMP data also may be used to assist the Calleguas Creek Watershed TMDL Monitoring Program (CCWTMP) in determining pollutant loads from irrigated agriculture. Conversely, data collected concurrently in the Calleguas Creek Watershed (CCW) through the CCWTMP or other regulatory programs (e.g., NPDES, Stormwater), may be evaluated to determine whether agricultural drainages may be contributing to receiving water impairments. Data collected through the CCWTMP may also inform BMP implementation and effectiveness.

Water Quality Benchmarks

Water quality objectives contained in the Basin Plan for the Los Angeles Region, as well as TMDL load allocations and water quality criteria contained in the California Toxics Rule (CTR), form the basis for the water quality benchmarks that will be used to assess water quality data collected through the VCAILGMP as found in Appendices 2 and 3 of the *Conditional Ag Waiver*. Water quality benchmarks applicable to receiving waters in Ventura County watersheds are summarized in Appendix B of this QAPP.

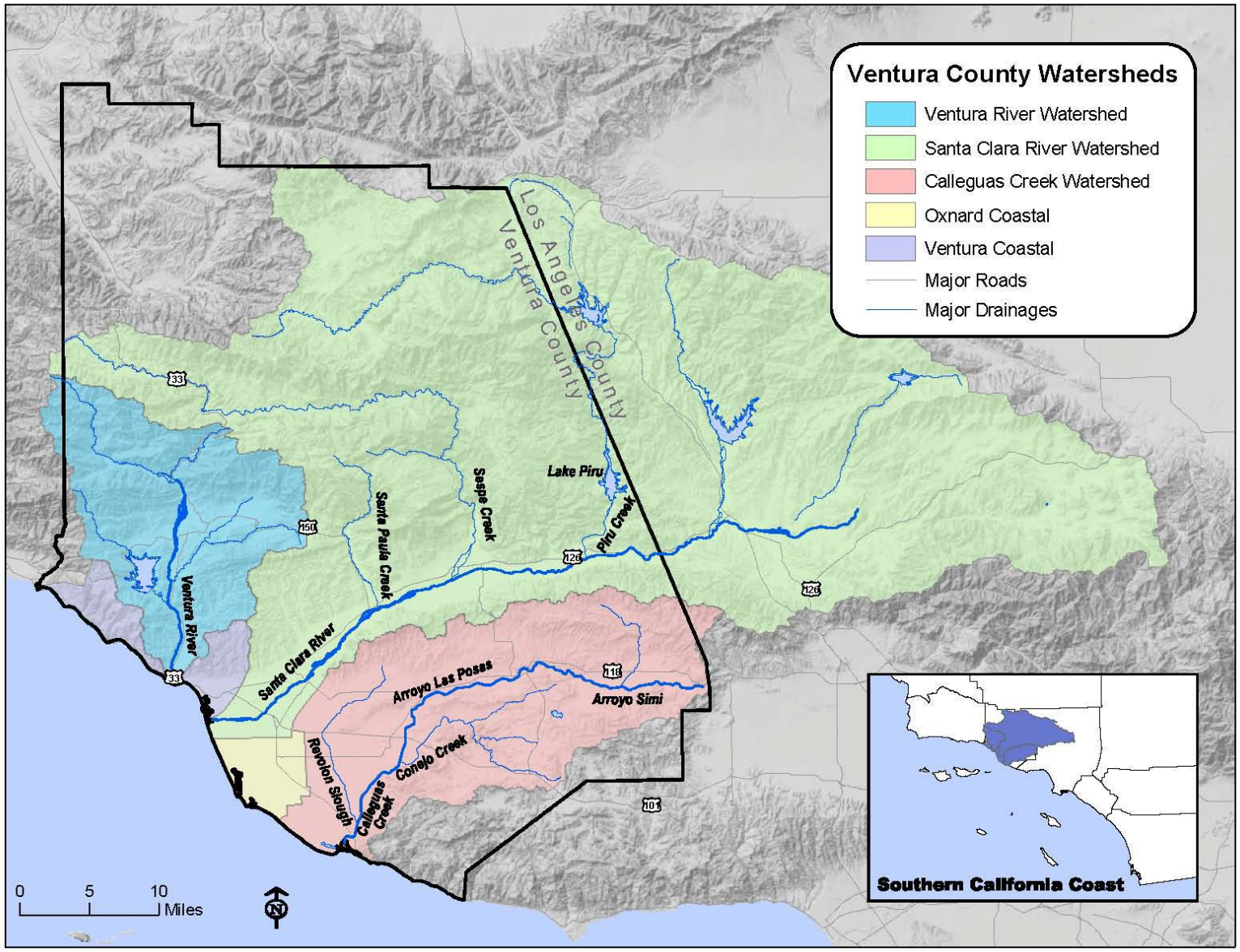

Figure 2. Ventura County Watersheds

6. Project Description

The VCAILGMP includes two types of water quality monitoring, data collection for comparison with *Conditional Ag Waiver* benchmarks and TMDL specific monitoring. Other programs meeting TMDL requirements are also summarized and referenced here to provide a complete description of agricultural compliance. The following focuses on the region-wide monitoring required by the *Conditional Ag Waiver* and ends with TMDL specific requirements. The VCAILGMP will collect water quality data at up to 18 monitoring sites: 15 sites located on surface waterbodies influenced primarily by irrigated agriculture, and 3 potential background sites used to account for inputs from other land uses (i.e., landscape irrigation, golf course).

Overall there are thirteen agricultural monitoring sites and two background sites in the Calleguas Creek watershed. These sites are split between the VCAILGMP and the Calleguas Creek Watershed TMDL Monitoring Program (CCWTMP). There are 7 agricultural land use sites that are part of the CCWTMP. Five of those seven sites were previously also part of the VCAILGMP, but to avoid duplicative efforts, the CCWTMP will assume full responsibility for these sites. Due to the number and types of constituents covered by these TMDLs, results from the seven CCWTMP sites cover the *Conditional Ag Waiver* requirements and will be compared to Appendix 2 *Conditional Ag Waiver* benchmarks. Additionally, the monitoring frequency of the CCWTMP is greater than the *Conditional Ag Waiver* required monitoring.

In the Santa Clara River Watershed there are two effective TMDLs. VCAILGMP data will be used to assess whether agriculture is meeting the load allocations for those TMDLs. For the Nitrogen Compounds TMDL, data from all 6 VCAILGMP sites (not including the one background site) will be compared to the load allocation. Compliance with the Santa Clara River Estuary Toxaphene TMDL will be evaluated at monitoring sites S02T_ELLS, S01D_MONAR, and within the Santa Clara River Estuary. Data from S02T_ELLS and S01D_MONAR will be compared to the suspended sediment load allocation. Additionally, fish will be collected every three years from the estuary for comparison with the fish tissue load allocation.

The Channel Islands Harbor Bacteria TMDL includes a requirement for agricultural dischargers to perform monitoring. To comply with this TMDL the VCAILGMP includes monitoring site CIHD_VICT, from which bacteria samples will be collected.

There are two effective trash TMDLs in Ventura County; Ventura River Estuary and Revolon Slough & Beardsley Wash. Monitoring and Reporting Plans have been submitted and approved for both of these TMDLs on behalf of the responsible parties, which includes VCAILG. Compliance with these TMDLs is currently being attained through the implementation of a MFAC/BMP program as outlined in the approved Trash Monitoring and Reporting Plans.

Monitoring Elements

The following region-wide surface water monitoring elements are included in the VCAILGMP as per Appendix 1, Table 1 of the *Conditional Ag Waiver*:

- General water quality constituents;
- Nitrogen and phosphorus compounds (nutrients);
- Pesticides;
- Copper;
- Trash observations;

- Aquatic chronic toxicity.

Table 1 lists the constituents for which samples will be analyzed according to Appendix 1, Table 1 of the *Conditional Ag Waiver*. Table 2 includes the sites, constituents, and monitoring frequency necessary to fulfill TMDL monitoring requirements that are not covered by other programs (i.e. CCWTMP, Ventura River Estuary TMRP, and Revolon Slough & Beardsley Wash TMRP). Element 10 (Sampling Process Design) contains monitoring site descriptions and maps of site locations. Element 11 (Sampling Methods) and Element 13 (Analytical Methods) outline the measurement processes and techniques that will be used to generate data.

Table 1. Constituents and Monitoring Frequency for the VCAILGMP

CONSTITUENT	FREQUENCY [1]
FIELD MEASUREMENTS	2 dry events; 2 wet events
Flow, pH, Temperature, Dissolved Oxygen, Turbidity, Conductivity	
GENERAL WATER QUALITY CONSTITUENTS (GWQC)	
Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Hardness, Chloride, Sulfate	
NUTRIENTS	
Total Ammonia-N, Nitrate-N, Phosphate	
PESTICIDES	
Organochlorine Pesticides [2], Organophosphorus Pesticides [3], Pyrethroid Pesticides [4]	
METALS	
Dissolved Copper, Total Copper	
TRASH	
Trash observations	
AQUATIC CHRONIC TOXICITY	1 wet event; second dry event

1. The "wet" season is defined as October 15th through May 15th; the "dry" season is defined as May 16th through Ocober 14th each year.
2. Organochlorine Pesticides include: 2,4'-DDD, 2,4'-DDE, 2,4'-DDT, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, adrin, BHC-alpha, BHC-beta, BHC-delta, BHC-gamma, chlordane-alpha, chlordane-gamma, dieldrin, endosulfan sulfate, endosulfan I, endosulfan II, endrin, endrin aldehyde, endrin ketone, and toxaphene.
3. Organophosphorus Pesticides include: bolstar, chlorpyrifos, demeton, diazinon, dichlorvos, dimethoate, disulfoton, ethoprop, fenchlorphos, fensulfothion, fenthion, malathion, merphos, methyl parathion, mevinphos, phorate, tetrachlorvinphos, tokuthion, and trichloronate.
4. Pyrethroid Pesticides include: allethrin, bifenthrin, cyfluthrin, cypermethrin, danitol, deltamethrin, esfenvalerate, fenvalerate, lambda-cyhalothrin, permethrin, and prallethrin.

Table 2. Site Specific Monitoring Frequency and Constituents for TMDL Monitoring Performed Under the VCAILGMP

SITE ID	CONSTITUENT [1]	FREQUENCY
S01D_MONAR	Field Measurements TSS, toxaphene, chlordane, dieldrin (water)	2 dry events; 2 wet events
	Field Measurements Toxaphene, chlordane, dieldrin (filtered sediment)	2 wet events
S02T_ELLS	Toxaphene, chlordane, dieldrin (filtered sediment) [2]	2 wet events
Santa Clara River Estuary	Toxaphene, chlordane, dieldrin (fish tissue)	Every three years
CIHD_VICT	Field Measurements *E. coli*, enterococcus, total coliform, fecal coliform	2 dry events; 2 wet events

1. This table only lists constituents necessary for data comparison with TMDL load allocations that are not already collected at the specified site as part of the Table 1 VCAILGMP sampling.
2. Required TMDL constituents not listed in this table will already be collected as part of the *Conditional Ag Waiver* constituents listed in Table 1.

Project Schedule

The project schedule is outlined in Table 3 and is based on a projected monitoring start date of October 2011. This start date is based on the assumption that the Notice of Applicability will be issued to the VCAILG by August 2011.

Table 3. Project Schedule for the VCAILGMP

DELIVERABLE	ANTICIPATED DATE OF INITIATION	ANTICIPATED DATE OF COMPLETION
Initiate Year 1 Monitoring	October 2011	August 2012
Preliminary Data Submittal [1]		
Complete Review of Year 1 Data	Ongoing	September 2012
Complete Year 1 Annual Report [2]		October 2012
Complete Year 1 WQMP (if necessary) [3]	October 2012	April 2013
Initiate Year 2 Monitoring	October 2012	August 2013
Preliminary Data Submittal [1]		
Complete Review of Year 2 Data	Ongoing	September 2013
Complete Year 2 Annual Report [2]		October 2013
Complete Year 2 WQMP (if necessary) [3]	October 2013	April 2014
Initiate Year 3 Monitoring	October 2013	August 2014
Preliminary Data Submittal [1]		
Complete Review of Year 3 Data	Ongoing	September 2014
Complete Year 3 Annual Report [2]		October 2014
Complete Year 3 WQMP (if necessary) [3]	October 2014	April 2015
Initiate Year 4 Monitoring	October 2014	August 2015
Preliminary Data Submittal [1]		
Complete Review of Year 4 Data	Ongoing	September 2015
Complete Year 4 Annual Report [2]		October 2015
End of 2010 Conditional Ag Waiver Program		October 2015

1. Preliminary monitoring data will be submitted to the Regional Board within 90 days of each monitoring event.
2. Annual Monitoring Report is due annually beginning 12 months after issuance of the NOA.
3. WQMP = Water Quality Management Plan, due annually 6 months after each Annual Monitoring Report containing water quality benchmark exceedances.

7. Quality Objectives and Criteria for Measurement Data

The objective of the monitoring program, in terms of data quality, is to produce data that represent as closely as possible, *in situ* conditions of waterbodies from which samples are collected. This objective will be achieved by using accepted, standard methods for sample collection and laboratory analysis. Assessing the program's ability to meet this objective will be accomplished by evaluating the resulting laboratory measurements in terms of detection limits, precision, accuracy, representativeness, comparability, and completeness, as discussed in Element 14 (Quality Control).

Table 4 lists data quality objectives for the constituents that will be measured as required in Appendix 1, Table 1 of the *Conditional Ag Waiver*. Table 5 lists constituents and information regarding TMDL required monitoring that will be performed as part of the VCAILGMP and are not already included in Table 4. For information regarding the CCWTMP, refer to the Calleguas Creek Watershed Management Plan QAPP (LWA, 2008).

Table 4. VCAILGMP Data Quality Objectives

PARAMETER	ACCURACY	PRECISION	RECOVERY	TARGET REPORTING LIMITS	COMPLETENESS
Field Measurements					
Water Velocity (for Flow calc.)	± 2%	NA	NA	0.05 ft/sec	See Element 14
pH	± 0.2 pH units	± 0.5 pH units	NA	NA	See Element 14
Temperature	± 0.5 °C	± 5%	NA	NA	See Element 14
Dissolved Oxygen	± 0.5 mg/L	± 10%	NA	0.5 mg/L	See Element 14
Turbidity	± 10%	± 10%	NA	0.2 NTU	See Element 14
Conductivity	± 5%	± 5%	NA	2.5 µmhos/cm	See Element 14
Laboratory Analyses					
Aquatic Chronic Toxicity	[1]	[2]	NA	NA	See Element 14
Total Suspended Solids (TSS)	80-120%	25%	80-120%	5 mg/L	See Element 14
Total Dissolved Solids (TDS)	80-120%	25%	80-120%	20 mg/L	See Element 14
Hardness (as $CaCO_3$)	80-120%	30%	80-120%	5 mg/L	See Element 14
Chloride	80-120%	25%	80-120%	1 mg/L	See Element 14
Sulfate	80-120%	25%	80-120%	1 mg/L	See Element 14
Ammonia-Nitrogen	80-120%	30%	80-120%	0.06 mg/L	See Element 14
Nitrate-Nitrogen	80-120%	30%	80-120%	0.05 mg/L	See Element 14
Orthophosphate-P	80-120%	30%	80-120%	0.01 mg/L	See Element 14
Dissolved Copper	75-125%	30%	80-120%	0.8 µg/L	See Element 14
Total Copper	75-125%	30%	80-120%	0.8 µg/L	See Element 14
Organochlorine Pesticides	80-120%	30% [3]	50-150% [3]	See Element 14	See Element 14
Organophosphorus Pesticides	80-120%	30% [3]	50-150% [3]	See Element 14	See Element 14
Pyrethroid Pesticides	80-120%	30% [3]	50-150% [3]	See Element 14	See Element 14
Trash	NA	NA	NA	NA	See Element 14

NA = Not Applicable

1. Must meet all method performance criteria relative to the reference toxicant test.
2. Must meet all method performance criteria relative to sample replicates.
3. Or control limits established as the mean ± 3 standard deviations based on laboratory precision and recovery data.

Table 5. TMDL Specific Data Quality Objectives

PARAMETER	ACCURACY	PRECISION	RECOVERY	TARGET REPORTING LIMITS	COMPLETENESS
Toxaphene (filtered sediment)	50-150%	30%	50-150% [1]	50 ng/L	See Element 14
Chlordane (filtered sediment)	50-150%	30%	50-150% [1]	5 ng/L	See Element 14
Dieldrin (filtered sediment)	50-150%	30%	50-150% [1]	5 ng/L	See Element 14
Toxaphene (fish tissue)	50-150%	30%	50-150% [1]	50 ng/g	See Element 14
Chlordane (fish tissue)	50-150%	30%	50-150% [1]	5 ng/g	See Element 14
Dieldrin (fish tissue)	50-150%	30%	50-150% [1]	5 ng/g	See Element 14
E. coli	80-120% [2]	RPD <25%	80-120%	<2 MPN/100mL	See Element 14
Enterococcus	80-120% [2]	RPD <25%	80-120%	<1	See Element 14
Total Coliform	80-120% [2]	RPD <25%	80-120%	<2	See Element 14
Fecal Coliform	80-120% [2]	RPD <25%	80-120%	<2	See Element 14

1. Or control limits established as the mean $\pm$ 3 standard deviations based on laboratory precision and recovery data.
2. Negative control = no growth on filter.

8. Training and Certification

The Project Manager or designee will ensure that all field personnel, including field crews from Fruit Grower's Laboratory (FGL), receive refresher training prior to initiation of sampling and will document staff training events. LWA staff responsible for field sampling receive annual refresher training to ensure that samples are collected properly and safely. Documentation will consist of a sign-in sheet listing attendees, course time and date, instructor, and any handouts. Training documentation will be maintained in the Project Manager's project files. All sampling shall be performed under the supervision of experienced staff. No volunteers will be used for sampling.

At a minimum, laboratories selected to perform analyses for this program must maintain current certification through the California Department of Health Services – Environmental Laboratory Accreditation Program (ELAP). Pacific EcoRisk (toxicity testing laboratory) and FGL (chemistry laboratory) are both certified by the National Environmental Laboratory Accreditation Program (NELAP); their certificate numbers are 04225CA and 01110CA, respectively. Physis Environmental Laboratories (Physis) is certified by ELAP (certificate number 2769). Toxicity and chemistry laboratories are required to maintain records of analyst training and will make these records available upon request.

9. Documents and Records

Documents and records generated and maintained for the VCAILGMP include the following: the Monitoring and Reporting Program (MRP) Plan, this QAPP, Event Summary Reports, Analytical Data Reports, Annual Monitoring Reports, and Water Quality Management Plans (WQMP). Annual Monitoring Report and WQMP content is discussed in detail in Element 21 (Reports to Management).

Event Summary Reports

Event Summary Reports will be created by the field crew and submitted to the Project Manager and Project QA Manager within one week of the completion of each sampling event, and will consist of the following:

1. A brief summary of the sampling event and any issues that arose in the field or unusual occurrences;
2. Completed checkbox table showing at which sites samples were collected or not collected and which field crew visited each site;
3. A summary of any deviations from the QAPP; and,
4. A copy of the field logbook and chain-of-custody (COC) forms.

The field logbook and COCs will be scanned into PDF files and stored electronically by the Project Manager and in hard copy format by the field crew lead. The field logbook and COC forms are discussed in more detail in Element 12 (Sample Handling and Custody).

Analytical Data Reports

Results of chemical analyses, toxicity testing, and any Toxicity Identification Evaluations (TIEs) performed will be provided to the Project QA Manager in the laboratory's standard hardcopy report format and a SWAMP comparable electronic data format approved by the Project Manager within 30 business days of sample receipt by the laboratory. All final data reports will include results for environmental samples and associated quality control samples, and a narrative summary of quality control data. All results meeting data quality objectives and results having satisfactory explanations for deviations from data quality objectives shall be reported in tabular format on electronic media. For each sample analyzed, hard copy and electronic reports will contain the following information:

- Name of the analyzing laboratory;
- Client sample ID;
- Laboratory sample ID;
- Date of sample receipt;
- Date and time of sample collection;
- Date of sample preparation (if applicable);
- Batch ID;
- Method of sample preparation (if applicable);
- Date(s) of analysis;
- Matrix analyzed;
- Analytical method(s);
- Analyte or parameter measured;
- Fraction of analyte measured;
- Units of measure;
- Dilution factor;
- Method detection limit (MDL), if applicable;
- Reporting limit (RL), if applicable;
- Measured value of the analyte or parameter;
- Relative percent difference (RPD) and percent recovery statistics for quality control (QC) samples, if applicable, as well as applicable acceptance ranges for QC limits and appropriate qualifiers for results that fail to meet QC criteria.

Information contained in hard copy and electronic reports must allow Project staff to easily determine whether sample preparation and analytical holding times were met. The analyzing laboratory will provide

results for all laboratory QC samples (blanks, duplicates, spikes, reference materials, etc.) and the sample IDs associated with each sample batch at the same time environmental sample results are submitted. Data reports will be compiled in a Microsoft™ Access database as described in Element 19 (Data Management).

Quality Assurance Project Plan (QAPP)

The Project Manager or designee is responsible for the development, management and distribution of the QAPP to those individuals listed in Element 3 (Distribution List).

Monitoring and Reporting Program (MRP) Plan

The Project Manager or designee is responsible for the development, distribution and management of the MRP Plan. The MRP Plan is intended to be a working field guide that contains specific information regarding the monitoring schedule, monitoring sites, field and sample collection and handling protocols, and required analytical methods and detection limits.

Distribution and Management of Documents

The Project Manager or designee is responsible for the development, management and distribution of the approved QAPP and MRP Plan.

All hard copy and electronic data will be stored by the Project Manager or designee. Data will be maintained for the length of the program and will be available for review. A backup copy of each data report will also be saved on a local server, which is 100% mirrored in case of equipment failure. Upon completion of the VCAILGMP, the hard copy and electronic data will be retained for an additional five years.

B. DATA GENERATION AND ACQUISITION

10. Sampling Process Design

The VCAILGMP will monitor water quality at up to 18 monitoring sites located throughout Ventura County for constituents listed in Appendix 1, Table 1 of the *Conditional Ag Waiver*. Other monitoring will take place in the Santa Clara River and Channel Islands Harbor watersheds to comply with TMDLs not covered by other monitoring programs. For additional information regarding the additional TMDL monitoring, refer to Element 6 and the following tables in this section. Monitoring frequency is consistent for the entire term of this *Conditional Ag Waiver*, with toxicity testing performed semiannually and the remaining constituents sampled during two dry and two wet events. Wet season sampling will be conducted during or shortly after storm events producing runoff, preferably including the first storm event that results in significant runoff. Toxicity identification evaluations (TIEs) will be conducted on samples as outlined in Element 13 (Analytical Methods).

Monitoring Sites

The process for selection of appropriate sites for monitoring is based on land uses, subwatershed characteristics, VCAILG landowner representation, and access considerations. The specific criteria for selection of monitoring sites are as follows:

1. Land use (primarily agricultural drainages);
2. Subwatershed representation;

3. Acres of agricultural irrigated lands represented;
4. Proximity to agricultural operations;
5. Previous or existing monitoring locations under the 2005 *Conditional Ag Waiver* or TMDL monitoring programs;
6. Drainage into waterbodies included on the 2010 303(d) list of impaired waterbodies;
7. Size and complexity of watershed;
8. Size and flow of waterbodies; and,
9. Safe access during dry and wet weather.

Monitoring sites were selected to best characterize agricultural inputs to receiving waters and are generally located at the lower ends of mainstem tributaries or agricultural drainages in areas associated with agricultural activity. In some cases, "background" sites are also monitored to aide in distinguishing agricultural inputs from other sources (i.e., landscape irrigation runoff). Background sites will be sampled only for chemical parameters when flow is present at the site to which they are tributary.

Monitoring sites in the Calleguas Creek Watershed supplement monitoring performed under the CCWTMP and retain consistency with previous VCAILG sampling. Monitoring sites in the Santa Clara River and Ventura River Watersheds were selected to continue building on existing data previously collected by VCAILG.

Table 6 lists monitoring sites selected in each watershed and the annual monitoring frequency for meeting *Conditional Ag Waiver* requirements, excluding TMDLs. Table 7 and Table 8 provide information regarding monitoring performed to meet TMDL requirements including sites, TMDLs covered by the monitoring site, and monitoring frequency. VCAILGMP monitoring sites located in the Calleguas Creek/Oxnard Coastal, Santa Clara River and Ventura River watersheds are presented in Figure 3, Figure 4, and Figure 5, respectively. CCWTMP sites are shown in Figure 6 and all Calleguas Creek Watershed sites are included in Figure 7. The location of the Channel Islands Harbor Bacteria TMDL monitoring site can be found in Figure 8. Sites in the Santa Clara River Watershed to be used for comparison with the Toxaphene TMDL load allocations are depicted in Figure 9.

The VCAILG Monitoring and Reporting Program (MRP) Plan contains detailed descriptions of each monitoring site, including GPS coordinates and driving directions to each site.

Table 6. VCAILGMP Monitoring Locations for *Conditional Ag Waiver* Constituents and Annual Monitoring Frequency

Watershed/ Subwatershed	Site ID	Reach	Waterbody Type [1]	Site Location	Monitoring Frequency	
					Chronic Toxicity	General WQ Constituents, Pesticides, Nutrients, etc.
Calleguas Creek/ Mugu Lagoon	01T_ODD3_ARN	1	T	Rio de Santa Clara/Oxnard Drain #3 at Arnold Rd.	1 dry, 1 wet	2 dry weather, 2 wet events
Calleguas Creek/ Calleguas Creek	02D_CSUCI [2]	2	B	02D_BROOM background site near CSUCI	None	2 dry weather, 2 wet events
Calleguas Creek/ Revolon Slough	04D_ETTG	4	D	Discharge to Revolon Slough at Etting Rd.	None	2 dry weather, 2 wet events
	04D_LAS	4	D	Discharge to Revolon Slough at S. Las Posas Rd.	None	2 dry weather, 2 wet events
Calleguas Creek/ Beardsley Channel	05D_SANT_BKGD [2]	5	D	05D_SANT_VCWPD background site near the golf course.	None	2 dry weather, 2 wet events
	05D_LAVD	5	T	La Vista Drain at La Vista Ave.	1 dry, 1 wet	2 dry weather, 2 wet events
	05T_HONDO	5	T	Hondo Barranca at Hwy. 118	1 dry, 1 wet	2 dry weather, 2 wet events
Calleguas Creek/ Arroyo Las Posas	06T_LONG2	6	T	Long Canyon at Balcom Canyon Rd. crossing	1 dry, 1 wet	2 dry weather, 2 wet events
Oxnard Coastal	OXD_CENTR	--	D	Central Ditch at Harbor Blvd.	None	2 dry weather, 2 wet events
Santa Clara River	S02T_ELLS	2	T	Ellsworth Barranca at Telegraph Rd.	1 dry, 1 wet	2 dry weather, 2 wet events
	S02T_TODD	2	T	Todd Barranca at Hwy. 126	1 dry, 1 wet	2 dry weather, 2 wet events
	S03T_TIMB	3	T	Timber Canyon at Hwy. 126	1 dry, 1 wet	2 dry weather, 2 wet events
	S03T_BOULD	3	T	Boulder Creek at Hwy. 126	1 dry, 1 wet	2 dry weather, 2 wet events
	S03D_BARDS	3	D	Discharge along Bardsdale Ave. upstream of confluence with Santa Clara River	None	2 dry weather, 2 wet events
	S04T_TAPO	4	T	Tapo Canyon Creek	1 dry, 1 wet	2 dry weather, 2 wet events
	S04T_TAPO_BKGD [2]	4	B	S04T_TAPO background site upstream of agricultural operations.	None	2 dry weather, 2 wet events
Ventura River	VRT_THACH	--	T	Thacher Creek at Ojai Avenue	1 dry, 1 wet	2 dry weather, 2 wet events
	VRT_SANTO	--	T	San Antonio Creek at Grand Avenue	1 dry, 1 wet	2 dry weather, 2 wet events

1. T = Tributary to receiving water; D = agricultural Drain; B = Background site
2. Background sites are only visited during storm events when the corresponding downstream site is sampled.

Table 7. Effective TMDL Monitoring Locations, Constituents, and Testing Frequency

TMDL	Monitoring Responsibility	Site ID	Constituents	Frequency[1]
Calleguas Creek Watershed & Mugu Lagoon OC Pesticides & PCBs	CCWTMP	01T_ODD2_DCH	OC Pesticides and PCBs (water)	Quarterly + 2 wet events
		02D_BROOM		
		04D_WOOD		
		05D_SANT_VCWPD		
		06T_FC_BR		
		07D_HITCH_LEVEE_2		
		9BD_GERRY		
Calleguas Creek Watershed Mugu Lagoon Toxicity, Chlorpyrifos, & Diazinon	CCWTMP	01T_ODD2_DCH	OP Pesticides (water)	Quarterly + 2 wet events
		02D_BROOM		
		04D_WOOD		
		05D_SANT_VCWPD		
		06T_FC_BR		
		07D_HITCH_LEVEE_2		
		9BD_GERRY		
Calleguas Creek Watershed Salts	CCWTMP	04D_WOOD	Salts (water)	Quarterly + 2 wet events
		05D_SANT_VCWPD		
		06T_FC_BR		
		07D_HITCH_LEVEE_2		
		9BD_GERRY		
Calleguas Creek Watershed & Mugu Lagoon Metals & Selenium	CCWTMP	01T_ODD2_DCH	Metals (water)	Quarterly + 2 wet events
		02D_BROOM		
		04D_WOOD		
		05D_SANT_VCWPD		
		9BD_GERRY		

TMDL	Monitoring Responsibility	Site ID	Constituents	Frequency[1]
Calleguas Creek Nitrogen Compounds	CCWTMP	CCWTMP agricultural land use sites and VCAILGMP non-background sites in the CCW will be compared to the TMDL load allocation.	Nutrients (water)	Quarterly +2 wet events
Revolon Slough & Beardsley Wash Trash	Revolon Slough & Beardsley Wash TMRP	[2]	Trash	[2]
Santa Clara River Nitrogen Compounds	VCAILGMP	The 6 SCR VCAILG monitoring sites (excluding the background) listed in Table 6 will be compared to the TMDL load allocation.	Nitrogen (water)	2 dry weather, 2 wet events
Ventura River Estuary Trash	Ventura River Estuary TMRP	[3]	Trash	[3]
Santa Clara River Estuary Toxaphene	VCAILGMP	S01D_MONAR	Toxaphene, chlordane, dieldrin, TSS (water); Toxaphene, chlordane, dieldrin (filtered sediment)	2 dry weather, 2 wet events (water); 2 wet events (filtered sediment)
		S02T_ELLS		
		Santa Clara River Estuary	Toxaphene, chlordane, dieldrin (fish tissue)	Every three years
Channel Islands Harbor Bacteria	VCAILGMP	CIHD_VICT	*E. coli*, enterococcus, total coliform, fecal coliform	2 dry weather, 2 wet events

Note: For evaluating data against TMDL load allocations, all appropriate data collected from the CCWTMP and VCAILMP will be utilized.

1. Frequencies are listed on an annual basis, unless otherwise noted.
2. Site locations and trash collection frequencies can be found in the *Revolon Slough and Beardsley Wash Trash Monitoring and Reporting Plan*.
3. Site locations and trash collection frequencies can be found in the *Ventura Estuary Trash Monitoring and Reporting Plan.*

Table 8. Monitoring Locations for Effective TMDLs

Watershed/ Subwatershed	Site ID	Reach	Waterbody Type [1]	Site Location	Effective TMDLs Monitored [1, 2]
Calleguas Creek/ Mugu Lagoon	01T_ODD2_DCH	1	T	Duck Pond/Oxnard Drain #2/Mugu Drain S. of Hueneme Rd.	CCW OC Pesticides and PCBs CCW Toxicity, Chlorpyrifos, & Diazinon CCW Nitrogen CCW Metals & Selenium
Calleguas Creek/ Calleguas Creek	02D_BROOM	2	D	Discharge to Calleguas Creek at Broome Ranch Rd.	CCW OC Pesticides and PCBs CCW Toxicity, Chlorpyrifos, & Diazinon CCW Nitrogen CCW Metals & Selenium
Calleguas Creek/ Revolon Slough	04D_WOOD	4	D	Agricultural drain on E. side of Wood Rd. N of Revolon	CCW OC Pesticides and PCBs CCW Toxicity, Chlorpyrifos, & Diazinon CCW Nitrogen CCW Metals & Selenium CCW Salts
	05D_SANT_VCWPD	5	D	Santa Clara Drain at VCWPD Gage #781	CCW OC Pesticides and PCBs CCW Toxicity, Chlorpyrifos, & Diazinon CCW Nitrogen CCW Metals & Selenium CCW Salts
Calleguas Creek/ Arroyo Las Posas	06T_FC_BR	6	T	Fox Canyon at Bradley Rd.	CCW OC Pesticides and PCBs CCW Toxicity, Chlorpyrifos, & Diazinon CCW Nitrogen CCW Salts
Calleguas Creek/ Arroyo Simi	07D_HITCH_LEVEE_2	7	D	2nd corrugated pipe discharging on N. site of Arroyo Simi flood control levee off of Hitch Blvd.	CCW OC Pesticides and PCBs CCW Toxicity, Chlorpyrifos, & Diazinon CCW Nitrogen CCW Salts
Calleguas Creek/ Conejo Creek	9BD_GERRY	9B	D	Drain crossing Santa Rosa Rd. at Gerry Rd.	CCW OC Pesticides and PCBs CCW Toxicity, Chlorpyrifos, & Diazinon CCW Nitrogen CCW Metals & Selenium CCW Salts

Watershed/ Subwatershed	Site ID	Reach	Waterbody Type [1]	Site Location	Effective TMDLs Monitored [1, 2]
Santa Clara River Estuary	S01D_MONAR	1	D	Drain entering SCR Estuary at Monarch Lane between Harbor Blvd. and Victoria Ave.	Santa Clara River Toxaphene
Santa Clara River	S02T_ELLS	2	T	Ellsworth Barranca at Telegraph Rd.	Santa Clara River Toxaphene
Oxnard Coastal/ Channel Islands Harbor	CIHD_VICT	--	D	Discharge to Doris Drain at S. Victoria Ave.	Channel Islands Harbor Bacteria

1. CCW and SCR Nitrogen TMDLs are not included in this table since all VCAILGMP and CCWTMP agricultural land use sites for the corresponding watershed will be compared to the appropriate load allocations.
2. Trash TMDLs are not included in this table since collection areas do not correspond with water quality sampling locations.

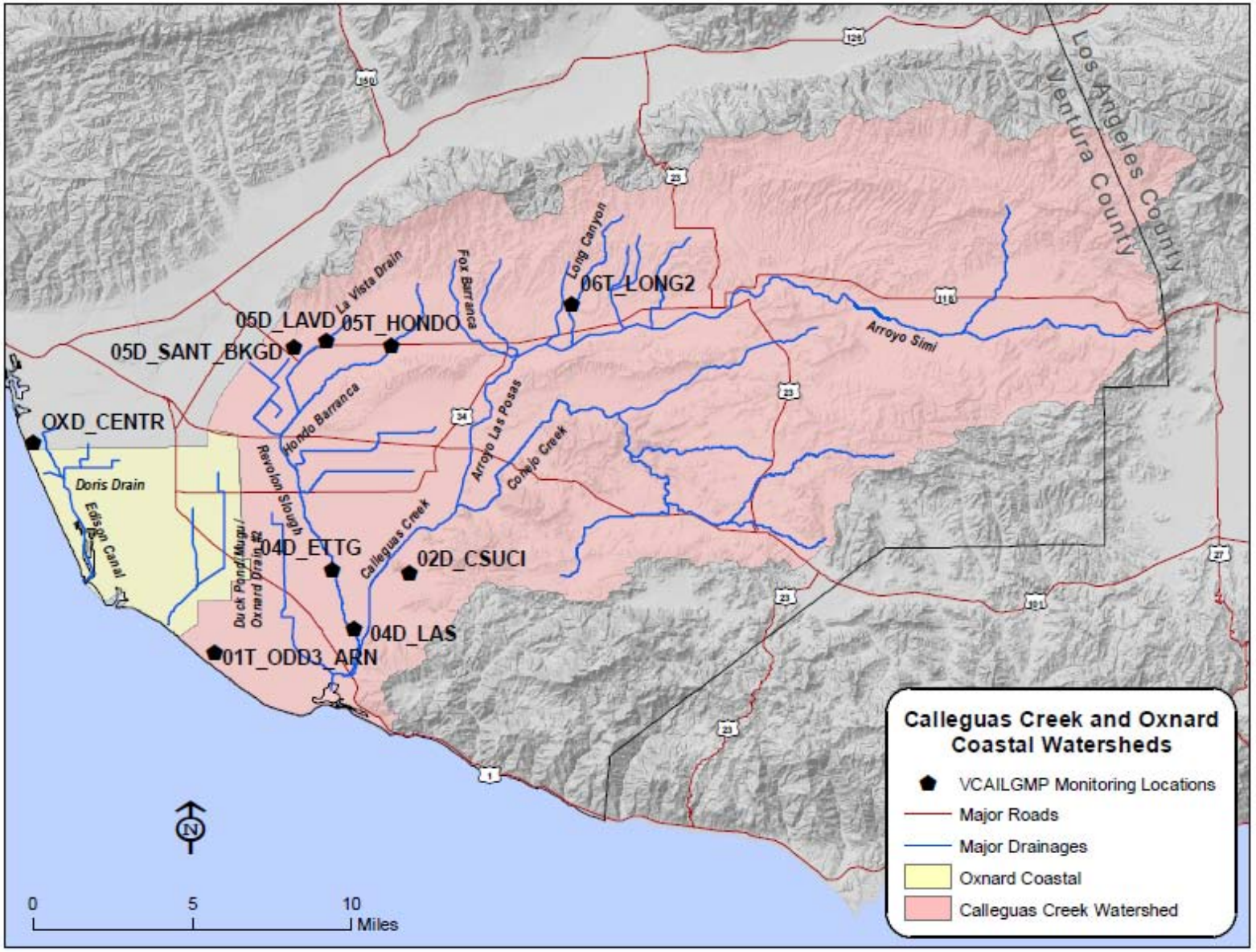

Figure 3. VCAILGMP Monitoring Sites in the Calleguas Creek/Oxnard Coastal Watersheds

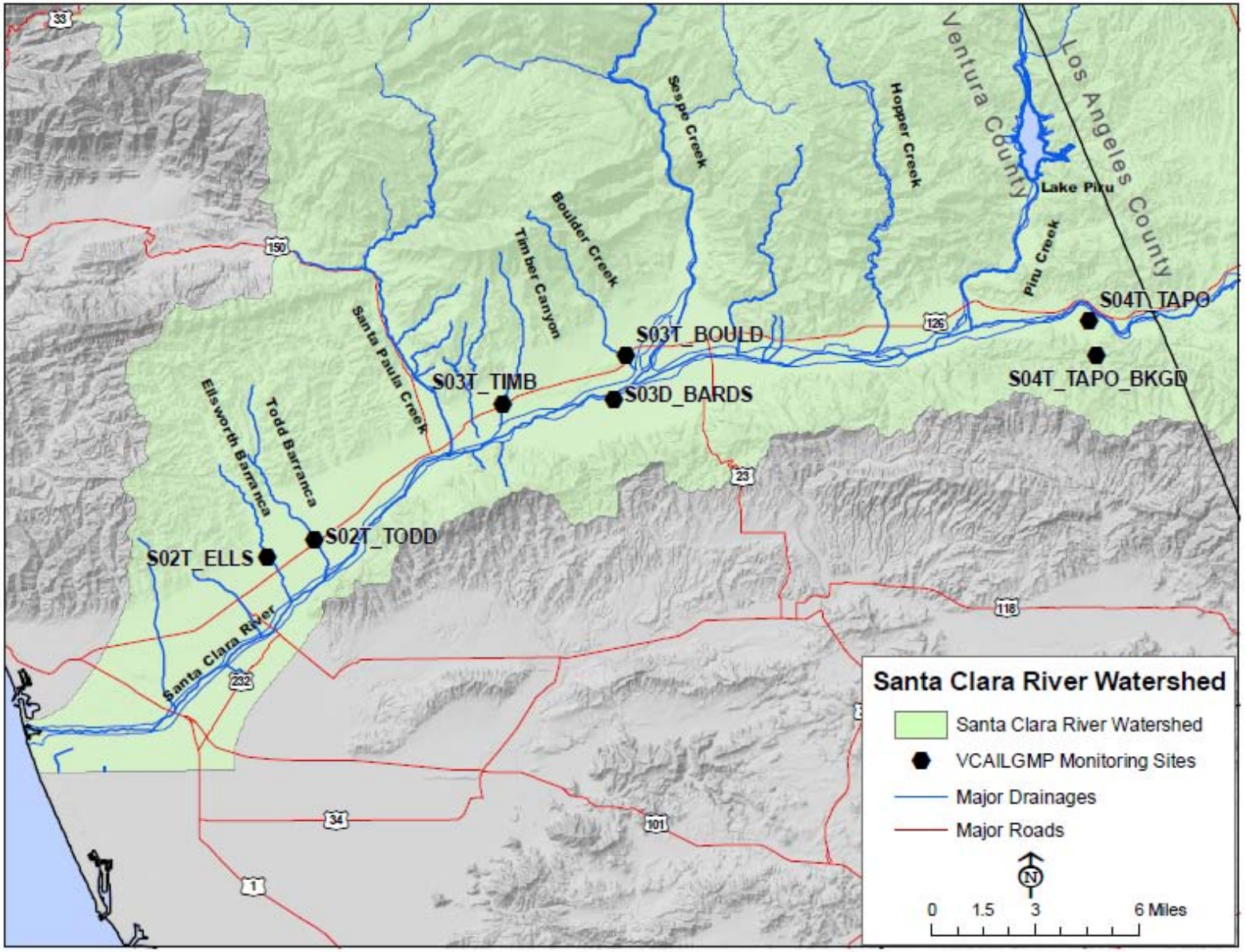

Figure 4. VCAILGMP Monitoring Sites Located in the Santa Clara River Watershed

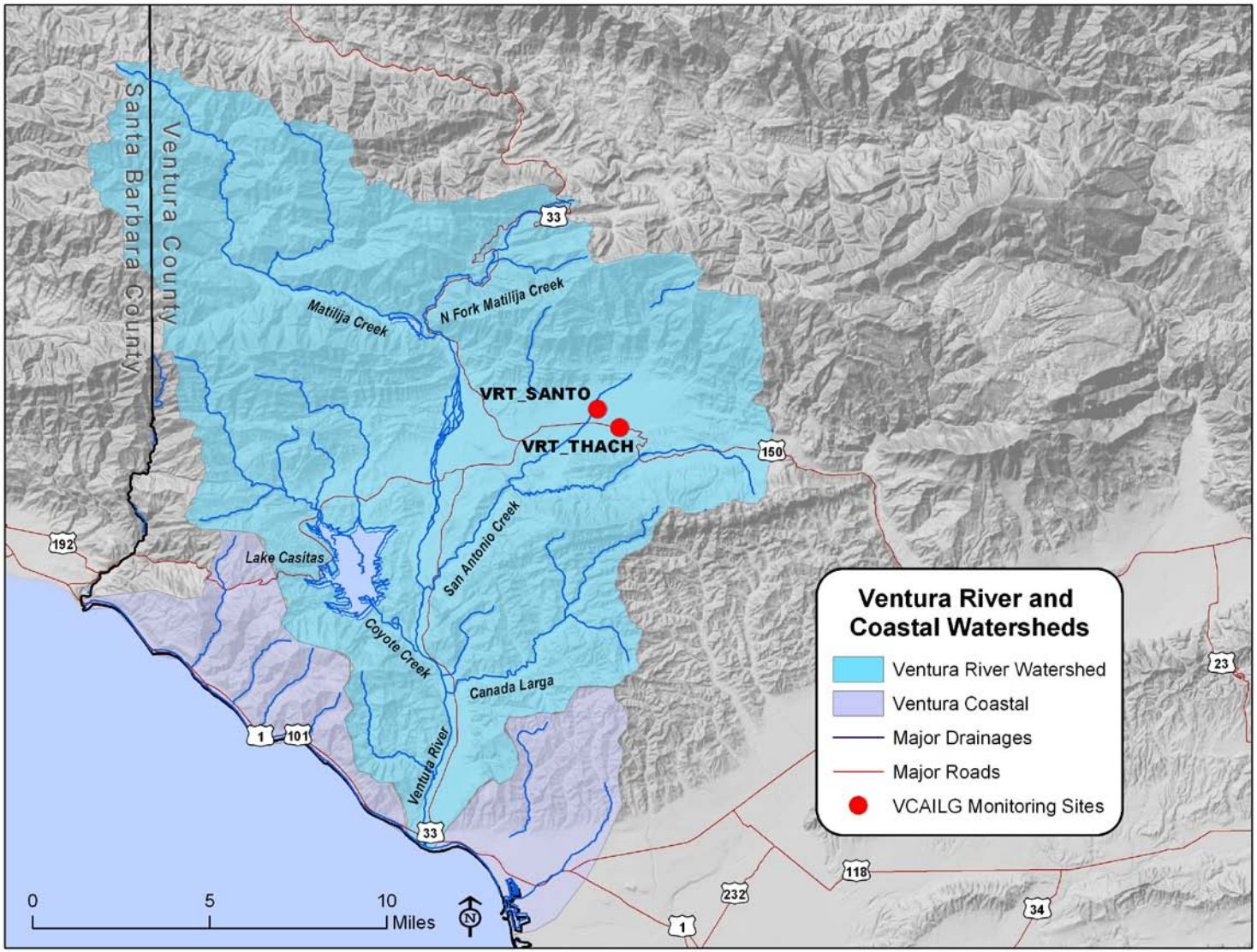

Figure 5. VCAILGMP Monitoring Sites Located in the Ventura River Watershed

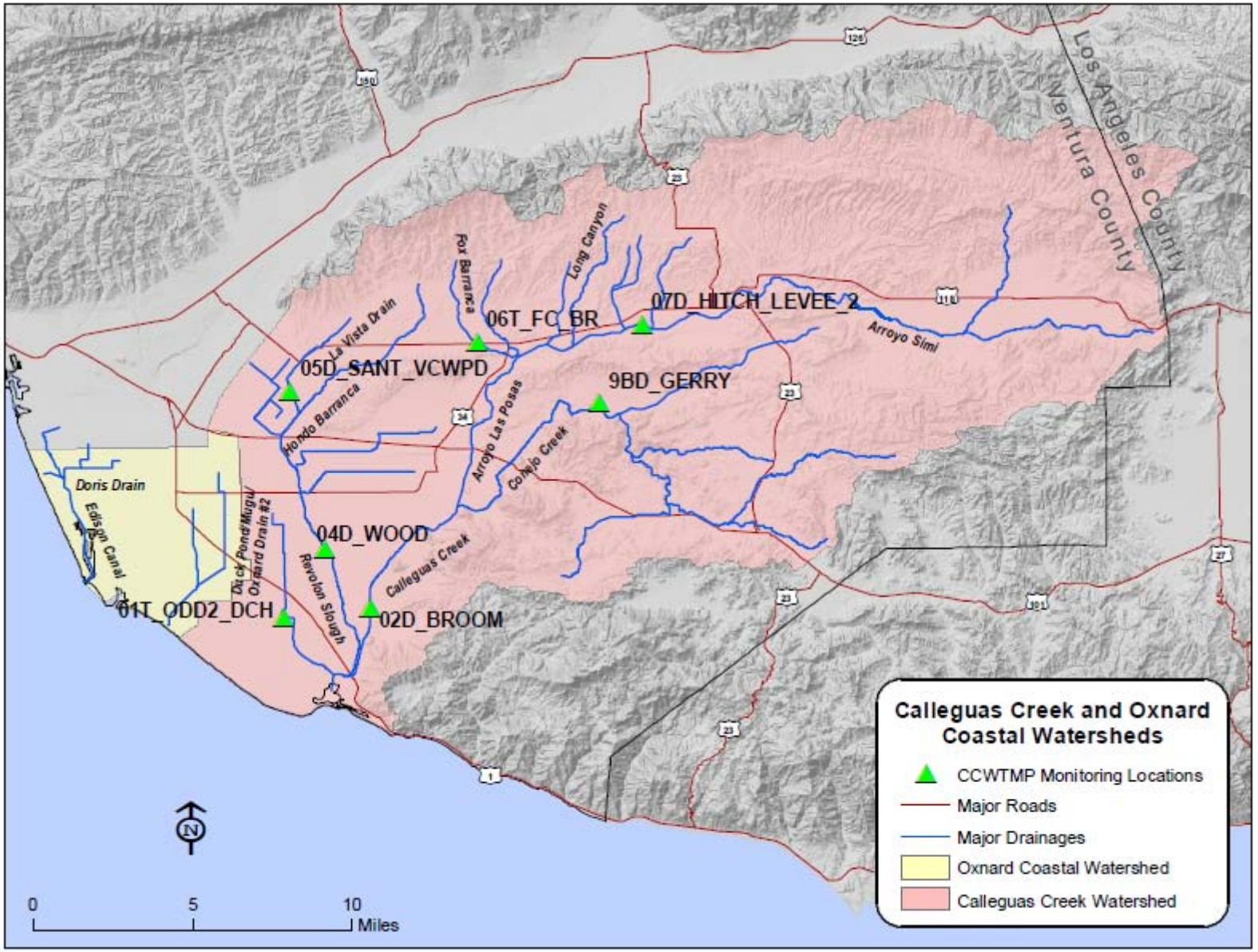

Figure 6. CCWTMP Monitoring Sites

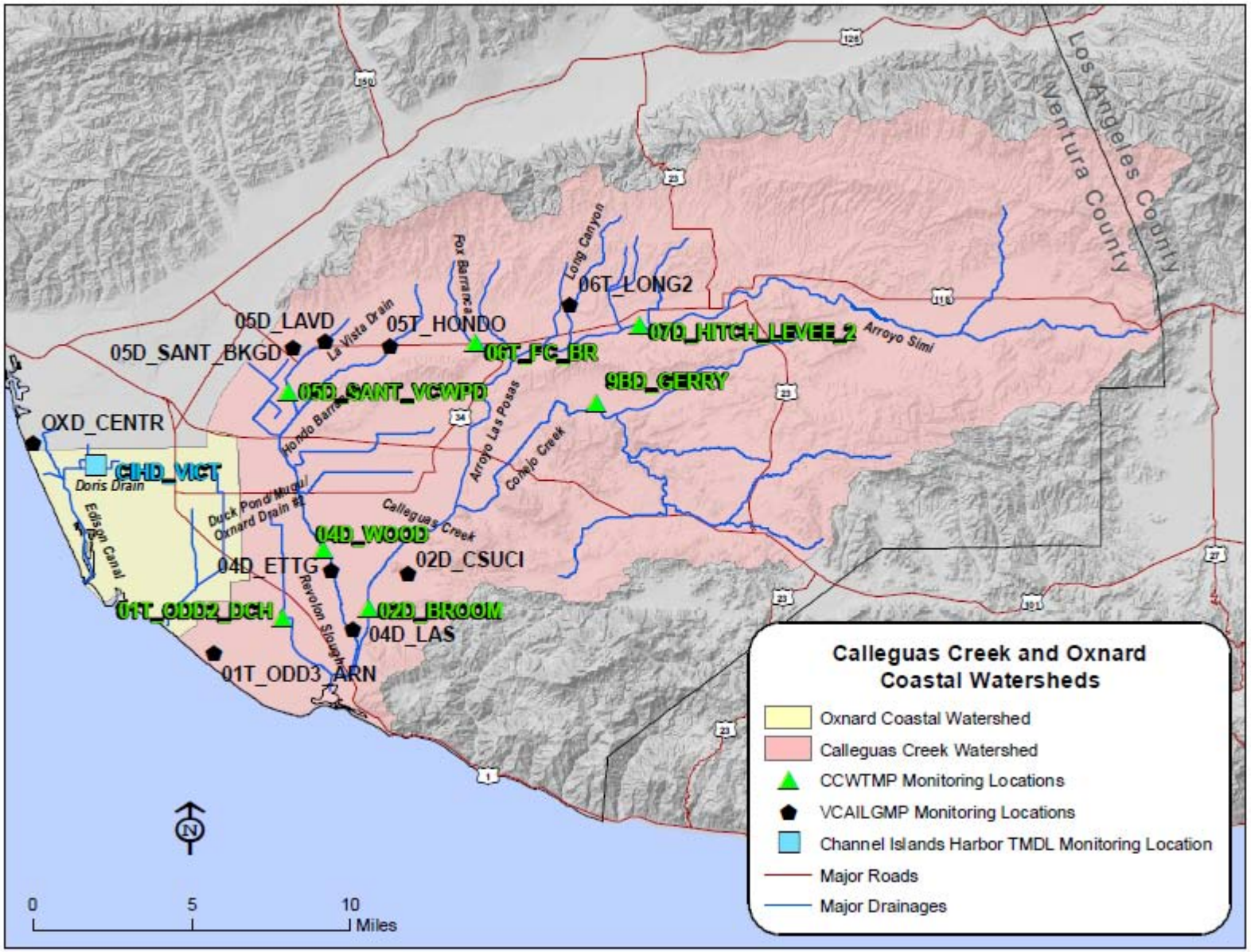

Figure 7. Calleguas Creek Watershed Monitoring Sites for All Programs

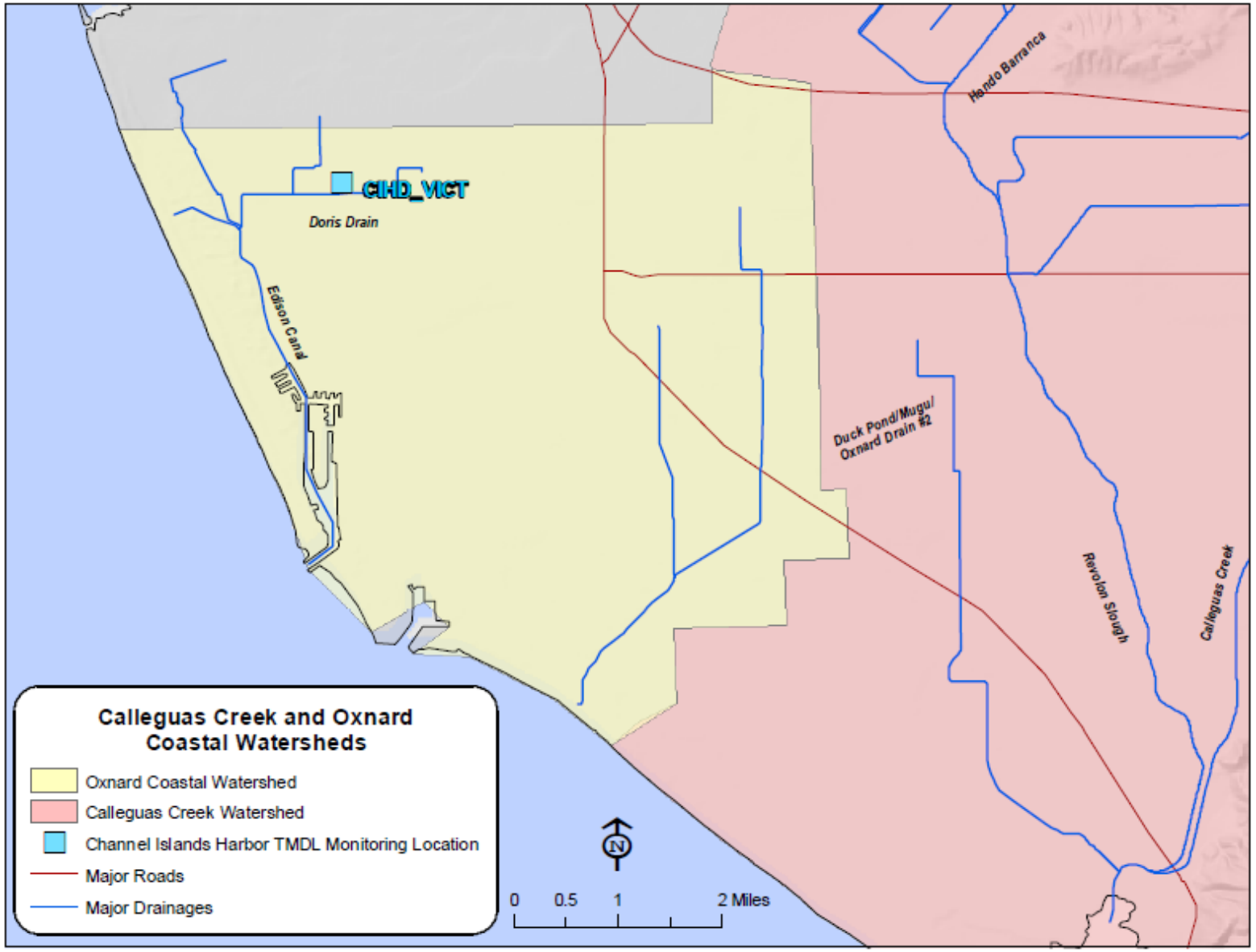

Figure 8. Channel Islands Harbor Bacteria TMDL Monitoring Site

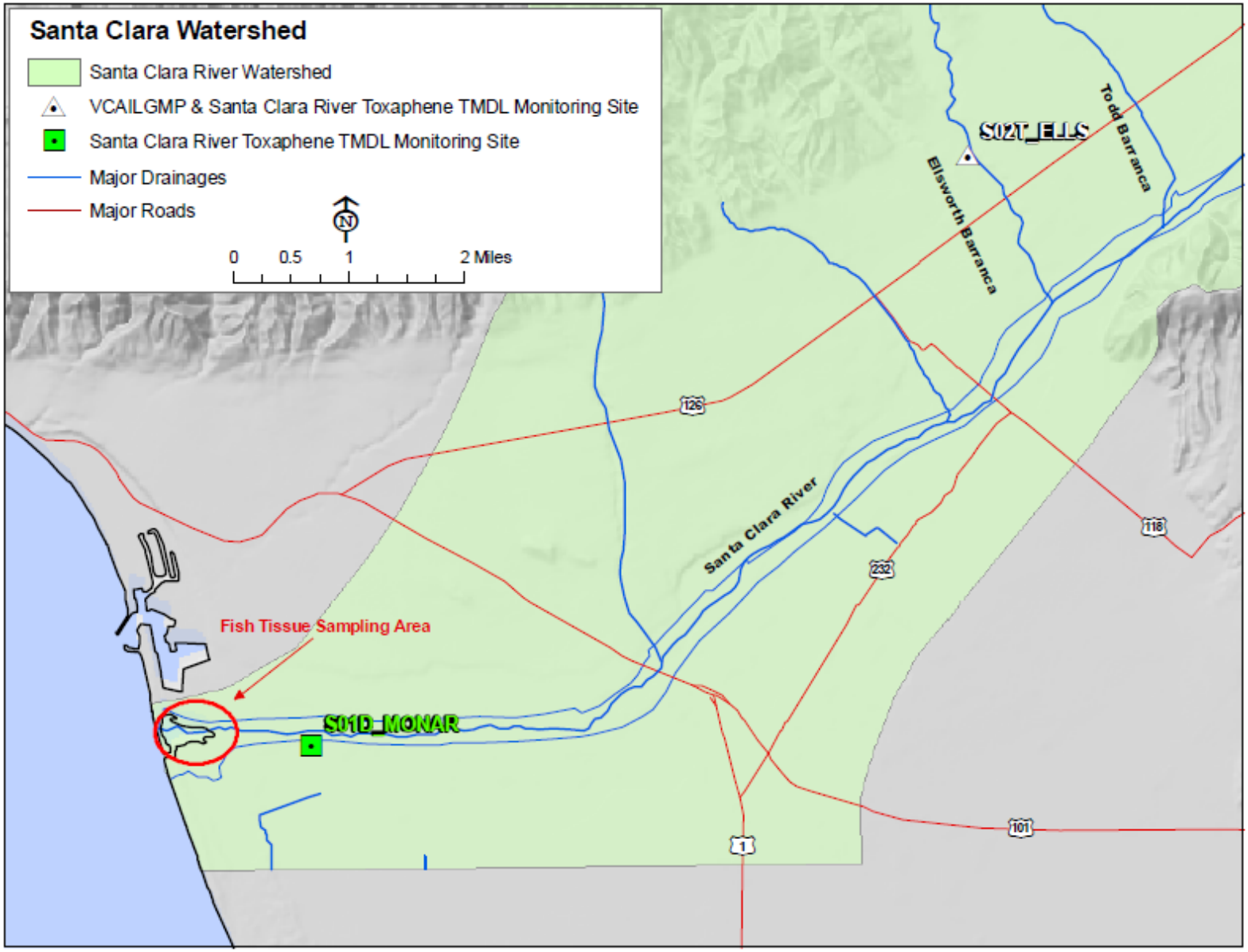

Figure 9. Santa Clara River Estuary Toxaphene TMDL Monitoring Sites

Sampling Schedule

Monitoring will be conducted during two wet and two dry events each year for all water quality constituents and during one storm event and the second dry weather event for toxicity testing. Table 9 presents the yearly monitoring to be conducted at each VCAILGMP site. Table 10 presents the yearly monitoring at each TMDL monitoring site that has been incorporated into the VCAILG MP. For information regarding TMDL monitoring that is the responsibility of other programs, refer to the appropriate QAPP. Toxicity testing will be conducted on VCAILGMP receiving water monitoring sites only. Toxicity testing will be conducted concurrently by the CCWTMP on TMDL receiving water sites to provide an indication of whether agricultural drainages are causing or contributing to toxicity in the receiving water.

Table 9. VCAILGMP Monitoring Schedule

WATERSHED / SUBWATERSHED	SITE ID	REACH	YEARLY EVENTS			
			WET EVENT 1	WET EVENT 2	DRY EVENT 1	DRY EVENT 2
Calleguas Creek / Mugu Lagoon	01T_ODD3_ARN	1	TOX,WQ	WQ	WQ	TOX,WQ
Calleguas Creek / Calleguas Creek	02D_CSUCI [1]	2	WQ	WQ	WQ	WQ
Calleguas Creek / Revolon Slough	04D_ETTG	4	WQ	WQ	WQ	WQ
	04D_LAS	4	WQ	WQ	WQ	WQ
Calleguas Creek / Beardsley Channel	05D_SANT_BKGD [1]	5	WQ	WQ	WQ	WQ
	05D_LAVD	5	TOX,WQ	WQ	WQ	TOX, WQ
	05T_HONDO	5	TOX,WQ	WQ	WQ	TOX, WQ
Calleguas Creek / Arroyo Las Posas	06T_LONG2	6	TOX,WQ	WQ	WQ	TOX, WQ
Oxnard Coastal	OXD_CENTR	--	WQ	WQ	WQ	WQ
Santa Clara River	S02T_ELLS	2	TOX,WQ	WQ	WQ	TOX,WQ
	S02T_TODD	2	TOX,WQ	WQ	WQ	TOX,WQ
	S03T_TIMB	3	TOX,WQ	WQ	WQ	TOX,WQ
	S03T_ BOULD	3	TOX,WQ	WQ	WQ	TOX,WQ
	S03D_BARDS	3	WQ	WQ	WQ	WQ
	S04T_TAPO	4	TOX,WQ	WQ	WQ	TOX,WQ
	S04T_TAPO_BKGD [1]	4	WQ	WQ	WQ	WQ
Ventura River	VRT_THACH	--	TOX,WQ	WQ	WQ	TOX,WQ
	VRT_SANTO	--	TOX,WQ	WQ	WQ	TOX,WQ

TOX = Toxicity WQ = All water quality constituents listed in Table 1, excluding toxicity, which is noted separately.

1. Background sites are only visited during storm events when the corresponding upstream site is sampled.

Table 10. Monitoring Schedule for Sites Incorporated into VCAILGMP

WATERSHED / SUBWATERSHED	SITE ID	REACH	YEARLY EVENTS			
			WET EVENT 1	WET EVENT 2	DRY EVENT 1	DRY EVENT 2
Santa Clara River Estuary	S01D_MONAR	1	OC-W, OC-S, TSS	OC-W, OC-S, TSS	OC-W, TSS	OC-W, TSS
	Estuary	1	OC-F every three years			
Santa Clara River	S02T_ELLS	2	OC-W, OC-S, TSS	OC-W, OC-S, TSS	OC-W, TSS	OC-W, TSS
Oxnard Coastal/ Channel Islands Harbor	CIHD_VICT	--	Bact	Bact	Bact	Bact

OC-W = OC pesticides toxaphene, chlordane, and dieldrin in water

OC-S = OC pesticides toxaphene, chlordane, and dieldrin in filtered sediment

OC-F = OC pesticides toxaphene, chlordane, and dieldrin in fish tissue

TSS = Total Suspended Solids

Bact = *E. coli*, enterococcus, total coliform, fecal coliform

Should measurable precipitation occur during the seven days prior to a scheduled dry weather event, data from stream gages within each watershed will be evaluated to determine if flow rates have returned to pre-storm levels. If flow rates have returned to pre-storm levels, the sampling event may be conducted as scheduled. If flow rates have not returned to pre-storm levels, the sampling event will be rescheduled either to allow for flow rates to return to pre-storm levels, or for at least seven days without measurable precipitation prior to sampling, whichever period is shorter. Dry weather monitoring will be scheduled to occur after the majority of growers have applied pesticides and/or fertilizers and during the period when irrigation is required, where practicable.

All efforts will be made to conduct two wet weather events during the wet season (October 15 through May 15). Sufficient precipitation is needed to produce runoff and increase drainage/stream flow. The *Conditional Ag Waiver* Monitoring and Reporting Program requires that the wet season samples "shall be collected within 24 hours of a storm with greater than 0.5 inch rain as measured by the nearest National Weather Service rain gauge, to the extent practicable. Practical constrains on wet season sampling events include but are not limited to 1) lab closures on weekends and holidays, 2) sampling holding times, and 3) safety of monitoring team." The timing of sample collection will be targeted toward the first 24 hours of discharge. Regional Board staff will be notified by email and/or phone when a wet weather monitoring event is initiated.

Dry weather samples will be collected between May 16th and October 14th at a time when the majority of growers have applied pesticides or fertilizers and during the period when irrigation is necessary. Additional considerations will be made to coordinate with CCWTMP quarterly dry weather monitoring events, when feasible.

Classification of Measurements

Because the VCAILGMP is intended to be a long-term monitoring program, data that are not successfully collected for a specific monitoring event will not be collected at a later date as a "make-up" sample collection for said earlier event. Rather, subsequent events conducted over the course of the program will

provide a data set of sufficient size to appropriately characterize conditions at individual sampling sites. Moreover, some monitoring sites will often be dry during the dry season, which is relevant information that identifies areas where runoff from irrigated agricultural lands is not occurring. For these reasons, most of the data planned for collection cannot be considered absolutely critical. All information collected as outlined in the QAPP will be reported.

Validation of Non-Standard Methods

For non-standard sampling and analytical methods or other unusual situations, appropriate method validation study information will be documented to confirm the performance of the method for the particular need. The purpose of this validation is to assess the potential impact on the representativeness of the data generated. Such validation studies may include the initial demonstration of capability, split samples sent to another laboratory for analysis by a standard method, or round-robin studies performed by USEPA or other organizations. If previous validation studies are not available, some level of validation study will be performed during the project and included as part of the project's final report.

11. Sampling Methods

All samples will be collected in a manner appropriate for the specific analytical method(s) to be used. Proper sampling techniques must be used to ensure that samples are representative of environmental conditions. Field personnel will adhere to established sample collection protocols in order to ensure the collection of representative, uncontaminated (*i.e.*, contaminants not introduced by the sample handling process itself) water samples for laboratory analyses. If protocols are revised or altered, the deviations from the standard protocols must be documented. Standard operating procedures (SOPs) for collection of samples are provided in Appendix C of this QAPP. Summary descriptions of specific sampling methods and requirements are provided below.

Surface water samples will be collected for analysis of the constituents listed in Table 1 and Table 2, as appropriate for the monitoring event. Surface water samples will be collected for chemical analyses and toxicity testing. Monitoring of additional constituents may be required in the future, depending on the results of Toxicity Identification Evaluations (TIEs), through source identification efforts as prescribed in Water Quality Management Plans (WQMPs), or other unforeseen reasons. In this case, the QAPP will be amended to provide adequate sampling and analytical guidance, as necessary.

Field Protocols

Briefly, the key aspects of quality control associated with sample collection for eventual chemical and toxicological analyses are as follows:

- Field personnel will be thoroughly trained in the proper use of sample collection gear and will be able to distinguish the collection of acceptable versus unacceptable water samples in accordance with pre-established criteria;
- Field personnel will be thoroughly trained to recognize and avoid potential sources of sample contamination (*e.g.*, engine exhaust, ice used for cooling);
- Sampling gear and utensils which come in direct contact with the sample will be made of non-contaminating materials (*e.g.*, borosilicate glass, high-quality stainless steel and/or Teflon™, according to protocol) and will be thoroughly cleaned between sampling stations according to appropriate cleaning protocol (rinsing thoroughly with laboratory reagent water at minimum);
- Sample containers will be of the recommended type and will be free of contaminants (*i.e.*, pre-cleaned);

- Conditions for sample collection, preservation and holding times will be followed.

Field crews (2 persons per crew, minimum) will be mobilized for sampling only when weather conditions and flow conditions are considered to be safe. For safety reasons, sampling will be scheduled to occur during daylight hours. Sampling events will proceed in the following manner:

1. Before leaving the base of operations, confirm number and type of sample bottles as well as the complete equipment list.
2. Proceed to the first monitoring site.
3. Record the general information on the field log sheet.
4. Collect the samples indicated on the event summary sheet in the manner described in this QAPP. Collect additional volume and blank samples for field-initiated Quality Control (QC) samples as necessary. Place filled sample containers in coolers and carefully pack and ice samples as described in this QAPP. Using the log sheet, confirm that all appropriate bottles were filled.
5. Collect field measurements and observations, and record these on the field log sheet.
6. Repeat the procedures in steps 3, 4, and 5 for each of the remaining monitoring sites.
7. Complete the chain-of-custody forms using the field log sheets.
8. After sample collection is completed at all monitoring sites, deliver and/or ship samples to the appropriate laboratory.

Water Sample Collection

Grab samples will be collected at approximately mid-stream, mid-depth at the location of greatest flow (where feasible) by direct submersion of the sample bottle. This is the preferred method for grab sample collection; however, due to monitoring site configurations and safety concerns, direct filling of sample bottles as described above may not always be feasible, especially during wet events. Monitoring site configuration will dictate grab sample collection technique. Grab samples will be collected directly into the appropriate bottles whenever feasible (containing the required preservatives as outlined in Table 11). Clean, powder-free nitrile gloves will be worn while collecting samples. In the event that a peristaltic pump and priority-cleaned silicone and Teflon™ tubing are used as a last resort to collect samples (*i.e.*, due to unsafe conditions during wet events), the sample collection tubing and the sample bottle and lid shall come into contact only with surfaces known to be clean, or with the water sample. Standard operating procedures (SOPs) for collection of surface water samples are provided in Appendix C of this QAPP.

The potential exists for monitoring sites to lack discernable flow. The lack of discernable flow may generate unrepresentative data as standing puddles will not appropriately characterize agricultural discharges. To address the potential confounding interference that can occur under such conditions, sites monitored under the guidance of this QAPP should be assessed for the following conditions and sampled (or not sampled) accordingly:

- Pools of water with no flow or visible connection to another surface water body should NOT be sampled. The field log should be completed for non-water quality data (including date and time of site visit), and the site condition should be photo-documented.
- Flowing water (*i.e.*, determined by visual observations, flow meter data, and a photo-documented assessment of conditions immediately upstream and downstream of the sampling site) should be sampled.

It is the combined responsibility of all members of the sampling crew to determine if the performance

requirements of the specific sampling method have been met, and to collect additional samples if required. If the performance requirements outlined above or documented in sampling protocols are not met, the sample will be re-collected. If contamination of the sample container is suspected, a fresh sample container will be used. The Project Manager will be contacted if at any time the sampling crew has questions about procedures or issues based on site-specific conditions.

Sediment Sample Collection

Sediment sample collection is required for the Calleguas Creek Watershed and Mugu Lagoon OC Pesticides and PCBs TMDL. Sampling for this TMDL is being performed as part of the Calleguas Creek Watershed TMDL Compliance Monitoring Program. Samples are collected for this monitoring program as prescribed in the Calleguas Creek Watershed Management Plan QAPP: Appendix C, Attachment 2 (LWA, 2008).

Fish Tissue Sample Collection – Santa Clara River Estuary

Estuary fish species compositions can be variable from year-to-year; additionally, the Santa Clara River Estuary salinity changes based upon river flows, saltwater inflow from breaches of the sand berm, and inputs from the Ventura Water Reclamation Facility. For these reasons, it is proposed that target species in the estuary are selected based on the local abundances and fish size at the time of field collection. Fish targeted should be those that are commonly consumed by humans, but based on past collection events, this may not be feasible. According to the staff report prepared for the Santa Clara River Estuary Toxaphene TMDL, fish tissue data for arroyo chub and Santa Ana sucker were used in evaluating the fish tissue impairment. The Santa Ana sucker is federally listed as a threatened species and therefore, will not be collected for fish tissue analysis. Some fish species noted as abundant or common in a recent City of Ventura Special Study of the Estuary (Stillwater, 2011) that are likely targets for collection by the VCAILGMP include: arroyo chub, mosquitofish, fathead minnow, and common carp.

Fish will be collected using gear appropriate to field conditions and the species being targeted. Sampling gear may include electrofishing boats, backpack electrofishers, seine nets, gill nets, trap nets, hook and line, or other equipment as required. Larger specimens are collected as individuals for filleting to allow for an evaluation of human health risks. Small species are collected as bulk samples as the whole body tissue is analyzed which will potentially allow for an evaluation of ecological risk. Tissue monitoring will involve the field-collection of fish and the obtaining and storing of tissue samples to be analyzed for toxaphene, chlordane, and dieldrin, using protocols detailed in accordance with the USEPA *Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories: Volume 1 Fish Sampling and Analysis* (EPA 823-B-00-0007, USEPA 2000). Appendix C provides a summary of CDFG protocols and protocols for collection of tissue samples.

Quality Control Sample Collection

Quality control (QC) samples will be collected in conjunction with environmental samples to verify data quality. QC samples collected in the field include field blanks and field duplicates. The frequency of QC sample collection is presented in Element 14 (Quality Control).

Field Measurements and Observations

Field measurements (listed in Table 1) will be collected and observations will be made at each monitoring site after all samples associated with the site are collected. Field measurements will include flow, pH, temperature, dissolved oxygen, turbidity, and conductivity. Measurements (except for flow) will be collected at approximately mid-stream, mid-depth at the location of greatest flow (if feasible) with a portable field

meter that meets data quality objectives listed in Table 4. All portable monitoring equipment must meet the requirements outlined in Table 4. All field measurement results and comments regarding site observations will be recorded in a field log sheet similar to the example presented in Appendix F.

Flow will be estimated using a velocity meter and channel cross-sectional area measurements, or will be estimated by other means at each sampling station after all samples are collected. Appendix C contains the flow measurement SOP. When a velocity meter is unavailable or flow is not sufficiently deep to use a velocity meter, depth, width, and velocity will be estimated to provide an estimate of flow. Depth will be estimated using the average of several depth measurements taken across the width of the channel. Width will be measured by extending a tape measure from one bank to the other. Velocity will be estimated by measuring the time it takes a floating object (*e.g.,* stick, orange peel) to travel a known distance. Regardless of the measurement technique used, if a staff gage is present, gage height will be noted on the field log sheet. Flow at the time of sampling will also be obtained from the nearest Ventura County stream gage, if one exists on the channel in question and if channel depth is sufficient to produce an accurate measurement.

If at any time the collection of field measurements by wading appears to be unsafe, field crews will not attempt to collect mid-stream, mid-depth measurements. Rather, field measurements will be made either directly from a stable, unobstructed area at the channel edge, or by using a telescoping pole and intermediate container to obtain a sample for field measurements and for filling sample containers. Use of sample collection methods other than the mid-stream, mid-depth method will be documented on the field log sheet. Field crews may not be able to measure flow at several sites during wet weather because of inaccessibility of the site. If this is the case, site inaccessibility will be documented on the field log sheet.

The field sampling crew has the primary responsibility for responding to failures in the sampling or measurement systems. Deviations from established monitoring protocols and this QAPP will be documented in the comment section of the field log sheet. If monitoring equipment fails, monitoring personnel will report the problem in the notes section of the field log sheet and will not record data values for the variables in question. Broken equipment will be replaced or repaired prior to the next field use. Data collected using faulty equipment will not be used for the VCAILGMP.

In addition to field measurements, observations will be made at each sampling station and noted on the field log sheet. Observations will include water color, water odor, floating materials, and observations of contact and non-contact recreation, to name just a few.

12. Sample Handling and Custody

Documentation Procedures

The Project Manager is responsible for ensuring that each field sampling team adheres to proper custody and documentation procedures. Field log sheets documenting sample collection and other monitoring activities for each site will be bound in a separate master logbook for each event. Field personnel have the following responsibilities:

- Keep an accurate written record of sample collection activities on the field log sheets.
- Ensure that all field log sheet entries are legible and contain accurate and inclusive documentation of all field activities.
- Note errors or changes using a single line to cross out the entry and date and initial the change.

- Ensure that a label is affixed to each sample collected and that the labels uniquely identify samples with the sample ID, site ID, date and time of sample collection and the sampling crew initials.
- Complete the chain-of-custody forms accurately and legibly in ink.

Field Documentation/Field Log

Field crews will keep a field log book for each sampling event. The field log book will contain a calibration log sheet, a field log sheet for each site, and appropriate contact information. The following items should be recorded on the field log sheet for each sampling event:

- Monitoring station location (Site ID)
- Date and time(s) of sample collection
- Name(s) of sampling personnel
- Sampling depth
- Sample ID numbers and unique IDs for any replicate or blank samples.
- QC sample type (if appropriate)
- Requested analyses (specific parameters or method references)
- Sample type, (*i.e.*, grab)
- The results of any field measurements (*i.e.*, flow, pH, temperature, dissolved oxygen, turbidity, conductivity) and the time field measurements were made.
- Qualitative descriptions of relevant water conditions (*e.g.*, water color, flow level, clarity) or weather (*e.g.*, wind, rain) at the time of sample collection.
- A description of any unusual occurrences associated with the sampling event, particularly those that may affect water quality or data quality.

The field log will be scanned into a PDF and transmitted along with the Event Summary Report to the Project Manager within one week of the conclusion of each sampling event. Appendix F contains an example of the field log sheet.

Container Labeling and Sample Identification Scheme

All samples must be identified with a unique identification code to ensure that results are properly reported and interpreted. Samples will be identified such that the site, sampling location, matrix, sampling equipment and sample type (i.e., environmental sample or QC sample) can be distinguished by a data reviewer or user. Sample identification codes will consist of a site identification code, a matrix code, and a unique sample ID number assigned by the monitoring manager. The format for sample ID codes is *VCAILGMP - ###.# - AAAA - XXX,* where:

- *VCAILGMP* indicates that the sample was collected as part of the VCAILGMP.
- ###- identifies the sequentially numbered sample event, and # is an optional indicator for re-samples collected for the same event. Sample events are numbered from 001 to 999 and will not be repeated.
- *AAAA* indicates the unique site identification code assigned to each site. Site identification codes are provided in Table 6.

XXX identifies the sample number unique to a sample bottle collected for a single event. Sample bottles are numbered sequentially from 001 to 999 and will not be repeated within a single event.

All sample containers will be pre-labeled before each sampling event to the extent practicable. Pre-labeling

sample containers simplifies field activities, leaving only sample collection time and date and field crew initials to be filled out in the field. Custom labels will be produced using blank waterproof labels. This approach will allow the site and analytical constituent information to be entered in advance and printed as needed prior to each sampling event. Labels will be applied to the appropriate sample containers in a dry environment as labels usually do not adhere to wet bottles. The labels will not be applied to container caps. Container labels will contain the following information:

- Program Name
- Station ID
- Sample ID
- Date
- Collection Time
- Sampling Personnel
- Analytical Requirements
- Preservative Requirements
- Analytical Laboratory

Sample Containers, Volume, Storage, Preservation, and Holding Time

Sample containers must be pre-cleaned and certified free of contamination according to the USEPA specification for the appropriate methods. Sample container, required sample volume, storage and preservation, and holding time requirements are provided in Table 11. The analytical laboratories will supply sample containers that contain preservative, including ultra pure acids, where applicable. After collection, samples will be stored at 4^{o}C until arrival at the contract laboratory.

Table 11. VCAILGMP Sample Container, Volume, Initial Preservation, and Holding Time Requirements

Parameter	Sample Container	Sample Volume [1]	Immediate Processing and Storage	Holding Time
Aquatic Toxicity				
Chronic Aquatic Toxicity	FLPE-lined jerrican	5 gallons	Store at 4°C	36 hours [2]
Field Measurements				
Flow, pH, Temperature, Dissolved Oxygen, Turbidity, Conductivity	Field Meter	N/A	N/A	N/A
General Water Quality Constituents				
Total Suspended Solids (TSS)	Plastic	1 L	Store at 4°C	7 days
Total Dissolved Solids (TDS)	Plastic	500 mL	Store at 4°C	7 days
Chloride				28 days
Sulfate				28 days
Hardness	HDPE Plastic	250 mL	Store at 4°C	6 months
Total Ammonia-N	Glass	250 mL	H_2SO_4; Store at 4°C	28 days
Nitrate-N	HDPE Plastic	250 mL	Store at 4°C	48 hours
Total Orthophosphate-P	HDPE Plastic	250 mL	Store at 4°C	48 hours
Pesticides				
Organochlorine Pesticides	Amber Glass	2 L	Store at 4°C	7/40 days [3]
Organophosphorus Pesticides				
Pyrethroid Pesticides				
Metals				
Dissolved Copper	HDPE Plastic	250 mL	Store at 4°C	48 hours
Total Copper	HDPE Plastic	250 mL	Store at 4°C	180 days

N/A = Not Applicable

1. Additional sample volume may be required for quality control analyses.
2. Tests should be initiated within 36 hours after sample collection. The 36-hour hold time does not apply to subsequent analyses for TIEs. For interpretation of toxicity results, samples may be split from toxicity samples in the laboratory and analyzed for specific chemical parameters. All other sampling requirements (sample containers, preservation, and holding times) for these samples are as specified in this document for the specific analytical method. Results of these analyses are qualified for any other use (*e.g.*, characterization of ambient conditions) because of potential holding time exceedances and variance from sampling requirements.
3. 7/40 days = 7 days to extraction and 40 days from extraction to analysis.

Table 12. TMDL Sample Container, Volume, Initial Preservation, and Holding Time Requirements for Constituents Monitored Under the VCAILGMP

Parameter	Sample Container	Sample Volume [1]	Immediate Processing and Storage	Holding Time
OC Pesticides (filtered sediment)	Amber Glass	2 L	Store at 4°C	40 days
OC Pesticides (fish tissue)	Teflon Sheet	200 g	Store on dry ice	1 year if frozen
E. coli	Sterile Plastic	120 mL	Sodium thiosulfate; Store at 4°C	6 hours
Enterococcus	Sterile Plastic	120 mL	Sodium thiosulfate; Store at 4°C	6 hours
Total Coliform	Sterile Plastic	120 mL	Sodium thiosulfate; Store at 4°C	6 hours
Fecal Coliform	Sterile Plastic	120 mL	Sodium thiosulfate; Store at 4°C	6 hours

1. Additional sample volume may be required for quality control analyses.

Sample Handling and Shipment

The field crews will have custody of samples during each monitoring event. Chain-of-custody (COC) forms will accompany all samples during shipment to contract laboratories to identify the shipment contents. All water quality samples will be transported to the analytical laboratory by the field crew or by overnight courier. The original COC form will accompany the shipment, and a signed PDF copy of the COC form will be sent, by the laboratory to the field crew to be retained in the project file.

While in the field, samples will be stored on ice in an insulated container (*i.e.*, ice chest), so that sample temperature will be maintained at approximately 4˚C. Samples that must be shipped to the laboratory must be examined to ensure that container lids are tight and that containers don't leak. The ice packed with samples must be double-bagged in re-sealable bags, be approximately 2 inches deep at the top and bottom of the cooler, and must contact each sample to maintain temperature. Ice chests containing jerricans must be packed with as much loose ice as possible. The original COC form(s) will be double-bagged in re-sealable plastic bags and either taped to the outside of the cooler or to the inside lid. Samples must be shipped to the contract laboratory according to Department of Transportation standards. The method(s) of shipment, courier name, and other pertinent information should be entered in the "Received By" or "Remarks" section of the COC form.

Coolers must be sealed with packing tape before shipping and must not leak. It is assumed that samples in tape-sealed ice chests are secure whether being transported by a field staff vehicle, laboratory courier, by common carrier, or by commercial package delivery. The laboratory's sample receiving department will examine the shipment of samples for correct documentation, proper preservation, and compliance with holding times.

The following procedures are used to prevent bottle breakage and cross-contamination:

- Bubble wrap or foam pouches are used to keep glass bottles from contacting one another to

prevent breakage.

- All samples are transported inside hard plastic coolers or other contamination-free shipping containers.
- The coolers are taped shut to prevent accidental opening.
- Arrangements must be made in advance to notify the laboratory's sample receiving department prior to sample shipment.

All samples remaining after successful completion of analyses will be disposed of properly. It is the responsibility of each analytical laboratory to ensure that all applicable regulations are followed in the disposal of samples or related chemicals.

Chain-of-Custody Form

Sample custody procedures provide a mechanism for documenting information related to sample collection and handling. Sample custody must be traceable from the time of sample collection until results are reported. A sample is considered under custody if it is:

- in actual possession.
- in view after in physical possession.
- placed in a secure area (accessible by or under the scrutiny of authorized personnel only after in possession).

A chain-of-custody (COC) form must be completed after sample collection and prior to sample shipment or release. The COC form, sample labels, and field documentation will be cross-checked by the field crew prior to shipment or delivery to the laboratory to verify sample identification, types of analyses, number of containers, sample volume, preservatives, and types of containers. A completed COC form is to accompany the samples to the analyzing laboratory. A typical COC form is illustrated in Appendix F.

Laboratory Custody Procedures

Contract laboratories will follow sample custody procedures as outlined in the laboratory's Quality Assurance (QA) Manual. A copy of each contract laboratory's QA Manual is retained in the project file. Laboratories shall maintain custody logs sufficient to track each sample submitted and to analyze or preserve each sample within specified holding times. The following sample control activities must be conducted at the laboratory:

- Initial sample login and verification of samples received with the COC form;
- Document any discrepancies noted during login on the COC;
- Initiate internal laboratory custody procedures;
- Verify sample preservation (*e.g.*, temperature);
- Notify the Project Manager if any problems or discrepancies are identified; and
- Perform proper sample storage protocols, including daily refrigerator temperature monitoring and sample security.

Laboratories shall maintain records to document that the above procedures are followed. Once samples have been analyzed, samples will be stored at the laboratory for at least 30 days. After this period, samples may be disposed of properly.

13. Analytical Methods

Portable field meters used for the VCAILGMP must meet specifications outlined in Table 13. Analytical methods, method detection limits (MDLs), and reporting limits (RLs) required for samples analyzed in the laboratory are summarized in Table 14 and Table 15; MDLs and RLs are discussed in more detail in this Element.

Prior to the analysis of any environmental samples, the laboratory must have demonstrated the ability to meet the minimum performance requirements for each analytical method presented in Table 14 and Table 15. The initial demonstration of capability includes the ability to meet the project-specified method detection limits and reporting limits, the ability to generate acceptable precision and accuracy, and other analytical and quality control parameters documented in this QAPP. Data quality objectives for accuracy, precision, and recovery are summarized in Table 4. Laboratory SOPs for analytical methods listed below are included in Appendix E of this QAPP.

Table 13. Analytical Methods and Project Reporting Limits for Field Measurements

Parameter	Method	Range	Project Reporting Limit
Flow	Electromagnetic	-0.5 to +20 ft/s	0.05 ft/s
pH	Electrometric	0 – 14 pH units	NA
Temperature	High stability thermistor	-5 – 50 ^{o}C	NA
Dissolved oxygen	Membrane	0 – 50 mg/L	0.5 mg/L
Turbidity	Nephelometric	0 – 3000 NTU	0.2 NTU
Conductivity	Graphite electrodes	0 – 10 mmhos/cm	2.5 µmhos/cm

NA = Not Applicable

Table 14. VCAILGMP Analytical Methods and Project Method Detection Limits / Project Reporting Limits for Laboratory Analyses

Parameter	Analytical Method [1]	Units	Project Method Detection Limits	Project Reporting Limits
Aquatic Chronic Toxicity [2]				
Pimephales promelas (fathead minnow)	EPA-821-R-02-013 and EPA 600-4-91-002	N/A	N/A	N/A
Ceriodaphnia dubia (water flea)	EPA 821-R-02-013 and EPA 600-4-91-002	N/A	N/A	N/A
Selenastrum capricornutum (green algae)	EPA 821-R-02-013 and EPA 600-4-91-002	N/A	N/A	N/A
General Water Quality Constituents				
Total Dissolved Solids (TDS)	SM 2540C	mg/L	13	20
Total Suspended Solids (TSS)	SM 2540D	mg/L	0.4	1
Chloride	EPA 300.0	mg/L	0.04	1

Parameter	Analytical Method [1]	Units	Project Method Detection Limits	Project Reporting Limits
Sulfate	EPA 300.0	mg/L	0.13	2
Hardness	SM 2340B	mg/L	1	5
Nutrients				
Total Ammonia-N	SM 4500-NH_3F	mg/L	0.03	0.06
Nitrate-N	EPA 300.0	mg/L	0.01	0.05
Total Orthophosphate-P	SM 4500-PE	mg/L	0.01	0.01
Metals				
Dissolved Copper	EPA 200.8	µg/L	0.4	0.8
Total Copper	EPA 200.8	µg/L	0.4	0.8
Organochlorine Pesticides [3]				
Aldrin	EPA 625	ng/L	1	5
BHC-alpha	EPA 625	ng/L	1	5
BHC -beta	EPA 625	ng/L	1	5
BHC-delta	EPA 625	ng/L	1	5
BHC-gamma (Lindane)	EPA 625	ng/L	1	5
Chlordane-alpha	EPA 625	ng/L	1	5
Chlordane-gamma	EPA 625	ng/L	1	5
2,4'-DDD	EPA 625	ng/L	1	5
2,4'-DDE	EPA 625	ng/L	1	5
2,4'-DDT	EPA 625	ng/L	1	5
4,4'-DDD	EPA 625	ng/L	1	5
4,4'-DDE	EPA 625	ng/L	1	5
4,4'-DDT	EPA 625	ng/L	1	5
Dieldrin	EPA 625	ng/L	1	5
Endosulfan I	EPA 625	ng/L	1	5
Endosulfan II	EPA 625	ng/L	1	5
Endosulfan Sulfate	EPA 625	ng/L	1	5
Endrin	EPA 625	ng/L	1	5
Endrin Aldehyde	EPA 625	ng/L	1	5
Endrin Ketone	EPA 625	ng/L	1	5
Toxaphene	NCI/GCMS	ng/L	1	50
Organophosphorus Pesticides				
Bolstar	EPA 625	ng/L	2	4
Chlorpyrifos	EPA 625	ng/L	1	2
Demeton	EPA 625	ng/L	1	2
Diazinon	EPA 625	ng/L	2	4
Dichlorvos	EPA 625	ng/L	3	6

Parameter	Analytical Method [1]	Units	Project Method Detection Limits	Project Reporting Limits
Dimethoate	EPA 625	ng/L	3	6
Disulfoton	EPA 625	ng/L	1	2
Ethoprop	EPA 625	ng/L	1	2
Fenchlorphos	EPA 625	ng/L	2	4
Fensulfothion	EPA 625	ng/L	1	2
Fenthion	EPA 625	ng/L	2	4
Malathion	EPA 625	ng/L	3	6
Merphos	EPA 625	ng/L	1	2
Methyl Parathion	EPA 625	ng/L	1	2
Mevinphos	EPA 625	ng/L	8	16
Phorate	EPA 625	ng/L	6	12
Tetrachlorvinphos	EPA 625	ng/L	2	4
Tokuthion	EPA 625	ng/L	3	6
Trichloronate	EPA 625	ng/L	1	2
Pyrethroid Pesticides				
Allethrin	8270C (NCI)	ng/L	0.5	2
Bifenthrin	8270C (NCI)	ng/L	0.5	2
Cyfluthrin	8270C (NCI)	ng/L	0.5	2
Cypermethrin	8270C (NCI)	ng/L	0.5	2
Danitol	8270C (NCI)	ng/L	0.5	2
Deltamethrin	8270C (NCI)	ng/L	0.5	2
Esfenvalerate	8270C (NCI)	ng/L	0.5	2
Fenvalerate	8270C (NCI)	ng/L	0.5	2
Lambda-Cyhalothrin	8270C (NCI)	ng/L	0.5	2
Permethrin	8270C (NCI)	ng/L	5	25
Prallethrin	8270C (NCI)	ng/L	0.5	2

1. Standard Methods (SM) or EPA Method number.
2. Alternative species may be used at high conductivity sites.
3. The MDLs and/or RLs listed for several organochlorine pesticides (4,4'-DDD, 4,4'-DDE, 4,4'-DDT, chlordane, dieldrin, and toxaphene) are higher than water quality benchmarks specified for the monitoring program. However, the MDLs and/or RLs listed here are significantly lower than levels currently attainable by commercial laboratories using standard analytical test methods and are consistent with the lowest detection limits reported for NPDES monitoring programs.

Table 15. TMDL Analytical Methods and Project Method Detection Limits / Project Reporting Limits for Laboratory Analyses Performed Under the VCAILGMP

Parameter	Analytical Method [1]	Units	Project Method Detection Limits	Project Reporting Limits
OC Pesticides (filtered sediment)	EPA 8270C	ng/L	1 [2]	5 [2]
OC Pesticides (fish tissue)	EPA 8270C	ng/g	1 [3]	5 [3]
E. coli	9223B	MPN/100mL	<2	<2
Enterococcus	Indexx Enterolert	MPN/100mL	<1	<1
Total Coliform	9221B	MPN/100mL	<2	<2
Fecal Coliform	9221E	MPN/100mL	<2	<2

1. Standard Methods (SM) or EPA Method number.
2. MDL for toxaphene is 10 ng/L; RL for toxaphene is 50 ng/L
3. MDL for toxaphene is 10 ng/g; RL for toxaphene is 50 ng/g

Toxicity Testing and Toxicity Identification Evaluations (TIEs)

Water quality samples will be analyzed for chronic toxicity to *Ceriodaphnia dubia*, *Pimephales promelas*, and *Selenastrum capricornutum* for the first monitoring event. The most sensitive species determined at each toxicity site will be used for subsequent monitoring events, upon Executive Officer approval. Toxicity testing will be performed only on receiving water sites, including agricultural drainages that appear on the 303(d) list of impaired waterbodies. Although chemistry data collected on agricultural drains can be used to estimate pollutant loads to receiving waters and thereby provide a sense of whether such loads will adversely impact the receiving water, toxicity measured in agricultural drains may have little or no impact on receiving water for various reasons (*i.e.*, chemical degradation, transformation or dilution) and does not provide information regarding receiving water impacts.

Determination of chronic toxicity to *C. dubia, P. promelas* and *S. capricornutum* will be performed generally as described in *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms*, Fourth Edition (USEPA, 2002). Toxicity tests will be conducted on 100% sample.

One toxicological protocol has been modified in this QAPP. The chronic fathead minnow test is susceptible to Pathogen Related Mortality (PRM), a phenomenon that is not uncommon in toxicity tests of ambient waters. PRM is characterized by high inter-replicate variability in mortality and pathogenic "coronas" around the fish, resulting in fish mortality related to a pathogen infestation and not due to toxicant exposure. The toxicity testing laboratory (Pacific EcoRisk) includes pathogen control modifications based on Geis (2003)[4], as approved by the EPA. The chronic fathead minnow SOP in Attachment 3 of Appendix D has been updated to include this PRM exposure protocol.

The results of toxicity testing will be used to trigger further investigation to determine the cause of observed laboratory toxicity. If testing indicates the presence of significant toxicity in the sample, Toxicity

[4] Geis, S.W. et al. 2003. "Modifications to the fathead minnow (*Pimephales promelas*) chronic test method to remove mortality due to pathogenic organisms." Environ Toxicol Chem, 22 (10), 2400-2404.

Identification Evaluation (TIE) procedures may be initiated to investigate the cause of toxicity. For the purpose of triggering a TIE, significant toxicity is defined as at least 50% mortality (*P. promelas* and *C. dubia*) or a 50% reduction in growth (*S. capricornutum*). The 50% threshold is consistent with the approach recommended in guidance published by U.S. EPA for conducting TIEs (USEPA, 1996), which recommends a minimum threshold of 50% mortality because the probability of completing a successful TIE decreases rapidly for samples with less than this level of toxicity. A targeted Phase I TIE will be conducted to determine the general class of constituents (*e.g.*, non-polar organics) causing toxicity. The targeted TIE will focus on classes of constituents anticipated to be observed in drainages dominated by urban and agricultural discharges and those previously observed to cause toxicity. These classes of constituents have been determined to be primarily non-polar organics. SOPs for typical TIE testing procedures to address pesticides and metals toxicity are included in Attachment 7 of Appendix D.

Adequate sample volume will be collected so that TIE procedures can be initiated as soon as possible after toxicity is observed. This will reduce the potential for loss of toxicity due to extended sample storage and will therefore increase the likelihood that the toxicant will be identified.

The decision to initiate TIE procedures on any sample, including samples exceeding the mortality threshold, as well as the focus and scope of TIE procedures, will be determined through consultation between the Project Manager and the toxicity laboratory. When deciding whether to initiate TIE procedures for a specific site and monitoring event, a number of factors will be considered, including the level of toxicity, history of toxicity at the site, the species and endpoints exhibiting toxic effects, as well as the primary technical basis for triggering TIEs described above. The rationale for determining the TIE procedures for a specific sample will be clearly documented in subsequent data reports.

The VCAILGMP includes some sites that are tidally influenced (01T_ODD3_ARN) or exhibit high conductivity (e.g. 01T_ODD2_DCH and S04T_TAPO). Attempts will be made to collect samples at low tide; however, even under this condition the measured salinity exceeds levels suitable for the three freshwater test species. If sample salinity at any monitoring site exceeds levels suitable for the three freshwater species identified in this Element, alternative species will be selected based on previous testing in the area and recommendations of the toxicity testing laboratory. Potential alternate species include the following:

- For *Ceriodaphnia dubia*: *Hyalella azteca*.
- For *Pimephales promelas*: *Menidia beryllina* (inland silverside).
- For *Selenastrum capricornutum*: *Thalassiosira pseudonana*.

Detection and Reporting Limits

Method detection limits (MDL) and reporting limits (RLs) must be distinguished for proper understanding and data use. The MDL is the minimum analyte concentration that can be measured and reported with a 99% confidence that the concentration is greater than zero.

The RL represents the concentration of an analyte that can be routinely measured in the sampled matrix within stated limits and with confidence in both identification and quantitation.

For this program, RLs must be verifiable by having the lowest non-zero calibration standard or calibration check sample concentration at or less than the RL. RLs have been established in this QAPP based on the verifiable levels and general measurement capabilities demonstrated for each method. These RLs should

be considered as maximum allowable reporting limits to be used for laboratory data reporting. Note that samples diluted for analysis may have sample-specific RLs that exceed these RLs. This will be unavoidable on occasion. However, if samples collected through the VCAILGMP are consistently diluted to overcome matrix interferences, the analytical laboratory will be required to notify the Project Manager how the sample preparation or test procedure in question will be modified to reduce matrix interferences so that project RLs can be met consistently.

Method Detection Limit Studies

Any laboratory performing analyses under this program must routinely conduct method detection limit (MDL) studies to document that the MDLs are less than or equal to the project-specified RLs. If any analytes have MDLs that do not meet the project RLs, the following steps must be taken:

- Perform a new MDL study using concentrations sufficient to prove analyte quantitation at concentrations less than or equal to the project-specified RLs per the procedure for the Determination of the Method Detection Limit presented in Revision 1.1, 40 Code of Federal Regulations (CFR) 136, 1984.
- No samples may be analyzed until the issue has been resolved. MDL study results must be available for review during audits, data review, or as requested. Current MDL study results must be reported for review and inclusion in project files.

An MDL is developed from seven aliquots of a standard containing all analytes of interest spiked at five times the expected MDL. These aliquots are processed and analyzed in the same manner as environmental samples. The results are then used to calculate the MDL. If the calculated MDL is less than 0.33 times the spiked concentration, another MDL study should be performed using lower spiked concentrations.

Project Reporting Limits

Laboratories generally establish RLs that are reported with the analytical results—these may be called *reporting limits*, *detection limits*, *reporting detection limits*, or several other terms by the analyzing laboratory. These laboratory limits must be less than or equal to the project RLs listed in Table 14 and Table 15. Wherever possible, project RLs are lower than benchmarks identified in the *Conditional Ag Waiver*. It is noteworthy that benchmarks for some of the organochlorine pesticides (e.g. chlordane, DDTs, dieldrin and toxaphene) are lower than current analytical methodologies are capable of detecting. However, the MDLs and/or RLs listed herein, obtained using non-standard analytical test methods, are significantly lower than levels currently attainable by commercial laboratories using standard analytical test methods and are equivalent to the lowest detection limits reported for NPDES monitoring programs. Laboratories performing analyses for this project must have documentation to support quantitation at the required levels.

Laboratory Standards and Reagents

All stock standards and reagents used for standard solutions and extractions must be tracked through the laboratory. The preparation and use of all working standards must be documented according to procedures outlined in each laboratory's Quality Assurance Manual; standards must be traceable according to U.S. EPA, A2LA or National Institute for Standards and Technology (NIST) criteria. Records must have sufficient detail to allow determination of the identity, concentration, and viability of the standards, including any dilutions performed to obtain the working standard. Date of preparation, analyte or mixture,

concentration, name of preparer, lot or cylinder number, and expiration date, if applicable, must be recorded on each working standard.

Alternate Laboratories

In the event that the laboratories selected to perform analyses for the VCAILGMP are unable to fulfill data quality requirements outlined herein (e.g., due to an instrument malfunction), alternate laboratories will be selected based on their ability to meet ELAP and/or NELAP certification and data quality requirements specified in this QAPP. The original laboratory selected may recommend a qualified laboratory to act as a substitute. However, the final decision regarding alternate laboratory selection rests with the Project Manager and Project QA Manager.

14. Quality Control

Quality control procedures for field and laboratory activities are summarized in Table 16 and are discussed in more detail below. The table includes all quality control procedures for both the VCAILGMP and TMDL monitoring performed under the VCAILGMP. Toxicity testing quality control procedures are listed in Table 17. There are no SWAMP requirements for quality control for field analysis of general parameters (*i.e.*, pH, temperature, dissolved oxygen, turbidity, and conductivity). However, field crews will be required to calibrate equipment as outlined in Element 16 (Instrument / Equipment Calibration).

Table 16. Quality Control Requirements – Field and Laboratory

Quality Control Sample Type	QA Parameter	Frequency [1]	Acceptance Limits	Corrective Action
Quality Control Requirements – Field				
Equipment Blanks	Contamination	Once per equipment batch cleaned [2]	< MDL	Identify contamination source, re-clean equipment, and re-run equipment blank.
Field Blank	Contamination	5% of all samples	< MDL	Examine field log. Identify contamination source. Qualify data as needed.
Field Duplicate	Precision	5% of all samples	RPD $\leq$ 25% if |Difference| $\geq$ RL	If laboratory duplicate is within acceptance limits, no corrective action needed. Otherwise, reanalyze both samples if possible. Identify variability source. Qualify data as needed.
Quality Control Requirements – Chemistry Laboratory				
Method Blank	Contamination	1 per analytical batch	< MDL	Identify contamination source. Reanalyze method blank and all samples in batch. Qualify data as needed.
Lab Duplicate	Precision	1 per analytical batch	RPD $\leq$ 25% if |Difference| $\geq$ RL	Recalibrate and reanalyze.
Matrix Spike	Accuracy	1 per analytical batch	80-120% Recovery for GWQC 50-150% Recovery for Pesticides [3]	Check LCS/SRM recovery. Attempt to correct matrix problem and reanalyze samples. Qualify data as needed.
Matrix Spike Duplicate	Precision	1 per analytical batch	RPD $\leq$ 25% if |Difference| $\geq$ RL	Check lab duplicate RPD. Attempt to correct matrix problem and reanalyze samples. Qualify data as needed.
Laboratory Control Sample (or SRM)	Accuracy	1 per analytical batch	80-120% Recovery	Recalibrate and reanalyze LCS/ SRM and samples.
Surrogate Spike	Accuracy	Each sample	30-150% Recovery [3]	Check surrogate recovery in LCS. Attempt to correct matrix problem and reanalyze sample. Qualify data as needed.

MDL = Method Detection Limit RL = Reporting Limit RPD = Relative Percent Difference

LCS = Laboratory Control Sample/Standard SRM = Standard/Certified Reference Material

GWQC = General Water Quality Constituents

1. "Analytical batch" refers to a number of samples (not to exceed 20 environmental samples plus the associated quality control samples) that are similar in matrix type and processed/prepared together under the same conditions and using the same reagents (equivalent to preparation batch).
2. Equipment blanks will be collected by the analytical laboratory responsible for cleaning equipment, before returning equipment to the field crew for use.
3. Or control limits established as the mean $\pm$ 3 standard deviations based on actual laboratory recovery data.

Table 17. Quality Control Requirements – Toxicity Testing

Quality Control Sample Type	Frequency[1]	Acceptance Limits	Corrective Action
Laboratory Control Water	Laboratory Control Water consistent with Section 7 of the appropriate EPA method must be tested with each analytical batch.	Must meet all test acceptability criteria (refer to Section 7 of the EPA manuals) for the species of interest.	If tested with in-house cultures, affected samples and associated quality control must be retested within 24 hours of test failure. If commercial cultures are used, they must be ordered within 16 hours of test failure for earliest possible receipt. The lab should try to determine the source of contamination, document the investigation, and document steps taken to prevent recurrence.
Conductivity Control Water	A conductivity control must be tested with each analytical batch when the conductivity of any freshwater ambient sample approaches the species' tolerance for conductivity per method.	Follow EPA guidance on interpreting data.	Affected samples and associated quality control must be qualified.
Additional Control Water	Additional method blanks are required whenever manipulations are performed on one or more of the ambient samples within each analytical batch.	No statistical difference between the laboratory control water and each additional control water within an analytical batch.	A water sample that has similar qualities to the test sample may be used as an additional control based on the objectives of the study. Results that show statistical differences from the laboratory control should be qualified. The lab should try to determine the source of contamination, document the investigation, and steps taken to prevent recurrence. This is not applicable for TIE method blanks.
Reference Toxicant Tests	Reference Toxicant Tests must be conducted monthly for species that are raised within a laboratory. Reference Toxicant Test must be conducted per analytical batch for species from commercial suppliers. Reference Toxicant Tests must be conducted concurrently for test species or broodstocks that are field collected.	Last plotted data point must be within 2 SD of the cumulative mean (n=20).	Affected samples and associated quality control must be retested within 24 hours of test failure if tested with in-house cultures. If commercial cultures are used, they must be ordered within 16 hours of test failure for earliest possible receipt, and retests must be initiated within 8 hours of receipt. The lab should try to determine the source of contamination, document the investigation, and steps taken to prevent recurrence.
Field Duplicate	5% of total project sample count	According to method	All field duplicate results that do not meet SWAMP criteria should be qualified. All field duplicate results that do not meet SWAMP criteria should be communicated to the Project Manager, who in turn will notify the sampling team so that the source of contamination can be identified and corrective measures taken prior to the next sampling event.

1. "Analytical batch" refers to a number of samples (not to exceed 20 environmental samples plus the associated quality control samples) that are similar in matrix type and processed/prepared together under the same conditions and using the same reagents (equivalent to preparation batch).

Comparability

Comparability of the data can be defined as the similarity of data generated by different monitoring programs. For this monitoring program, this objective will be ensured mainly through use of standardized procedures for field measurements, sample collection, sample preparation, laboratory analysis, and site selection; adherence to quality assurance protocols and holding times; and reporting in standard units. If monitoring requires participation of several monitoring teams, data comparability will be ensured through regular group training sessions, as well as adherence to standard sample collection procedures outlined in the Monitoring and Reporting Program Plan. Additionally, comparability of analytical data will be addressed through the use of standard operating procedures and extensive analyst training at the analyzing laboratory.

Representativeness

Representativeness can be defined as the degree to which the environmental data generated by the monitoring program accurately and precisely represent actual environmental conditions. For the VCAILGMP, this objective will be addressed by the overall design of the program. Representativeness is attained through the selection of sampling locations, methods, and frequencies for each parameter of interest, and by maintaining the integrity of each sample after collection. Sampling locations were chosen that are representative of discharges from agricultural irrigated lands, which will allow for the characterization of the impacts that such discharges may have on receiving water quality.

Completeness

Data completeness is a measure of the amount of successfully collected and validated data relative to the amount of data planned to be collected for the project. It is usually expressed as a percentage value. A project objective for percent completeness is typically based on the percentage of the data needed for the program or study to reach valid conclusions.

Because the VCAILGMP is intended to be a long-term monitoring program, data that are not successfully collected for a specific monitoring event will not be collected at a later date. Rather, subsequent events conducted over the course of the program will provide a sufficient data set to appropriately characterize conditions at individual sampling sites. Moreover, some monitoring sites will often be dry during the dry season, which is important information necessary to identify areas where discharge from irrigated agricultural lands is nonexistent. For these reasons, most of the data planned for collection cannot be considered absolutely critical, and it is difficult to set a meaningful objective for data completeness. However, some reasonable objectives for data are desirable, if only to measure the effectiveness of the program. The program goals for data completeness shown in Table 18 are based on the planned sampling frequency, SWAMP recommendations, and a subjective determination of the relative importance of the monitoring element within the VCAILGMP.

Table 18. VCAILGMP and Associated TMDL Required Data Completeness

Monitoring Element	Completeness Objective
Field Measurements	90%
General Water Quality Constituents	90%
Total & Dissolved Copper	90%
Organic Constituents - Pesticides	90%
Organic Constituents - Tissue	90%
Organic Constituents – Filtered Sediment	90%
Bacteria	90%
Aquatic Toxicity	90%

Field Procedures

For basic water quality analyses, quality control samples to be collected in the field will consist of equipment blanks, field blanks and field duplicates.

Equipment Blanks

The purpose of analyzing equipment blanks is to demonstrate that sampling equipment is free from contamination. Equipment blanks will be collected by the analytical laboratory responsible for cleaning equipment, before sending cleaned equipment back to the field crew for use, and will be analyzed for chloride, sulfate, nutrients and the classes of pesticides identified in Table 1. Equipment blanks will consist of laboratory-prepared blank water (certified to be contaminant-free by the laboratory) processed through the sampling equipment that will be used to collect environmental samples.

The blanks will be analyzed using the same analytical methods and detection limits specified for environmental samples. If any analytes of interest are detected at levels greater than the MDL, the source(s) of contamination will be identified and eliminated (if possible), the affected batch of equipment will be re-cleaned, and new equipment blanks will be prepared and analyzed before the equipment is returned to the field crew for use.

In previous years of VCAILG monitoring, equipment was not necessary to collect samples; therefore, negating the need for equipment blanks. Information is included in this QAPP to allow for potential future conditions that would require equipment, such as a peristaltic pump, to collect samples.

Field Blanks

The purpose of analyzing field blanks is to demonstrate that sampling procedures do not result in contamination of the environmental samples. Field blanks will be collected at a frequency of 5% of samples collected, which is more rigorous than the Quality Assurance Management Plan for SWAMP (SWRCB, 2008a). Blanks will consist of laboratory-prepared blank water (certified to be contaminant-free by the laboratory) processed through the sampling equipment using the same procedures used for environmental samples.

If any analytes of interest are detected at levels greater than the MDL, the source(s) of contamination should be indentified and eliminated, if possible. The sampling crew should be notified so that the source of contamination can be identified (if possible) and corrective measures taken prior to the next sampling event.

Field Duplicates
The purpose of analyzing field duplicates is to demonstrate the precision of sampling and analytical processes. Field duplicates will be prepared at the rate of 5% of all samples, and analyzed along with the associated environmental samples. Field duplicates will consist of two grab samples collected simultaneously, to the extent practicable. If the Relative Percent Difference (RPD) of field duplicate results is greater than 25% and the absolute difference is greater than the RL, both samples should be reanalyzed if possible. The sampling crew should be notified so that the source of sampling variability can be identified (if possible) and corrective measures taken prior to the next sampling event.

Laboratory Analyses

Quality control samples prepared in the laboratory will consist of method blanks, laboratory duplicates, matrix spikes/duplicates, laboratory control samples (standard reference materials), and toxicity quality controls.

Method Blanks
The purpose of analyzing method blanks is to demonstrate that sample preparation and analytical procedures do not result in sample contamination. Method blanks will be prepared and analyzed by the contract laboratory at a rate of at least one for each analytical batch. Method blanks will consist of laboratory-prepared blank water processed along with the batch of environmental samples. If the result for a single method blank is greater than the MDL, the source(s) of contamination should be identified and eliminated, and the sample batch should be prepared and analyzed again, if possible. If this is not possible, the data should be qualified accordingly. If method blank contamination is consistently reported, the laboratory will be expected to propose to the Project Manager a systematic approach for identifying and eliminating the source of contamination. The laboratory should also be prepared to sub-contract analysis for that method to another qualified laboratory until the contamination issue is resolved.

Laboratory Duplicates
The purpose of analyzing laboratory duplicates is to demonstrate the precision of the sample preparation and analytical methods. Laboratory duplicates will be analyzed at the rate of one pair per sample batch. Laboratory duplicates will consist of either replicate environmental samples or duplicate laboratory fortified method blanks. If the Relative Percent Difference (RPD) for any analyte is greater than 25% *and* the absolute difference between duplicates is greater than the RL, the analytical process is not being performed adequately for that analyte. In this case, the sample batch should be prepared and analyzed again, if possible.

Matrix Spikes and Matrix Spike Duplicates
The purpose of analyzing matrix spikes and matrix spike duplicates is to demonstrate the performance of the sample preparation and analytical methods in a particular sample matrix. Matrix spikes and matrix spike duplicates will be analyzed at the rate of one pair per sample batch. Each matrix spike and matrix spike duplicate will consist of an aliquot of laboratory-fortified environmental sample. Spike concentrations should be added at five to ten times the reporting limit for the analyte of interest.

If the matrix spike recovery of any analyte is outside the acceptable range, the results for that analyte have failed to meet acceptance criteria. If recovery of laboratory control samples is acceptable, the analytical process is being performed adequately for that analyte, and the problem is attributable to the sample matrix. An attempt will be made to correct the problem (*e.g.*, by dilution, concentration, etc.), and the

samples and matrix spikes will be re-analyzed.

If the matrix spike duplicate RPD for any analyte is outside the acceptable range, the results for that analyte have failed to meet acceptance criteria. If the RPD for laboratory duplicates is acceptable, the analytical process is being performed adequately for that analyte, and the problem is attributable to the sample matrix. An attempt will be made to correct the problem (*e.g.*, by dilution, concentration, etc.), and the samples and matrix spikes will be re-analyzed.

Laboratory Control Samples
The purpose of analyzing laboratory control samples (or a standard reference material) is to demonstrate the accuracy of the sample preparation and analytical methods. Laboratory control samples will be analyzed at the rate of one per sample batch. Laboratory control samples will consist of a laboratory fortified method blank or a standard reference material. If recovery of any analyte is outside the acceptable range, the analytical process is not being performed adequately for that analyte. In this case, the sample batch should be prepared and analyzed again.

Surrogate Spikes
Surrogate recovery results are used to evaluate the accuracy of analytical measurements for organics analyses on a sample-specific basis. A surrogate is a compound (or compounds) added by the laboratory to all samples in a batch, including method blanks, LCSs, environmental samples, and matrix spikes prior to sample preparation, as specified in the analytical methodology. Surrogates are generally brominated, fluorinated or isotopically labeled compounds that are not usually present in environmental media. Results are expressed as percent recovery of the surrogate spike. Surrogate spikes are applicable for analysis of organochlorine, organophosphorus and pyrethroid pesticides. Surrogate recoveries must fall within acceptance limits as specified by the analytical method.

Aquatic Toxicity Quality Control
For aquatic toxicity tests, the acceptability of test results is determined primarily by performance-based criteria for test organisms, culture and test conditions, and the results of control bioassays. Table 17 summarizes the types of quality control testing performed to evaluate chronic toxicity. For additional information, refer to the method documents for each test species included in Appendix D.

15. Instrument/Equipment Testing, Inspection and Maintenance

Sample Equipment Cleaning Procedures
Equipment used for sample collection (*i.e.*, peristaltic pump tubing, sediment scoops, sample containers and caps) will be cleaned by the analytical laboratory prior to each monitoring event, according to procedures documented for each analytical method. After cleaning, sample containers will be stored with lids secured, and additional clean caps will be stored in clean re-sealable bags. Cleaned tubing will be stored in clean polyethylene bags.

Each batch of cleaned equipment will be used to generate an equipment blank as discussed in Element 14 (Quality Control).

Field Measurement Equipment
Each field crew will be responsible for testing, inspecting, and maintaining their field measurement

equipment in accordance with the manufacturer's specifications. This includes battery checks, routine replacement of membranes, and cleaning of probes and electrodes.

Analytical Equipment Testing Procedures and Corrective Actions

Testing, inspection, and maintenance of analytical equipment used by the contract laboratory and corrective actions are documented in the QA Manual for each analyzing laboratory. Laboratory QA Manuals are available for review at the analyzing laboratory.

16. Instrument/Equipment Calibration and Frequency

Laboratory Analytical Equipment

Frequencies and procedures for calibration of analytical equipment used by each contract laboratory are documented in the QA Manual for each contract laboratory. Any deficiencies in analytical equipment calibration should be managed in accordance with the QA Manual for each contract laboratory. Any deficiencies that affect analysis of samples submitted through this program must be reported to the Project Manager or designee. Laboratory QA Manuals are available for review at the analyzing laboratory.

Field Measurement Equipment

Calibration of field measurement equipment is performed as described in the user manual for each individual instrument. Each field crew will be responsible for calibrating their field measurement equipment. Field monitoring equipment must meet the requirements outlined in Table 4 and be calibrated at a frequency recommended by the manufacturer, but at a minimum prior to each event. Each calibration will be documented on each event's calibration log (presented in Figure 10).

If calibration results do not meet manufacturer specifications, the field crew should first try to recalibrate using fresh aliquots of calibration solution. If recalibration is unsuccessful, new calibration solution should be used and/or maintenance should be performed. Each attempt should be recorded on the equipment calibration log. If the calibration results cannot meet manufacturer's specifications, the field crew should use a spare field measuring device that can be successfully calibrated. Additionally, the Project Manager should be notified.

Calibration should be verified using at least one calibration fluid within the expected range of field measurements, both immediately following calibration and within 24 hours of completing the monitoring event. Individual parameters should be recalibrated if results for the calibration check do not fall within the range of accuracy identified in Table 4. Post-event calibration verification documentation will be retained in the event's Calibration Verification Log presented in Figure 11. Table 19 outlines the typical field instrument calibration procedures for each field probe requiring calibration. Results of initial calibration checks will be recorded on the Field Measurement Equipment Calibration Log, an example of which is shown in Figure 10. Results of calibration checks will be recorded on the calibration log sheet.

Table 19. Calibration of Field Measurement Equipment

Field Meter Parameter	Calibration and Verification Description	Frequency of Calibration	Frequency of Calibration Verification	Responsible Party
pH	Calibration for pH measurement is accomplished using standard buffer solutions. Analysis of a mid-range buffer will be performed to verify successful calibration.	Day prior to 1st day or 1st day of sampling event	After each day's calibration and within 24 hours of completing the sampling event	Individual Sampling Crew
Temperature	Temperature calibration is factory-set and requires no subsequent calibration.			
Dissolved Oxygen	Calibration for dissolved oxygen measurements is accomplished using a water saturated air environment. Dissolved oxygen measurement of water-saturated air will be performed to verify successful calibration.			
Conductivity	Conductivity calibration will follow manufacturer's specifications. A mid-range conductivity standard will be analyzed to verify successful calibration.			
Turbidity	Turbidity calibration will follow manufacturer's specifications. A mid-range turbidity standard will be analyzed to verify successful calibration.			

Field Measurement Equipment Calibration Log & Initial Calibration Verification

Date:

Parameter	Meter ID	Calibration Standard	Post-Cal Measurement	Calibration Valid if:	Time	Initials
Dissolved Oxygen		_____ mmHG _____ ^{o}C _____mg/L [1]	_____ mg/L (water-sat'd air)	D.O. reads within 10% of value from D.O. tables [5]		
Conductivity		0 uS/cm (air)				
		10,000 uS/cm	_____uS/cm (1,000 uS/cm)	900 – 1,100 uS/cm		
pH		7.0 Units				
		10.0 Units	_____Units (pH = 8.0)	pH 8 = 7.8 - 8.2 (or w/in manuf's specs)		
Turbidity		0 NTU				
		3000 NTU	_____NTU (1,000 NTU)	NTU = 900 - 110		

Notes:

Figure 10. Example Field Measurement Equipment Calibration Log Sheet

[5] "D.O. tables" refers to tables of dissolved oxygen in water as a function of temperature and barometric pressure, typically found in wastewater engineering text books.

Field Measurement Equipment Post Event Calibration Verification Log

Date:

Parameter	Meter ID	Verification Standard	Measurement	Calibration Valid if:	Time	Initials
Dissolved Oxygen		_____ mmHG _____ ^{o}C _____mg/L	_____ mg/L (water-sat'd air)	D.O. reads within 10% of value from D.O. tables		
Conductivity		_____ uS/cm	_____uS/cm (1,000 uS/cm)	EC of 1,000 std = 900 – 1,100 uS/cm		
pH		_____Units	_____Units (pH = 8.0)	pH 8.0 = 7.8 - 8.2 (or w/in manuf's specs)		
Turbidity		_____ NTU	_____NTU (1,000 NTU)	NTU = 900 – 1,100		

Notes:

Figure 11. Example Post-Event Field Measurement Equipment Calibration Verification Log Sheet

17. Inspection/Acceptance of Supplies and Consumables

Inspection of gloves, sample containers, and any other consumable equipment used for sampling will be the responsibility of each individual sampling crew. Inspection should be conducted immediately upon receipt of equipment; equipment should be rejected and returned if any obvious signs of contamination (torn packages, etc.) are observed. Inspection protocols and acceptance criteria for laboratory analytical reagents and other consumables are documented in the QA Manual for each laboratory.

18. Non-Direct Measurements

Water quality data collected through other monitoring programs may be used to augment data collected through the VCAILGMP. Data reported by other entities will be evaluated for suitability for inclusion in the VCAILGMP database. It is the responsibility of the Project QA Manager or designee to acquire, validate, and compile the necessary data from other programs. The data will be assessed against the data quality objectives stated in Element 7 of this QAPP (Quality Objectives and Criteria for Measurement Data).

19. Data Management

Event Summary Reports and Analytical Data Reports (described in Element 9) will be delivered to the Project QA Manager or designee. Each type of report will be stored separately and ordered chronologically. The field crew shall retain the original field logs. The contract laboratory shall retain original COC forms. Concentrations of all parameters will be calculated as described in laboratory SOPs or referenced method document for each analyte or parameter. The various data and information generated through the VCAILGMP will be stored and maintained as described in Element 9 (Documents and Records).

The field log and analytical data generated will be converted to a standard database format maintained on staff computers and the local server. After data entry or data transfer procedures are completed for each monitoring event, data will be validated as described in Section D (Data Validation and Usability). After the final quality assurance checks for errors and analytical issues are completed, the data will be added to the final database. The database will be a Microsoft Access® database developed for the program and administered by the Project QA Manager or designee. The version of the database used to manage VCAILGMP data will be upgraded as necessary to meet the requirements of the program.

Program data will be submitted electronically with the Annual Monitoring Report in either Microsoft Access® or Microsoft Excel® file format. Tabular data summaries included in the Annual Monitoring Report will be generated from this data file ("database"). Additionally, those data collected by the program will be formatted to comply with the State Water Resources Control Board's Surface Water Ambient Monitoring Program (SWAMP) database requirements.

C. ASSESSMENT AND OVERSIGHT

20. Assessments and Response Actions

Data will be evaluated and documented after each monitoring event to determine whether project quality assurance objectives have been met, to quantitatively assess data quality, and to identify potential limitations on data use. The following assessments of compliance with quality control procedures will be performed during the data collection phase of the project:

- Performance assessment of the sampling procedures will be performed by the field sampling crews. Corrective action shall be carried out by the field sampling crew and reported to the Project Manager.
- Field crews will be audited annually by the Project Manager or designee. Additional audits will occur as necessary to observe corrective actions taken to resolve errors identified during a previous audit.
- The laboratory is responsible for following established SOPs, including those for proper instrument calibration and maintenance and laboratory QC sample analyses at the required frequency (*i.e.*, method blanks, laboratory control samples, etc.). Associated QC sample results are reported with all sample results so that project staff can evaluate the analytical process performance.
- Assessment of laboratory QC results and implementation of corrective actions will be the responsibility of the QA Officer at each laboratory and shall be reported to the Project QA Manager, or designee, as part of any data reports.
- Assessment of field QC results and implementation of corrective actions shall be the responsibility of the Project QA Manager or designee.

All project data must be reviewed as part of the data assessment. Review is conducted on a preparation batch basis by assessing QC samples and all associated environmental sample results. Project data review established for this project includes the following steps:

- Initial review of analytical and field data for complete and accurate documentation, chain-of-custody procedures, compliance with required holding times, and required frequency of field and

laboratory QC samples;

- Evaluation of analytical and field blank results to identify random and systematic contamination;
- Comparison of all spike and duplicate results with data quality objectives for precision and accuracy;
- Assigning data qualifier flags to the data as necessary to reflect data use limitations identified by the assessment process; and
- Calculating completeness by analyte.

The Project QA Manager, or designee, is responsible for conducting the data assessment and for ensuring that data qualifier flags are assigned, as needed, based on the established quality control criteria. If an assessment or audit discovers any discrepancy, the Project QA Manager will address the observed discrepancy with the appropriate person responsible for the activity. Discussion points will include whether the information collected is accurate, identifying the cause(s) leading to the deviation, how the deviation might impact data quality, and what corrective actions might be considered. The Project QA Manager will maintain a QA Log of all communications and any specified corrective actions, and will make the QA Log available to the Project Manager upon request.

In addition to assessments of data quality and completeness, all valid monitoring results will be compared to relevant water quality benchmarks to identify exceedances and determine compliance with the *Conditional Ag Waiver*.

Routine procedures to assess the success of the data collection effort are discussed in Section D (Data Validation and Usability). Routine procedures for corrective actions are summarized in Table 16 and Table 17.

21. Reports to Management

In addition to the information provided in Element 9 (Documents and Records), the following reports will be generated:

- Toxicity Trigger Exceedance Report: Prepared by the Project Manager and submitted to the Regional Board's QA Officer, this report will consist of an email notification that the toxicity trigger has been exceeded and at which site(s). This report will be submitted within five business days of a toxicity trigger exceedance.
- QA Summary Report: Prepared by the Project QA Manager or designee after each monitoring event and submitted to the Project Manager, this will present a tabular summary of any lab performance issues and the actions taken to correct those problems (e.g. reanalysis of samples not meeting quality control criteria).
- Preliminary Data Report: Prepared by the QA and Project Managers, within 90 days of each monitoring event and shall include preliminary monitoring data after a QA/QC evaluation has been performed. Preliminary data will not be considered final until it is submitted as part of the AMR, nor will it be used to formally assess attainment of Water Quality Benchmarks.
- Annual Monitoring Report: The Annual Monitoring Report will be prepared annually by the Project Manager and will be submitted annually beginning one year after issuance of the NOA. As required by Monitoring and Reporting Requirements, the Annual Monitoring Report will contain the following components:

    - Description/Summary of Discharger Group membership and setting;

- Updated membership list, submitted electronically;
- Monitoring objectives;
- Sampling site descriptions, including photographs;
- Location map of sampling sites including GPS coordinates;
- Parameters monitored and frequency;
- Sampling and analytical methods used, submitted in a tabular format;
- Tabulated results of analyses;
- Data interpretation including assessment of compliance and/or non-compliance with Water Quality Benchmarks;
- Results of toxicity exceedances and results of TIE(s), clearly identified in the report as a separate section;
- Copy of Chain-of-Custody forms, submitted electronically;
- Associated laboratory and field quality control sample results;
- Summary of precision and accuracy;
- Quality control data interpretation, including assessment of data quality objectives;
- If Water Quality Benchmarks are not attained as demonstrated by monitoring, the AMR shall include a statement of intent to prepare a WQMP within six months to address all benchmark exceedances;
- Documentation that education requirements have been fulfilled by each member of the Discharger Group;
- Conclusions and recommendations.

Copies of all field documentation and laboratory original data will be included in the AMR as attachments. The monitoring data will be submitted in a format consistent with SWAMP reporting requirements, both electronically and in hard copy tabular form.

- Water Quality Management Plan (WQMP): A Water Quality Management Plan (WQMP) will be submitted annually six months after the first Annual Monitoring Report is submitted that contains data demonstrating that water quality benchmarks have been exceeded. As required by Monitoring and Reporting Requirements, a WQMP will contain the following components:

  - A summary review of monitoring objectives and sample locations including GPS coordinates and maps;
  - A summary of Water Quality Benchmark exceedances;
  - Determination of pollutant loading from irrigated agricultural land, where practicable;
  - Identification of likely waste sources, review of possible correlations between sampling conditions, seasonal growing activities, and water quality results;
  - Follow-up monitoring, if deemed appropriate, to better understand the nature and source of wastes and/or to document attainment of Water Quality Benchmarks;
  - A description and documentation of existing management practices, including the degree and location of implementation;
  - A review of existing management practice maintenance;
  - Identification of priority areas for management practice implementation, follow-up monitoring (if deemed appropriate), and focused outreach and education;
  - Description and general location of management practices which will be implemented to address water quality impairments;
  - Explanation of the management practice selection process and how they will address Water Quality Benchmark exceedances;

- Schedule and strategy for implementation of new and/or revised management practices;
- Pesticide use evaluation assessment compared to pesticide concentrations at monitoring sites;
- Tracking of management practice implementation and maintenance;
- An approach to determine the effectiveness of management practices at reducing waste discharge and protecting water quality;
- An evaluation of compliance with Water Quality Benchmarks to determine if improvement or additional management practice implementation is necessary; or alternatively, provide technical documentation of natural, historical, or existing conditions that are causing non-compliance.

Table 20 outlines the schedule of report submittals to management.

Table 20. Schedule of Report Submittals to Management

Type of Report	Frequency	Delivery Date	Person/Organization Responsible for Preparation	Report Recipient(s)
Toxicity Trigger Exceedance	Per Occurrence	Within 5 business days of receipt of exceedance result	Project Manager	LARWQCB
Event Summary Reports	Quarterly	Within 1 week of completion of a monitoring event	Field Crew(s)	Project Manager and Project QA Manager
Analytical Data Reports	Quarterly	Within 30 business days of sample receipt by the lab	Analytical Laboratories	Project QA Manager
QA Summary Report	Quarterly	Within 3 weeks of receiving analytical data	Project QA Manager	Project Manager
Preliminary Data Report	Quarterly	Within 90 days after each monitoring event	QA and Project Managers	LARWQCB
Annual Monitoring Report	Annually	One year after issuance of the NOA	Project Manager	LARWQCB, VCAILG Steering Committee
Water Quality Management Plan	Annually, if necessary	Six months after each Annual Monitoring Report containing a benchmark exceedance	Project Manager	LARWQCB, VCAILG Steering Committee

D. DATA VALIDATION AND USABILITY

22. Data Review, Verification and Validation Requirements

The acceptability of data is determined through data verification and data validation. Both processes are discussed in detail below. In addition to the data quality objectives presented in Table 4, the standard data validation procedures documented in the contract laboratory's QA Manual will be used to accept, reject, or qualify the data generated by the laboratory. Each laboratory's QA Officer will be responsible for validating data generated by the laboratory.

Once analytical results are received from the analyzing laboratory, the Project QA Manager will perform an independent review and validation of analytical results. Appendix G contains equations that are used to calculate precision, accuracy, and completeness of the data. Decisions to reject or qualify data will be made by the Project QA Manager, or designee, based on the evaluation of field and laboratory quality control data according to procedures outlined in Section 13 of Caltrans document No. CTSW-RT-00-005, *Guidance Manual: Stormwater Monitoring Protocols*, 2nd Edition, included in this QAPP as Appendix H.

23. Data Verification and Validation Methods

Data verification involves verifying that required methods and procedures have been followed at all stages of the data collection process, including sample collection, sample receipt, sample preparation, sample analysis, and documentation review for completeness. Verified data have been checked for a variety of factors, including transcription errors, correct application of dilution factors, appropriate reporting of dry weight versus wet weight results, and correct application of conversion factors. Verification of data may also include laboratory qualifiers, if assigned.

Data verification should occur in the field and the laboratory at each level (*i.e*., all personnel should verify their own work) and as information is passed from one level to the next (*i.e*., supervisors should verify the information produced by their staff). Records commonly examined during the verification process include field and sample collection logs, chain-of-custody forms, sample preparation logs, instrument logs, raw data, and calculation worksheets.

In addition, laboratory personnel will verify that the measurement process was "in control" (*i.e*., all specified data quality objectives were met or acceptable deviations explained) for each batch of samples before proceeding with the analysis of a subsequent batch. Each laboratory will also establish a system for detecting and reducing transcription and/or calculation errors prior to reporting data.

In general, data validation involves identifying project requirements, obtaining the documents and records produced during data verification, evaluating the quality of the data generated, and determining whether project requirements were met. The main focus of data validation is determining data quality in terms of accomplishment of measurement quality objectives (*i.e.*, meeting QC acceptance criteria). Data quality indicators, such as precision, accuracy, sensitivity, representativeness, and completeness, are typically used as expressions of data quality. The Project QA Manager, or designee, will review verified sample results for the data set as a whole, including laboratory qualifiers, summarize data and QC deficiencies and evaluate the impact on overall data quality, assign data validation qualifiers as necessary, and include this information in a Quality Assurance Report. The validation process applies to both field and laboratory data.

In addition to the data quality objectives presented in Table 4 the standard data validation procedures documented in the analyzing laboratory's QA Manual will be used to accept, reject or qualify the data generated. The laboratory will submit only data that have met data quality objectives, or data that have acceptable deviations explained. When QC requirements have not been met, the samples will be reanalyzed when possible, and only the results of the reanalysis will be submitted, provided that they are acceptable. Each laboratory's QA Officer is responsible for validating the data it generates.

24. Reconciliation with User Requirements

This monitoring program requires that sufficient data be collected in order to evaluate agricultural discharges and whether water quality benchmarks are being attained. Data will also be used to determine areas where BMPs need to be improved or implemented in order for agricultural discharges to meet benchmarks and/or applicable TMDL load allocations. This will be done by direct comparison between monitoring data and applicable water quality benchmarks and/or TMDL load allocations. For more information regarding project objectives, please refer to Element 5. A 90% completeness objective has been set for this monitoring program and collecting data at or above this threshold will allow program objectives to be met, however, since this is a long-term program, project goals can still be attained if there are some unforeseen issues that result in less than 90% completeness for some parameters.

Data generated under the VCAILGMP will be submitted to the Regional Board in three different formats: tabular form within the Annual Monitoring Report, lab reports, and a SWAMP comparable Microsoft Access® or Microsoft Excel® file format.

E. AMENDMENTS TO QAPP

The intent of this section is to provide a place within the QAPP to document significant additions, deletions and revisions to the approved QAPP and to provide the rationale for such changes. This version has been revised to address comments provided by Regional Board staff in the letter dated September 15, 2011. Most changes were minor/cosmetic corrections and do not change the overall monitoring program. The only significant change was to add total copper to the list of constituents to be monitored.