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DRAFT
Calleguas Creek Watershed Toxicity TMDL and OCs TMDL Monitoring Program

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Introduction

The Calleguas Creek Watershed Total Maximum Daily Load Monitoring Program (CCWTMP) was developed as part of the Calleguas Creek Watershed Toxicity TMDL (Toxicity TMDL) and the Organochlorine Pesticides and PCBs TMDL (OCs TMDL) Implementation Plans. The CCWTMP is designed to monitor and evaluate the implementation of the Toxicity and OCs TMDLs and refine the understanding of current loads as well as to continue efforts to identify the cause(s) of remaining or future unknown toxicity. The CCWTMP is intended to parallel efforts of the CCW Nutrients TMDL. Monitoring conducted through the forthcoming Conditional Waiver for Irrigated Lands (Conditional Waiver Program) may meet all or part of the needs of the CCWTMP. To the extent monitoring required by the Implementation Plans parallel monitoring required by the Conditional Waiver Program, it shall be coordinated with Conditional Waiver Program monitoring. The goals of the CCWTMP include:

1. To determine compliance with OCs pesticides and PCBs (collectively referred to as OCs), chlorpyrifos, diazinon, and toxicity numeric targets at receiving water monitoring stations located at the discharge points of the subwatersheds and at Publicly Owned Treatment Works (POTW) discharges.
2. To determine compliance with waste load and load allocations for OCs, chlorpyrifos, diazinon, and toxicity at the discharge points of the subwatersheds and at POTW discharges.
3. To evaluate the presence of sediment toxicity at sediment monitoring stations located in Mugu Lagoon (Reach 1), Lower Calleguas Creek (Reach 2), Calleguas Creek (Reach 3), Revolon Slough (Reach 4), and Conejo Creek (Reach 9A).
4. To identify causes of unknown toxicity and/or potential additive and/or synergistic effects.
5. To generate additional land use runoff data to increase the resolution of current loadings.
6. To evaluate the implications of diazinon and chlorpyrifos replacement pesticides on water quality with regard to toxicity.
7. To determine the effectiveness of implementation actions by urban, POTW, and agricultural dischargers on in-stream fish tissue, water, and sediment quality.
8. To implement the CCWTMP in a manner consistent with other TMDL implementation plans and regulatory actions within the CCW.

Current loading estimates and load reduction estimates are based on limited data. Due to the nature of the data set, assumptions were made about loadings from the various discharges. The collection of data through the CCWTMP will increase the resolution of current loadings and may indicate the need to refine the waste load allocations (WLAs) and load allocations (LAs).

Background

The 303(d) listings addressed by the Toxicity TMDL include water column and sediment toxicity, organophosphate (OP) pesticides in water, and chlorpyrifos in fish tissue (Figure 1). The 303(d) listings addressed by the OCs TMDL include water column, sediment, and fish tissue listings associated with OC pesticides and PCBs (Figure 2). Through various monitoring programs, the presence of water and sediment toxicity as well as chlorpyrifos, diazinon, and OC concentrations

above criteria were identified in reaches not on the 303(d) list. Table 1 presents all of the reaches addressed by the Toxicity TMDL and OCs TMDL.

Table 1. Calleguas Creek Watershed Reaches Addressed by Toxicity TMDL and/or OCs TMDL

	Reach	Water Column Toxicity	Sediment Toxicity	Chlorpyrifos and/or Diazinon in Water	OCs in Water, Sediment, and/or Fish Tissue[1]
1	Mugu Lagoon		X[2]		X[2]
2	Calleguas Creek Lower		X[2]		X[2]
3	Calleguas Creek Upper	X	X	X	X
4	Revolon Slough	X[2]	X	X[2]	X[2]
5	Beardsley Channel	X[2]		X[2]	X[2]
6	Arroyo Las Posas	X		X	X[2]
7	Arroyo Simi	X		X[2]	X
8	Tapo Canyon			X	X
9A	Conejo Creek	X	X	X	X[2]
9B	Conejo Creek Main Stem	X[2]		X	X[2]
10	Hill Canyon	X[2]		X	X[2]
11	Arroyo Santa Rosa	X[2]		X	X[2]
13	Conejo Creek South Fork	X[2]			X[2]

1 OCs addressed by the OCs TMDL include: DDT (DDE and DDD), PCBs, dacthal, aldrin, chlordane, dieldrin, endosulfan, endrin, heptachlor, heptachlor epoxide, hexachlorocyclohexane (HCH, including lindane), and toxaphene.
2 Identified as impaired on the 2002 303(d) list.

Data presented in the Toxicity TMDL identified chlorpyrifos, diazinon, and ammonia as constituents causing acute toxicity (mortality) in water in various reaches. The triazine herbicides atrazine, prometryn, and simazine have been detected in toxic samples and may potentiate toxicity of OP pesticides, but were not observed to cause toxicity on their own. Toxicity of unknown cause(s) continues to exist as toxicant(s) have not been identified at all times toxicity has been observed.

Chlorpyrifos and ammonia have been identified as constituents causing acute toxicity (mortality) in sediment in various reaches. The triazine herbicide prometryn has been detected in toxic samples and may potentiate toxicity, but is not causing toxicity on its own. In addition, toxicity of unknown cause(s) continues to exist as the toxicant(s) causing toxicity have not been identified in all reaches at all times toxicity was observed.

Agricultural runoff is the largest source of OCs to surface waters of the CCW, although urban runoff and POTWs also contribute. POTW discharges and agricultural and urban runoff are the largest sources of chlorpyrifos and diazinon to waterbodies in the CCW. Urban use of diazinon and chlorpyrifos are unlikely to be a long-term source to the CCW as neither of these pesticides will be sold for non-agricultural uses as of December 31, 2005. However, as estimated in the Toxicity TMDL, stockpiles of chlorpyrifos and diazinon for urban uses will likely continued to be applied until depleted around 2005 and 2007, respectively.

POTW and urban discharges were assigned WLAs and agricultural discharges were assigned LAs to address the potential impacts of chlorpyrifos, diazinon, and OC loadings to waterbodies. WLAs and LAs were assigned to the various discharges based on their location in subwatersheds in the CCW. Figure 1 and Figure 2 present the six subwatersheds designated in each TMDL.

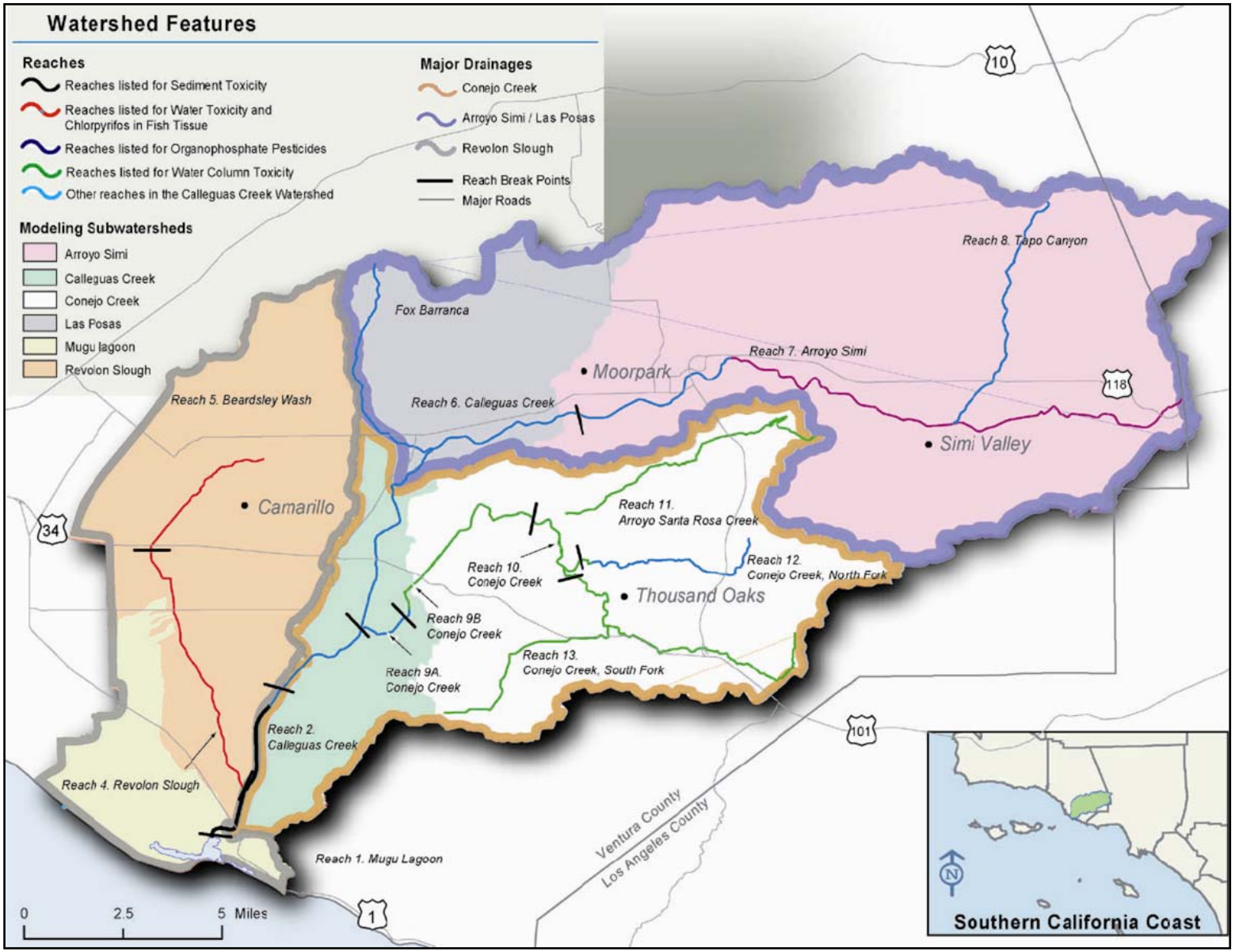

Figure 1. Reaches in the Calleguas Creek Watershed listed on the 2002 303(d) List for water or sediment toxicity, chlorpyrifos in fish tissue, and/or organophosphate pesticides.

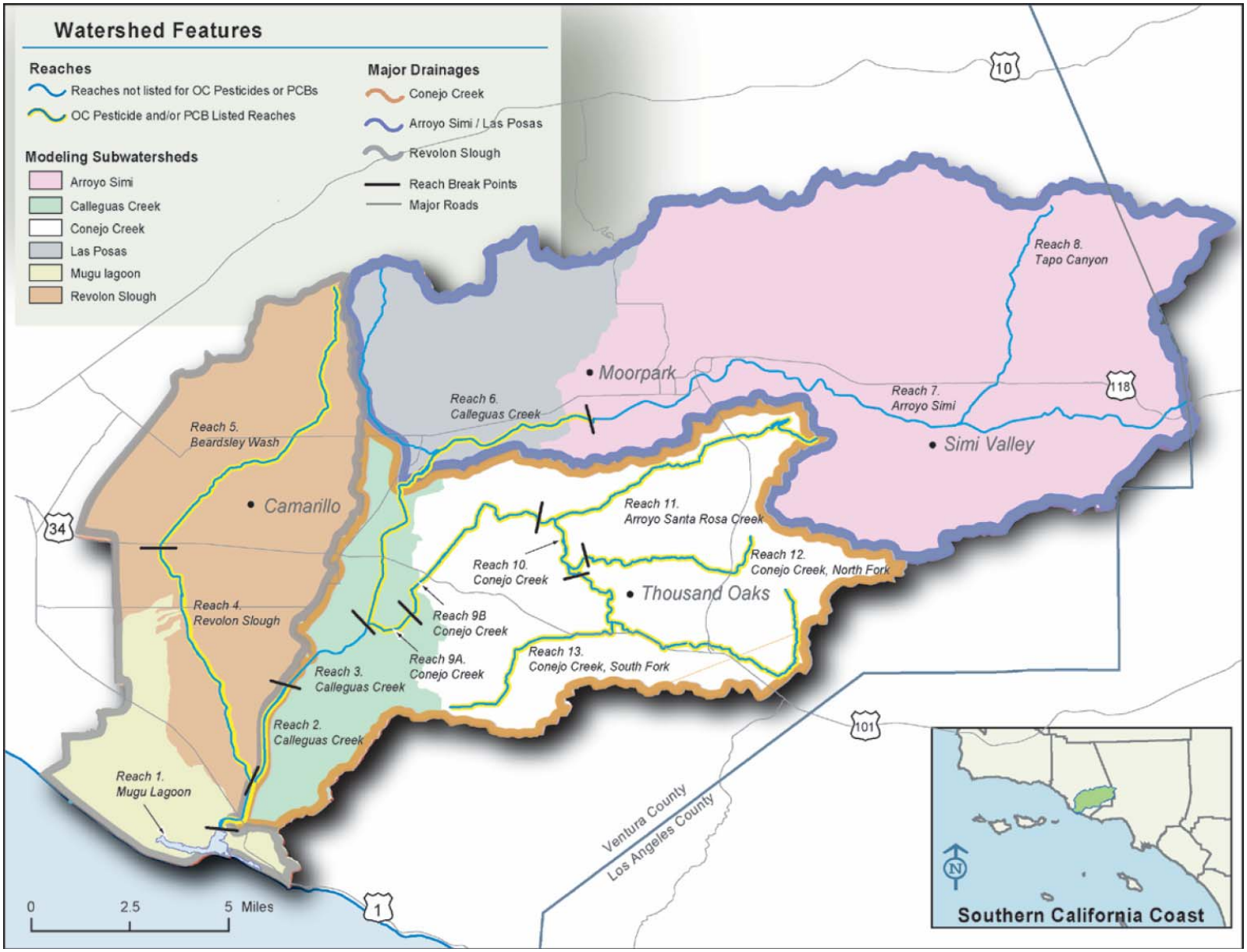

Figure 2. Reaches in the Calleguas Creek Watershed listed on the 2002 303(d) List for organochlorine pesticides and/or PCBs in water, sediment, and/or fish tissue.

Approach

Compliance monitoring for constituents associated with the Toxicity TMDL will begin within one year of the effective date this TMDL. Compliance monitoring for constituents associated with the OCs TMDL will begin within one year of the effective date this TMDL. For compliance monitoring, in-stream water column samples will be collected quarterly for analysis of water column toxicity, general water quality constituents (GWQC), and target organic constituents. Target organic constituents for the OCs TMDL include the OCs listed in Table 1. Target organic constituents for the Toxicity TMDL include chlorpyrifos and diazinon, triazine herbicides, and pyrethroid insecticides. Triazine herbicides are included because the potential exists for toxicity caused by chlorpyrifos and diazinon to be increased in their presence (Anderson and Lydy, 2002). Although pyrethroids are not on the 303(d) list and have not been identified as contributing to toxicity in the CCW, they have been identified as contributing to sediment toxicity elsewhere in California as the use of this group of pesticides increases (Weston *et al.*, in press).

In-stream water column samples will generally be collected at the discharge points of each of the subwatersheds. Additional samples will be collected concurrently at representative agricultural and urban runoff discharge sites as well as at POTWs in each of the subwatersheds and analyzed for selected GWQC and target organic constituents. The locations of compliance monitoring sampling stations are discussed in the Sampling Stations section. Toxicity Identification Evaluations (TIEs) will be conducted on toxic samples as outlined in the Follow-up Toxicity Testing section. For organic constituents, environmentally relevant detection limits will be used. Detection limits will be the lower of either the allocations or the numeric targets, if attainable at a commercial laboratory.

Toxicity investigation monitoring will begin within one year of the effective date of the Toxicity TMDL. For toxicity investigation monitoring, in-stream water column samples will be collected at select sampling stations where the cause(s) of water toxicity have not been identified. The locations of toxicity investigation sampling stations are discussed in the Sampling Stations section. The sampling schedule targets months during which toxicity of unknown causes were observed in previous studies. The monitoring schedule will be revised if it does not adequately characterize toxicity of unknown cause(s). These samples will be analyzed for water column toxicity, and GWQC and target organic constituents. TIEs will be conducted on toxic samples as outlined in the Follow-up Toxicity Testing section.

Streambed sediment samples will be collected twice a year for analysis of sediment toxicity, general sediment quality constituents (GSQC), and target organic constituents. Streambed sediment samples collected for compliance monitoring will be collected in all subwatersheds. Streambed sediment samples collected for toxicity investigation will be collected in reaches of the CCW where the cause(s) of sediment toxicity have not been identified. The locations of compliance monitoring and toxicity investigation monitoring sampling stations are discussed in the Sampling Stations section. TIEs will be conducted on toxic samples as outlined in the Follow-up Toxicity Testing section.

All efforts will be made to include two additional wet weather water sampling events for both compliance and toxicity investigation monitoring during targeted storm events between October and May. Wet weather sampling conditions are discussed in the Sampling Schedule section.

Sampling Stations

Compliance Monitoring Sampling Stations

Table 2 lists the in-stream compliance monitoring sampling stations and identifies the media sampled and constituents analyzed. Figure 3 shows the general locations of the in-stream sampling stations, not including Mugu Lagoon. Figure 4 shows the general locations of the in-stream sampling stations in Mugu Lagoon.

Compliance monitoring sampling stations will generally be located at the discharge points of each of the six subwatersheds at POTWs. In the case of the Revolon Slough and Calleguas Subwatersheds, compliance monitoring sampling stations will be located upstream of the discharge points as 1) these locations are not tidally influenced and 2) the majority of the data addressing toxicity in these subwatersheds have been collected at the upstream locations. Compliance monitoring sampling stations for sediment toxicity are located in the Revolon Slough and Calleguas Subwatersheds. In the case of the Mugu Lagoon Subwatershed, compliance with water targets will be measured at the discharge point of the upstream subwatersheds to the lagoon and compliance with sediment targets will be measured at several stations throughout the lagoon. At such a time as numeric targets are consistently met at the discharge point of a subwatershed, an additional site or sites within the subwatershed will be considered for monitoring to ensure numeric targets are met throughout the subwatershed.

Agricultural and urban runoff land use sampling stations will be selected within one year of the effective date of the Toxicity and/or OCs TMDL, whichever occurs first. At least one agricultural and urban runoff land use sampling station will be located in each subwatershed, unless this is determined unnecessary. Land use sampling stations will be located at a point where water from a representative group of similar land uses discharges to one of the reaches listed in Table 1. Land use sampling stations will coincide with current and previous sampling programs in the CCW, where available. The number and location of land use stations may be revised if it is determined that alternative locations are needed or the number of stations needed to accurately characterize these discharges may be modified.

The water and sediment compliance monitoring sampling stations generally coincide with current and previous sampling programs in the CCW. Current or previously used sampling stations were selected whenever practical to save time and resources, and to provide historical data. Appendix 1 presents detailed descriptions of and directions to the sampling stations identified in this plan.

Table 2. Compliance Monitoring Sampling Station Locations and Constituents

Subwatershed	Station ID	Station Location	Sample Media		
			Water	Sediment	Fish Tissue[1]
Mugu Lagoon	01_11_BR	11th Street Bridge	T, OP, OC		OC[2]
	01_BPT_1	Located near entrance to lagoon after Calleguas Creek and Revolon Slough join, south of Oxnard Drain #2 discharge, formerly site BPTCP-1.		T, OP, OC	
	01_BPT_3	Located in the eastern arm of the lagoon, formerly site BPTCP-3.		T, OP, OC	
	01_BPT_6	Located in the eastern part of the western arm of the lagoon, formerly site BPTCP-6.		T, OP, OC	
	01_BPT_9	Located near 17th street in far side of western arm of the lagoon, east of Oxnard Drain #3 discharge, formerly site BPTCP-9.		T, OP, OC	
	01_BPT_1	Located in central part of the lagoon, formerly site BPTCP-15.		T, OP, OC	
	01_SG_74	Located in central part of the lagoon in mudflat area, south of Oxnard Drain #7 discharge, formerly site SG11-74.		T, OP, OC	
Revolon Slough	04_WOOD	Revolon Slough East Side of Wood Road	T, OP, OC	T, OP, OC	OP, OC
Calleguas	03_CAMAR	Calleguas Creek at University Drive	T, OP, OC	T, OP, OC	OC
	03D_CAMR	Camrosa Water Reclamation Plant	OP, OC		
	9AD_CAMA	Camarillo Water Reclamation Plant	OP, OC		
Conejo	9B_ADOLF	Conejo Creek at Adolfo Road	T, OP, OC	OC	OC
	10D_HILL	Hill Canyon Wastewater Treatment Plant	OP, OC		
Las Posas	06_SOMIS	Arroyo Las Posas off Somis Road	T, OP, OC	OC	OC
	06D_MOOR	Moorpark Wastewater Treatment Plant	OP, OC		
Arroyo Simi	07_HITCH	Arroyo Simi East of Hitch Boulevard	T, OP, OC	OC	OC
	07D_SIMI	Simi Valley Water Quality Control Plant	OP, OC		

T Toxicity samples will be collected OP Organophosphate samples will be collected
OC Organochlorine samples will be collected
1 Attempts will be made to collect fish tissue samples in the same location as water and sediment samples. However, samples may be collected elsewhere if no fish are found at pre-established sample stations.
2 Fish tissue sampling locations in Mugu will be determined in conjunction with biologists prior to sample collection.

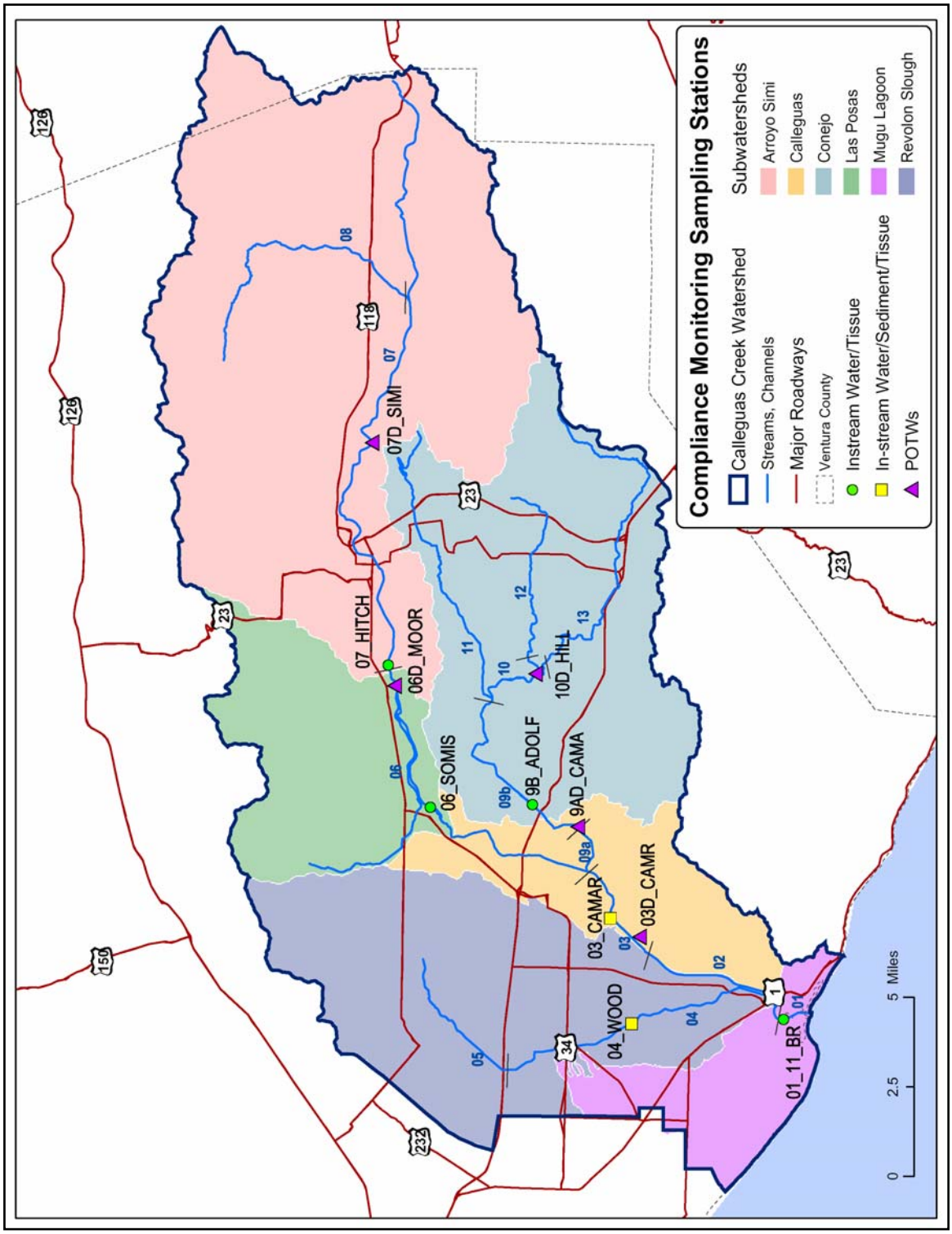

Figure 3. Compliance monitoring sampling stations for the CCW Toxicity TMDL and OCs TMDL.

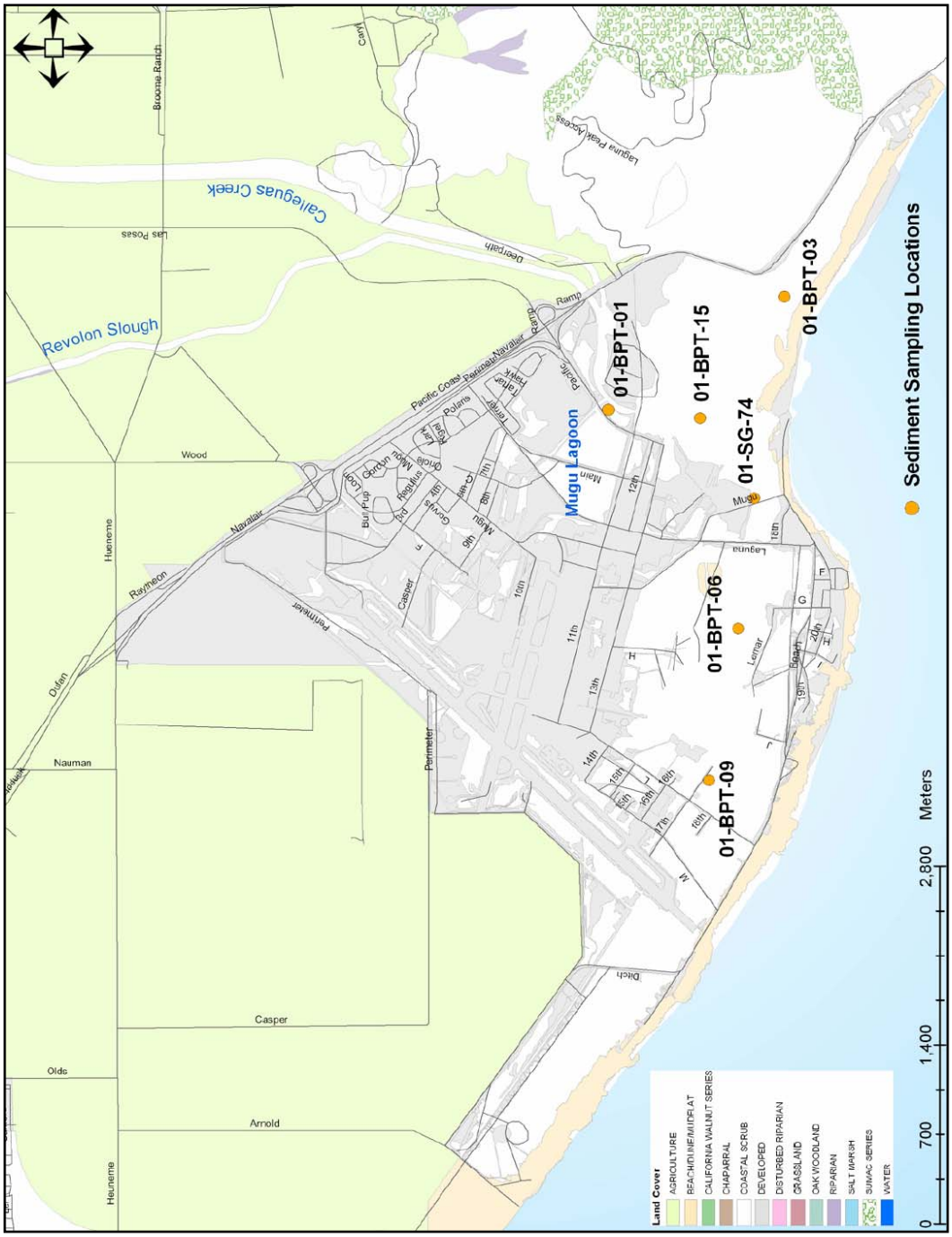

Figure 4. Compliance monitoring sampling stations in Mugu Lagoon for the CCW Toxicity TMDL and OCs TMDL.

Toxicity Investigation Sampling Stations

Table 3 lists the toxicity investigation sampling stations and identifies the media that will be sampled. Figure 5 shows the general locations of the sampling stations in the CCW. The water and sediment toxicity investigation sampling stations generally coincide with current and previous sampling programs in the CCW. Current or previously used sampling stations were selected whenever practical to save time and resources, and to provide historical data. Appendix 1 presents detailed descriptions of and directions to the sampling stations.

Table 3. Toxicity Investigation Sampling Station Locations

Subwatershed	Station Location	Sample Media		Station ID
		Water	Sediment	
Calleguas	Calleguas Creek Northeast Side of Highway 1 Bridge		X	02_PCH
	Conejo Creek at Howard Road Bridge	X	X	9A_HOWAR
Conejo	Conejo Creek Hill Canyon Below North Fork of Conejo Creek	X		10_GATE
	Above Confluence with Conejo Creek North Fork	X		13_BELT

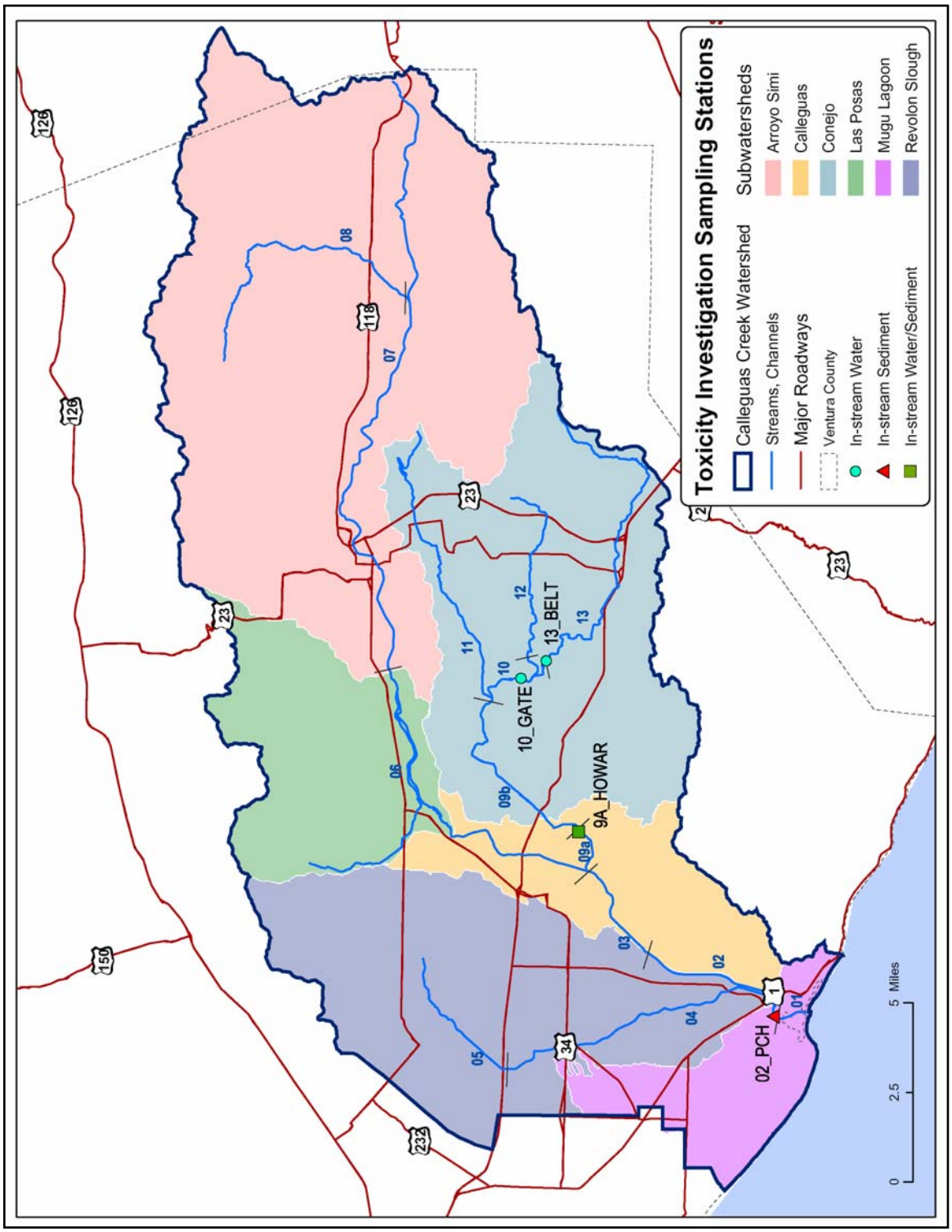

Figure 5. Toxicity Investigation sampling stations for the CCW Toxicity TMDL.

Sampling Schedule

Table 4 presents the sampling schedule. Dates will be finalized during coordination with other monitoring efforts (NPDES Stormwater Permit monitoring, CCW Nutrients TMDL, and any agricultural water quality monitoring program) in order to minimize duplication of effort and to develop a representative data set.

As mentioned previously, all efforts will be made to include two additional wet weather water sampling events during targeted storm events between October and May.

Table 4. Compliance and Toxicity Investigation Monitoring Schedules

Subwatershed	Station ID	Station Type	Month[1]			
			Feb	May	Aug	Nov
Mugu Lagoon	01_11_BR	C	W	W	W	W
	01_BPT_1	C, I			S	S
	01_BPT_3	C, I			S	S
	01_BPT_6	C, I			S	S
	01_BPT_9	C, I			S	S
	01_BPT_1	C, I			S	S
	01_SG_74	C, I			S	S
	TBD	C		T		T
Revolon	04_WOOD	C	W	W, T	W, S	W, S, T
Calleguas	02_PCH	I		T	S	S, T
	03_CAMAR	C, I[2]	W	W	W, S	W, S
	9A_HOWAR	I			S	S
Conejo	9B_ADOLF	C	W	W, T	W, S	W, S, T
	10_GATE	I	W		W	W
	13_BELT	I	W		W	
Las Posas	06_SOMIS	C	W	W, T	W, S	W, S, T
Arroyo Simi	07_HITCH	C	W	W, T	W, S	W, S, T

C indicates compliance station; I indicates toxicity investigation station;
W indicates water sample; S indicates sediment sample; T indicates tissue sample
TBD Fish tissue sampling locations in Mugu will be determined in conjunction with biologists prior to sample collection.
1 All attempts will be made to include two wet weather sampling events during the wet season (October through April).
2 Sediment will be collected at this station to determine compliance and water will be collected as part of the toxicity investigation.

Dry weather water column samples shall be collected quarterly. Should measurable precipitation occur during the seven days prior to a scheduled dry weather event, the sampling event shall be rescheduled to allow for at least seven days without measurable precipitation prior to sampling. All efforts will be made to collect two wet weather samples during the wet season (October through April). Wet weather water samples shall be collected during a targeted storm event, defined as a storm that produces at least 0.5 inches of precipitation. Sufficient precipitation is needed to produce runoff, mobilize constituents of interest, and increase stream flow. The decision to sample a storm event shall be made in consultation with weather forecasting information services and after a quantity of precipitation forecast (QPF) has been determined. Peak flows shall be targeted, to the extent practicable. Should measurable precipitation occur in the three days prior to a wet event, the sampling event shall be rescheduled to allow for at least three days without measurable

precipitation prior to sampling. Sediment samples collected during the wet season shall be collected as a dry weather samples (i.e. no measurable precipitation seven days prior to sampling).

Parameters to be Monitored

Table 5 lists the constituents for which analysis will be conducted, analytical methods and the expected detection limits, and holding times for each constituent. Additional constituents will be added to Table 5, if potential toxicants not currently on this table are identified.

Wet weather water column samples will be filtered, after which the sediment and aqueous fractions will be analyzed separately for target organic constituents. The sediment fraction will be sieved into two grain size fractions (2mm-63um and less than 63um), after which the whole sample as well as the two grain size fractions will be analyzed separately. Measurements of general water quality constituents (GWQC) will be conducted on the whole sample. Streambed sediment samples will be sieved into two grain size fractions (2mm-63um and less than 63um), after which the whole sample as well as two grain size categories will be analyzed separately for target organic constituents. Measurements of general sediment quality constituents (GSQC) will be conducted on the whole sample. The various fractions (aqueous and sediment and the two grain size fractions) are considered to develop an understanding of how target organic constituents are transported through the watershed. This information can be used to assess the potential effectiveness of best management practices given the association of target organic constituents with the different grain size fractions. There might not be a need to continue this type of fractionation indefinitely if a relationship between target organic concentrations and grain size fractions can be developed.

Table 5. Constituents, Methods, Detection Limits, and Holding Times

Constituent	Analytical Method	Detection Limit	Holding Time
Aquatic Toxicity			
Chronic (~ 7 day) *Ceriodaphnia dubia*[1]	EPA/821/R-02/013 1002.0	N/A	36 hours
Sediment Toxicity			
Chronic (10 day) *Hyalella azteca* bulk sediment	EPA 600/R-99/064 100.1	N/A	14 days[2]
Chronic (10 day) *Eohaustorius estuarius*[3] bulk sediment	EPA 600/R-94/025	N/A	14 days[2]
Chronic (10 day) *Hyalella azteca* porewater	EPA 600/R-99/064 100.1	N/A	14 days[2]
Chronic (10 day) *Eohaustorius estuarius*[3] porewater	EPA 600/R-94/025	N/A	14 days[2]
Fish Tissue			
Percent Lipids	Gravimetric/Bligh and Dyer	NA	1 year if frozen
OC Pesticides and PCBs	EPA 8270	0.001 ug/wet g	1 year if frozen
OP Pesticides	EPA 8270	0.005 ug/wet g	1 year if frozen
General Water Quality Constituents (GWQC)			
Total Ammonia	SM4500-NH_3	0.01 mg/L	28 days
Hardness	SM 2340-B	1 mg/L	180 days
Total Suspended Solids (TSS)	SM 2540-D	0.1 mg/L	7 days
Flow	Field Measurement		N/A
pH	Field Measurement	0.1 (IR)	N/A
Temperature	Field Measurement	0.1°C(IR)	N/A
Dissolved Oxygen	Field Measurement	0.1 mg/L (IR)	N/A
Conductivity	Field Measurement	1 umho/cm (IR)	N/A
Salinity	Field Calculation		N/A
Organic Constituents in Water			
OC Pesticides and PCBs	EPA 608/625	1 – 10 ng/L	7/40 days[5]
OP Pesticides	EPA 614/625	5 – 10 ng/L	7/40 days[5]
Pyrethroids and Triazines	Modified EPA 625[4]	5 ng/L	7/40 days[5]
General Sediment Quality Constituents (GSQC)			
Total Ammonia	SM4500-NH3 F	0.01 mg/L	28 days
Percent Moisture	EPA160.3	0.1 Percent	1 year[6]
Grain Size Analysis	SM2560B	0.02 µm	6 months
Total Organic Carbon (TOC)	EPA 415.1	0.012 mg/L	28 days
***Organic Constituents in Sediment (*measured in whole sample, <63um, and between 2mm and 63um fractions**			
OC Pesticides and PCBs	EPA 8081/8082	1 – 10 ng/dry g	1 year[6]
OP Pesticides	EPA 8141/8270	5 – 10 ng/dry g	1 year[6]
Pyrethroids and Triazines	Modified 8270[4]	5 ng/dry g	1 year[6]
Additional Constituents for Mugu Lagoon Sediment			
Acid Volatile Sulfides	SM 4500-Sulfide	0.5 ppm	6 months
Simultaneously Extractable Metals (SEM)	EPA200.8	0.05-1 ppb	180 days, Hg 6months

1 If sample salinity exceeds 1 PPT *Americamysis bahia* (formerly *Mysidopsis bahia*) will be used to conduct toxicity testing.
2 No longer than 8 weeks
3 If sample salinity exceeds 15 PPT *Eohaustorius estuarius* will be used to conduct toxicity testing.
4 Analytical methods for Pyrethroids and Triazines have not been standardized and are analyzed based on modified EPA methods.
5 7/40 = 7 days to extract and 40 days from extraction to analysis.
6 One year if frozen, otherwise 14/40 days
IR – Instrument resolution; N/A – Not applicable; N/M – Analytical methods for Pyrethroids have not been standardized.

Ambient samples of water and sediment will be tested in the laboratory for toxicity to aquatic life to provide an indication of the conditions that exist in the natural environment. Standard test species and test procedures shall be used to provide reliable results. Toxicity is deemed to occur when test species are adversely affected by exposure to ambient water, bulk sediment, or sediment

porewater. Adverse effects may include impaired growth or reproduction, abnormalities, and/or death of test species. Effects may occur rapidly (acute toxicity) or may occur over a longer period (chronic toxicity).

Selection of appropriate analytical methods and laboratory selection are fundamentally important steps in constructing a monitoring program. All analyses shall meet data quality objectives, as stated in the Quality Assurance Project Plan (QAPP) for Calleguas Creek TMDL Work Plan Monitoring (LWA, August 2003), and be otherwise qualified in conformity with USEPA QA/QC guidance. The choice of analytical method may change if a different method is found to give better results (better QA/QC results and/or a more suitable detection limit). The laboratory conducting water and sediment chemical analyses (with the exception of field measurements) will be selected within a year after the effective date of either the Toxicity TMDL or the OCs TMDL. The selected laboratory will be certified by the California Department of Health Services – Environmental Laboratory Accreditation Program to perform all analyses, and in conformance with USEPA and California (DHS-ELAP) requirements, unless it is determined by project staff that an uncertified lab is more qualified for a particular analysis. The laboratory conducting water and sediment toxicity analyses will be selected within a year after the effective date of the Toxicity TMDL. The laboratory conducting toxicity analyses will have proven experience in water and sediment toxicity testing as well as conducting all phases of the TIE procedures.

The United States Geological Survey (USGS) has identified various issues with the current methodology for collecting and analyzing water samples for total suspended sediment (TSS) using method SM 2540 D. The issue with the method for analyzing samples using the TSS analytical method is that it does not produce representative results in samples that contain greater than 25 percent sand-size material (Gray *et al.*, 2000). The suggested alternative method of analysis to determine the amount of suspended sediments in a sample (Gray *et al.*, 2000) is the concentration (SC) method (ASTM, 2002). The primary issue with the TSS analytical method is that it is performed on a portion of the sample which may not be representative of the whole sample, whereas, the SC analytical method is performed on the whole sample. However, suspended sediment data generated using the SC method is not necessarily directly comparable to suspended sediment data generated using the TSS method. As such, conducting statistical analysis using historic TSS data and SC data may not be possible. It may be necessary to run analysis using both methods to develop a correlation between the two. The issues with determining suspended sediment in water using the TSS and/or the SC method will be addressed before the CCWTMP is implemented.

Toxicity Testing Procedures

For the CCWTMP, standard test species will be used for toxicity testing. *Ceriodaphnia dubia* will be used for the aquatic toxicity testing. *Hyalella azteca* will be used for the bulk sediment and porewater toxicity testing. *Eohaustorius estuarius* will be used for aquatic, bulk sediment, and porewater toxicity at sampling locations where salinity levels adversely affect the other test species. *Americamysis bahia* (formerly *Mysidopsis bahia*) will be used to conduct aquatic toxicity testing if sample salinity exceeds 1 part per thousand (PPT) but is less than 15 PPT. These species are standard USEPA test species considered to be among the most sensitive species to many different types of pollutants. These test species are particularly sensitive to constituents previously identified as contributing to toxicity in water and/or sediment. *C. dubia* is a water flea

known to be extremely sensitive to organophosphate pesticides and some metals and also is used as an indicator of ammonia toxicity. *H. azteca* is a sediment dwelling invertebrate that is sensitive to ammonia and organochlorine pesticides. *E. estuarius* is a burrowing amphipod that is sensitive to organochlorine and organophosphate pesticides. *A. bahia* is a shrimp known to be sensitive to organophosphate pesticides. Chronic tests will be used to assess both survival and reproductive/growth endpoints for each species. Test species may be added or removed in the future to adequately identify the presence/absence of toxicity.

Multiple dilution tests on water samples will be conducted to determine the magnitude of toxicity and subsequently the value of the toxic unit chronic (TUc). At the initiation of monitoring the following five dilutions will be used: 100%, 50%, 25%, 12.5%, and 6.25%. The number of dilutions and percent dilutions may be adjusted based on analytical results.

Follow-up Toxicity Testing

The results of toxicity testing will be used to trigger further investigations to determine the cause of observed laboratory toxicity. If testing indicates the presence of significant toxicity in the sample, TIE procedures may be initiated to investigate the cause of toxicity. For the purpose of triggering TIE procedures, significant toxicity is defined as at least 50% mortality. The 50% mortality threshold is consistent with the approach recommended in guidance published by USEPA 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 Phase 1 TIE will be conducted to determine the general class of constituent (*i.e.*, metal, non-polar organics) causing toxicity. Phase 2 TIEs may also be utilized to identify specific constituents causing toxicity if warranted. TIE methods will generally adhere to USEPA procedures documented in conducting TIEs (USEPA, 1991, 1992, 1993a-b). For samples exhibiting toxic effects consistent with carbofuran, diazinon, or chlorpyrifos, TIE procedures will follow those documented in Bailey *et al*. (1996).

At present, TIEs can not be conducted on bulk sediments; however, TIEs can be conducted on sediment porewater. To address toxicity of unknown causes in sediment, sediment porewater will be extracted and tested for toxicity when significant toxicity, defined as at least 50% mortality, is observed in the bulk sediment sample. If the sediment porewater toxicity testing results in greater than 50% mortality, a Phase 1 TIE may be initiated on the porewater.

TIEs may be conducted on samples collected at sites where non-lethal chronic toxicity is consistently observed. The decision to initiate TIE procedures on any sample, including samples exceeding the mortality threshold, will be made after consultation between the monitoring manager and the project manager for the laboratory responsible for performing toxicity testing and TIEs. When deciding whether to initiate TIE procedures for a specific site and sample event, a number of different factors will be considered including the history of toxicity at the site, the level of toxicity, and the species and endpoints exhibiting toxic effects. The rationale for initiating TIE procedures for a specific sample will be clearly documented in subsequent data reports.

Planned Use of Data

Data generated through the CCWTMP shall be used to further characterize water and sediment quality in the watershed focusing on water and sediment toxicity as well as levels of chlorpyrifos,

diazinon, and OCs. Flow and chemical data collected during the study, in conjunction with other available data, may be analyzed to determine the following, as the data allow:

- Frequency of exceedance of in-stream numeric targets;
- Constituents contributing to toxicity of unknown causes in water and sediment;
- Whether a relationship can be established between reported use of chlorpyrifos and diazinon and resulting water quality;
- The particle size association of targeted organic constituents;
- Effectiveness of WLAs and LAs at meeting in-stream numeric targets; and,
- Changes in in-stream water and sediment quality.

Modification of CCWTMP

An adaptive management approach to the CCWTMP will be adopted as it may be necessary to modify aspects of the CCWTMP. Results of sampling carried out through the CCWTMP and other programs within the CCW may be used to modify this plan, as appropriate. Possible modifications could include:

- The inclusion of additional land use sites to accurately characterize loadings;
- The removal of land use sites if it is determined they are duplicative (*i.e.,* a land use site in one subwatershed accurately characterize the land use in other subwatersheds);
- Discontinuation of analysis of sediment fractions;
- The addition of analysis for constituents identified as contributing to toxicity; and,
- The elimination of analysis for constituents no longer identified in land use and/or in-stream samples.

Sampling Event Preparation

Sample event preparation includes preparation of field equipment, placing bottle orders, and contacting the necessary personnel regarding site access and schedule. The following steps shall be completed two weeks prior to each sampling event:

1. Contact laboratories to order bottles and to coordinate sample transportation details;
2. Confirm scheduled sampling date with field crew, and set-up sampling day itinerary including sample drop-off;
3. Prepare equipment (see Table 6);
4. Prepare sample labels and apply to bottles;
5. Prepare the sampling event summary and field log sheet to indicate the type of field measurements, field observations and samples to be taken at each of the stations; and,
6. Calibrate field measurement equipment.

Table 6 provides a checklist of field equipment to prepare prior to each sampling event.

Table 6. Field Equipment Checklist

All Events				Water Specific	
X	Monitoring Plan	X	Tape Measure	X	Peristaltic Pump
X	Sample Bottles and Jars w/ Pre-Printed and Extra Labels	X	Paper Towels or Rags in a Box	X	Extra Pump Batteries
X	Event Summary Sheets	X	Safety Equipment	X	1 length of Clean Tubing per Site
X	Field Log Forms	X	First Aid Kit		
X	Chain of Custody Forms	X	Cellular Telephone		**Sediment Specific**
X	Bubble Wrap	X	Gate Keys	X	4-mil Poly Bags
X	Coolers w/ Ice	X	Hip Waders	X	Sampling and Mixing Spoons
X	New Powder-Free Nitrile Gloves	X	Plastic Trash Bags		
X	Pens	X	Distilled/DI Wash Bottles		
X	Watch	X	Blank Water		
X	Field Measurement Equipment	X	Sealable Plastic Bags		
X	Camera	X	Grab Pole		

Sampling Event Summary and Post Event Summary

A sampling event summary sheet shall be produced for the sampling crew prior to each sampling event. Appendix II presents an example of a sampling event summary sheet. The event summary sheet shall outline sampling requirements at each sampling station, including a list of samples to be collected and QA/QC requirements. This summary will act as a guide to help field crews prepare for and track sample collection during each event. Additionally, the sheet shall show bottle and processing and storage requirements.

A post sampling event summary will be produced by the sampling crew subsequent to each sampling event. This summary will act as a guide for quality assurance personnel to qualify data. The post event summary will contain: chain-of-custody (COC) forms submitted with samples, field log sheets, and a post event summary sheet. The post event summary sheet will follow the same outline as the event summary sheet. In addition, the following information will be included: the sample collection date, name of lab(s) used, when the data were made available by the lab and the format in which they were made available (hard copy or electronic). Appendix III presents an example of a post sampling event summary sheet.

Bottle Order/Preparation

Sample bottle orders will be placed with the appropriate analytical laboratory at least two weeks prior to each sampling event. Bottles and jars will be ordered for all water and sediment samples, including quality control samples as well as extra bottles in case of a need for intermediate containers or replacement. The bottles must be the proper size and material, and contain preservatives as appropriate for the specified laboratory analytical methods. Table 7 presents the proper bottle and jar material and volume, sample type, and immediate processing and storage needs. The field crew must inventory sample bottles upon receipt from the laboratory to assure that adequate bottles have been provided to meet analytical requirements for each sampling event. After each sampling event, any bottles and tubing used to collect water samples and the equipment used for collecting sediment samples shall be cleaned by the laboratory and either picked up by or shipped to the sampling crew.

Sample Bottle Labeling

All samples will be pre-labeled before each sampling event to the extent practicable. Pre-labeling sample bottles and jars simplifies field activities; leaving only sample collection time, sample number, and the names of sampling personnel to be filled out in the field. Custom labels will be produced using blank water-proof labels. This approach will allow the stations and analytical constituent information to be entered into the computer program in advance, and printed as needed prior to each sampling event.

Labels shall be applied to the appropriate bottles and jars in a dry environment; attempting to apply labels to sample bottles after filling may cause problems, as labels usually do not adhere to wet bottles. The labels shall be applied to the bottles and jars rather than to the caps. Field labels shall contain the following information:

- Program Name
- Station ID
- Event Number
- Date
- Time
- Sampling Personnel
- Analytical Requirements
- Preservation Requirements
- Laboratory Conducting Analysis

Sample Collection

Table 7 lists specific constituents for which samples will be analyzed, sample volume required, and immediate processing and storage requirements.

Table 7. Sample Container, Preservation, and Storage Requirements

Parameter	Sample Container	Sample Volume	Immediate Processing and Storage
Aquatic Toxicity			
Initial Screening	FLPE-Lined Jerrican	40 L	Store at 4^{0}C
Follow-up Testing			
Phase I TIE			
Sediment Toxicity			
Initial Screening	4–Mil Poly Bag	3 L	Store at 4^{0}C
Follow-up Testing		10 L[1]	Store at 4^{0}C
Phase I TIE		45 L[1]	Store at 4^{0}C
Fish Tissue			
Organics and Percent Lipids	Teflon sheet	200g	Store on dry ice immediately
General Water Quality Constituents (GWQC)			
Total Ammonia	Polyethylene	250 mL	H_2SO_4 and Store at 4^{0}C
Hardness	Polyethylene	250 mL	Store at 4^{0}C
Total Suspended Solids	Polyethylene	1 L	Store at 4^{0}C
Flow, pH, Temperature, Dissolved Oxygen, Conductivity, Salinity	Field Meter	N/A	N/A
Organic Constituents in Water			
Organics – Dry Weather	Amber Glass	4 x 1L	Store at 4^{0}C
Organics – Wet Weather	Glass	4 x 0.5 gallon	Store at 4^{0}C
Constituents in Sediment			
Total Ammonia	Glass	3 x 8 oz jar	Store at 4^{0}C
Percent Moisture			
Grain Size Analysis			
Total Organic Carbon			
Organics			
Acid Volatile Sulfides			
Simultaneously Extractable Metals (SEM)			

[1] Sample Volumes for Follow-up Testing and Phase I TIEs for sediments may change based on percent solids in previous samples. In addition, collection of sediment for Follow-up Testing and Phase I TIEs may change based on observations of toxicity in previous sampling events.
All water samples will be grab samples
All sediment samples will be composite samples
N/A = Not Applicable

Sampling Technique

Samples will be collected in a manner that minimizes the possibility of sample contamination. These sampling techniques are summarized below:

- Samples are collected only into rigorously pre-cleaned sample bottles.
- At least two persons, wearing clean powder-free nitrile gloves at all times, are required on a sampling crew.
- Clean, powder-free nitrile gloves are changed whenever something not known to be clean has been touched.
- To reduce the potential for contamination, sample collection personnel must adhere to the following rules while collecting samples:

1. No smoking.
2. Never sample near a vehicle, running or otherwise.
3. During wet weather events avoid allowing rain water to drip from rain gear or any other surface into sample bottles.
4. Do not eat or drink during sample collection.
5. Do not breathe, sneeze or cough in the direction of an open sample bottle.

Water Sample Collection

The primary objectives of water sample collection are to identify the presence/absence of chronic and/or acute toxicity as well as to determine compliance with WLAs and LAs. Toxicity samples collected in the CCW have displayed degrading toxicity. The toxic signal is lost during TIE procedures, making the results inconclusive. Collection of sample over an extended time period could lead to increased decay of constituents of interest which could affect the toxicity of the sample and the ability to determine the cause of observed toxicity. In addition, the logistics (from a cost and time perspective) of collecting composite samples for the foreseeable future seems excessive given the lack of clear benefits for collecting toxicity samples in such a manner. Due to the aforementioned concerns, all water samples will be collected as grab samples. At most stations, 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 sampling station configurations and safety concerns, direct filling of sample bottles may not always be feasible. Sampling station configuration will dictate grab sample collection technique. Grab samples will be collected directly into the appropriate bottles (containing the required preservatives as outlined in Table 7).

The grab sample techniques that may be employed are described below.

Direct Submersion: Hand Technique

Where practical, all grab samples will be collected by direct submersion at mid-stream, mid-depth using the following procedures.

1. Wear clean powder-free nitrile gloves when handling bottles and lids. Change gloves if soiled or if the potential for cross-contamination occurs from handling sampling materials or samples;
2. Use pre-labeled sample containers as described in the Sample Bottle Labeling section;
3. Remove lid, submerge bottle to mid-stream/mid-depth, let bottle fill, and replace lid;
4. Place sample on ice;
5. Collect remaining samples including quality control samples, if needed, using the same protocols described above; and,
6. Fill out COC form, note sample collection on field form, and deliver to appropriate lab.

Intermediate Container Technique

Samples for which the introduction of a secondary container is acceptable, and which will be colleted from an open channel, may be collected with the use of a specially cleaned intermediate container following the steps listed below. A secondary container could include a bottle of similar

composition to the sample bottle or a pre-cleaned pitcher of the same material as the sample bottle.

1. Wear clean powder-free nitrile gloves when handling bottles and lids. Change gloves if soiled or if the potential for cross-contamination occurs from handling sampling materials or samples;
2. Use pre-labeled sample containers as described in the Sample Bottle Labeling section;
3. Submerge specially cleaned intermediate container to mid-stream/mid-depth, let container fill, and pour off into individual sample bottles;
4. Place sample on ice;
5. Collect remaining samples including quality control samples, if needed, using the same protocols described above; and,
6. Fill out COC form, note sample collection on field form, and deliver to appropriate lab.

Pumping

Samples for which the use of a peristaltic pump is acceptable and/or necessary because of sampling station configuration, and which will be collected from an open channel, may be collected with the use of a peristaltic pump and specially cleaned tubing following the steps listed below. Pumping may not be used to collect samples analyzed for ammonia.

1. Wear clean powder-free nitrile gloves when handling bottles, lids, and pump tubing. Change gloves if soiled or if the potential for cross-contamination occurs from handling sampling materials or samples;
2. Use pre-labeled sample containers as described in the Sample Bottle Labeling section;
3. Insert pre-cleaned tubing into the pump using "clean sampling techniques". New clean tubing must be used at each sample location for which the pump is used;
4. Place one end of the tubing below the surface of the water. To the extent possible, avoid placing the tubing near the bottom of the channel so that settled solids are not pumped into the sample.
5. Hold the other end of the tubing over the opening of the sample container. Be careful not to touch the tubing to the sample container.
6. Pump the necessary sample volume into the sample container;
7. Place sample on ice;
8. Collect remaining samples including quality control samples, if needed, using the same protocols described above; and,
9. Fill out COC form, note sample collection on field form, and deliver to appropriate lab.

Sediment Sample Collection

Collection of in-stream sediment samples for chemical analysis and toxicity testing shall be conducted according to methods developed by the USGS and outlined in *Guidelines for Collecting and Processing Samples of Stream Bed Sediment for Analysis of Trace Elements and Organic Contaminants for the National Water Quality Assessment Program*, Open-File Report 94-458, 1994. Sediment sampling stations will encompass a section of the reach approximately 100 meters in length upstream from water-column sampling stations. However, this definition may vary based on conditions at each sampling station. Sediment sampling stations should contain 5 to 10

wadeable depositional zones. Depositional zones are defined as locations in streams where the energy regime is low and fine-grained particles accumulate in the stream bed. Depositional zones include areas on the inside bend of a stream or areas downstream from obstacles such as boulders, islands, sand bars, or simply shallow waters near the shore.

The purpose of selecting numerous wadeable depositional zones is to collect a representative sample of each reach. Each depositional zone identified at a sampling station shall be subsampled several times and composited in the field for chemical analysis, or at the lab for toxicity analysis. The number of subsamples collected at each depositional zone shall be based on the size of the zone. If all of the depositional zones within a reasonable distance of the water sampling station have dried, samples should be collected from a partially wetted zone. Wetted zones include areas near the active stream channel.

All sediment samples to be analyzed for organic constituents shall be collected as composite samples as described below. Sediment samples analyzed for toxicity will be combined at the toxicity laboratory. Sediment samples will be collected using pre-cleaned stainless steel trowels from the top 3 cm of sediment. In areas where water is too deep such that no wadeable zones exist (such as Mugu Lagoon), an Ekman dredge or similar coring device should be used. Composite samples shall be collected directly into a clean polyethylene bag, mixed, and then placed into the appropriate jars as outlined in Table 7. Sediment sampling techniques that may be employed are described below.

Sediment Sample Collection for Chemical Analysis

1. Wear clean powder-free nitrile gloves when handling bottles and lids. Change gloves if soiled or if the potential for cross-contamination occurs from handling sampling materials or samples;
2. Use pre-labeled sample containers as described in the Sample Bottle Labeling section;
3. Approach first depositional zone from downstream, care should be taken to minimize the disturbance of sediments;
4. Collect a sample of the top layer (3 cm) of sediment carefully with stainless steel trowel. Avoid loosing the fines when lifting the sample;
5. Place sample into a clean polyethylene bag;
6. Repeat collection in the deposition zone 5 times, if feasible;
7. Move to the next depositional zone and repeat collection;
8. Upon gathering sediment at each depositional zone in the reach, mix the composite sample in the polyethylene bag and fill sample containers used for chemical analysis;
9. Place sample on ice; and,
10. Fill out COC form, note sample collection on field form, and deliver to appropriate lab;

Sediment Sample Collection for Toxicity Analysis

1. Wear clean powder-free nitrile gloves when handling bottles and lids. Change gloves if soiled or if the potential for cross-contamination occurs from handling sampling materials or samples;
2. Use pre-labeled sample containers as described in the Sample Bottle Labeling Section;

3. Approach first depositional zone from downstream, care should be taken to minimize the disturbance of sediments;
4. Collect a sample of the top layer (3 cm) of sediment carefully with stainless steel trowel. Avoid loosing the fines when lifting the sample;
5. Place sample into a clean polyethylene bag,
6. Collect sample for chemical analysis, as described immediately above;
7. Move to the next depositional zone and repeat collection;
8. Repeat collection with sample spoon in each of the deposition zones until a total volume of 60 L of sample has been collected;
9. Place sample on ice; and,
10. Fill out COC form, note sample collection on field form, and deliver to appropriate lab;

Fish Tissue Sample Collection

Fish species collected in the past in the CCW include goldfish, fathead minnow, black and brown bullhead, arroyo chub, mosquito fish, and green sunfish. According to USEPA guidance (2000), the target fish species for sample collection should be the largest individual fish captured from both 1) the highest trophic level sampled (e.g., predatory species) and 2) a bottom feeder. The USEPA guidance document lists bass, crappie, walleye, yellow perch, common carp, suckers, catfish, and trout among its recommended target species for inland fresh waters. Other species not listed above may be collected if they are species known to be consumed by people in the Watershed, within the size range typically kept for consumption, and are predatory or bottom-feeding species.

Total length (longest length from tip of tail fin to tip of nose/mouth) and fork length should be measured and recorded in the field. Scale samples should be collected for aging purposes.

Sampling Protocols

Either the California Department of Fish and Game (CDFG) or a local environmental consulting firm with knowledge of resident species will be contracted to perform sample collection.

Tissue monitoring will involve the field-collection of fish and the obtaining and storing of fish tissue samples to be analyzed for trace levels of target organics, using protocols detailed in CDFG's (2000) standard operating procedures for fish tissue sample collection and preparation. These protocols are summarized below.

Collection of fish for analysis of trace levels of pesticides and PCBs in tissue may be accomplished by a variety of methods, including hook and line, seines, gill nets, and electroshocking. The preferred species to be collected will be species of the highest trophic level at a given location. Efforts will be made to collect fish of a variety of sizes for each species collected, but all within the typical size range selected by anglers. Efforts also will be made to collect and freeze more samples than the target number to be initially analyzed, thereby providing opportunity to conduct subsequent rounds of tissue analyses, if appropriate.

Individual fish will be wrapped in trace metal- and organic-free Teflon™ sheets and frozen for transportation to the laboratory. The tissue samples are prepared in the laboratory using non-

contaminating techniques in a clean room environment. For larger species and individual fish, tissue samples for analysis will consist of a 200-g skin-on fillet sample excised from individual fish (except for catfish and other scaleless species, which are usually prepared as skin-off fillets) (USEPA, 2000). If multiple fish are required to achieve a 200-g sample, smaller, equal-sized skin-on tissue samples from similar size individuals may be combined for a composite sample of 200 g. However, the preferred method is to collect an adequate size sample from individual fish. Collection, handling and storage of tissue samples will be performed in a manner to assure the collection of representative, uncontaminated tissue chemistry samples. Briefly, the key aspects of quality control associated with fish tissue sample collection are as follows:

- Field personnel must be trained in the proper use of sample collection gear and will be able to distinguish acceptable versus unacceptable samples in accordance with pre-established criteria.
- Field personnel must be thoroughly trained to recognize and avoid potential sources of sample contamination (e.g., engine exhaust, winch wires, deck surfaces, ice used for cooling).
- Samplers and utensils that come in direct contact with the sample will be made of non-contaminating materials (e.g., glass, high-quality stainless steel and/or Teflon™) and will be thoroughly cleaned between sampling stations.
- Sample containers will be pre-cleaned and of the recommended type.

In general, sampling protocols are consistent with national guidance developed by USEPA (2000). The minimum number of fish tissue samples to be initially analyzed for each sampling site is three, but five samples is recommended. These samples may be from the same or different fish species. For any single composite sample of smaller fish, the total length of the smallest fish should be no less than 75% of the total length of the largest fish. If, after expending a reasonable amount of effort, the field crew is unable to catch the required number of fish of an appropriate size at a location, CDFG staff or the sampling contractor will contact the sampling plan manager of the CCWTMP to discuss whether sampling should continue at that location.

Field Measurements and Observations

Field measurements (listed in Table 7) will be collected and observations made at each sampling station (water and sediment) after a sample is collected. Field measurements will include flow, pH, temperature, dissolved oxygen, salinity, and conductivity. Temperature, pH, dissolved oxygen, salinity, and conductivity measurements will be collected at approximately mid-stream, mid-depth at the location of greatest flow (if feasible). Field probes shall be lowered to mid-depth and readings recorded on the field log for that station. Field measurements for sediment samples shall be collected from within one meter of the sediment. All field measurement results and comments on field observations will be recorded in the field log presented in Appendix IV.

Flow measurements will be collected using a velocity meter or estimated at each sampling station after a sample is collected. 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 by using the average of several depth measurements taken along the channel. Width will be measured by extending a tape measure from one side of the bank to the

other. Velocity will be estimated by measuring the time it takes a floating object (*e.g.,* stick, orange) to travel a known distance.

If at any time the collection of field measurements by wading appears unsafe, do not attempt to collect mid-stream, mid-depth measurements. Rather, collect field measurements from a stable, unobstructed area at the reach's edge or use an expandable pole and intermediate container obtain sample for field measurements.

In addition to field measurements, observations shall be made at each sampling station. Observations will include color, odor, floating materials as well as observations of contact and non-contact recreation. All comments on field observations will be recorded in the field log presented in Appendix IV.

Chain-of-Custody

Chain-of-custody (COC) forms shall be filled out for all field samples submitted to each laboratory. Sample data, sample location, sample collection crew names, and analyses requested shall be noted on each COC form. See Appendix V for a blank COC form.

Transport to Lab

Samples shall be stored in coolers with ice and bubble wrap and delivered to the appropriate laboratory (Table 8). Samples will be analyzed according to the methods listed in Table 5. In addition, Table 5 provides reporting limits and holding times.

Table 8. Analytical Laboratories

Lab	Analysis	Shipping Method	Address
To be determined	Water and sediment toxicity, TIEs	Overnight delivery	To be determined
To be determined	GWQC and Organics in water and sediment	Same day or overnight delivery	To be determined

Field Protocols

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

1. Before leaving the sampling crew base of operations, confirm number and type of sample bottles as well as the complete equipment list.
2. Proceed to the first sampling station.
3. Fill-out the general information on the field log sheet.
4. Collect the samples indicated on the event summary sheet in the manner described in this study plan. Collect additional volume and blank samples for field-initiated QA/QC samples, if necessary. Place bottles and/or jars in the coolers, carefully pack and ice samples. Double check against the log sheet that all appropriate bottles were filled.
5. Collect field measurements and observations, and record on the field log sheet.
6. Repeat the procedures in steps 3, 4, and 5 for each of the remaining sampling stations.
7. Complete the chain of custody forms using the field notes.
8. After sample collection is completed, deliver and/or ship samples to appropriate laboratory listed in Table 8 on the same day as sample collection.

Quality Assurance/Quality Control

Water and sediment chemistry quality control samples shall be collected according to the schedule shown in Table 9 and Table 10. Specific collection methods for each type of quality control sample type are described below.

Field Blank

Field blanks shall be collected for the stations and events specified in Table 9. Field blanks will be collected for water samples analyzed for organic constituents. The field crew will use blank water provided by the laboratory to generate field blanks by pouring blank water directly into the sample bottles. Field blanks shall be submitted "blind" to the laboratory as Station 20. If detected values are reported for field blanks, the frequency of collection outlined in Table 9 will be increased.

Equipment Blank

Equipment blanks shall be collected once for sediment samples and once for water samples if a pump is used. Equipment blanks will be collected for organic constituents. The field crew will use blank water provided by the laboratory to generate equipment blanks. For water sampling equipment, blank water will be collected from the laboratory water provided using each of the water sampling techniques employed. For sediment sampling equipment, blank water will be poured over pre-cleaned sampling device (trowel) into a clean polyethylene bag and then poured into sample containers. Equipment blanks should be submitted "blind" to the laboratory as Station 21.

Matrix Spike/Matrix Spike Duplicate

Matrix spike and matrix spike duplicate (MS/MSD) analyses shall be requested on samples specified in Table 9. MS/MSD analyses shall be requested for water and sediment samples analyzed for organic constituents and ammonia. No special sampling considerations are required. However, double or triple the normal sample volume may be necessary for each set of water samples (check with analytical laboratory).

Field Duplicates

Field duplicates shall be collected for the stations and events specified in Table 9 and Table 10. Field duplicate water and sediment samples shall be collected and analyzed for organics and GWQC. Field duplicates for water samples shall be collected immediately following the collection of normal samples. In cases where multiple intermediate bottles are used for a single analysis, field duplicates and normal sample containers shall be filled in an alternating sequence (*i.e.*, sample-duplicate- sample -duplicate). Field duplicates for sediment samples shall be produced with the same composite sample as the original sample. Field duplicates shall be submitted "blind" to the laboratory as Station 22.

Laboratory Duplicates

Laboratory duplicate analyses shall be requested for all constituents for the stations and events specified in Table 9 and Table 10. No special sampling considerations are required. However, double sample volume must be collected, per laboratory requirements, for each analysis.

Quality Control Sample Collection Schedule

Table 9 presents the quality assurance/quality control (QA/QC) sample collection schedule for both the compliance monitoring and toxicity investigation sampling. It is intended to provide general guidance on the timing of QA/QC sample collection. However, due to the nature of environmental sampling it may not be possible to collect all QA/QC samples as outlined in this schedule. As such, this schedule is flexible and may be modified to meet in-field conditions and sampling schedule requirements as long as a field blank, an MS/MSD, and either a lab or field duplicate are collected during each event. Changes to this schedule should be recorded on the event summary, field log, and post event summary.

Table 9. Quality Control Sample Collection Schedule for Water Samples

Subwatershed	Station ID	Water Event Number[1]							
		1	2	3	4	5	6	7	8
Mugu Lagoon	01_11_BR	FB						FD	MS
Revolon Slough	04_WOOD	MS	FB						LD
Calleguas Creek	03_CAMAR	FD	MS	FB					
Las Posas	06_SOMIS		LD	MS	FB				
Arroyo Simi	07_HITCH			FD	MS	FB			
Conejo Creek	9B_ADOLF				LD	MS	FB		
	10_GATE					FD	MS	FB	
	13_BELT						LD	MS	FB

1 After eight events the cycle of quality control sample collection is repeated.
FB = Field Blank: water quality field blanks analyzed for pesticides/PCBs. If a site requires sample collection using a peristaltic pump, a pumped sample field blank will be collected in addition to the grab sample field blank.
FD = Field Duplicate, LD = Lab Duplicate: water duplicate samples analyzed for GWQC/pesticides/PCBs.
MS = Matrix Spike/Matrix Spike Duplicate: water quality MS/MSD samples analyzed for ammonia/pesticides/PCBs.

Table 10. Quality Control Sample Collection Schedule for Sediment Samples

Subwatershed	Station ID	Sediment Event Number[1]							
		1	2	3	4	5	6	7	8
Mugu Lagoon	Multiple[2]	FD							
Calleguas Creek	02_PCH	EB	LD						
	03_CAMAR			FD					
	9A_HOWAR				LD				
Revolon Slough	04_WOOD					FD			
Conejo	9B_ADOLF						LD		
Las Posas	06_SOMIS							FD	
Arroyo Simi	07_HITCH								LD

EB = Equipment Blank: sediment quality equipment blanks analyzed for pesticides/PCBs.
FD = Field Duplicate, LD = Lab Duplicate: sediment duplicate samples analyzed for GSQC/pesticides/PCBs.
1 After eight events the cycle of quality control sample collection is repeated.
2 Sediment QA/QC samples will be collected at one of the Mugu Lagoon sampling locations for each event where a quality control sample is required in Mugu Lagoon.

Table 11. Quality Control Sample Collection Schedule for Fish Tissue Samples

Subwatershed	Station ID	Fish Tissue Event Number[1]					
		1	2	3	4	5	6
Mugu Lagoon	TBD[2]	FD					
Calleguas Creek	02_PCH	EB	LD				
Revolon Slough	04_WOOD			FD			
Conejo	9B_ADOLF				LD		
Las Posas	06_SOMIS					FD	
Arroyo Simi	07_HITCH						LD

EB = Equipment Blank: fish tissue quality equipment blanks analyzed for pesticides/PCBs.
FD = Field Duplicate; LD = Lab Duplicate: fish tissue duplicate samples analyzed % lipids/pesticides/PCBs.
TBD Fish tissue sampling locations in Mugu will be determined in conjunction with biologists prior to sample collection.
1 After six events the cycle of quality control sample collection is repeated.
2 Fish Tissue QA/QC samples will be collected at one of the Mugu Lagoon sampling locations for each event where a quality control sample is required in Mugu Lagoon.

References

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Appendix I. Sampling Stations

Mugu Lagoon Subwatershed
Reach 1: Mugu Lagoon – 11th Street Bridge
Station ID: 01_11_BR
Directions: From the southern end of Camarillo, heading north on Hwy 101 exit Las Posas. Turn left onto Las Posas and follow until Naval Base Ventura County. Upon entering the base through the furthest gate south; turn left at 11th Street. Access lagoon from bridge. Thomas Guide 2004 p. 583-H4.

For remaining stations in Mugu Lagoon (01_BPT_1, 01_BPT_3, 01_BPT_6, 01_BPT_9, 01_BPT_1, and 01_SG_74) use Figure 4 to determine approximate location for sample collection. Record GPS coordinates during first event and attempt to collect at the same location during future events.

Revolon Subwatershed
Reach 4: Revolon Slough - East Side of Wood Road
Station ID: 04_WOOD
Directions: From the southern end of Camarillo, heading north on Hwy 101 exit Las Posas. Turn left onto Las Posas; turn right onto Pleasant Valley Road; turn left onto Wood Road and continue until Wood Road crosses Revolon Slough. Access slough on east side of Wood Rd through a locked VCWPD gate. Thomas Guide 2004 p. 553-H3.

Calleguas Subwatershed
Reach 2: Calleguas Creek Lower Main Stem - Northeastern side of Highway 1
Station ID: 02_PCH
Directions: From Oxnard, heading south on Hwy 1, turn left, across northbound Hwy 1 traffic, just south of Las Posas Rd intersection, onto Deer Path. Make way north to Calleguas Creek. Thomas Guide 2004 p. 583-J4.

Reach 3: Calleguas Creek Upper Main Stem - Below Camrosa Wastewater Reclamation Facility
Station ID: 03_CAMAR
Directions: From Lewis Rd take University Dr. (previously Camarillo Dr.) southeast to Calleguas Creek. Sample just upstream of bridge. Thomas Guide p. 554-E1.

Reach 9A: Conejo Creek - Below Camarillo Wastewater Treatment Plant
Station ID: 9A_HOWAR
Directions: From US 101 in Camarillo exit Pleasant Valley Rd, and head south to Pancho Rd. Turn left (south) on Pancho Rd. Turn left (east) on Howard Rd. Sample upstream of Howard Road Bridge. Thomas Guide 2004 p. 524-J7.

Las Posas Subwatershed
Reach 6: Arroyo Las Posas - Off of Somis Road
Station ID: 06_SOMIS

Directions: From Somis Rd turn east onto road at Hagel Tree Farm, between Ag Rx and Paty's Farm stand. Cross railroad tracks and follow road until you reach Arroyo Las Posas. Sample upstream of bridge. Thomas Guide 2004 p. 495-A5**.**

Arroyo Simi Subwatershed
Reach 7: Arroyo Simi - North of Hitch Boulevard
Station ID: 07_HITCH
Directions: Follow Hitch Blvd south from Highway 118 to intersection of Arroyo Simi. Pass through a locked VCWPD gate. Sample upstream of bridge. Thomas Guide 2004 p. 495-J3.

Conejo Creek Subwatershed
Reach 9B: Conejo Creek Main Stem - At the end of Adolfo Road
Station ID: 9B_ADOLF
Directions: From US 101 in Camarillo head north on Santa Rosa Rd. Turn right (east) on Adolfo Rd and continue to the end. Pass through a locked VCWPD gate. Thomas Guide 2004 p. 525-B4.

Reach 10: Conejo Creek Hill Canyon - Below North Fork of Conejo Creek
Station ID: 10_GATE
Directions: From Santa Rosa Rd head south on Hill Canyon Rd. Access creek through gate which is located before the last bend in the road before reaching Hill Canyon Wastewater Treatment Facility. Contact facility staff for access though gate. Thomas Guide 2004 p. 525-J3.

Reach 13: Conejo Creek South Fork - South of Confluence with Conejo Creek North Fork
Station ID: 13_BELT
Directions: From Santa Rosa Rd head south on Hill Canyon Rd. Access creek behind belt press building at Hill Canyon Wastewater Treatment Facility. Contact facility staff for access. Thomas Guide 2004 p. 526-A4.

Appendix II. Example Event Summary Sheet

Calleguas Creek Watershed TMDL Sampling Program Event Summary
Receiving Water Sites
Sampling Event # – x Month y Date, 200z

Station	Requirements	Bottles	Lab
01_11_BR + Water QA/QC – FIELD BLANK (ORGANICS ONLY)			
Water	OC & OP Pest./PCBs and Triazines	2 x 1L Amber glass	xy Labs
	Total Suspended Solids	1 L HDPE	xy Labs
	Total Ammonia	250 mL polyethylene	xy Labs
	Hardness	250 mL polyethylene	xy Labs
	Toxicity	2 x 5 Gallons FLPE-Lined Jerricans	xz Labs
	QA/QC - Field Blank - Label as Station 20 *** Collect field blank with lab water before collecting any other samples at this site***		
	OC & OP Pest./PCBs and Triazines	2 x 1 L Amber	xy Labs
	Total Suspended Solids	1 L HDPE	xy Labs
	Total Ammonia	250 mL polyethylene	xy Labs
	Hardness	250 mL polyethylene	xy Labs
Sediment	**Whole Sample**	3 X 8 oz glass	xy Labs
	Total Ammonia		
	Percent Moisture		
	Grain Size Analysis		
	Total Organic Carbon		
	OC & OP Pest./PCBs, Triazines and Pyrethroids		
	Acid Volatile Sulfides		
	Simultaneously Extractable Metals (SEM)		
	2.0 mm to > 0.63 mm and < 0.63 mm fractions		
	OC & OP Pest./PCBs, Triazines and Pyrethroids		
	Acid Volatile Sulfides		
	Simultaneously Extractable Metals (SEM)		
	Sediment Toxicity	15 gallons in polyethylene bags	xz Labs
02_PCH + Sediment QA/QC - LAB DUP (ALL CONSTITUENTS) - Request Lab Dups on COC			
Sediment	**Whole Sample**	6 X 8 oz glass	xy Labs
	Total Ammonia		
	Percent Moisture		
	Grain Size Analysis		
	Total Organic Carbon		
	OC & OP Pest./PCBs, Triazines and Pyrethroids		
	2.0 mm to > 0.63 mm and < 0.63 mm fractions		
	OC & OP Pest./PCBs, Triazines and Pyrethroids		
	Sediment Toxicity	15 gallons in polyethylene bags	xz Labs

03_CAMAR + Water QA/QC - MS/MSD (ORGANICS AND AMMONIA ONLY)			
Water	OC & OP Pest./PCBs and Triazines	6 x 1L Amber glass **(MS/MSD)**	xy Labs
	Total Suspended Solids	1 L HDPE	xy Labs
	Total Ammonia	250 mL polyethylene	xy Labs
	Hardness	250 mL polyethylene	xy Labs
	Toxicity	2 x 5 Gallons FLPE-Lined Jerricans	xz Labs
Sediment	**Whole Sample**	3 X 8 oz glass	xy Labs
	Total Ammonia		
	Percent Moisture		
	Grain Size Analysis		
	Total Organic Carbon		
	OC & OP Pest./PCBs, Triazines and Pyrethroids		
	2.0 mm to > 0.63 mm and < 0.63 mm fractions		
	OC & OP Pest./PCBs, Triazines and Pyrethroids		
	Sediment Toxicity	15 gallons in polyethylene bags	xz Labs
04_WOOD			
Water	OC & OP Pest./PCBs and Triazines	2 x 1L Amber glass	xy Labs
	Total Suspended Solids	1 L HDPE	xy Labs
	Total Ammonia	250 mL polyethylene	xy Labs
	Hardness	250 mL polyethylene	xy Labs
	Toxicity	2 x 5 Gallons FLPE-Lined Jerricans	xz Labs
Sediment	**Whole Sample**	3 X 8 oz glass	xy Labs
	Total Ammonia		
	Percent Moisture		
	Grain Size Analysis		
	Total Organic Carbon		
	OC & OP Pest./PCBs, Triazines and Pyrethroids		
	2.0 mm to > 0.63 mm and < 0.63 mm fractions		
	OC & OP Pest./PCBs, Triazines and Pyrethroids		
	Sediment Toxicity	15 gallons in polyethylene bags	xz Labs
06_SOMIS + QA/QC - LAB DUP (ALL CONSTITUENTS) - Request Lab Dups on COC			
Water	OC & OP Pest./PCBs and Triazines	4 x 1L Amber glass	xy Labs
	Total Suspended Solids	2 x 1L HDPE	xy Labs
	Total Ammonia	2 x 250 mL polyethylene	xy Labs
	Hardness	2 x 250 mL polyethylene	xy Labs
	Toxicity	2 x 5 Gallons FLPE-Lined Jerricans	xz Labs

Appendix III. Example Post-Event Summary Sheet

Calleguas Creek Watershed Toxicity TMDL Sampling Program Post Event Summary
Receiving Water Sites
Sampling Event # – x Month y Date, 200z

Station	Requirements	Date Submitted to Lab	Date Returned from Lab	Format of Data	Lab
01_11_BR + Water QA/QC - FIELD BLANK (ORGANICS ONLY)					
Water	OC & OP Pest./PCBs and Triazines				xy Labs
	Total Suspended Solids				xy Labs
	Total Ammonia				xy Labs
	Hardness				xy Labs
	Toxicity				xz Labs
	QA/QC - Field Blank - Label as Station 20 **Collect field blank with lab water before collecting any other samples at this site***				
	OC & OP Pest./PCBs and Triazines				xy Labs
	Total Suspended Solids				xy Labs
	Total Ammonia				xy Labs
	Hardness				xy Labs
Sediment	**Whole Sample**				
	Total Ammonia				
	Percent Moisture				
	Grain Size Analysis				
	Total Organic Carbon				
	OC & OP Pest./PCBs, Triazines and Pyrethroids				xy Labs
	Acid Volatile Sulfides				Labs
	Simultaneously Extractable Metals (SEM)				
	2.0 mm to > 0.63 mm and < 0.63 mm fractions				
	OC & OP Pest./PCBs, Triazines and Pyrethroids				
	Acid Volatile Sulfides				
	Simultaneously Extractable Metals (SEM)				
	Sediment Toxicity				xz Labs
02_PCH + Sediment QA/QC - LAB DUP (ALL CONSTITUENTS)					
Sediment	**Whole Sample**				xy Labs
	Total Ammonia				
	Percent Moisture				

	Grain Size Analysis				
	Total Organic Carbon				
	OC & OP Pest./PCBs, Triazines and Pyrethroids				
	2.0 mm to > 0.63 mm and < 0.63 mm fractions				
	OC & OP Pest./PCBs, Triazines and Pyrethroids				
	Sediment Toxicity				xz Labs
03_CAMAR + Water QA/QC - MS/MSD (ORGANICS AND AMMONIA ONLY)					
Water	OC & OP Pest./PCBs and Triazines				xy Labs
	Total Suspended Solids				xy Labs
	Total Ammonia				xy Labs
	Hardness				xy Labs
	Toxicity				xz Labs
Sediment	**Whole Sample**				
	Total Ammonia				
	Percent Moisture				
	Grain Size Analysis				xy Labs
	Total Organic Carbon				
	OC & OP Pest./PCBs, Triazines and Pyrethroids				
	2.0 mm to > 0.63 mm and < 0.63 mm fractions				
	OC & OP Pest./PCBs, Triazines and Pyrethroids				
	Sediment Toxicity				xz Labs
04_WOOD					
Water	OC & OP Pest./PCBs and Triazines				xy Labs
	Total Suspended Solids				xy Labs
	Total Ammonia				xy Labs
	Hardness				xy Labs
	Toxicity				xz Labs
Sediment	**Whole Sample**				
	Total Ammonia				
	Percent Moisture				
	Grain Size Analysis				xy Labs
	Total Organic Carbon				
	OC & OP Pest./PCBs, Triazines and Pyrethroids				
	2.0 mm to > 0.63 mm and < 0.63 mm fractions				
	OC & OP Pest./PCBs, Triazines and Pyrethroids				
	Sediment Toxicity				xz Labs

Appendix IV. Blank Field Log

Calleguas Creek Watershed TMDL Monitoring Program
Field Log

GENERAL INFORMATION

Station ID: _____ Date: _____ Time: Arrival _____
Departure_____

Sampler's Name(s): _____

OBSERVATIONS

Weather: _____

Floating material or debris: _____

Oil (extent): _____Water color or odor: _____

Photograph No. (if taken): _____

Recreation uses observed: _____

Other Notes (presence of algae, wildlife observations, etc.):

FLOW MEASUREMENTS / ESTIMATES

Measured Flow: _____

Estimated Flow:

Mid-stream depth _____ Width of flow _____ Velocity _____

SAMPLE COLLECTION – Water

Water Toxicity ID:_____ Time: _____ Volume: _____

Circle those that apply: TSS Total Ammonia Hardness Pesticides

ID:_____ Time: _____ Volume: _____

QA/QC: _____ ID:_____ Time: _____ Volume: _____

SAMPLE COLLECTION – Sediment

Sediment Toxicity ID:_____ Time: _____ Volume: _____

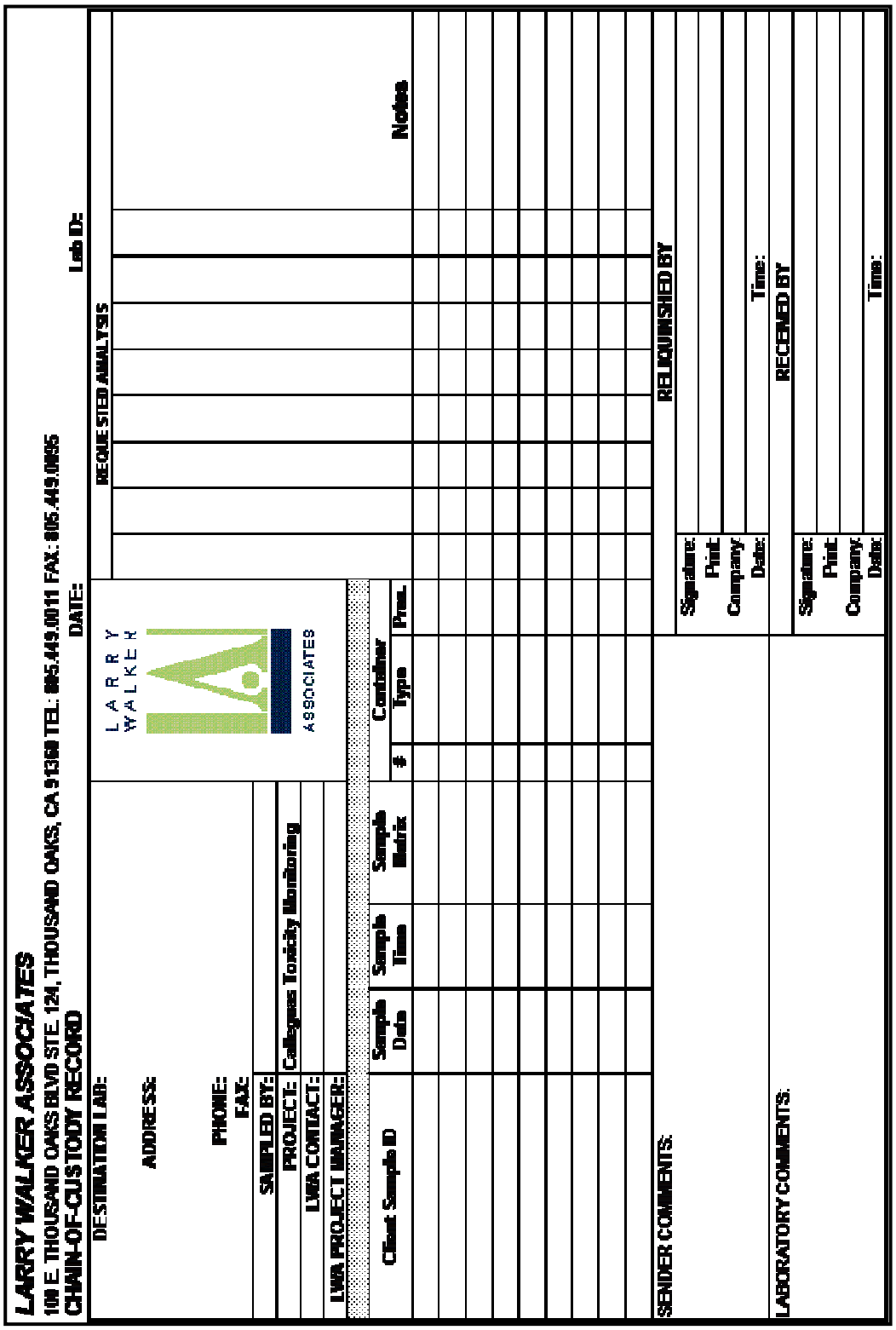
Circle those that apply: Total Ammonia Percent Moisture Grain Size Analysis

Total Organic Carbon Pesticides Acid Volatile Sulfides Simultaneously Extractable Metals

ID:_____ Time: _____ Volume: _____

QA/QC: _____ ID:_____ Time: _____ Volume: _____

Appendix V. Blank Chain of Custody Form



LARRY WALKER ASSOCIATES
1100 E. THOUSAND OAKS BLVD STE. 124, THOUSAND OAKS, CA 91360 TEL: 805.449.0011 FAX: 805.449.0055
CHAIN-OF-CUSTODY RECORD

DESTINATION LAB:
ADDRESS:
PHONE:
FAX:
SAMPLED BY:
PROJECT: Calleguas Toxicity Monitoring
LWA CONTACT:
LWA PROJECT MANAGER:

DATE:
Lab ID:

LARRY WALKER ASSOCIATES

REQUESTED ANALYSIS

Client Sample ID	Sample Date	Sample Time	Sample Matrix	Container #	Container Type	Container Pres.	Notes

SENDER COMMENTS:

RELINQUISHED BY
Signature:
Print:
Company:
Date:
Time:

LABORATORY COMMENTS:

RECEIVED BY
Signature:
Print:
Company:
Date:
Time: