Bioassessment Survey of the Stormwater Monitoring Coalition

Workplan for Years 2021 through 2025
Version 5.0 (2025)

Raphael D. Mazor

Southern California Coastal Water Research Project

SCCWRP Technical Report #1174

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INTRODUCTION

Southern California's coastal watersheds contain important aquatic resources that support a variety of ecological functions and environmental values, but results of the Stormwater Monitoring Coalition's (SMC's) five-year survey ending in 2013 suggest that less than half of southern California's perennial, wadeable streams are in good biological condition—mostly in headwaters and undeveloped portions of the region (Mazor 2015). A second five-year cycle, beginning in 2015, showed that conditions were largely stable, with only a small number of streams showing improving or degrading trends. For its third cycle, the SMC will expand on assessments of status and trends, while including modifications to address knowledge gaps, such as how development affects the ecological potential of streams.

Comprising over 7,000 stream-kilometers, southern California's coastal watersheds are crucial for both humans and wildlife's habitat, drinking water, agriculture, and industrial uses. In order to assess the health of streams in these watersheds, the Stormwater Monitoring Coalition (SMC), a coalition of multiple state, federal, and local agencies, began monitoring stream condition in 2009 using multiple indicators of ecological health. This survey documented the condition of presumed perennial wadeable streams in the region and set a baseline for monitoring regional trends. In 2015, a new five-year program built on the initial survey to focus on trend detection. In 2021, a third five-year survey will go further, expanding coverage in under-sampled areas, conducting causal assessments at sites in poor condition, and getting a better understanding of the extent of perennial, intermittent, and ephemeral streams in the region.

The SMC stream survey is a collaborative effort of leading stormwater and regulatory agencies in southern California. Through a re-allocation of permit-required monitoring efforts, this survey is intended to provide valuable data about the condition of Southern California coastal streams in a cost-effective way. Additionally, the SMC's stream survey serves as the southern California component of the statewide stream condition survey (i.e., the Perennial Stream Assessment, PSA).

The goal of this document is to guide implementation of a collaborative large-scale, regional monitoring program of southern California's coastal streams. It describes sample draw parameters, analytes that will be assessed, quality assurance requirements, standard protocols, and other information needed to ensure comparability across different programs. While the details concerning implementation (such as specific labs and contractors) will vary among participants, each agency can use this document to create consistent sampling programs within their regions that will contribute to an assessment of the entire region.

The SMC is a coalition of multiple state, federal, and local agencies that works collaboratively to improve the management of stormwater in southern California. SMC members include regulatory agencies, flood control districts, and research agencies: County of Los Angeles Department of Public Works, Orange County Public Works, County of San Diego Department of Public Works, Riverside County Flood Control and Water Conservation District, San Bernardino County Flood Control District, Ventura County Watershed Protection District, City of Long Beach Public Works Department, City of Los Angeles Department of Public Works, California Regional Water Quality Control Board—Los Angeles Region, Santa Ana Region, and San Diego Region, State Water Resources Control Boards, California Department of Transportation, and the Southern California Coastal Water Research Project (SCCWRP). In addition, the SMC collaborates with the U.S. Environmental Protection Agency Office of Research and Development. For more information, visit the SMC webpage at http://socalsmc.org/.

KEY MONITORING QUESTIONS AND APPROACH

The Southern California Stream Survey was originally designed to generate data to answer three key management questions.

1. What is the condition of streams in Southern California?
2. What stressors are associated with poor condition?
3. Are conditions changing over time?

The survey will continue to provide data to address these questions but will be modified to address new questions as part of special studies:

1. What are conditions at under-sampled areas of interest, such as restored sites, soft-bottom channels, small urban streams, and headwaters?
2. What are likely causes of poor conditions at selected low-scoring sites?
3. Where do streams support flows sufficient for assessing conditions with benthic macroinvertebrates?

Each of these questions will be addressed through new special studies included within the survey.

Watersheds within the SMC region are shown in Figure 1 and Table 1.

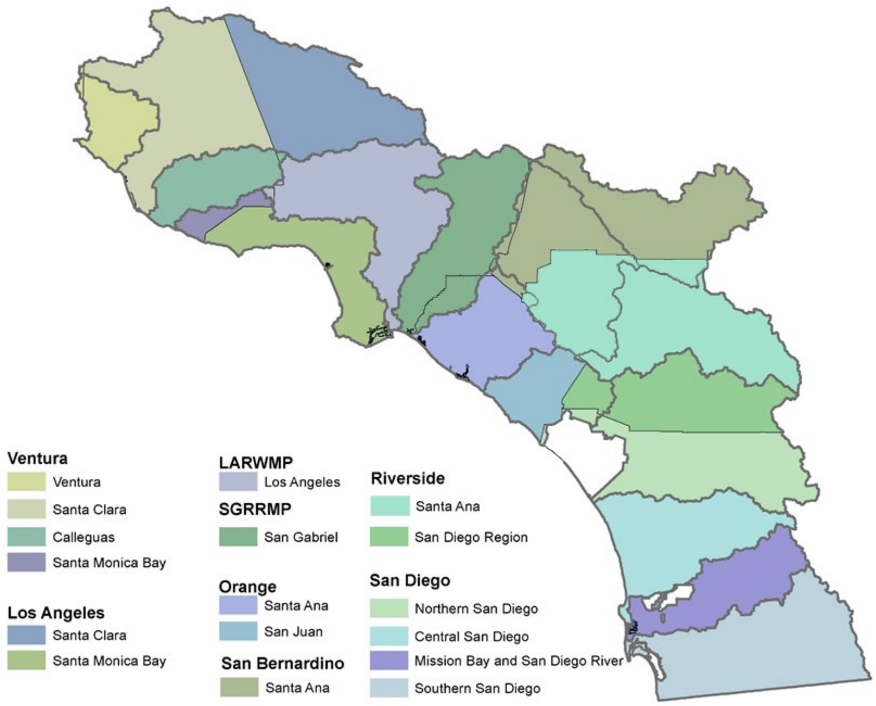

Figure 1. Sampling strata for participating SMC agencies. White spaces correspond to military land excluded from condition estimates of the survey. Marine Corps lands within Camp Pendleton and Miramar Air Station are excluded from the survey.

Table 1. Watersheds of the SMC survey.

Watershed			Counties
Los Angeles Region			
	VEN	Ventura River	Ventura County
	SCL	Santa Clara River	Ventura and Los Angeles Counties
	CAL	Calleguas Creek	Ventura County
	SMB	Santa Monica Bay	Ventura and Los Angeles Counties
	LAR	Los Angeles River	Los Angeles County
	SGR	San Gabriel River	Los Angeles and Orange Counties
Santa Ana			
	LSA	Lower Santa Ana	Orange and Riverside Counties
	MSA	Middle Santa Ana	Riverside and San Bernardino Counties
	USA	Upper Santa Ana	Riverside and San Bernardino Counties
	SJC	San Jacinto River	Riverside County
San Diego			
	SJU	San Juan Creek	Orange, Riverside and San Diego Counties
	NSD	Northern San Diego	Riverside and San Diego Counties
	CSD	Central San Diego	San Diego County
	MBSD	Mission Bay and San Diego River	San Diego County
	SSD	Southern San Diego	San Diego County

KEY PARTNERS

Several SMC member and non-member agencies or programs directly contribute to the SMC stream survey (Table 2). Contribution levels of stormwater agencies are determined by monitoring requirements in their permits, whereas the contributions of regulatory agencies are based on discretionary funding or funding from the Surface Water Ambient Monitoring Program (SWAMP). Contributions from permittees may change if their permit requirements are modified over the course of the survey. In many cases, these partners participate on behalf of co-permittees in their regions.

Table 2. Agencies contributing to the SMC stream survey.

Agency	Expected contribution over 5 years (# sampling events)
Stormwater agencies	
Ventura County Watershed Protection District	75
Los Angeles County Flood Control District	35
Los Angeles River Watershed Monitoring Program	30
San Gabriel River Regional Monitoring Program	30
Orange County Public Works	40
Riverside County Flood Control and Water Conservation District on behalf of Riverside County Co-Permittees (combined)	30
San Diego County Watershed Management Areas (WMAS, combined)	80
San Bernardino County Department of Public works	18*
Regulatory agencies	
Regional Water Quality Control Board – Los Angeles	60**
Regional Water Quality Control Board – Santa Ana	65**
Regional Water Quality Control Board – San Diego	30**
Surface Water Ambient Monitoring Program	Direct support for algal taxonomic analysis and quality assurance
Total	**487**

*San Bernardino County Department of Public Works is participating in the survey for three years (2023 to 2025), contributing 6 sites per year.

** Until this year, the Regional Water Quality Control Boards contributed to the SMC program using regional SWAMP funds. As of 2025, those funds are no longer available. Thus, regional board support for the SMC program is reduced until other resources can be identified.

SURVEY ELEMENTS

There are five major elements to this cycle of the SMC stream survey:

1. Condition estimates of stream condition, made at one-time visits to probabilistic sites
2. Trend estimates, made at revisits to a set of previously sampled probabilistic sites
3. Estimates at under-sampled areas of interest, made at sites located in areas that have little data about stream condition
4. Causal assessments at sites in poor condition
5. Wet-dry mapping in catchments with poorly characterized hydrologic regimes

Each element is described below.

Committed and uncommitted elements

This workplan describes the elements of a regional stream survey that SMC members have identified as priority needs. However, these priorities outstrip available resources, and in some cases go beyond permit requirements of some participants. Therefore, the SMC commits to collecting data for some of these elements, identified as **committed elements** below. In contrast, **uncommitted elements** may be implemented if additional resources become available, or non-SMC partners wish to contribute to the program.

Each SMC participant commits to one or more survey elements, based on agency priorities and permit requirements. Because these priorities and requirements may change, the SMC will re-evaluate these commitments on an annual basis. Table 3 summarizes the expected contribution each program element. Participants may alter their allocations on an annual basis (e.g., shifting sites from one study to another, or one watershed to another), with the approval of the SMC technical workgroup.

Note: Table 3 describes the anticipated and past contributions of each SMC participant, and it should not be used to assess compliance with monitoring requirements in permits.

Table 3. Expected number of samples contributed to each survey elements by participant and watershed over 5 years. 5Y: Number of samples planned to be collected over the 5 years of the survey. ACH: Number of samples collected so far. 24: Number of samples planned for sampling in 2024. Targeted: Target under-sampled areas or stream types. Causal: Causal assessment. Wet-Dry: Wet-dry mapping. 5Y: Number of samples allocated over the entire 5-year survey. ACH: Samples achieved as of the end of the 2023 sampling season. 24: Number of samples expected to be collected in 2024. Watershed abbreviations are presented in Table 1. LARWMP: Los Angeles River Watershed Monitoring Program. SGRRMP: San Gabriel River Regional Monitoring Program. RB4: Regional Water Quality Control Board – Los Angeles. RB8: Regional Water Quality Control Board – Santa Ana. RB9: Regional Water Quality Control Board – San Diego. *: Condition sites within Riverside County are not stratified within the Santa Ana region, and numbers in this table reflect a region- and county-wide total, rather than a planned distribution of effort. Ventura: Ventura County Watershed Protection District. Los Angeles: Los Angeles Public Works. LARWMP: Los Angeles River Watershed Monitoring Program. SGRRMP: San Gabriel River Regional Monitoring Program. Orange: Orange County Public Works. San Bernardino: San Bernardino County Public Works Department. RCFC&WCD: Riverside County Flood Control and Water Conservation District. San Diego WMAs: San Diego County Watershed Management Areas. Note: Some sampling events may serve dual purposes (e.g., trend sites that are also used in causal assessments); these sampling events are only counted once in this table.

		Overall			Condition			Trend			Causal			Targeted			Wet-Dry		
Participant	**Watershed**	**5Y**	**ACH**	**25**	**5Y**	**ACH**	**25**	**5Y**	**ACH**	**25**	**5Y**	**ACH**	**25**	**5Y**	**ACH**	**25**	**5Y**	**ACH**	**25**
Ventura	All	75	60	15	23	20	3	52	40	12	0	0	0	0	0	0	0	0	0
Ventura	VEN	36	26	10	9	8	1	23	14	9	0	0	0	0	0	0	0	0	0
Ventura	SCL	15	12	3	5	4	1	11	9	2	0	0	0	0	0	0	0	0	0
Ventura	CAL	20	18	2	9	8	1	14	13	1	0	0	0	0	0	0	0	0	0
Ventura	SMB	4	4	0	0	0	0	4	4	0	0	0	0	0	0	0	0	0	0
Los Angeles	All	35	24	11	11	9	2	17	9	8	4	4	0	1	0	1	0	0	0
Los Angeles	SCL	12	9	1	6	5	1	9	4	5	0	0	0	0	0	0	0	0	0
Los Angeles	SMB	13	9	3	5	4	1	8	5	3	0	0	0	1	0	1	0	0	0
Los Angeles	LAR	10	2	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0
LARWMP	LAR	60	49	11	19	15	4	40	33	7	0	0	0	1	1	0	0	0	0
SGRRMP	SGR	106	85	21	25	13	12	50	47	3	30	18	12	7	7	0	0	0	0
Orange	All	40	37	3	14	14	0	15	15	0	0	0	0	8	5	3	3	3	0
Orange	LSA	20	18	2	8	8	0	9	9	0	0	0	0	3	1	2	0	0	0
Orange	SJU	20	19	1	6	6	0	6	6	0	0	0	0	5	4	1	3	3	0
San Bernardino	All	18	12	6	8	6	2	6	2	4	0	0	0	2	2	0	0	0	0

San Bernardino	MSA	9	6	3	4	3	1	3	1	2	0	0	0	1	1	0	0	0	0
San Bernardino	USA	9	6	3	4	3	1	3	1	2	0	0	0	1	1	0	0	0	0
RCFC&WCD	All	30.5	28	2.5	4	4	0	14	13	0	2	2	0	7.5	6.5	1	2.5	2	0.5
RCFC&WCD	RB8*	20.5	19.5	1	3	3	0	9	8	1	2	2	0	4.5	4.5	0	2	2	0
RCFC&WCD	RB9* (NSD)	10	8.5	1.5	1	1	0	5	5	0	0	0	0	3	2	1	0.5	0	0.5
San Diego WMAs	All	80	64	16	20	16	4	40	32	8	12	12	0	8	8	0	0	0	0
San Diego WMAs	NSD	20	16	4	5	4	1	10	8	2	3	3	0	2	2	0	0	0	0
San Diego WMAs	CSD	20	5	2	5	2	0	10	0	0	3	0	0	2	2	0	0	0	0
San Diego WMAs	MBSD	20	6	1	5	1	0	10	0	0	3	0	0	2	2	0	0	0	0
San Diego WMAs	SSD	20	11	4	5	3	1	10	6	2	3	1	0	2	2	0	0	0	0
RB4	All	84	84	0	1	1	0	59	59	0	0	0	0	24	24	0	0	0	0
RB4	VEN	8	8	0	0	0	0	8	8	0	0	0	0	0	0	0	0	0	0
RB4	SCL	32	32	0	0	0	0	29	29	0	0	0	0	3	3	0	0	0	0
RB4	CAL	10	10	0	0	0	0	10	10	0	0	0	0	0	0	0	0	0	0
RB4	SMB	30	30	0	1	1	0	12	12	0	0	0	0	17	17	0	0	0	0
RB4	LAR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RB4	SGR	4	4	0	0	0	0	0	0	0	0	0	0	4	4	0	0	0	0
RB8	All	107	107	0	10	10	0	30	30	0	0	0	0	67	67	0	0	0	0
RB8	LSA	3	3	0	0	0	0	3	3	0	0	0	0	0	0	0	0	0	0
RB8	MSA	17	17	0	6	6	0	11	11	0	0	0	0	0	0	0	0	0	0
RB8	USA	79	79	0	4	4	0	8	8	0	0	0	0	67	67	0	0	0	0
RB8	SJC	8	8	0	0	0	0	8	8	0	0	0	0	0	0	0	0	0	0
RB9	All	89	71	18	0	0	0	0	0	0	2	1	1	87	70	17	0	0	0
RB9	SJU	20	15	5	0	0	0	0	0	0	0	0	0	20	15	5	0	0	0
RB9	NSD	12	7	5	0	0	0	0	0	0	0	0	0	12	7	5	0	0	0
RB9	CSD	20	18	2	0	0	0	0	0	0	0	0	0	20	18	2	0	0	0
RB9	MBSD	8	5	3	0	0	0	0	0	0	1	0	1	7	5	2	0	0	0
RB9	SSD	29	26	3	0	0	0	0	0	0	1	1	0	28	25	3	0	0	0

*Samples designated as “RB8” may be collected from the Upper Santa Ana, Middle Santa Ana, or San Jacinto watersheds. Samples designated as RB9 may be collected from the Northern San Diego or San Juan watersheds.

Condition estimates

Condition estimates are made by collecting bioassessment samples at probabilistically selected sites from a sample frame representing streams in the region.

Sampling frame

The sampling frame is the stream network represented by the National Hydrography Dataset (NHD Plus) (McVay et al. 2014) within the three Southern Californian regional boards, as modified for use by the Perennial Stream Assessment. Streams on the Channel Islands, on Camp Pendleton, and on Miramar military lands are excluded because of limited access.

The sampling frame was divided into strata based on agency jurisdictions, as well as other units of interest. Watersheds and land use classifications follow the designations used by the Perennial Stream Assessment.

Sample draw

For the 2021-2025 cycle, the SMC will continue to use the sample draw it created for the previous survey (Mazor 2015). For the condition estimate, sites are selected from the sample frame using a spatially balanced design (Stevens and Olsen 2004). Each agency will have its own sample draw, and most agencies will have multiple strata, each with their own list of sites to evaluate. Every stratum will also have an extensive oversample to allow replacement of unsampleable sites. These sample draws will implement multi-density intensifications for certain stream types; specifically, higher order streams and agricultural streams will be weighted to improve representation of these scarce and/or frequently rejected stream types. These sampling strata are shown in the map below (Figure 1, Table 1). The final distribution of sites will depend on the sampling success rate, but is expected to range from 5 to 12 sites per watershed over the course of 5 years. Previous SMC surveys sought to collect data from 30 sites in each watershed over 5 years; however, this current survey will redirect resources towards other prioritized survey elements. Thus, a number of condition sites in each watershed are **uncommitted** elements.

The condition site sample draw is included in Appendix A.

Selecting sites from the sample draw

The sample draws are sorted into draws for each agency, subdivided into watersheds. Participants shall evaluate each site in numerical order, from smallest to largest, evaluating sites for the following factors:

- Stream status: Is the target location on or near a stream channel? Exclude tidal creeks, reservoirs, pipelines, and other non-stream habitats. Agricultural canals and conveyances that exhibit signs of bidirectional flow may be excluded as non-streams.
- Flow status: Is the stream perennial or intermittent? Is it sufficient to conduct sampling?
- Wadeability status: Is the stream wadeable?
- Physical access status: Can the reach be safely accessed by a field crew?
- Landowner permission status: Has the landowner granted permission for access?

Results of these evaluations are submitted on an annual basis at the end of the sampling season. Participants go down the list of sites as far as needed to obtain the intended number of condition sites. The following year, participants continue at the same point on the list they stopped at the previous year.

The intended number of condition sites in each watershed is provided to each participant along with the sample draw. These numbers reflect five-year total numbers of intended condition sites; participants are advised to sample a consistent number of condition sites in each year.

Fully hardened channels

There are no categorical exemptions for fully hardened (concrete) channels from condition assessments. However, once a participant has sampled **one** condition site in a concrete channel in a watershed, subsequent condition sites in the sample draw falling in concrete channels in that watershed may be skipped. Site evaluation data (e.g., indications of whether a site is wadeable, flowing, accessible, etc.) for these "skipped" sites is still required. These will be treated as "target not sampled" sites in ambient assessments.

Sampling period

Condition sites (and all sites with bioassessment sampling) shall be sampled within the appropriate index period for southern California, in accordance with the SWAMP bioassessment protocol (Ode et al. 2017). In a year with typical precipitation, sampling should take place between April 15 and July 15. The sampling period may be delayed and extended in wet years with late rainfall or moved earlier in dry years. Ideally, samples are collected at least 4 weeks after the most recent storm event that elevates flows sufficient to cause streambed scour. Samples should not be collected from reaches where flows are insufficient to follow the standard SOP (e.g., reaches that are partially dry, or entirely stagnant).

Participants will determine whether they wish to sample all condition sites in a single year, or to distribute them across the 5 years of the survey.

Analytes measured at condition sites

Sampled parameters are described in this section. Details about methods, protocols, and quality assurance are provided in the appendix. At the Executive Committee's discretion, this list of recommended parameters may be modified if they believe it is appropriate. Except where indicated, all SMC participants are expected to sample all parameters. Table 4 summarizes commitments to sample analytes at condition sites. Table 5 and Table 6 summarize sample handling guidelines and relevant reporting limits. Unless otherwise indicated, the SMC commits to measuring these analytes at all condition sites.

Table 4. Analytes and commitments to collect or analyze samples at condition sites

Analyte		Requirement at condition sites
Biological indicators		
	Benthic macroinvertebrate taxonomy	Collect and analyze samples at every site-visit
	Diatom taxonomy	Collect and analyze samples at every site-visit
	Soft-bodied algae taxonomy	Collect samples and archive at SCCWRP (optional)

	Benthic algae samples for molecular analysis	Collect samples and archive at SCCWRP
	Vertebrate observations	Record data at every site-visit
	eDNA water samples	Uncommitted
Habitat		
	Full Physical Habitat protocol	Conduct protocol at every site-visit
	Hydromodification screening protocol	Conduct protocol at every site-visit
	California Rapid Assessment Method	Conduct protocol at every site-visit
	Channel engineering	Conduct protocol at every site-visit
	Hydrologic state	Conduct protocol at every site-visit
	Water presence loggers	Uncommitted
Sediment chemistry		
	Grain size	Uncommitted
	Total organic content	Uncommitted
	Pyrethroid pesticides	Uncommitted
	Cyanotoxins	Uncommitted
	Nutrients	Uncommitted
	Other constituents of emerging concern (CECs)	Uncommitted
Water chemistry		
	Conventional analytes and major ions	Collect and analyze samples at every site-visit
	Total suspended solids	Collect and analyze samples at every site-visit
	Nutrients	Collect and analyze samples at every site-visit
	Cyanotoxins	Uncommitted
Benthic algae biomass		
	Chlorophyll-a	Collect and analyze samples at every site-visit
	Ash-free dry mass	Collect and analyze samples at every site-visit
	Cyanotoxins	Uncommitted
Geospatial information		
	Watershed delineations, points	Generate for every site

Biological indicators

Benthic macroinvertebrates shall be sampled using standard SWAMP protocols (i.e., Ode et al. 2016). The reach-wide method shall be used in all cases; in low-gradient (<~1% slope), sandy streams the margin-center-margin modification may be used at the discretion of the field crew. Replicate samples are collected at 10% of sites. Data shall be submitted using standard SMC taxonomic data formats. All samples shall be identified to SAFIT Level 2, with a target count of 600 organisms.

Benthic diatoms and soft algae shall be sampled using standard SWAMP protocols (i.e., Ode et al. 2016). Qualitative samples are not required. Replicate samples are collected at 10% of sites. Data shall be submitted using standard SWAMP taxonomic data formats. Diatom samples shall be subject to taxonomic analysis and identified to the level specified in the diatom standardized taxonomic effort (Theroux et al. 2019). Samples for soft-bodied algal taxonomic analysis and for molecular analysis shall be collected and archived at SCCWRP; there is **no commitment** to lab analyses of these samples.

Benthic algae biomass (both ash-free dry mass and chlorophyll a) shall be sampled using standard SWAMP protocols (Ode et al 2016). Replicates shall be collected at 10% of sites; field blanks are also recommended. These data shall be submitted (in units of mass per area) using standard SMC chemistry data formats.

Molecular analysis of benthic algal biofilm. An aliquot of the composite algae sample may be saved for molecular analysis. Samples will undergo DNA extraction and will be analyzed with a DNA metabarcode sequencing approach that targets up to three DNA barcode regions (e.g., 16S, 18S, and rbcL). These three barcode regions allow for the identification of both prokaryotes and eukaryotes, including cyanobacteria, soft-bodied algae, diatoms, and metazoa. The raw DNA sequence data will be processed through bioinformatic workflows and compared against DNA reference libraries for taxonomic assignment. These data will be used to support the development of a molecular ASCI and other bioassessment tools. The SMC will **commit** to collect these samples and archive them at SCCWRP. There is **no commitment** to analyze these samples. Arrangements for archiving samples at SCCWRP may be made by contacting Jeff Brown (jeffb@sccwrp.org) or Susanna Theroux (susannat@sccwrp.org).

Molecular analysis of eDNA samples. Water column environmental DNA (eDNA) samples may be collected at any sites for future DNA metabarcode sequencing or quantitative PCR (qPCR) analysis of target taxa including invasive, endangered, or rare species. Water samples should be collected following the California Molecular Methods Workgroup water eDNA protocol (LINK). Samples will undergo DNA extraction and will be analyzed with either a DNA metabarcode sequencing approach (similar to the analysis of benthic algal biofilms, described above), or a targeted analysis such as quantitative PCR (qPCR) using species-specific probes (e.g., for native fish and amphibians, or invasive species). These data will be used to assess distributions of species of interest, to better understand the propagation of eDNA in the environment, and to explore the value of eDNA methods as a complement to traditional bioassessment sampling. There is **no commitment** to collect or analyze these samples. Participants may wish to collect these samples and archive them at SCCWRP by contacting Jeff Brown (jeffb@sccwrp.org) or Susanna Theroux (susannat@sccwrp.org).

Vertebrate observations are made opportunistically at every field visit where time allows. Vertebrates (invasive species in particular) observed during sampling or reconnaissance operations are reported using the SMC standard reporting form.

Habitat

Physical habitat (PHAB) shall be assessed using the standard SWAMP protocol (Ode et al 2016). The "full" suite of PHAB parameters shall be measured at every sampling event. Data shall be submitted using the SWAMP PHAB Data entry tool.

CRAM assessments shall be conducted using standard CRAM protocols (Riverine Field Book version 6.1). Replication is not required. Data shall be submitted to eCRAM.

Water presence loggers are not required at condition sites because they require more visits than is normally planned in the course of bioassessment sampling. Various types of loggers may be used to assess streamflow duration: pressure transducers, wildlife cameras, and stream temperature, intermittency and conductance (STIC) loggers, have all been effectively used to determine the presence or absence of surface flow. Costs range from <$100 (for STIC loggers) to $1000 (for paired pressure transducers, used to assess water level). Loggers should not be deployed in unsuitable locations (e.g., high traffic areas, or areas prone to extreme scour during winter storms).

Trash monitoring shall be assessed using the standard trash submission guidance document. Data can be submitted using the trash submission template.

Hydromodification data are collected according to the hydromod submission guide, and reported using the hydromod data submission template.

Hydrologic state shall be collected opportunistically, on every field visit (recon and sample collection of other analytes), where practical, using the SMC standard reporting form.

Channel engineering shall be collected at every site visit where it has not been previously assessed. Data shall be reported using the SMC standard reporting form.

Water chemistry

Core *water chemistry* analytes include nutrients, major ions, solids, and conventional analytes. Nutrients include total N, total P, ammonia-N, nitrate-N, nitrite-N, and orthophosphate-P. Major ions and conventional analytes include total suspended solids, alkalinity as $CaCO_3$, hardness as $CaCO_3$, chloride, sulfate, sodium, calcium, magnesium, chemical oxygen demand, turbidity, specific conductance, dissolved oxygen, pH, and temperature. Specific analytes and recommended reporting limits for the parameters listed above are presented in the tables below.

Cyanotoxins

Samples may be collected for the analysis of cyanotoxins, which can be measured in water, benthic algae, and sediments. Priority cyanotoxins are microcystins, cylindrospermopsin, and anatoxin-a, which currently have recreational guidance thresholds in California. The collection of water samples, surface scums and algal mats should follow the protocols outlined in the SWAMP HAB Field Guide for Sample Collection for Toxin Analysis. The collection of sediments should follow the sediment chemistry guidance below. Water and benthic algae (i.e., algal mats) samples can be analyzed with ELISA or LC-MS/MS, as long as target reporting levels are achieved (Table 5); sediment samples should be analyzed with LC-MS/MS.

Time-integrated concentrations of cyanotoxins can also be evaluated using *in situ* passive samplers. Solid phase adsorption toxin testing (SPATT) and organic diffusive gradients in thin films (o-DGT) samplers can be deployed for periods of 1-4 weeks to provide semi-quantitative, time-integrated estimations of microcystins, cylindrospermopsin, and/or anatoxin-a. Deployment and handling of SPATT samplers are outlined in Howard et al. 2018. Deployment and handling of o-DGT samplers are outlined in Du et al. (2020). Passive sampler extracts should be analyzed with LC-MS/MS.

There is **no commitment** to collecting or analyzing cyanotoxin samples at this time.

Sediment chemistry and toxicity

Sediments may be collected at sites where sufficient fine-grained sediment (i.e., silts and clays) are present. In general, labs require at least 750 mL of sediments for analysis; if only a small volume of sediment can be collected, analyses should prioritize chemistry over toxicity. Crews should collect sediment within the reach, but if necessary, may be collected up to 10 m up- or down-stream of the bioassessment reach. Each sample should be analyzed for grain size, total organic carbon, pyrethroid pesticides. If appropriate, sediment samples can also be analyzed for more CECs such as cyanotoxins, fipronil, and toxicity with *Hyallela azteca* (15°C or 23°C) or *Chironomus dilutus* (23°C). In addition, sediment samples can also be performed suspect screening and non-targeted analysis (NTA) for novel organic contaminants or causal chemicals to biological impacts. Bioavailable fraction (i.e., freely dissolved concentration) of CECs can be measured with *ex situ* passive sampling method in the laboratory. The extract of the *ex situ* passive samplers can be further used in suspect screening/NTA and cell assay tests. There is **no commitment** to collect or analyze sediment samples at this time.

Geospatial information

Participants shall generate shapefiles consisting of *watershed delineations* and sampling locations at every site where bioassessment samples are collected, following the steps in Boyle et al. 2020. Shapefile attribute table variables should be formatted according to the Shapefile Submission Guide, and uploaded to the SMC database using the SMC checker. SCCWRP personnel will review the submitted shapefiles for completeness and basic GIS checks and approve files to be archived in the SMC database. Submitting agencies will be notified if a shapefile is rejected.

Table 5. Sample holding guidelines for major analytes. These guidelines are not intended to supersede laboratory recommendations. Max RL Maximum reporting limits.

Table 5a. Water and sediment chemistry analytes. Asterisks indicate analytes that may be measured in the field, as well as in the lab.

Analyte	Max RL	Container type	Holding time	Holding conditions
Water chemistry				
Conventional analytes and major ions				
Suspended solids	1 mg/L	Polyethylene	7 days	Cool to ≤ 6°C
Alkalinity as $CaCO^3$*	5 mg/L	Polyethylene	14 days	Cool to ≤ 6°C
Hardness as $CaCO^3$	5 mg/L	Polyethylene	6 months	Cool to ≤ 6°C; HNO_3 or H_2SO_4 to pH < 2
Chloride	1 mg/L	Polyethylene	28 days	Room temperature OK
Sulfate	1 mg/L	Polyethylene	28 days	Cool to ≤ 6°C
Magnesium	0.1 mg/L	Polyethylene	28 days	Room temperature OK
Sodium	10 mg/L	Polyethylene	28 days	Room temperature OK
Calcium	0.1 mg/L	Polyethylene	28 days	Room temperature OK
Chemical oxygen demand	10 mg/L	Glass	28 days	H_2SO_4 to pH ≤ 2, cool to 4°C
Turbidity*	1 NTU	Polyethylene	48 hours	Cool to ≤ 6°C
Specific conductance*	1 uS/cm	Polyethylene	48 hours	Room temperature OK
Dissolved oxygen	0.1 mg/L	NA	NA	Measured in field
Temperature	0.1 °C	NA	NA	Measured in field
pH*	0.1 units	Polyethylene	48 hours	Cool to ≤ 6°C
Nutrients				
Ammonia as N	0.1 mg/L	Polyethylene	48 hours; 28 days if acidified	Cool to ≤ 6°C; H_2SO_4 to pH < 2
Nitrogen,Total	0.2 mg/L	Polyethylene	28 days	Cool to ≤ 6°C; H_2SO_4 to pH < 2
Nitrate + Nitrite as N	0.1 mg/L	Polyethylene	48 hours; 28 days if acidified	Cool to ≤ 6°C; H_2SO_4 to pH < 2
Phosphorus as P	0.05 mg/L	Polyethylene	28 days	Cool to ≤ 6°C; H_2SO_4 to pH < 2
OrthoPhosphate as P	0.05 mg/L	Polyethylene	48 hours	Cool to ≤ 6°C
Nitrite as N	0.1 mg/L	Polyethylene	48 hours; 28 days if acidified	Cool to ≤ 6°C; H_2SO_4 to pH < 2

Analyte	Max RL	Container type	Holding time	Holding conditions
Nitrogen, Total Kjeldahl	0.1 mg/L	Polyethylene	7 days; 28 days if acidified	Cool to $\leq$ 6°C; H_2SO_4 to pH < 2
Benthic algae biomass				
Ash-free dry mass	1 g/m^2	Glass-fiber filter within petri dish, wrapped in aluminum foil	28 days	Freeze to -20°C
Chlorophyll-a	10 mg/m^2		28 days	Freeze to -20°C
Cyanotoxins				
In water				
Microcystins	0.1 µg/L	Amber glass or dark HDPE	48 hours at 4°C; 6 months of -20°C; long term if -80°C	Freeze to -20°C
Cylindrospermopsin	0.05 µg/L	Amber glass or dark HDPE	48 hours at 4°C; 6 months of -20°C; long term if -80°C	Freeze to -20°C
Anatoxin-a	0.1 µg/L	Amber glass or dark HDPE	48 hours at 4°C; 6 months of -20°C; long term if -80°C	Freeze to -20°C
In sediment				
Microcystins	0.1 ng/g	250-mL Chem 300-series amber glass jars with Teflon lid-liner; pre-cleaned	48 hours at 4°C; 6 months of -20°C; long term if -80°C	Freeze to -20°C
Cylindrospermopsin	0.05 ng/g	250-mL Chem 300-series amber glass jars with Teflon lid-liner; pre-cleaned	48 hours at 4°C; 6 months of -20°C; long term if -80°C	Freeze to -20°C
Anatoxin-a	0.1 ng/g	250-mL Chem 300-series amber glass jars with Teflon lid-liner; pre-cleaned	48 hours at 4°C; 6 months of -20°C; long term if -80°C	Freeze to -20°C

Analyte	Max RL	Container type	Holding time	Holding conditions
In benthic algae				
Microcystins	0.1 ng/g	Amber glass or dark HDPE	24 hours at 4°C; 6 months of -20°C; long term if -80°C	Freeze to -20°C
Cylindrospermopsin	0.05 ng/g	Amber glass or dark HDPE	24 hours at 4°C; 6 months of -20°C; long term if -80°C	Freeze to -20°C
Anatoxin-a	0.1 ng/g	Amber glass or dark HDPE	24 hours at 4°C; 6 months of -20°C; long term if -80°C	Freeze to -20°C
In passive samplers				
Microcystins	0.1 µg/L	Dry in ziplock bag or whirlpak	48 hours at 4°C; long term if <-20°C	Freeze to -20°C
Cylindrospermopsin	0.05 µg/L	Dry in ziplock bag or whirlpak	48 hours at 4°C; long term if <-20°C	Freeze to -20°C
Anatoxin-a	0.1 µg/L	Dry in ziplock bag or whirlpak	48 hours at 4°C; long term if <-20°C	Freeze to -20°C
Sediment chemistry				
Total organic content (TOC)	See Table 6	250-mL glass jar	28 days at 4°C or 12 months at -20°C	Cool to 4°C or freeze to -20°C; dark
Grain size		250-mL glass jar (may be same as for TOC)	28 days at 4°C	Cool to 4°C; dark. Do not freeze.
Organics (e.g., CECs)		Two 250-mL Chem 300-series amber glass jars with Teflon lid-liner; pre-cleaned	14 days at 4°C or 12 months at -20°C	Cool to 4°C, or freeze to -20°C; dark

Table 5b. Field measurements

Parameter	Resolution	Calibration or check frequency
Dissolved oxygen	0.01 mg/L	Daily, or change in 500 m elevation

pH	0.01 pH units	2-point calibration, per manufacturer
Specific conductance	1 uS/cm	Per manufacturer
Temperature	0.1°C	Per manufacturer
Turbidity	0.1 NTU	2-point calibration, per manufacturer
Velocity (flow meter)	0.1 ft/s	Per manufacturer

Table 6. Analyte methods and reporting limits for sediment analysis

Analyte	Method	Modification for methods?	Reporting Level
TOC	EPA 9060am	Yes – Uses TCD	NA
Grain size	Plumb, 1981 or SM 2560 D	None	1%
% Solids	EPA 1684		
Pyrethroids	EPA 3540C followed by EPA 8270D by NCI-GCMS	Yes – Uses NCI and calibration checks differ	
Bifenthrin			0.25 ng/g
Cyfluthrin, total			1.25 ng/g
Cypermethrin, total			1.25 ng/g
Deltamethrin/ Tralomethrin			1.00 ng/g
Esfenvalerate/ Fenvalerate, total			0.50 ng/g
Fenpropathrin			0.25 ng/g
Permethrin, cis-			1.25 ng/g
Permethrin, trans-			2.5 ng/g
Cyhalothrin, lambda, total			0.50 ng/g
Fipronil			0.50 ng/g
CECs (screening)	Low- or High-Mass Resolution Mass Spectrometry		Varies
Toxicity			
Hyalella azteca (23°C)	US EPA (2000) 600/R-99/064		
Hyalella azteca (15°C)	US EPA (2000) 600/R-99/064	Yes, temperature	
Chironomus (23°C)	Granite Canyon-MPSL *Chironomus dilutus* sediment test SOP 2.1		

Trend sites

Trend sites are a subset of probabilistic sites that are revisited several times to determine if conditions are improving, degrading or stable. A probabilistic site must be visited over 3 separate years to be considered a trend site. For the SMC survey purposes, sites selected from targeted (rather than probabilistic) designs are not used for regional trend estimates.

The SMC survey will use a "panel" approach to sampling trend sites:

- Panel One: These probabilistic sites were visited three or more times as of 2020. A number of these sites (specified in Table 7) will be visited once over the 5 years of the present cycle (generally, in 2025). Sites that were determined to be in stable condition may be excluded from Panel One, if agreed to by the SMC workgroup as a whole.
- Panel Two: These probabilistic sites have been visited no more than twice as of 2020. Over the next 5-year cycle, a number of these sites (specified in Table 7) will be visited up to 4 more times (generally in 2021 to 2024).

For each sampling agency, a list of potential trend sites will be generated for each panel. Each list shall be evaluated in numeric order, which will preserve the spatial balance of the original sample draws.

For the trend estimates, the goal of having 30 sites sampled a minimum of 3 times in each watershed requires more sampling effort than the SMC is able to commit to. Therefore, a large number of trend sites are **uncommitted**.

Selecting trend sites from the sample draw

The sample draws are sorted into draws for each agency, subdivided into lists called Panel 1 or Panel 2. Panel 1 sites are those that have been sampled in 3 or more years, and need only be sampled once more over the 5-year course of the survey. Panel 2 sites are those that have been sampled less frequently, and should be visited up to 4 more times to improve trend estimates.

Participants shall evaluate each list in order. In most years, they evaluate Panel 2 list, evaluating sites in order to identify the intended number of sampleable sites. In subsequent years, these sites should be revisited; if that site becomes unavailable and a replacement is needed, re-evaluate sites on the sample draw, beginning again at the top of the list.

In a year of the participant's choosing, they shall evaluate the Panel 1 list. In general, Panel 1 sites should be evaluated in the final year of the survey (i.e., 2025). If a list is depleted (that is, all sites are rejected) prior to achieving the intended number of samples, an alternative site may be identified by consulting Raphael Mazor (raphaelm@sccwrp.org).

The intended number of trend sites is provided to each participant along with the sample draw. These numbers reflect five-year total numbers of intended trend sites; participants are advised to sample a consistent number of trend sites in each year. The trend sampling effort is summarized in Table 7.

Fully hardened channels

There are no categorical exemptions for fully hardened (concrete) channels from trend assessments. Trend sites that were previously identified to be stable (hardened or otherwise) may be skipped at the participant's discretion if another trend site on the sample draw is available for sampling. Participants may also cease sampling a concrete channel in Panel 2 once a third sample has been obtained.

Table 7. Summary of trend sampling effort. Watershed abbreviations are explained in Table 1. LARWMP: Los Angeles River Watershed Monitoring Program. SGRRMP: San Gabriel River Regional Monitoring Program. RB4: Regional Water Quality Control Board – Los Angeles. RB8: Regional Water Quality Control Board – Santa Ana. RCFC&WCD: Riverside County Flood Control and Water Conservation District.

Participant	Panel	Watershed	Sites available	Targeted number of sites	Visits per site	5-year allocation (Number of samples)	Guidance
Los Angeles	1	SMB	4	1	1	1	Sample 1 site once
Los Angeles	1	SCL	1	1	1	1	Sample 1 site once
Los Angeles	2	SMB	11	2	4	8	Sample 2 sites 4 times each
Los Angeles	2	SCL	10	2	4	8	Sample 2 sites 4 times each
Ventura	1	CAL	3	1	1	1	Sample 1 site once
Ventura	2	CAL	8	3	4	12	Sample 3 sites 4 times each
Ventura	1	SCL	1	1	1	1	Sample 1 site once
Ventura	2	SCL	13	2	4	8	Sample 2 sites 4 times each
Ventura	2	SMB	5	1	4	4	Sample 1 sites 4 times each
Ventura	2	VEN	9	3	4	12	Sample 3 sites 4 times each
LARWMP	1	LAR	8	3	1	3	Sample 3 sites once each
LARWMP	2	LAR	24	3	4	12	Sample 3 sites 4 times each
SGRRMP	1	SGR	8	2	1	2	Sample 2 sites once each
SGRRMP	2	SGR	24	3	4	12	Sample 3 sites 4 times each
Orange	1	LSA	1	1	1	1	Sample 1 site once
Orange	2	LSA	31	2	4	8	Sample 2 sites 4 times each
Orange	1	SJU	2	2	1	2	Sample 2 sites once each
Orange	2	SJU	20	1	4	4	Sample 1 sites 4 times each
San Bernardino	2	MSA	10	1	3	3	Sample 1 site 3 times each
San Bernardino	2	USA	10	1	3	3	Sample 1 site 3 times each
RCFC&WCD	2	MSA	11	1	3	3	Sample 1 sites 3 times each
RCFC&WCD	1	SJC	1	1	1	1	Sample 1 site once
RCFC&WCD	2	SJC	13	1	4	4	Sample 1 sites 4 times each
RCFC&WCD	1	NSD	1	1	1	1	Sample 1 site once
RCFC&WCD	2	NSD	5	1	4	4	Sample 1 sites 4 times each

San Diego	1	NSD	3	2	1	2	Sample 2 sites once each
San Diego	2	NSD	12	2	4	8	Sample 2 sites 4 times each
San Diego	1	CSD	3	2	1	2	Sample 2 sites once each
San Diego	2	CSD	17	2	4	8	Sample 2 sites 4 times each
San Diego	2	MBSD	11	2	5	10	Sample 2 sites 5 times each
San Diego	1	SSD	3	2	1	2	Sample 2 sites once each
San Diego	2	SSD	11	2	4	8	Sample 2 sites 4 times each
RB8	1	USA	2	2	1	2	Sample 2 sites once each
RB8	2	USA	11	2	5	10	Sample 2 sites 5 times each
RB8	1	MSA	1	1	1	1	Sample 1 site once
RB8	2	MSA	2	2	5	10	Sample 2 sites 5 times each
RB8	2	SJC	0	2	5	10	Sample 2 sites 5 times each
RB4	2	CAL	2	2	4	8	Sample 2 sites 4 times each
RB4	1	SCL	11	3	1	3	Sample 3 sites once each
RB4	2	SCL	10	2	4	8	Sample 2 sites 4 times each
RB4	1	SMB	2	2	1	2	Sample 2 sites once each
RB4	2	SMB	2	1	4	4	Sample 1 sites 4 times each
RB4	2	VEN	3	2	4	8	Sample 2 sites 4 times each

Sampling period

Trend sites have the same sampling period as condition sites.

Analytes

With the following exceptions and modifications, the analytes measured at sampling events at trend sites shall be the same as analytes measured at condition sites:

CRAM shall be measured at every trend site visit. It may be skipped if the trend site was visited in the previous year, and there have been no major changes in site conditions (e.g., no major channel-altering storms or wildfires in the watershed). Typically, CRAM is needed only once in fully hardened channels.

Hydromodification screening shall be measured at every trend site visit. It may be skipped if the trend site was visited in the previous year, and there have been no major changes in site conditions (e.g., no major channel-altering storms or wildfires in the watershed). Typically, hydromodification screening assessment is needed only once in fully hardened channels.

Channel engineering data typically does not change from year to year, and therefore need not be assessed at trend sites if previously collected data are available.

Water presence loggers are required at trend sites that meet the reference criteria described in Ode et al. (2016), as identified in the trend site sample draw. Loggers are not needed at “Panel 1” sites, because multiple visits aren’t anticipated at these sites. Sites that lack suitable locations for deployment or have alternative sources of hydrologic data (e.g., a nearby USGS gauge) do not need to have loggers deployed.

Geospatial information is generally not needed for trend sites, as this information should already be available at all condition sites.

SPECIAL STUDIES

Improving biological conditions in modified channels: Impacts of channel maintenance activities

Why is this a priority study?

The SMC has funded a special study (project 5.3) to develop a framework for improving biological conditions in modified channels, with the intention of partly supporting this effort through in-kind contributions of data at sites sampled under the SMC stream survey.

Fully and partially engineered channels can have significantly lower bioassessment index scores as compared to natural streams. At the same time, the SMC data and other studies have observed high index scores in certain partially engineered channels, but it is unclear what sets the biological condition in some engineered channels apart from other engineered channels, and what attributes can contribute to this biological potential.

There are a number of ways in which a natural stream channel can be physically modified including, but not limited to, channel straightening, channel-hardening, drop structures, flow dissipators, impoundments, and flow modification. Watershed based activities can also modify channel behavior such as increased imperviousness that alters runoff flow and volume, and contributions of pollutants that alters water quality. Finally, stream channel maintenance activities to manage streamflow volumes during storm events can modify streams including sediment removal, plant management, or vector control.

The challenges associated with managing biological potential in streams with modifications is reaching a turning point, as bioassessment tools are increasingly incorporated in statewide and regional regulations and programs. With biointegrity policies in place or in development, all of the SMC members – including both regulated and regulatory members – are going to be faced with decisions about protecting biological conditions in streams while also maintaining stream channels for flood protection and other uses.

Due to challenges with finding appropriate sites to sample, the study's previous focus on channel maintenance activities has been deferred. Instead, the study will focus on relatively high-scoring modified channels. Understanding the factors that contribute to these high scores could provide managers with insights on how to improve biological conditions in other modified channels. We will revisit previously sampled high-scoring modified channels to confirm that relatively good conditions are supported, and sample stressors to identify factors that distinguish high-scoring channels from other modified channels. Stressors will focus on temperature (measured through deployment of data loggers) and pesticides in sediment (soft bottom channels only). These stressors will also be measured in lower scoring but similarly modified comparator sites to see if these stressors explain differences in observed CSCI scores.

For the purposes of this study, "high scoring" means that, relative to a subpopulation of streams (e.g., hard-bottom channels within a certain county), a site has a relatively high CSCI score; these sites do not necessarily meet thresholds based on CSCI scores at reference sites (e.g., 0.79).

The highest scoring modified streams in one county may have substantially lower scores than similarly modified streams in another county, which may be due to the number of streams for which data are available. For this study, "lower scoring" means that a site has a substantially lower CSCI score (ideally, difference ≥ 0.1) than a similarly modified higher scoring site; sites with CSCI scores above 0.79 are not used as lower scoring sites in this study.

How sites are selected

We identified 5 or more bioassessment sites in modified channels with the highest CSCI scores within each region sampled by SMC participants (e.g., each county). These sites included both hard- and soft-bottom channels (soft-bottom channels with one hardened side were excluded because previous analyses have shown that they tend to behave similar to unmodified channels). Although these sites had relatively high CSCI scores, these scores may be below 0.79 (i.e., the 10^{th} percentile of scores at reference sites); thus, these higher scoring sites may fall into the "likely" or "very likely altered" category with CSCI scores between 0.5 and 0.7. Lists of candidate sites were distributed to SMC participants, each of whom selected a site to sample in 2024; in some cases, backup sites were also identified.

For each candidate site, we also identified potential lower-scoring comparator sites. These paired comparator sites met the following criteria:

- Within the same geographic area as the higher scoring site (i.e., could be sampled by the same participant)
- Similar modifications
- A CSCI score below 0.79 and a score below the higher scoring site (ideally, more than 0.1 points lower).
- Comparable to the high-scoring site (as defined by the methods described in Gillett et al. (2019).

Participants selected one candidate lower-scoring site (and in some cases, backup sites) to sample in 2024. Candidate sites are shown in Table 8. In some regions, the highest scoring sites in modified channels had very low CSCI scores (e.g., CSCI < 0.5), and thus no candidate sites were identified (e.g., the Santa Margarita portion of Riverside County); this lack of sites may reflect the low numbers of sites in modified channels with sufficient flow for sampling in that region, and may not indicate that conditions of modified channels there are particularly poor.

Table 8. Candidate sites for the SMC special study on high-scoring modified channels. HB: Hard-bottom channels. SB0: Soft-bottom channels with no hardened sides. SB1: Soft-bottom channels with one hardened side. SB2: Soft-bottom channels with two hardened sides. TBD: Sites have not yet been determined. RCFC&WCD: Riverside County Flood Control and Water Conservation District

Agency	SiteCode	Stream name	Class	Score status	Type	County	Watershed	Latitude	Longitude	# of samples	Most recent sample date	Min CSCI	Mean CSCI	Max CSCI
SGRRMP	SMC00236	Big Dalton Wash	HB	High	Primary	Los Angeles	San Gabriel	34.08951	-117.94783	3	7/8/2021	0.42	0.53	0.73
SGRRMP	SMC02656	Walnut Creek	HB	Low	Primary	Los Angeles	San Gabriel	34.07498	-117.87220	2	8/6/2018	0.46	0.54	0.62
SGRRMP	SMC01260	Walnut Creek	HB	Low	Backup	Los Angeles	San Gabriel	34.06502	-117.97473	2	8/5/2019	0.46	0.50	0.55
RB8	801STW258	San Timoteo Wash	SB0	High	Primary	San Bernardino	Upper Santa Ana	34.01399	-117.17834	4	6/9/2016	0.57	0.75	0.87
RB8	801STW055	San Timoteo Wash	SB0	Low	Primary	San Bernardino	Upper Santa Ana	34.03960	-117.21973	3	6/11/2014	0.54	0.67	0.76
RB4	403CE0188	Santa Paula Creek	SB2	High	Primary	Ventura	Santa Clara	34.35646	-119.04752	4	5/26/2016	0.52	0.72	0.93
RB4	404M07360	Medea Creek	SB2	Low	Primary	Ventura	Santa Clara	34.15459	-118.75848	2	6/8/2017	0.65	0.68	0.71
Ventura	403S00191	Santa Paula Creek	SB2	High	Primary	Ventura	Santa Clara	34.36762	-119.05380	2	7/12/2010	0.92	0.96	0.99
Ventura	SMC01860	Conejo Creek	SB2	High	Backup	Ventura	Calleguas Creek	34.22400	-118.97911	6	7/18/2022	0.49	0.67	0.82
LACFCD	404M07365	Rustic Creek	SB2	High	Primary	Los Angeles	Los Angeles	34.02441	-118.51361	1	6/27/2018	0.70	0.70	0.70
LACFCD	SGLT506	Walnut Creek	SB2	Low	Primary	Los Angeles	San Gabriel	34.06173	-117.99129	9	6/20/2022	0.35	0.52	0.59
LACFCD	LALT501		SB2	Low	Backup	Los Angeles	Los Angeles	34.08009	-118.22419	7	7/8/2020	0.58	0.69	0.78
LACFCD	LAR08599		SB2	Low	Backup	Los Angeles	Los Angeles	34.10602	-118.24338	6	7/21/2022	0.59	0.71	0.86
RCFC&WCD	SMC04749	Perris Valley Channel	SB2	High	Primary	Riverside	San Jacinto	33.85826	-117.21321	1	6/23/2009	0.61	0.61	0.61
RCFC&WCD	SMC32897	Perris Valley Channel	SB2	Low	Primary	Riverside	San Jacinto	33.86921	-117.21318	2	5/15/2014	0.40	0.48	0.56
San Diego	SMC01606	Rose Canyon	HB	High	Primary	San Diego	Mission Bay WMA	32.84200	-117.23500	1	5/26/2009	0.71	0.71	0.71
San Diego	SMC13062	Tecolote Creek	HB	Low	Primary	San Diego	Mission Bay WMA	32.77550	-117.19557	1	7/23/2013	0.55	0.55	0.55
San Diego	906M21770	Soledad Canyon	HB	Low	Backup	San Diego	Los Peñasquitos WMA	32.90376	-117.22665	1	5/29/2018	0.62	0.62	0.62
San Diego	SMC06458	Sweetwater trib	SB0	High	Primary	San Diego	Los Peñasquitos WMA	32.66901	-117.01724	1	6/6/2010	0.54	0.54	0.54
San Bernardino	801CYC121	City Creek	SB0	High	Primary	San Bernardino	Upper Santa Ana	34.12372	-117.19213	2	6/9/2007	0.63	0.71	0.78
San Bernardino	801PLC469	Plunge Creek	SB0	Low	Primary	San Bernardino	Upper Santa Ana	34.11160	-117.14689	5	6/19/2012	0.37	0.74	0.98
San Bernardino	801STW258	San Timoteo Wash	SB0	High	Backup	San Bernardino	Upper Santa Ana	34.01399	-117.17834	4	6/9/2016	0.57	0.75	0.87
Orange County	801SAR011	Santa Ana River	SB2	High	Primary	Orange	Lower Santa Ana	33.85899	-117.78347	1	6/15/2006	0.80	0.80	0.80
Orange County	801STC532	Santiago Creek	SB2	Low	Primary	Orange	Lower Santa Ana	33.77896	-117.83864	3	6/12/2012	0.18	0.40	0.71
Orange County	SMC01987	Aliso Creek	SB0	High	Primary	Orange	Aliso Creek	33.59028	-117.71185	2	6/15/2012	0.60	0.68	0.76
Orange County	SMC00910	Aliso Creek	SB0	Low	Primary	Orange	Aliso Creek	33.51383	-117.74426	3	4/29/2009	0.55	0.63	0.70
San Diego	SMC11430	Los Coches Creek	SB2	High	Primary	San Diego	San Diego River	32.84837	-116.86005	1	7/12/2012	0.87	0.87	0.87
San Diego	SMC00153	San Luis Rey	SB2	Low	Primary	San Diego	San Luis Rey	33.22193	-117.34610	3	6/8/2021	0.43	0.49	0.56

Frequency of sampling

shall be sampled once in 2024 during the normal sampling period (expected to be between May 15 and July 15).

Analytes to be measured

Sites sampled under this special study will have the same analytes measured as condition sites, described above (Table 4). The same analytes are measured at both the high- and low-scoring modified channel.

Sediment samples will be collected at every sampling event and evaluated for total organic content, as well as pesticide concentrations for analytes shown in Table 5 and meet the reporting levels specified in Table 6 (TOC, grain size, pyrethroids, and fipronil only).

Where practical, temperature loggers will be deployed at each site. Loggers should be deployed approximately 4 weeks prior to the intended sampling date (no less than 1 week). Loggers should target the likely coolest portion of the reach (e.g., shaded areas, deep pools); however, if loggers are being deployed to also track water level, they may be deployed in areas more suitable for that purpose (i.e., within the thalweg at the crests of riffles).

Analysis

Bioassessment index scores will be calculated to confirm biological conditions. We will compare stress levels at the high scoring site to appropriate, similarly modified comparators using rapid screening causal assessment (Gillett et al. 2023). Continuous temperature and sediment pesticide data require a different analytical approach because they will not be available at a sufficient number of sites to allow rapid screening causal assessment. Rather, these will be analyzed following a manual approach, comparing stress levels at the high scoring sites to their paired lower scoring sites. Stress from pesticides will be characterized by pesticide concentrations or detections. Stress from temperature will be characterized with metrics calculated from continuous temperature data (e.g., mean diel temperature range).

Other study elements

In addition to the data collection effort outlined above, this project includes analyses of historical data described below, under the direction of the project workgroup.

- Analysis of past channel maintenance activities. For all data collected from modified channels within the SMC region, we will investigate operations and maintenance records to determine whether any cleanout activities occurred prior to sampling. These data will be analyzed in conjunction with new data collected as described above. This study element has been deferred due to challenges in acquiring channel maintenance information.
- Update of rapid screening causal assessment tools for modified channels. We will apply rapid screening causal assessment tools to modified channels with poor bioassessment scores. We will explore ways to adapt the tools (e.g., by restricting comparator sites to sites with similar modifications). This will result in the identification of stressors contributing to poor conditions that go beyond the impacts resulting from channel

modification alone. At the same time, we will develop new analytical methods for including flow alteration in the rapid screening causal assessment toolkit.

Target under-sampled areas or stream types

Why is this a priority study?

Although the survey has covered extensive areas in the South Coast region through probabilistic sampling, some areas remain under-sampled. Some regions (such as high-elevation headwaters) are under-sampled due to difficult access and scarcity of intermittent or perennial streams. Other regions, such as Chollas Creek, are relatively small first-order streams that have high social importance yet represent only a small portion of the South Coast, and thus rarely come up on probabilistic sample draws. Targeting under-sampled regions can improve coverage and extend collective understanding of the conditions of streams in the region.

Collecting data in certain stream-types (rather than regions) may also have particular value to managers and may be included in this study. Examples of these stream types include soft-bottom engineered channels, and channels that have been subject to restoration or other rehabilitation efforts (such as low-impact development or stormwater best management practices). The former will help identify ranges of bioassessment index scores associated with modified channels, and the latter may help identify potential for improvements.

Some sites of interest (e.g., reference sites) were sampled for a limited number of analytes under other programs (e.g., sites that were sampled for benthic invertebrates but not algae or water chemistry). Targeting them for sampling under the SMC Survey will result in a more complete data set. Other targeted sites have no data collection within the past 10 years. These sites may also be included in this study.

How sites are selected

SMC participants identified sites of interest through discussions with colleagues within their agencies, and by consulting studies that identify regions with well- or poorly characterized biological conditions (e.g., Mazor et al. 2020). Sites shown in Appendix C may or may not be accessible and sampleable, and field reconnaissance prior to the sampling season will be needed to determine whether these sites may be included in the study. Coordinates indicate approximate locations, with specific locations to be determined through field reconnaissance.

More than 100 regions or sites have been identified as under-sampled areas, and sampling them all requires more resources than the SMC is able to commit. Therefore, a large number of under-sampled regions or sites are **uncommitted** elements of the survey.

Frequency of sampling

In general, sites targeted for sampling under this study will be sampled once over the 5 years of the survey.

Sampling period

This study has the same sampling period as condition sites.

Analytes to be measured

Sites sampled under this special study will have the same as condition sites, described above (Table 4).

Tradeoffs

One site sampled under this study is equivalent to sampling one condition site.

Analysis

To the extent practical, targeted sites will be included in estimates of regional condition by using spatial statistical networks (e.g., Mazor et al. 2020).

Causal assessment

Why is this a priority study?

Previous SMC surveys have indicated that poor biological conditions are widespread, affecting the majority of stream-miles in most of the South Coast region. Causal assessments are a direct way to identify the stressors potentially causing poor conditions at specific sites so that managers can determine appropriate actions for improving conditions.

The goal of a causal assessment is not to characterize general stressors to biology (e.g., elevated conductivity can create a reduction in BMI diversity). The goal of the assessment is to identify the specific stressors that are likely impacting the resident biota of a specific waterbody (e.g., excessive amounts of fine sediment in a reach are linked to the low CSCI scores observed there).

To better inform the management of California's aquatic resources and to take advantage of the large amounts of high-quality monitoring data, a three-tiered causal assessment framework – based upon the US EPA Causal Analysis Diagnosis Decision Information System (CADDIS, http://epa.gov/caddis) framework – has been developed and will be applied within the SMC program:

> **Rapid Screening Causal Assessment (RSCA)**: An evaluation configured to provide a rapid, overview assessment and summary of the stressors impacting a system using a standard set of potential stressors and analytical techniques to interpret the relationship between stressor exposure and biological response. Given its ease of use and relatively quick turnaround time, screening-level assessment can be applied at a large number of monitoring sites as soon as standardized monitoring data are collected and analyzed. This level of causal assessment could therefore be used to help managers prioritize remediation efforts within their region of responsibility. This tier produces an assessment of the causality for the most common stressors to a waterbody to better inform and streamline any more detailed follow-on analyses. The RSCA workflow is generically applicable to any site with poor CSCI scores, but can only derive certain types of

evidence (e.g., spatial co-occurrence, or comparison to thresholds) for a limited number of stressors that are widely measured (e.g., nutrients, solids, or habitat degradation).

Detailed Causal Assessment: A moderately intensive and site-specific assessment configured to provide an additional investigation of the "standard" stressors identified as likely causes during a screening casual assessment, as well as stressors and environmental characteristics unique to a given location. This level of causal assessment is a stakeholder informed process that uses site-specific data and analyses, with the goal of providing greater confidence on the likelihood of a stressor as a cause and provide some insight into potential sources of that stressor. This tier produces a detailed, rigorous investigation of select stressors impacting a waterbody, providing insight into sources and potential management actions to improve waterbody conditions. Unlike RSCA, detailed causal assessment allows consideration of stressors that may not be widely measured (e.g., long-term hydrologic records), and can consider lines of evidence not included in the RSCA workflow (e.g., temporal co-occurrence).

Confirmatory Causal Assessment: An assessment configured to provide the stakeholder and management community with confidence that remediating a given stressor will have a good likelihood of improving the condition of the resident biota in specific system. This level of causal assessment is a very situation-dependent process. It involves experimental manipulations and modeling to demonstrate the effectiveness of potential management actions to improve biotic conditions at a location, as well as set expectations for improvement before large-scale implementation. This tier produces a demonstration of how specific stressors are impacting the biota of a specific waterbody and how their amelioration may be expected to improve conditions there.

Within this three-tiered framework, stream locations with degraded biological conditions are referred to as test sites. The underpinnings of the causal assessment are a variety of comparative analyses that contrast biotic data, abiotic data, and combinations of the two from the test site and from other ecologically similar sites that are referred to as comparator sites.

As part of this special study, a combination of rapid screening and detailed causal assessments will be conducted at a series of test sites within the region where poor biotic conditions have been observed and managers wish to identify stressors causing those conditions. Confirmatory causal assessment is not proposed as part of the SMC survey. Each causal assessment will be led by participants sharing jurisdiction over the test site, providing data, local knowledge, or technical review throughout the survey.

How test sites are selected

Ideally, causal assessment will be performed at every site with low bioassessment index scores or other indicators of poor biological condition (e.g., fish kills, harmful algae blooms, etc.). For this survey, a small number of potential test sites have been prioritized by SMC participants based on their agency's priorities (Table 9). In general, test sites where the suspected causes are related to degraded water quality —as opposed to habitat alteration—will be selected. These sites were identified based on one or more of the following criteria:

- Low CSCI scores (e.g., less than 0.79, or less than predicted from landscape model of Beck et al. 2019a)
- Stresses are likely associated with water quality (vs. habitat) degradation. For example:
  - Identified as likely water quality stress in Stream Quality Index (Beck et al. 2019b)
  - IPI and CRAM scores indicate good habitat quality
  - Soft-bottom or natural channel structure in urban or agricultural settings
  - Landscape model predicts high scores (Beck et al. 2019a)
- Study outcomes are likely to inform management decisions affecting the site

Based on these criteria, the SMC technical workgroup has identified 14 test sites as high priority for causal assessment. However, the SMC is only able to allocate resources for 5 test sites (to be determined by the SMC bioassessment workgroup). Therefore, the remaining test sites are **uncommitted** elements of the survey. Conducting causal assessments at biologically degraded sites not listed in Table 9 are also considered **uncommitted** elements.

Table 9. Potential causal assessment test sites. See Table 1 for watershed abbreviations.

County	Watershed	Site(s)	Reach or site name	Latitude	Longitude	Notes
San Diego	SSD	911M24913	Campo Creek	32.590	-116.515	Revisited in 2022 (CSCI<0.79)
San Diego	CSD	SMC00710	Carrol Canyon	32.889	-117.200	Revisited in 2022 (CSCI<0.79)
San Diego	CSD	907NP9OSD	Oak Canyon in Mission Trails	32.847	-117.050	Potential revisit in 2025 if flow is sufficient
San Diego	CSD	907SDSVC3	San Vicente Creek	32.996	-116.844	Revisited in 2022 (CSCI <0.79) and 2023 (CSCI > 0.79). Water quality and wet-dry mapping conducted upstream.
San Diego	SSD	910OTJMC4	Jamul Creek	32.637	-116.884	Revisited in 2023 (CSCI > 0.79)
Los Angeles	LAR	SMC01096, SMC01320	Big Tujunga	34.285	-118.293	Revisited in 2022 and 2024 (CSCI > 0.79)
Los Angeles	SGR	SMC00428	Shortcut Canyon	34.247	-118.049	Revisited in 2022 and 2023 (CSCI > 0.79)
Los Angeles	SGR	SMC00144	Graveyard Canyon	34.245	-117.795	
Los Angeles	SGR	405CE0280, SGUT502	Cattle Canyon	34.232	-117.748	Revisited in 2022 (CSCI>0.79) and 2023 (CSCI < 0.79)
Ventura	VEN	402M00015, SMC04047, 402M00110, 402BA0031	Ventura River near Meiners Oaks	34.475	-119.292	Revisited in 2023 (CSCI >0.79)
Ventura	CAL	408M03119, SMC02884	Conejo Creek	34.228	-118.972	

Ventura	SCL	403CE0156	Santa Paula Creek	34.377	-119.060	
Ventura	SCL	403S01784	Santa Clara River	34.402	-118.747	
Ventura	CAL	ME-CC	Calleguas Creek Mass Emissions	34.179	-119.040	Revisited in 2023 (CSCI < 0.79)
Riverside	MSA	801M16861	Goldenstar Creek	33.897	-117.361	Revisited in 2022 (CSCI<0.79). Nutrients sampling and wet-dry mapping conducted upstream.
San Bernardino	USA	801STW085, 801M15524, 801STW055, 801RB8559, 801S03533, 801STW258, 801S02573, 801RB8387	San Timoteo Canyon	34.023	-117.191	Revisited in 2024 (CSCI<0.79)
San Bernardino	USA	801RB8575, 801S01523, 801MIC007, 801RB8501, 801MIC034, 801MIC272	Mill Creek	34.095	-116.964	
San Bernardino	MSA	801S03133, 801RB8566, 801M15424,	Deer Creek	33.992	-117.600	
San Bernardino	MSA	801S04078, 801RB8197, 801RB8521, 801RB8403	Chino Creek	33.982	-117.696	
San Bernardino	USA	801RB8327, 801S06231, 801RB8396	Cajon Creek	34.233	-117.426	
San Bernardino	USA	801BBMC01, 801BBMC02, 801MFC100	Metcalf Creek	34.239	-116.937	Revisited in 2023 (CSCI>0.79 and 2024 (CSCI<0.79)
San Bernardino	USA	801S31343, 801BBRC02, 801BBRC01	Rathbun Creek	34.241	-116.871	Revisited in 2024 (CSCI<0.79)
San Bernardino	USA	801BBGC01, 801BBGC02	Grout Creek	34.269	-116.948	Revisited in 2023 (CSCI < 0.79) and 2024 (CSCI > 0.79)

The 2024 Integrated Report, which lists impaired waterbodies, has not yet been adopted as the time of publishing this Workplan. However, the EPA partially approved and partially disapproved the State Water Board's proposed waterbody listings. The EPA identified several streams as having impaired aquatic life use based on CSCI scores (U.S. Environmental Protection Agency 2024). The EPA is expected to respond to Public Comments, revise the Integrated Report, and transmit final listings to the State Water Board for incorporation sometime in 2025. Bioassessment locations on these reaches are identified in Appendix E. These sites may also be targeted for sampling as causal assessment sites. These are **uncommitted**

elements that should undergo sampling for causal assessment if additional resources become available.

Approach

The SMC will combine elements of rapid screening causal assessment followed by detailed causal assessments to provide a cost effective, thorough analysis of selected test sites over the 5-year course of the survey. The rapid screening analyses will be used to provide an initial, baseline assessment for the test site, provide a prioritized list of stressors to be investigated in the follow-up detailed assessments, and provide summaries of biotic and abiotic data collected over the ensuing 5 years. The detailed analyses will provide supporting evidence for the screening results by incorporating temporal patterns in stressors/responses, as well as by considering site-specific stressors excluded from rapid causal assessment workflows (e.g., long-term flow data).

By the nature of these assessments, where one set of analyses informs the next, we will take an adaptive approach, updating the monitoring plan each year to determine the appropriate steps to take in the upcoming sampling season. These modifications must be agreed to by the SMC workgroup as a whole. The steps described below may not apply to all test sites, as some may have more information available at the outset of the study than others and will most likely have different stressors impacting them.

1. Conduct rapid-screening causal assessment (RSCA) to determine support for stressors that are incorporated into existing rapid workflows (e.g., nutrient concentrations, water temperature, ions).
2. Identify data gaps in standard stressor data at the test site and its comparator sites, ideally finding 30 comparator sites with complete data for each test site.
3. Review RSCA results and identify potential sources of those stressors characterized as Likely or as Indeterminant causes in the assessment.
4. Identify additional site-specific stressors potentially affecting the test site (i.e., those not considered in the rapid screening assessment) and their sources within the test site's catchment based upon land use or local knowledge (e.g., dam operations, urban runoff, proximity to a farm, wildfire, etc.).
5. Identify appropriate analytes to characterize the additional stressors identified in Step 4 or to better characterize the Likely/Indeterminate stressors from Step 3. For example, if a site is located near an agricultural area, pesticides and nutrient concentrations may be appropriate analytes to measure. These analytes may already be included in the standard suite of analytes measured at condition sites (Table 4), or may include additional analytes, some of which may require more intensive sampling strategies to measure (e.g., diel flux of dissolved oxygen). Some analytes in Table 4 may be pre-emptively ruled out if they are not linked to one of the potential sources that have been identified; for example, if the test site has excellent habitat quality, additional CRAM measurements may not be necessary for causal assessment.
6. Collect new data at test and comparator sites. Confirm that poor conditions occur at the test site by sampling the indicators listed in Table 4. This list may be adjusted to add analytes identified in Step 5 and by dropping analytes that have been pre-emptively ruled out in Step 3. Identify stressors with major data gaps as detailed in Step 2 and fill those data gaps at comparator sites within the participants' jurisdictions as needed.

7. Seek out additional data from other programs that may improve confidence or modify support for additional stressors at the test site (e.g., CEDEN, Healthy Watersheds portal, California Integrated Water Quality System Project [CIWQS], USGS stream gauges, groundwater monitoring, and other water quality databases).
8. Collect data on potential sources of stress, such as measuring pollutant concentrations at appropriate upstream locations.
9. Repeat the data gap and causal assessment analyses each year within the five-year period as needed to fill the data gaps and sufficiently evaluate each potential stressor identified at each test site.

Upon completion of the study, we should have produced a report for each test site that summarizes the results of the causal assessment at the site, cataloging each of the standard and site-specific stressors as either a Likely Cause, Unlikely Cause, or Indeterminate Cause of the observed low CSCI scores. At this point, the SMC participants will determine whether more intensive causal assessment is warranted (e.g., confirmatory causal assessment), and whether fixes for the identified stressors fall within their agency's capabilities or authority.

Analytes to be measured

At the outset of the study, the standard suite of biotic (BMI and Algae) and abiotic analytes (Table 3) will be measured at each test site. However, the results of the initial screening causal assessments and the local knowledge of each test site project group will be used to modify the suite of analytes to be measured at their respective test sites. It is to be expected that some of the standard biotic and abiotic measures will be reduced and replaced on a test-site-by-test-site basis with different test site- and comparator site-specific analytes to better inform and customize the causal assessment at each test site.

Tradeoffs

In general, one test or comparator site sampled under this study shall be considered the equivalent of one condition site. However, costs of sampling one site in this study may vary if additional expensive analytes are measured. These expenses may be mitigated in one of two ways, both of which require approval by the SMC workgroup. First, analytes may be dropped from test or comparator sites to maintain cost neutrality with new analytes. Second, if new analytes are particularly expensive, an entire condition site may be dropped.

Sampling period

This study has the same sampling period as condition sites, unless otherwise dictated by the needs of the investigation of the test site. For example, if hydromodification is a candidate cause, assessment of winter stormflows may be necessary.

Update for 2025

Jamul Creek: No sampling is planned for 2025.

Campo Creek: No sampling is planned for 2025.

Carroll Canyon: No sampling is planned for 2025.

Big Tujunga: No sampling is planned for 2025.

Ventura River: No sampling is planned for 2025.

Goldenstar Canyon: No sampling is planned for 2025. Sampling in 2022 confirmed poor biological conditions and high nutrient concentrations at the test site. Wet-dry mapping was conducted on multiple tributaries and sediment samples were collected and analyzed for pesticides. Upstream samples confirmed that both the north and south forks were sources of high nutrient loads. Discussion with SCCWRP staff confirmed legacy nutrients from historical agriculture land uses could be the cause of the biological impairment. No further investigation is needed at this time.

San Vicente Creek: No sampling is planned for 2025.

Wet-dry mapping

Why is this a priority study?

Previous surveys have shown that intermittent and ephemeral streams dominate the South Coast region, comprising between 50 and 95% of the stream-miles in different watersheds (Mazor 2015). Sites presumed to be perennial are sometimes determined to be intermittent, and sites presumed to be ephemeral may sometimes be sampleable in wetter years. Unfortunately, currently available maps and hydrologic models lack the precision and resolution to accurately display where perennial, intermittent, and ephemeral streams are located in some areas. Although the SMC survey has provided a snapshot of flow conditions at large numbers of sites, more intensive data collection is needed to determine which sites are perennial, intermittent, or ephemeral. As a result, managers have an insufficient understanding of their aquatic resources. For a bioassessment program, this uncertainty can increase costs of field reconnaissance to identify which streams are likely to be sampleable during the sampling period. Furthermore, knowledge of flow duration would give managers more understanding of which regulatory programs or water quality objectives apply to a given stream.

How sites are selected

SMC participants identified a number of catchments where improved understanding of streamflow duration is desired (Appendix D). Many of these areas have rarely, if ever, been sampled, often due to a presumption of insufficient flow or due to interpretation of limited data sources and field observations. These locations generally correspond to HUC12 catchments. However, the specific stream reaches included in the study (e.g., mainstems vs. tributaries) will be determined based on participant interest, access, and other factors. The total length of a stream assessment shall be limited to the length field crews can assess in a single day, including any study enhancements described below. In general, this is presumed to be around 10 km per catchment.

More than 100 regions or sites have been identified as requiring wet-dry mapping, and mapping them all requires more resources than the SMC is able to commit. Therefore, a large number of catchments are **uncommitted** elements of the survey.

Approach

The first step in the study is to conduct a desktop analysis to compile available data on flow duration in the catchment. Participants shall review data sources of aquatic monitoring data to determine what, if any, aquatic sampling has previously occurred (e.g., The SMC Data Portal or CEDEN for bioassessment and other water quality monitoring data; the California Natural Diversity Database for aquatic species observations). Historical imagery (e.g., Google Earth) shall be reviewed to determine places and times where surface water is visible. Social media resources (e.g., iNaturalist, Instagram) with time and geospatial information may also be used to assess flow conditions. The StreamTracker database shall be consulted to see if there is any available information in the catchment. Hydrologic models, if available, shall be identified and reviewed to determine if flow metrics relevant to flow duration (e.g., hydroperiod) have been calculated for reaches of interest. Based on this data review, participants shall prepare a short narrative statement describing data availability and likely flow duration conditions in the catchment submitted to SCCWRP (raphaelm@sccwrp.org or jeffb@sccwrp.org) at least one week prior to the field data collection event. This data review may result in modifications to the time or location of field data collection, or even a change in the selected catchment.

Once this desktop analysis is complete, field data collection can begin. This study consists of five possible data collection elements. The first element is required for the study; other elements may be added, generally at the cost of reducing the overall length of stream assessed or other tradeoffs determined by the SMC technical workgroup.

1. Baseline stream-walking
   Field crews shall conduct a stream-walking expedition along a stream corridor, recording hydrologic state at regular intervals (e.g., every ***~200 m***), and at points where hydrologic conditions change. Hydrologic state is determined by visual observation, and shall follow the categories identified in Gallart et al. (2016):
   - Hyperrheic: (flood conditions)
   - Eurheic (baseflow)
   - Oligorheic (trickling flow)
   - Arheic (stagnant surface water)
   - Hyporheic (subsurface flow, saturated sediment)
   - Edaphic (unsaturated sediment)

   Photo-documentation is also required at each location.

   Inaccessible reaches that cannot be visually observed shall be skipped from stream-walking. No sample collection or direct hydrological measurements (e.g., streamflow) are required. Additional information (e.g., channel engineering state, changes in channel morphology) may be recorded, as determined by the workgroup and participant interest.

   Expeditions shall be conducted at least ***two*** times per year for at least ***two*** years. Thus, every catchment in the study shall receive at least 4 visits over the course of the study. One visit shall occur in early Spring or late Winter (i.e., between February and April), when flows are presumed to be highest. Another visit shall occur in late Summer or early Fall (i.e., between August and November), when flows are presumed to be lowest.

The timing of the two expeditions may be modified to address questions related to seasonality and applicability of biological objectives. For example, the two expeditions may be timed 4 weeks apart to determine if a stream has at least 4 weeks of sustained flow.

2. Higher frequency of stream-walking
Higher frequency of visits may be desirable in certain cases. For example, planning two visits in early spring, one month apart, would be sufficient to determine if a stream meets the definition of *seasonal* in proposed biological objectives in the San Diego Basin Plan. Revisits over three or more years will provide better insight into interannual variability in streamflow. High frequency of visits (e.g., 12 or more) may allow the develop of dynamic, animated maps that visualize changes in flow conditions.

   Higher frequency of stream-walking may require tradeoffs in numbers of condition sites or other study elements, at a rate of 4 additional day-long expeditions for one condition site.

3. Streamflow Duration Assessment
The EPA has recently developed a streamflow duration assessment method (SDAM) for the Arid West (Mazor et al. 2024). Participants may implement this method at one or more locations on one or more visits. The protocol consists of rapid measurement of 5 indicators:
   - Number of hydrophytic plant species (e.g., willows, cattails, alders; (US Army Corps of Engineers 2018)) in or near the channel: None, 1 to 2, or 3+
   - Number of aquatic invertebrates (live specimens, cases, shells, or exuviae) found within the reach: None, 1 to 19, or 20+
   - Mayflies, stoneflies, or caddisflies: Presence or absence of live specimens, cases, or exuviae
   - Extent of live or dead algae cover on the streambed: None, < 10%, or ≥ 10%
   - Live fish: Presence or absence

   The protocol requires no sample collection, and typically takes about 30 minutes to conduct on a 40 m to 200 m reach, and results in a classification of streamflow duration: ephemeral, intermittent, perennial, at least intermittent, or need more information.

   If this is enhancement is included, it is recommended that ***four*** locations are assessed per catchment, per expedition, and that different locations are assessed upon repeat visits. This way, a larger number of locations (16 expected) are assessed.

   If this enhancement is included in the study, the overall length of an assessed catchment shall be reduced to ensure that an expedition can be completed in a single day.

   Note: This option depends on the availability of training opportunities being made available. At the time of this workplan, neither the US EPA or US Army Corps of Engineers have announced plans for public trainings.

4. Water presence logger deployment

Various types of water presence loggers have been used to assess streamflow duration: water level loggers, wildlife cameras, and stream temperature, intermittency and conductance (STIC) loggers, have all been effectively used to determine the presence or absence of surface flow. Costs range from < $100 (for STIC loggers) to $1000 (for paired pressure transducers, used to assess water level). Participants may deploy loggers at a number of suitable locations within the study area. It is recommended that at least one logger be deployed within each catchment. Loggers should not be deployed in unsuitable locations (e.g., high traffic areas, or areas prone to scour during winter storms). Loggers should remain deployed year-round where practical, but they may be temporarily removed during winter storms to prevent equipment loss.

If this enhancement is included in the study, the costs of acquiring new equipment may result in a tradeoff by dropping selected analytes from other study sites. These tradeoffs require approval of the entire SMC technical workgroup.

5. <u>Drone deployment</u>
   Drones may provide a rapid way of assessing surface water presence over a large area. Although drone use is only suitable in certain areas and may not provide the same precision as direct visual observation in differentiating hydrologic states, drone surveys may provide a great enhancement to the study.

   If this enhancement is included in the study, the overall length of an assessed catchment shall be reduced to ensure that an expedition can be completed in a single day. Costs of acquiring a drone or procuring services may require tradeoffs in numbers of condition sites or analytes measured in other study sites; these tradeoffs require approval of the SMC technical workgroup.

Update for 2025

Baseline stream-walking will occur at a tributary to the Santa Margarita within Riverside County.

UPDATING THE WORKPLAN

In contrast to previous workplans, the current workplan offers greater flexibility to SMC participants in determining how to pursue different survey elements. Therefore, the survey will require annual review and reappraisal to ensure that the participants' contributions fulfill the major goals of the SMC.

Every year, the SMC bioassessment workgroup shall reconvene to review potential updates to the workplan, such as reallocation of efforts among elements, modifications to measured analytes, and tradeoffs to maintain cost neutrality. For example, a participant may propose adding toxicity analysis at a causal assessment site and dropping CRAM assessment for that site to maintain cost neutrality. Another participant may propose eliminating a condition site altogether to cover the costs of sediment analysis at a number of other sites they are sampling. These updates require approval from the SMC bioassessment workgroup. Major modifications (determined by the SMC survey coordinator, Raphael Mazor [raphaelm@sccwrp.org]) may require approval from the SMC steering committee.

These modifications should be approved in the Fall or Winter prior to the sampling season.

Tracking contributions from each agency

Prior to every sampling season, each participant shall submit to SCCWRP a report summarizing the intended contributions to each survey element. Within a month of the completion of a sampling season, participants shall submit a post-sampling report, identifying sites that were sampled under each survey element. Formats for these reports are currently in development.

DATA SUBMISSION AND ACCESS

SMC data portal

Submitting data

The SMC will share chemistry, toxicity, taxonomy data and index scores with CEDEN on an annual basis, as described in the subsequent section. Agencies submitting these data directly to CEDEN or SWAMP do not need to submit duplicative data to the SMC; participants doing so are requested to inform SCCWRP about direct submissions to CEDEN or SWAMP.

Data shall be submitted according to the schedule below:

- Inform SCCWRP of new site codes, personnel, collection devices, analytes, analytic methods, and agencies needed for CEDEN data submissions (year of sampling; information for future sampling should also be submitted if known): *March 1.*
- SCCWRP shall distribute an updated shell for PHAB data recording: *March 31.*
- PHab data are submitted to SWAMP FTP in shells: *October 31*
- Other non-biological data (including shapefiles) are submitted to SMC data portal: *October 31*
- CRAM data shall be submitted to eCRAM (https://www.cramwetlands.org/): *October 31*
- Taxonomy data: *February 28* after sample collection, except for permits requiring submission by *October 31* the year of sampling.

Prior to every sampling season, each participating agency shall identify a single contact person responsible for all data submission from that agency (multiple contacts may be identified if appropriate). Most data should be submitted by the end of October of the year of sampling; taxonomic data should be submitted by the end of February the year following sampling. Data submission guides are available for data submitted through the SMC data portal (http://smc.sccwrp.org/). Details about data submission deadlines are provided in Table 10.

Table 10. Summary of annual data submission deadlines. ADD URLs HERE: Data portal, SWAMP FTP, and eCRAM

Data type	What is submitted?	How is it submitted?	Typical deadline
New vocabulary requests for CEDEN submission:	1 Excel template per data type	Email (jeffb@sccwrp.org)	Mar 1

Data type	What is submitted?	How is it submitted?	Typical deadline
- **Site info** - **Personnel** - **Collection devices** - **Agencies** - **Analytic methods** - **Analytes**			
Site evaluation data	1 Excel template	Data portal	Oct 31
Chemistry	2 Excel templates (batch and results)	Data portal	Oct 31
Toxicity	3 Excel templates (batch, results, and summary)	Data portal	Oct 31
BMI taxonomy	2 Excel templates (sample info and results)	Data portal	Feb 28 (unless permits require submission by Oct 31 the year of sampling)
Algae taxonomy	2 Excel templates (sample info and results)	Data portal	Feb 28 (unless permits require submission by Oct 31 the year of sampling)
PHAB	Access shell database (provided by SCCWRP by Mar 31 each year)	SWAMP FTP	Oct 31
CRAM	eCRAM forms	eCRAM	Oct 31
Hydromod PHAB module	1 Excel template	Data portal	Oct 31
Channel engineering	1 Excel template	Data portal	Oct 31
Vertebrate observations	1 Excel template	Data portal	Oct 31
Trash	1 Excel template	Data portal	Oct 31
Time series data	1 to 3 Excel templates (results, details, and effort)	Data portal	Oct 31
Site photos	JPEG file	Email	Oct 31
Geospatial data*	2 shapefiles (points and polygons)	Data portal	Oct 31

*Only for new sites that have not been sampled in previous years

Receipts for data submission, if not provided by the data portal, may be requested from SCCWRP (Jeff Brown: jeffb@sccwrp.org). Submitting correct data is the responsibility of each participating agency. If problems are discovered with submitted data, the participating agency shall resubmit corrected data. Although formal training for data submission will not be provided, SCCWRP will support the data submission process on an individual basis.

Data submission for discontinued parameters (such as water column toxicity) will be supported for participants who wish to continue sampling them.

Accessing data

All SMC data may be accessed through the SMC data portal (http://smc.sccwrp.org/). Data in the portal are considered public after the SMC has published a report to summarize the data (typically one year after sample collection).

The SMC portal aggregates all data submitted to the portal, as well as all public bioassessment data submitted to CEDEN in the South Coast region, plus all public SMC and SWAMP data submitted to CRAM.

CEDEN and SWAMP

To the extent possible, all data submitted to the SMC data portal shall be submitted to CEDEN or SWAMP. At the time of this workplan, CEDEN can accept these data types:

- Taxonomy
- Water and sediment chemistry
- Field water quality
- Habitat (including “Phab”, CSCI, and ASCI scores)

Schedule of CEDEN data submissions

The transfer of data from the SMC to CEDEN will be scheduled to support development of the Water Board’s Integrated Report to the EPA on the condition of California’s surface waters. Therefore, SMC data will be transferred to CEDEN by the appropriate deadlines in years that the Integrated Report covers the Los Angeles, Santa Ana, and San Diego regions.

Data submitted to the SMC data portal shall be submitted to CEDEN annually according to the timeline shown in Table 11. Briefly, SCCWRP will coordinate vocabulary requests (e.g., new site codes, personnel) necessary to a) enable submissions of data to CEDEN, and b) prepare MS Access PHab data entry shells before data collection begins (these shells are required for PHab data submission). Data submitted outside this timeline may be submitted to CEDEN the following year.

Table 11. Timeline and roles for syncing SMC data with CEDEN.

Date (year of sampling)	Survey participants	SCCWRP
March 1	Inform SCCWRP of new site codes, personnel, collection devices, associated analytes, agency codes, and methods needed for CEDEN data submission	
March 7		SCCWRP submits vocab requests
March 31		SCCWRP provides participants with an updated shell
October 31	PHab data are submitted to SWAMP FTP in shells CRAM data are submitted to eCRAM Other non-taxonomy data (including shapefiles) are submitted to SMC data portal. Taxonomy data are submitted to SMC data portal if permits require submission in the same year as sample collection.	

November 15		SCCWRP reviews and approves/rejects shapefiles
November 15		SCCWRP submits additional data requests to CEDEN to enable submission of Chemistry results
December 20		SCCWRP submits Chemistry results to CEDEN
February 28 (subsequent year)	Taxonomy results and sample info submitted to SMC data portal Index scores are available automatically (if shapefiles have been submitted)	
March 15 (subsequent year)		SCCWRP submits additional vocab requests to CEDEN to enable submission of Taxonomy results
May 30 (subsequent year)		SCCWRP submits Taxonomy results to SWAMP SCCWRP submits index scores to SWAMP (if available)

Reporting

The SMC uses two primary mechanisms to report data collected under the stream survey: dashboards and written reports. Other mechanisms (e.g., peer-reviewed journal articles, fact sheets, presentations at conference, etc.) may also be used as determined by the SMC steering committee or workgroup.

Dashboards

The SMC has developed a prototype dashboard to present and synthesize bioassessment data collected in the region (Figure 2). This dashboard is based on the Stream Quality Index (SQI), which brings together biological response data (i.e., CSCI and ASCI scores), habitat data (i.e., CRAM and the IPI), and water chemistry data (i.e., total nitrogen, total phosphorus, and specific conductivity). The current dashboard is based on a limited, static dataset, and cannot accommodate new data.

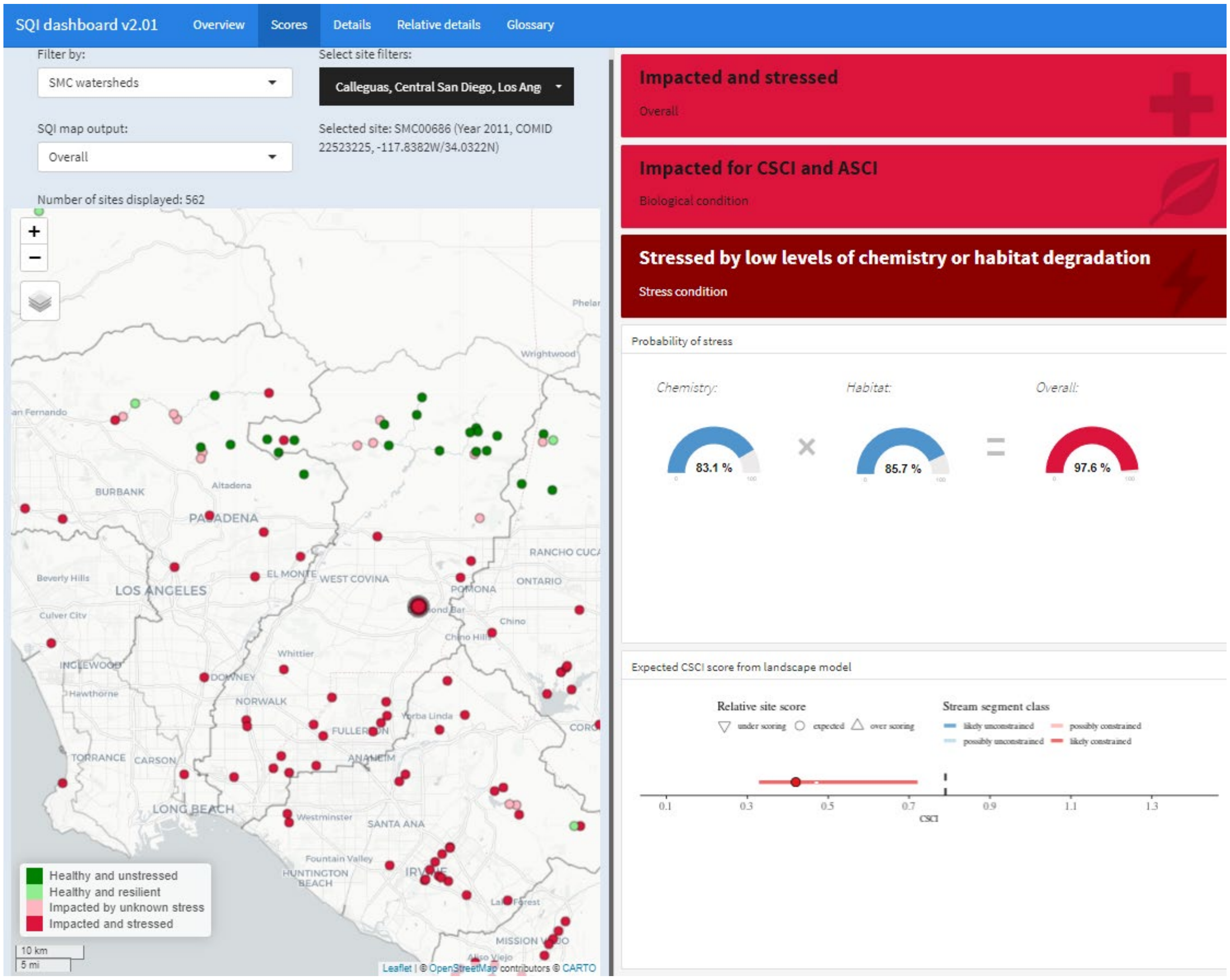

Figure 2. Dashboard for the SMC's Stream Quality Index (https://sccwrp.shinyapps.io/sqi_shiny_dynamic/).

The SMC will link the dashboard to the SMC data portal so that it can be dynamically updated with the most recently available data. This is a **committed element**. It has been completed in 2024.

The SMC may expand the dashboard to include new components identified by the SMC workgroup. These components include:

- Instant report generation for subregions (e.g., watersheds, counties) or sites of interest (**uncommitted element**). This element has been partially completed in 2024.
- A user interface for rapid screening causal assessment (**uncommitted element**)
- Addition of data types not incorporated into the SQI (**uncommitted element**). This element was partially completed in 2024, but the SMC workgroup did not ultimately approve a method for visualizing sites with incomplete data.
- Improved data access tools (**uncommitted element**)

Written reports

The SMC publishes technical reports at least once every other year. These reports are typically written in a "feature" style format, highlighting key messages for non-technical audiences. Feature subjects are determined by the SMC workgroup or steering committee. Past topics have included biological conditions in engineered channels, assessments with algal indices, and a regional analysis of hydromodification susceptibility. In general, these features are accompanied by shorter articles on a wide range of topics, both technical (e.g., extent of pyrethroid contamination in sediments) and non-technical (e.g., use of SMC data in developing water quality improvement plans). Production of three reports during the workplan period is a **committed element**.

Priority topics and data mining efforts

The SMC workgroup had tentatively identified a wide range of priority topics to address in technical reports. Although these topics will form part of the written reports described above, they are by and large **uncommitted efforts** requiring additional support to complete publication.

- Biological conditions in soft-bottom modified channels
- Trends in constrained streams
- Impacts of climate change on biological reference conditions in Southern California
- Relationships between biological conditions and restoration efforts
- Relationships between biological conditions and stormwater BMP or green infrastructure implementation
- Regional causal assessments
- Relationships between algal composition and physical habitat, flow alteration, and background water chemistry

QA REQUIREMENTS

Field replicates are collected as required by the SWAMP QAPrP: 10%, or one per participant: benthic macroinvertebrates, diatoms, and benthic algae biomass, and 5% for sediment toxicity, bioanalytic screens, and all water and sediment chemistry analytes. This requirement may be reduced or waived by the SWAMP Bioassessment Coordinator. No duplicates are required for CRAM, vertebrates, phab, hydromod, trash assessments, channel engineering, and hydrology.

Field or travel blanks are collected as required by the SWAMP QAPrP (i.e., one per method): bioanalytic screens, and all water chemistry analytes. Field blanks are also recommended for sediment chemistry and toxicity samples. Not required: benthic macroinvertebrates, diatoms, soft algae, benthic algae biomass, CRAM, vertebrates, phab, hydromod, channel engineering, and hydrology.

Matrix spikes are required by the SWAMP QAPrP: 5% or one per batch for water chemistry and sediment chemistry samples (pyrethroids). Matrix spikes are not required for algae biomass, or suspended solids.

Toxicity tests shall be consistent with requirements of the SWAMP QAPrP. Sediment toxicity control consistent with Section 7 of the appropriate EPA method/manual must be tested with each analytical batch of sediment toxicity tests. Reference toxicant tests must be conducted monthly for species that are raised within a laboratory, or per analytical batch for commercially-supplied or field-collected species.

Training and auditing

For the first year of the survey, field crews should expect to participate in 1 to 2 days of training. In subsequent years, crews should participate in 1 to 2 days of training and intercalibration events. Training will be provided by SCCWRP staff or by the UC Davis Training Academy.

For the first year of the survey, all field crews will be audited, with repeat audits conducted as needed. Thereafter, crews will be audited every other year. The SMC survey coordinator may require additional audits as he or she sees fit.

Total training/auditing costs per agency (expected; additional training or audits may be required for individual crews as determined by the SMC survey coordinator):

- Field methods intercalibration, training: 1 day
- Auditing: 1-2 days. Audits may be waived if a crew has received a satisfactory audit in the previous year.

SUMMARY OF UNCOMMITTED PROGRAM ELEMENTS

To facilitate collaboration with partners outside the SMC program, this workplan identifies a number of uncommitted elements that can be supported by interested parties. This section of the workplan summarizes uncommitted elements, and describes how these parties (SMC members themselves, or outside collaborators) may contribute to the SMC survey.

Collect data at additional sites

Every element of the program needs greater sampling effort than the SMC is currently able to provide. These outstanding needs are summarized in Table 12. SMC members or outside collaborators may collect and submit data at sites that fulfill SMC program needs, in accordance with the element designs described above. These sites will be selected by the SMC survey coordinator in consultation with participants who share jurisdiction over the region in question. Estimated costs are summarized in Table 13.

Table 12. Needs for each survey element of the SMC survey. Table 3 summarizes current levels of commitment to meet these needs.

Survey element	Survey need
Condition assessment	30 sites per watershed
Trend assessment	30 sites per watershed
Targeted sites in under-sampled regions	Sites listed in Appendix C
Causal assessment sites	30 samples per test site (including samples at comparator sites) • Highest need: Test sites identified in Table 9 • Additional need: All sites with CSCI scores < 0.79
Wet-dry mapping	Catchments listed in Appendix D

Cost estimate: $8,000 and $12,000 per site, including site reconnaissance, field sampling, and lab analysis.

Unmeasured analytes at survey sites

Some analytes identified as a need for the SMC survey do not have commitments to sample. Collaborators may support lab analysis of samples collected by SMC member field crews, or collect and analyze the samples themselves.

Cyanotoxins

Sites sampled by the SMC may be revisited by collaborators to collect additional cyanotoxin data (or analyze archived samples, if available). These collections may include water column grabs, sediment, algal mats, benthic algal biofilm, or time-integrated passive samplers deployed for an appropriate length of time. Analyses should cover the analytes listed in Table 5 and/or Table 6.

Cost estimate: $400 to $600 per site (does not include sample collection).

Water presence loggers

Water presence information from data loggers may be collected at trend sites, or any other site where long-term monitoring is expected. Water level loggers (i.e., paired pressure transducers) or wildlife cameras will be used.

Cost estimate: $750 for loggers/camera (does not include deployment or retrieval)

Sediment chemistry and toxicity

Sediment samples may be collected concurrently with bioassessment, or by revisiting assessed sites, and analyzed for the analytes identified in Table 5 and Table 6, such as pyrethroid and cyanotoxin concentrations, novel CEC screening and identification, or used in toxicity assays.

Cost estimate: $250 to $300 per sample for sediment grain size and total organic carbon, $800 to $1000 per sample for pyrethroids and fipronil, $1000 to $1200 per sample for non-target analysis, and $1200 to $1600 for sediment toxicity. Costs do not include sample collection

Molecular analysis of eDNA or benthic biofilm samples

Samples collected and archived at SCCWRP may be analyzed by extracting DNA, and subjected to metabarcode sequencing, or qPCR, as described above.

Cost estimate: $200 to 300 per sample for metabarcoding, sample-and-target species for qPCR. Costs do not include sample collection.

Conduct additional causal assessments

Collaborators able to make large contributions to the SMC survey may conduct causal assessments focusing on test sites where SMC participants are unable to make a commitment. These test sites may include some of the candidates listed in Table 9, or at other biologically degraded sites identified in consultation with the SMC technical workgroup.

Cost estimate: $35,000 to $45,000 with no additional data collection. If data collection is necessary, costs are an additional $10,000 to $12,000 per sample.

Improve the SMC survey dashboard to aid access to and interpretation of survey data

The SMC dashboard requires the development components identified by the SMC workgroup. These components include:

Small modifications (cost estimate: $10,000 to $15,000)

- Addition of data types not incorporated into the SQI
- Improvements to facilitate data access (e.g., map-based querying tools, query tools linked to the SQI dashboard, automated generation of data dictionaries, etc.)

Moderate modifications (cost estimate: $20,000 to $25,000)

- Instant report generation for subregions (e.g., watersheds, counties) or sites of interest

Major modifications (cost estimate: $60,000 to $80,000)

- A user interface for rapid screening causal assessment

Support analysis and reporting of data on topics of interest to the SMC

The SMC workgroup had tentatively identified a wide range of priority topics to address in technical reports:

- Biological conditions in soft-bottom modified channels
- Trends in constrained streams
- Impacts of climate change on biological reference conditions in Southern California
- Relationships between biological conditions and restoration efforts
- Relationships between biological conditions and stormwater BMP or green infrastructure implementation
- Regional causal assessments

Cost estimates: $30,000 to $40,000 each report, covering all data available to date.

Table 13. Summary of costs of uncommitted elements of the SMC survey.

Item	Estimated cost
Full data collection	$8,000 to $12,000 per site
Cyanotoxin analysis	$400 to $600 per sample
Water presence loggers	$750 per site
Sediment analysis	
- Grain size and TOC	$250 to $300 per sample
- Pyrethroids and fipronil	$800 to $1000 per sample
- Non-target analysis	$1000 to $1200 per sample
- Toxicity (*Hyalella azteca*)	$1200 to $1600 per sample
Molecular analysis	
- Metabarcoding	$200 to $300 per sample

- Quantitative PCR	$200 to $300 per sample and target species
Causal assessments - Analysis of existing data - Collection of new data	 $35,000 to $40,000 per test site $10,000 to $12,000 per site
Updates to SMC dashboard - Minor modifications - Moderate modifications - Major modifications	 $10,000 to $15,000 $20,000 to $25,000 $60,000 to $80,000
Additional reports on selected subjects	$30,000 to $40,000 per report

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APPENDIX A. CONDITION SITES SAMPLE DRAW

A spreadsheet with the condition site sample draw may be downloaded here:

https://ftp.sccwrp.org/pub/download/PROJECTS/SMCConditionSites2021.zip

APPENDIX B. TREND SITES SAMPLE DRAW

A spreadsheet with the trend site sample draw may be downloaded here:

https://ftp.sccwrp.org/pub/download/PROJECTS/SMCTrendSites2021sampledraw_12232020.zip

Appendix C. List of candidate sites for targeting under-sampled areas

These sites are located in areas or stream-types that require additional data. Sites on this list may or may not have sufficient flow for sampling, and may or may not be accessible. Field and desktop reconnaissance each sampling season is required to determine which, if any, of these sites are sampleable.

Table C-1. Sites in under-sampled regions in Ventura County. Coordinates indicate approximate locations.

Watershed	Site or reach name	Latitude	Longitude	Notes
LAR	Bell Canyon	34.20479	-118.68159	Urban
SCL	Upper Fish Creek	34.60927	-118.80213	Open
SCL	Upper Piedra Blanca Creek	34.60063	-119.17952	Open
SCL	Hot Springs Canyon	34.57845	-118.98933	Open
SCL	Alder Creek	34.57301	-118.95263	Open
SCL	Upper Agua Blanca Creek	34.56804	-118.84233	Open
SCL	Upper Sespe	34.56561	-119.04880	Open
SCL	Trout Creek	34.56174	-119.14244	Open
SCL	Middle Sespe	34.55682	-118.94349	Open
SCL	Timber Creek	34.55041	-119.06956	Open
SCL	West Fork Sespe	34.50594	-118.97033	Open
SCL	Middle Sespe	34.45847	-118.93396	Open
SCL	403BA0015	34.53173	-119.18367	Reference site
SCL	403BA0171	34.58579	-119.28339	Reference site
SCL	403STC024	34.44967	-119.05647	Reference site
SCL	403STC026	34.55916	-119.26916	Reference site
SCL	403STC085	34.64270	-119.07834	Reference site
SCL	403WE0795	34.64087	-119.08205	Reference site
SCL	403WE0891	34.65923	-119.14343	Reference site
SMB	Upper Big Sycamore Canyon	34.12017	-119.00212	Open
VEN	Abadi Creek	34.60340	-119.39804	Open
VEN	Cañada Larga	34.34450	-119.26647	Open
VEN	402BA0095	34.46260	-119.34602	Reference site
VEN	402BA0287	34.50284	-119.36579	Reference site
VEN	402PS0048	34.51967	-119.40631	Reference site
VEN	402WE0536	34.51967	-119.40631	Reference site
VEN	402WE0803	34.42130	-119.38173	Reference site
VEN	VENTURA13	34.50144	-119.34800	Reference site

Table C-2. Sites in under-sampled regions in Los Angeles County. Coordinates indicate approximate locations.

Watershed	Site or reach name	Latitude	Longitude	Notes
LAR	Little Tujunga	34.37754	-118.26888	Open

LAR	Little Tujunga	34.36083	-118.33917	Open
LAR	Fox Creek	34.30760	-118.17749	Open
LAR	Pacoima Wash	34.31309	-118.40800	Urban natural channel
SCL	Fish Creek	34.64501	-118.52618	Open
SCL	San Francisquito Trib	34.62191	-118.44295	Open
SCL	San Francisquito	34.61077	-118.43591	Open
SCL	Soledad Canyon	34.43964	-118.26804	Open
SCL	Soledad Canyon	34.43902	-118.21468	Open
SCL	Aliso Canyon	34.43681	-118.13657	Open
SCL	Soledad Canyon	34.43452	-118.36547	Open
SCL	Aliso Canyon	34.42961	-118.11451	Open
SCL	Aliso Canyon Tributary	34.42698	-118.15028	Open
SCL	Aliso Canyon Tributary	34.40244	-118.12750	Open
SCL	South Fork Santa Clara	34.38526	-118.54965	Soft-bottom engineered
SCL	South Fork Santa Clara	34.37162	-118.51142	Soft-bottom engineered
SCL	Bouquet Canyon	34.45006	-118.50412	Soft-bottom engineered
SCL	403STC066	34.58488	-119.16533	Reference site
SGR	Upper East Fork	34.34337	-117.70222	Open
SGR	Fish Fork	34.30788	-117.72819	Open
SGR	Cattle Canyon	34.23150	-117.71542	Open
SGR	San Dimas Canyon	34.16880	-117.76776	Open
SGR	Tonner Canyon	33.95122	-117.83787	Open
SGR	RBBIO-304	34.27211	-117.89234	Reference site
SGR	405SGB003	34.27283	-117.88967	Reference site
SGR	405SGB006	34.25082	-117.82265	Reference site
SMB	Ramirez Canyon	34.05951	-118.79747	Open
SMB	Temescal Canyon	34.05597	-118.52904	Open
SMB	Corrall Canyon	34.04477	-118.73334	Open
SMB	Zuma Canyon	34.04031	-118.81449	Open
SMB	Zuma Canyon	34.02500	-118.81431	Urban natural channel
SMB	Ramirez Canyon	34.03620	-118.79320	Urban natural channel
SMB	Dume Canyon	34.01498	-118.79939	Urban natural channel

Table C-3. Sites in under-sampled regions in San Bernardino County. Coordinates indicate approximate locations.

Watershed	Site or reach name	Latitude	Longitude	Notes
MSA	San Antonio Creek	34.27413	-117.63507	Open
MSA	Day Canyon	34.19540	-117.54610	Open
MSA	801WE1020	34.25224	-117.53177	Reference site
USA	WF City Creek	34.20695	-117.18930	Open
USA	WF City Creek	34.20646	-117.20768	Open
USA	WF City Creek	34.20620	-117.20118	Open
USA	EF City Creek	34.18639	-117.17748	Open

USA	Keller Creek	34.16912	-117.04490	Open
USA	Plunge Creek	34.16674	-117.12302	Open
USA	Grout Creek	34.27207	-116.95095	Open
USA	Big Bear tributary	34.29128	-116.88442	Open
USA	Green Canyon	34.22313	-116.80612	Open
USA	801CE0152	34.18870	-117.18186	Reference site
USA	801WE0787	34.14541	-116.87918	Reference site
USA	801WE0806	34.15014	-117.13425	Reference site
USA	801SBCATC	34.20161	-117.22852	Reference site
USA	R5BIO-304	34.16405	-116.83301	Reference site

Table C-4. Sites in under-sampled regions in Orange County. Coordinates indicate approximate locations.

Watershed	Site or reach name	Latitude	Longitude	Notes
LSA	Modjeska Canyon, Santiago side	33.70822	-117.61214	Open
LSA	Modjeska Canyon, Modjeska side	33.71450	-117.62404	Open
LSA	Gypsum Canyon	33.83926	-117.70899	Open
LSA	Black Star Canyon	33.77890	-117.67413	Open
LSA	Silverado Canyon d/s town at turnout	33.74790	-117.64100	Open
LSA	Silverado Canyon u/s of site SMC00105	33.75109	-117.57871	Open
LSA	Weir Canyon	33.81072	-117.75676	Open
LSA	Bolsa Chica Channel u/s Westminster Blvd.	33.75998	-118.04298	Earthen rip rap channel u/s BCC02
LSA	Greenville Banning Channel u/s I-405	33.69138	-117.92347	Earthen rip rap channel
LSA	Pelanconi Park Anaheim Hills	33.84838	-117.79511	Natural watercourse from dissipator
LSA	Santiago Creek (E08) around Maybury Ranch	33.81489	-117.79460	Urban
LSA	Oak Canyon Nature Center	33.84105	-117.75888	Developed
LSA	Serrano Creek u/s Trabuco Rd.	33.65326	-117.68108	Developed, restored
LSA	Buck Gully d/s of 2018 site	33.59674	-117.86262	Developed
LSA	Upper Brea Canyon Channel	33.94432	-117.87174	Developed
SJU	Holy Jim u/s community	33.68460	-117.51500	Natural
SJU	Upper Trabuco, u/s Holy Jim parking lot	33.68175	-117.50680	Natural
SJU	Falls Canyon at REF-TCAS	33.67768	-117.53628	Natural
SJU	Trabuco Canyon at Arizona crossing	33.66687	-117.56739	Natural
SJU	Trabuco Creek u/s 241	33.65000	-117.60014	Developed
SJU	English Channel d/s Entidad	33.64488	-117.65652	Developed, never sampled
SJU	901BELOLV	33.64154	-117.55300	Open
SJU	Aliso Creek u/s Creekside	33.63943	-117.67003	Developed
SJU	Bell Creek outfalls	33.62046	-117.56459	Developed, never sampled
SJU	Trabuco Creek, 901M14118	33.60980	-117.62700	Urban, needs resampling
SJU	Oso Creek d/s Jeronimo	33.60445	-117.65022	Developed

SJU	Hot Springs Canyon, SMC01705	33.60370	-117.51000	Natural
SJU	Lower Tijeras, 901M14134	33.59230	-117.63300	Urban, needs resampling
SJU	Upper Laguna Canyon, I02S01	33.59194	-117.75009	Developed
SJU	San Juan Creek u/s Lucas Canyon Road	33.58805	-117.51659	Natural
SJU	San Juan Creek u/s #7	33.57966	-117.52834	Natural
SJU	Middle Bell Canyon	33.57509	-117.56664	Natural
SJU	San Juan Creek u/s Caspers	33.57368	-117.54098	Natural
SJU	Prima Deshecha d/s PDCM01	33.44397	-117.64372	Developed, never sampled
SJU	Arroyo Trabuco, 901ATCAAS	33.68264	-117.50159	Natural
SJU	Bell Canyon, 901BELOLV	33.64060	-117.55310	Natural
SJU	Falls Creek, 901NP9FLC	33.67583	-117.53655	Natural
SJU	San Mateo Creek, 901SMCBNB	33.5166	-117.438	

Table C-5. Sites in under-sampled regions in Riverside County. Coordinates indicate approximate locations.

Watershed	Site or reach name	Latitude	Longitude	Notes
NSD	Upper De Luz	33.48441	-117.30638	Open, State Lands
NSD	902ASTRLC	33.44330	-116.98800	Open
NSD	Los Alamos Canyon	33.54715	-117.35615	Open
SJC	Poppet Creek	33.83106	-116.86719	Open
SJC	SF San Jacinto	33.68178	-116.75635	Open
SJC	802WE0658	33.72932	-116.67480	Reference site
SJC	RB8_172	33.78419	-116.83941	Reference site
SJC	RB8_543	33.80340	-116.73136	Reference site
SJC	RB8_070	33.77175	-116.76756	
SJU	901NP9BWR	33.53047	-117.42858	Open
SJU	901NP9TNC	33.52740	-117.40706	Open
SJU	Nickel Canyon	33.50850	-117.44898	Open, Wilderness
SJU	San Mateo Canyon, 901S00469	33.52999	-117.40855	
SJU	Bluewater, 901NP9BWR	33.5166	-117.438	
SJU	Upper Los Alamos Canyon Creek North Fork, 901NP9LAN	33.5494	-117.354	
SJU	Upper Los Alamos Canyon Creek South Fork, 901NP9LAS	33.5475	-117.354	
SJU	San Juan Creek, 901SJOF1x	33.6163	-117.427	Natural
SJU	San Mateo Creek below Los Alamos, 901S02873	33.54344	-117.3973	

SJU	San Mateo Creek above Los Alamos, 901S06969	33.55334	-117.39579	

Table C-6. Sites in under-sampled regions in San Diego County. Coordinates indicate approximate locations.

Watershed	Site or reach name	Latitude	Longitude	Notes
SJU	901DCCDCx	33.47286	-117.46576	Reference site
NSD	Upper Long Canyon	33.41067	-116.90271	Open, USGS Site
NSD	Rainbow Creek	33.40906	-117.18733	Transition between high and low scoring reaches
NSD	Upper Long Canyon Trib	33.39440	-116.87880	Open, USGS Site
NSD	Santa Margarita	33.36691	-117.31808	Transition between high and low scoring reaches
NSD	903FCPSPx	33.35170	-116.91389	Open
NSD	903R9PPCD	33.33980	-116.95700	Open
NSD	903NP9UAC	33.32036	-116.62265	Open
NSD	903ACPCT1	33.29606	-116.63860	Open
NSD	902NP9CWC	33.41925	-116.86102	Open
NSD	Sandia Creek, 902SCSCRx	33.42486	-117.249415	Natural
NSD	Agua Caliente Creek, 903ACPCT1	33.29595	-116.63863	Natual
NSD	French Creek, 903FCPSPx	33.35170	-116.91389	Natural
NSD	Upper Agua Caliente Creek, 903NP9UAC	33.3204	-116.623	
NSD	San Luis Rey River, 903WE0900	33.33052	-116.81511	Natural
NSD	Cottonwood Temecula, 902NP9CWC	33.41925	-116.86102	
NSD	Cole Canyon Creek, 902R9CCC1	33.5595	-117.253	
NSD	Arroyo Seco, 902SMAS1x	33.45695	-116.97047	Natural
CSD	905DGCC1x	33.15997	-116.84040	Open
CSD	905WE0679	33.13395	-116.65636	Open
CSD	Guejito Creek	33.12016	-116.94721	Natural
CSD	Bear Valley	33.08635	-117.05672	Natural urban channel
CSD	San Bernardo Valley	33.07560	-117.06402	Natural urban channel
CSD	Poway Creek	32.95711	-117.00602	Transition between high and low scoring reaches
CSD	Poway Creek	32.95253	-117.02731	Transition between high and low scoring reaches
CSD	909SWCASR	32.94193	-116.55349	Open
CSD	Sycamore Creek	32.89714	-116.99130	Natural
CSD	Sycamore Creek	32.89714	-116.99130	Transition between high and low scoring reaches
CSD	Sycamore Creek	32.88117	-116.99957	Transition between high and low scoring reaches
CSD	905CE0512	33.11107	-116.74311	Reference site
CSD	Black Mountain Creek, 905BMCCGx	33.12706	-116.80361	Natural
MBSD	Boulder Creek, 907SDB0C2	32.96354	-116.66413	
MBSD	907NP9SVC	32.99037	-116.85274	Open, State Lands

MBSD	907CSVDFW	32.98390	-116.86700	Open, State Lands
MBSD	San Vicente Creek	32.95219	-116.90638	Natural
MBSD	West Branch San Vicente Creek	32.94645	-116.91312	Natural
MBSD	Padre Barona Creek	32.93191	-116.87616	Natural
MBSD	San Diego River near Lakeside	32.87176	-116.91118	Transition between high and low scoring reaches
MBSD	Peutz Creek	32.85590	-116.79230	Open, SDRPF
MBSD	907NP9OSD	32.84794	-117.04997	Open, State Lands
MBSD	Forester Creek	32.80574	-116.74400	Restored soft-bottom channel
MBSD	San Vicente Creek, 907NP9SVC	32.99099	-116.85408	
SSD	909HPCASR	32.93310	-116.54600	Open, State Lands
SSD	911FCCPCT	32.76440	-116.43900	Open
SSD	911TJKC1x	32.75980	-116.45078	Open
SSD	911PVCAEC	32.74530	-116.65100	Open
SSD	911NP9EPC	32.74481	-116.64880	Open
SSD	910NP9CCN	32.64150	-116.83600	Open, Wilderness
SSD	910NP9ARP	32.62880	-116.88200	Open, State Lands
SSD	Lower Cold Stream, 909LCSASR	32.924149	-116.559871	
SSD	Granite Spring Canyon, 911GSCAPV	32.89759	-116.52806	
SSD	Kitchen Creek, 911KCKCRx	32.78745	-116.45100	Natural
SSD	Nobel Creek, 911NCPCRx	32.86408	-116.51847	Natural
SSD	Kitchen Creek, 911TJKC1x	32.75980	-116.45078	Natural
SSD	Long Canyon Creek 2, 911TJLCC2	32.77887	-116.44162	Natural
SSD	Harper Creek, 909HPCASR	32.9331	-116.546	
SSD	Stonewall, 909SWCASR	32.94249	-116.55409	
SSD	Jamul Creek, 910OTJMC4	32.6375	-116.884	Natural
SSD	Espinosa, 911NP9EPC	32.7448	-116.649	
SSD	Pine Valley, 911PVCAEC	32.7453	-116.651	
SSD	Pine Valley Creek, 911PS0794	32.88930	-116.52890	
SSD	Pine Valley Creek 1, 911TJPVC1	32.83572	-116.54322	Natural

APPENDIX D. LIST OF CANDIDATE CATCHMENTS OF WET-DRY MAPPING

List of catchments recommended for wet-dry mapping.

Table D-1. Catchments selected for potential inclusion in wet-dry mapping in Ventura County. Coordinates indicate approximate downstream end of catchment.

Watershed	Catchment	Latitude	Longitude	Notes
CAL	Happy Camp Canyon	34.293635	-118.860489	Never sampled
CAL	Chivos - Las Llajas Canyons	34.282371	-118.699580	Never sampled
CAL	Tapo Canyon	34.267726	-118.743492	Sparsely sampled
CAL	South Branch Arroyo Conejo	34.184624	-118.915002	Never sampled
CAL	Alamos Canyon	34.181152	-118.874032	Sparsely sampled
CAL	Arroyo Conejo	34.171890	-118.822537	Never sampled
SCL	Seymour Creek	34.734010	-119.042291	Never sampled
SCL	Hungry Valley	34.721981	-118.851873	Never sampled
SCL	Lockwood Creek	34.702141	-119.000661	Sparsely sampled
SCL	Matau Creek	34.677411	-119.018292	Sparsely sampled
SCL	Piedra Blanca Creek	34.59937	-119.152869	Eastern portion
SCL	Agua Blanca Creek	34.539977	-118.766759	Sparsely sampled
SCL	Lake Piru	34.469247	-118.752689	Sparsely sampled
SCL	Pole Creek	34.401070	-118.904200	Sparsely sampled
SCL	Adams Canyon	34.346318	-119.102994	Never sampled
SCL	Fagan Canyon	34.340538	-119.074463	Never sampled
SCL	Wheeler-Hampton Canyon	34.303915	-119.110775	Never sampled
SCL	Hall Canyon	34.278306	-119.264469	Never sampled
SMB	Potrero Valley Creek	34.144918	-118.836519	Sparsely sampled
SMB	Big Sycamore Canyon	34.074549	-119.014183	Sparsely sampled
VEN	Upper Sespe Creek	34.604850	-119.368366	Never sampled
VEN	Thacher Creek	34.443449	-119.228712	Sparsely sampled
VEN	Los Sauces Creek	34.348983	-119.422027	Never sampled

Table D-2. Catchments selected for potential inclusion in wet-dry mapping in Los Angeles County. Coordinates indicate approximate downstream end of catchment.

Watershed	Catchment	Latitude	Longitude	Notes
LAR	Upper Pacoima Wash	34.341623	-118.393935	Sparsely sampled
LAR	Mill Creek	34.310498	-118.142656	Never sampled
LAR	Alder Creek	34.310228	-118.071915	Sparsely sampled
LAR	Fox Creek	34.302392	-118.176890	Never sampled
LAR	Little Tujunga Creek	34.273004	-118.371362	Sparsely sampled
SCL	Hungry Valley	34.702963	-118.804083	Never sampled
SCL	Gorman Creek	34.683604	-118.786052	Sparsely sampled
SCL	Liebre Gulch	34.661982	-118.755294	Never sampled
SCL	Upper Castaic	34.611177	-118.663968	Never sampled

SCL	Fish Canyon	34.610429	-118.654764	Never sampled
SCL	Middle Castaic Creek	34.547329	-118.618087	Never sampled
SCL	Lake Piru	34.491811	-118.731557	Never sampled
SCL	Kentucky Springs Canyon	34.474676	-118.158125	Never sampled
SCL	Aliso Canyon	34.469066	-118.160269	Never sampled
SCL	Acton Canyon	34.467328	-118.198150	Never sampled
SCL	Agua Dulce Canyon	34.441365	-118.333343	Never sampled
SCL	Lower Castaic Creek	34.436679	-118.625127	Sparsely sampled
SCL	Arrastre Canyon	34.436347	-118.327533	Never sampled
SCL	Sand Canyon	34.424124	-118.536915	Sparsely sampled
SCL	Mint Canyon	34.421013	-118.452296	Never sampled
SGR	Iron Fork	34.298871	-117.744628	Never sampled
SGR	Devil's Canyon	34.246715	-117.974659	Never sampled
SGR	Devil's Canyon	32.247050	-117.975223	Never sampled
SGR	Upper Cattle Canyon	34.232804	-117.724994	Never sampled
SGR	Roberts Canyon	34.164674	-117.907668	Never sampled
SGR	Fish Canyon	34.157313	-117.925591	Never sampled
SGR	San Dimas Wash	34.136335	-117.776236	Never sampled
SMB	Rustic Canyon	34.034422	-118.517612	Sparsely sampled
SMB	Sullivan Canyon	34.031701	-118.512455	Sparsely sampled
SMB	Mandeville Canyon	34.030989	-118.516666	Sparsely sampled
SMB	Palos Verdes canyons	33.749541	-118.341337	Never sampled

Table D-3. Catchments selected for potential inclusion in wet-dry mapping in San Bernardino County. Coordinates indicate approximate downstream end of catchment.

Watershed	Catchment	Latitude	Longitude	Notes
MSA	East Etiwanda Creek	34.039331	-117.513050	Sparsely sampled
USA	Baldwin Lake	34.264971	-116.859901	Never sampled
USA	Big Bear Lake	34.244515	-116.970243	Sparsely sampled
USA	Mission Zanja	34.071615	-117.265189	Never sampled
USA	Warm Creek	34.064853	-117.305453	Sparsely sampled
USA	Reche Canyon	34.053702	-117.289144	Never sampled
USA	Yucaipa Creek	34.005029	-117.120854	Never sampled

Table D-4. Catchments selected for potential inclusion in wet-dry mapping in Orange County. Coordinates indicate approximate downstream end of catchment.

Watershed	Catchment	Latitude	Longitude	Notes
LSA	Upper Santiago Creek	33.745946	-117.672855	Sparsely sampled
LSA	Los Trancos Creek	33.577558	-118.839314	Sparsely sampled
SJU	Upper Aliso Creek	33.619416	-117.688204	Never sampled
SJU	Moro Canyon	33.561921	-117.819983	Never sampled
SJU	Emerald Canyon	33.555785	-117.804784	Never sampled

SJU	Laguna Canyon	33.543447	-117.784040	Sparsely sampled
SJU	Middle San Juan Creek	33.531514	-117.553985	Sparsely sampled
SJU	Salt Creek	33.482001	-117.721483	Sparsely sampled
SJU	Lower San Mateo Creek	33.454255	-117.569564	Sparsely sampled

Table D-5. Catchments selected for potential inclusion in wet-dry mapping in Riverside County. Coordinates indicate approximate downstream end of catchment.

Watershed	Catchment	Latitude	Longitude	Notes
LSA	Carbon Creek	33.937567	-117.768722	Never sampled
LSA	Aliso Creek - Santa Ana River	33.871959	-117.672218	Never sampled
MSA	Reche Canyon	34.017212	-117.272262	Never sampled
MSA	Upper Chino Creek	34.011203	-117.728660	Sparsely sampled
MSA	Lake Norconian - Temescal Wash	33.889757	-117.576758	Tributaries never sampled
MSA	Moreno Valley	33.876123	-117.210299	Sparsely sampled
MSA	Lake Mathews	33.837712	-117.394603	Sparsely sampled
MSA	Arroyo Del Torro - Temescal Wash	33.725301	-117.378200	Never sampled
MSA	Goldenstar Canyon	33.924096	-117.417283	Sparsely sampled. Causal assessment site
NSD	Warm Springs Creek	33.687646	-117.072782	Sparsely sampled
NSD	Rawson Canyon	33.605233	-117.022998	Never sampled
NSD	Upper Tucalota Creek	33.591898	-117.028774	Never sampled
NSD	Lower Tucalota	33.548450	-117.454640	Sparsely sampled
NSD	Upper Cahuilla Creek	33.536774	-116.755345	Vail Lake tributary
NSD	Santa Gertudis Creek	33.523871	-117.169769	Never sampled
NSD	Upper Wilson Creek	33.505071	-116.859791	Vail Lake tributary
NSD	Lower Cahuilla Creek	33.501422	-116.853618	Vail Lake tributary
NSD	Lower Wilson Creek	33.492371	-116.956214	Vail Lake tributary
NSD	Arroyo Seco Creek	33.484792	-116.977863	Has had loggers at some points at 902ASTRLC and 902SMAS1x
NSD	Long Canyon Murrieta	33.483878	-117.144620	Sparsely sampled
NSD	Cottonwood Creek - Temecula Creek	33.481483	-116.962809	Vail Lake tributary. Has a long-term logger already at 902NP9CWC
NSD	Pechanga Creek	33.474570	-117.128129	Sparsely sampled
NSD	Tule Creek	33.440322	-116.861428	Vail Lake tributary
NSD	Chihuahua Creek	33.398340	-116.799511	Vail Lake tributary
NSD	Rattlesnake Creek - Temecula Creek	33.394500	-116.807360	Vail Lake tributary
SJC	Laborde Canyon-San Jacinto River	33.847290	-117.055081	Never sampled
SJC	Potrero Creek	33.846497	-116.991979	Never sampled
SJC	Mount Rudolph-San Jacinto River	33.845244	-117.131036	Never sampled
SJC	Poppet Creek - San Jacinto River	33.766863	-116.906204	Never sampled
SJC	Perris Valley - San Jacinto River	33.736918	-117.248360	Never sampled

SJC	Lower South Fork San Jacinto River	33.727520	-116.810632	Sparsely sampled
SJC	Sant Johns Canyon	33.712635	-116.985654	Never sampled
SJC	Bautista Creek	33.709789	-116.868585	Sparsely sampled
SJC	San Jacinto Valley	33.687074	-117.163539	Never sampled
SJC	Menifee Valley	33.675529	-117.229935	Never sampled
SJC	Upper South Fork San Jacinto River (Hemet Valley)	33.661815	-116.664595	Northern portion well sampled, but southern portion not sampled at all
SJC	Lake Elsinore	33.644478	-117.327544	Sparsely sampled
SJU	Lower San Mateo Creek	33.522036	-117.504749	Never sampled
USA	Little San Gorgonio Creek	33.940332	-117.038076	Never sampled

Table D-6. Catchments selected for potential inclusion in wet-dry mapping in San Diego County. Coordinates indicate approximate downstream end of catchment.

Watershed	Catchment	Latitude	Longitude	Notes
CSD	Temescal Creek	33.121810	-116.851717	Sparsely sampled
CSD	Upper Santa Maria Creek	33.027561	-116.910706	Never sampled
MBSD	Ritchie Creek	32.991203	-116.740739	Sparsely sampled
MBSD	Upper San Vicente Creek	32.934535	-116.907080	Sparsely sampled
MBSD	Conejos Creek	32.891213	-116.763953	Sparsely sampled
MBSD	Lower San Vicente Creek	32.875054	-116.921043	Never sampled
MBSD	Rose Canyon	32.851092	-117.229588	Never sampled
MBSD	Sycamore Canyon	32.846376	-117.006572	Sparsely sampled
MBSD	San Clemente Canyon	32.837956	-117.228809	Sparsely sampled
NSD	San Onofre Creek	33.385477	-117.556930	Never sampled
NSD	Pauma Creek	33.342528	-117.020559	Sparsely sampled
NSD	Las Pulgas Canyon	33.293461	-117.459940	Never sampled
NSD	Aliso Canyon	33.269937	-117.439337	Never sampled
NSD	Paradise Creek	33.263652	-116.952060	Sparsely sampled
NSD	Pilgrim Creek	33.249233	-117.331298	Never sampled
NSD	Loma Alta Creek	33.188509	-117.359553	Sparsely sampled
SJU	Lower San Mateo Creek	33.392477	-117.589746	Sparsely sampled
SSD	Taylor Creek	32.791702	-116.743169	Never sampled
SSD	Loveland Reservoir	32.754797	-116.851407	Sparsely sampled
SSD	La Posta Creek	32.713178	-116.493995	Sparsely sampled
SSD	Powerhouse Canyon	32.710740	-117.143896	Never sampled
SSD	Lower Pine Valley Creek	32.701247	-116.677290	Sparsely sampled
SSD	Chollas Creek	32.691272	-117.121164	Sparsely sampled
SSD	Sweetwater Reservoir	32.690645	-117.004184	Sparsely sampled
SSD	Morena Reservoir	32.681393	-116.178680	Sparsely sampled
SSD	Paradise Valley	32.676188	-117.084235	Never sampled

SSD	Jamul Creek	32.652119	-116.870737	Never sampled
SSD	Dulzura Creek	32.651321	-116.862631	Sparsely sampled
SSD	Miller Creek - Campo Creek	32.641591	-116.420291	Never sampled
SSD	Telegraph Canyon	32.613519	-117.089858	Never sampled
SSD	Lower Otay Reservoir	32.613116	-116.930123	Tribs never sampled
SSD	McAlmond Canyon	32.612864	-116.700019	Sparsely sampled
SSD	Campo Valley	32.608213	-116.477400	Never sampled
SSD	Potrero Creek	32.607019	-116.693930	Sparsely sampled
SSD	Poggi Canyon	32.589320	-117.086370	Sparsely sampled
SSD	Bell Valley - Campo Creek	32.582754	-116.564026	Sparsely sampled
SSD	Lower Tecate Creek	32.578588	-116.617246	Never sampled
SSD	Bee Canyon	32.570116	-116.760133	Never sampled
SSD	Otay Mesa	32.562040	-116.828919	Sparsely sampled
SSD	Mine Canyon	32.561935	-116.805672	Sparsely sampled
SSD	Tijuana River mainstem	32.550740	-117.081752	Sparsely sampled

APPENDIX E. SITES ON THE 303D LIST OF IMPAIRED WATERBODIES BASED ON BIOASSESSMENT DATA

Reaches proposed on the 2024 list of impaired waterbodies (i.e., category 5, with benthic community effects or bioassessment listed as a pollutant;, as well as sites identified in the EPA review of that list (U.S. Environmental Protection Agency 2024), were associated with known bioassessment locations in the SMC database. These sites are listed below. This table is not intended to reflect data sources used in the listing process as Public Comments are still being reviewed by the EPA. As of March 2025 at the time this document is being updated, the EPA may make further revisions as the 2024 303(d) list has not been fully approved.

Region	Waterbody Name	Watershed	County	Site code
RB4	Compton Creek	LAR	Los Angeles	LALT502
RB4	Compton Creek	LAR	Los Angeles	SMC01358
RB4	Walnut Creek Wash (Drains from Puddingstone Res)	SGR	Los Angeles	SMC02656
RB4	Walnut Creek Wash (Drains from Puddingstone Res)	SGR	Los Angeles	SMC02284
RB4	Walnut Creek Wash (Drains from Puddingstone Res)	SGR	Los Angeles	SMC01260
RB4	Walnut Creek Wash (Drains from Puddingstone Res)	SGR	Los Angeles	SGLT506
RB4	Las Virgenes Creek	SMB	Los Angeles	404M04517
RB4	Las Virgenes Creek	SMB	Los Angeles	404S44642
RB4	Las Virgenes Creek	SMB	Ventura	404S24066
RB4	Las Virgenes Creek	SMB	Ventura	404S33670
RB4	Las Virgenes Creek	SMB	Ventura	SMC01640
RB4	Las Virgenes Creek	SMB	Ventura	404S17664
RB4	Las Virgenes Creek	SMB	Ventura	404S14952
RB4	Las Virgenes Creek	SMB	Ventura	404R4S049
RB4	Las Virgenes Creek	SMB	Ventura	404S37670
RB4	Las Virgenes Creek	SMB	Ventura	404S28068
RB4	Las Virgenes Creek	SMB	Ventura	404S35270
RB4	Las Virgenes Creek	SMB	Ventura	404S22464
RB4	Las Virgenes Creek	SMB	Ventura	404LVCALC
RB4	Las Virgenes Creek	SMB	Ventura	404S11880
RB4	Las Virgenes Creek	SMB	Ventura	404S25668
RB4	Las Virgenes Creek	SMB	Ventura	404M07380
RB4	Las Virgenes Creek	SMB	Ventura	404S17266
RB4	Las Virgenes Creek	SMB	Ventura	404LCCALV
RB4	Las Virgenes Creek	SMB	Ventura	404S01128
RB4	Las Virgenes Creek	SMB	Ventura	404S13416
RB4	Las Virgenes Creek	SMB	Ventura	404M07364
RB4	Malibu Creek	SMB	Los Angeles	404S25298

Region	Waterbody Name	Watershed	County	Site code
RB4	Malibu Creek	SMB	Los Angeles	404R4S050
RB4	Malibu Creek	SMB	Los Angeles	404S11406
RB4	Malibu Creek	SMB	Los Angeles	SMC01384
RB4	Malibu Creek	SMB	Los Angeles	404R4S036
RB4	Malibu Creek	SMB	Los Angeles	404S16168
RB4	Malibu Creek	SMB	Los Angeles	404S13672
RB4	Malibu Creek	SMB	Los Angeles	404S35418
RB4	Malibu Creek	SMB	Los Angeles	404MBCASC
RB4	Malibu Creek	SMB	Los Angeles	SMC02152
RB4	Malibu Creek	SMB	Los Angeles	404S00104
RB4	Medea Creek Reach 1 (Lake to Confl. with Lindero)	SMB	Los Angeles	404S16232
RB4	Medea Creek Reach 1 (Lake to Confl. with Lindero)	SMB	Los Angeles	404M07368
RB4	Medea Creek Reach 1 (Lake to Confl. with Lindero)	SMB	Los Angeles	404S16516
RB4	Medea Creek Reach 1 (Lake to Confl. with Lindero)	SMB	Los Angeles	SMC04264
RB4	Medea Creek Reach 1 (Lake to Confl. with Lindero)	SMB	Los Angeles	404M07372
RB4	Medea Creek Reach 1 (Lake to Confl. with Lindero)	SMB	Los Angeles	404S28270
RB4	Medea Creek Reach 2 (Abv Confl. with Lindero)	SMB	Ventura	404S44210
RB4	Medea Creek Reach 2 (Abv Confl. with Lindero)	SMB	Ventura	SMC19466
RB4	Medea Creek Reach 2 (Abv Confl. with Lindero)	SMB	Ventura	404R4S046
RB4	Medea Creek Reach 2 (Abv Confl. with Lindero)	SMB	Ventura	404M07360
RB4	Medea Creek Reach 2 (Abv Confl. with Lindero)	SMB	Ventura	404S05992
RB4	Medea Creek Reach 2 (Abv Confl. with Lindero)	SMB	Ventura	404S13160
RB4	Medea Creek Reach 2 (Abv Confl. with Lindero)	SMB	Ventura	404S26670
RB4	Medea Creek Reach 2 (Abv Confl. with Lindero)	SMB	Los Angeles	404S31468
RB4	Medea Creek Reach 2 (Abv Confl. with Lindero)	SMB	Los Angeles	404S18666
RB4	Medea Creek Reach 2 (Abv Confl. with Lindero)	SMB	Los Angeles	404S27470

Region	Waterbody Name	Watershed	County	Site code
RB4	Medea Creek Reach 2 (Abv Confl. with Lindero)	SMB	Los Angeles	404S02920
RB4	Triunfo Canyon Creek Reach 1	SMB	Los Angeles	404S00808
RB4	Triunfo Canyon Creek Reach 1	SMB	Los Angeles	404S17016
RB4	Triunfo Canyon Creek Reach 1	SMB	Los Angeles	404S08616
RB4	Triunfo Canyon Creek Reach 2	SMB	Los Angeles	404S44532
RB4	Triunfo Canyon Creek Reach 2	SMB	Los Angeles	404S18250
RB4	Lindero Creek Reach 1	SMB	Los Angeles	No samples collected by SMC program
RB4	Los Angeles River Reach 5 (within Sepulveda Basin)	LAR	Los Angeles	No samples collected by SMC program
RB4	Ventura River Reach 1 and 2 (Estuary to Weldon Canyon)	VR	Ventura	SMC05423
RB4	Ventura River Reach 1 and 2 (Estuary to Weldon Canyon)	VR	Ventura	402M00082
RB4	Ventura River Reach 1 and 2 (Estuary to Weldon Canyon)	VR	Ventura	402M00066
RB4	Ventura River Reach 1 and 2 (Estuary to Weldon Canyon)	VR	Ventura	402M00130
RB4	Ventura River Reach 1 and 2 (Estuary to Weldon Canyon)	VR	Ventura	SMC04399
RB4	Ventura River Reach 1 and 2 (Estuary to Weldon Canyon)	VR	Ventura	402M00002
RB4	Ventura River Reach 1 and 2 (Estuary to Weldon Canyon)	VR	Ventura	SMC20497
RB4	Calleguas Creek Reach 4 (Revolon Slough)	CAL	Ventura	408WE1039
RB4	Calleguas Creek Reach 4 (Revolon Slough)	CAL	Ventura	408CGCS13
RB4	Calleguas Creek Reach 4 (Revolon Slough)	CAL	Ventura	408CGCS13
RB4	Calleguas Creek Reach 4 (Revolon Slough)	CAL	Ventura	408CAL005
RB4	Calleguas Creek Reach 4 (Revolon Slough)	CAL	Ventura	408M03116
RB4	Calleguas Creek Reach 4 (Revolon Slough)	CAL	Ventura	408M03052
RB4	Calleguas Creek Reach 4 (Revolon Slough)	CAL	Ventura	408M03188
RB4	Calleguas Creek Reach 4 (Revolon Slough)	CAL	Ventura	408CALBWC
RB4	Calleguas Creek Reach 4 (Revolon Slough)	CAL	Ventura	SMC05764
RB4	Santa Clara River Reach 5 (Blue Cut gaging station to West Pier Hwy 99 Bridge) (was named Santa Clara River Reach 7 on 2002 303(d) list)	SCL	Ventura	403S15608

Region	Waterbody Name	Watershed	County	Site code
RB4	Santa Clara River Reach 5 (Blue Cut gaging station to West Pier Hwy 99 Bridge) (was named Santa Clara River Reach 7 on 2002 303(d) list)	SCL	Ventura	403STCNRB
RB4	Santa Clara River Reach 5 (Blue Cut gaging station to West Pier Hwy 99 Bridge) (was named Santa Clara River Reach 7 on 2002 303(d) list)	SCL	Los Angeles	403S01272
RB4	Santa Clara River Reach 5 (Blue Cut gaging station to West Pier Hwy 99 Bridge) (was named Santa Clara River Reach 7 on 2002 303(d) list)	SCL	Los Angeles	SMC21382
RB4	Santa Clara River Reach 5 (Blue Cut gaging station to West Pier Hwy 99 Bridge) (was named Santa Clara River Reach 7 on 2002 303(d) list)	SCL	Los Angeles	SMC04748
RB4	Santa Clara River Reach 5 (Blue Cut gaging station to West Pier Hwy 99 Bridge) (was named Santa Clara River Reach 7 on 2002 303(d) list)	SCL	Los Angeles	SMC20092
RB4	Santa Clara River Reach 5 (Blue Cut gaging station to West Pier Hwy 99 Bridge) (was named Santa Clara River Reach 7 on 2002 303(d) list)	SCL	Los Angeles	403STC004
RB4	Santa Clara River Reach 5 (Blue Cut gaging station to West Pier Hwy 99 Bridge) (was named Santa Clara River Reach 7 on 2002 303(d) list)	SCL	Los Angeles	SMC17692
RB4	Santa Clara River Reach 5 (Blue Cut gaging station to West Pier Hwy 99 Bridge) (was named Santa Clara River Reach 7 on 2002 303(d) list)	SCL	Los Angeles	403M05774
RB4	Santa Clara River Reach 5 (Blue Cut gaging station to West Pier Hwy 99 Bridge) (was named Santa Clara River Reach 7 on 2002 303(d) list)	SCL	Los Angeles	403S39062
RB4	Santa Clara River Reach 5 (Blue Cut gaging station to West Pier Hwy 99 Bridge) (was named Santa Clara River Reach 7 on 2002 303(d) list)	SCL	Los Angeles	SMC01372

Region	Waterbody Name	Watershed	County	Site code
RB4	Santa Clara River Reach 5 (Blue Cut gaging station to West Pier Hwy 99 Bridge) (was named Santa Clara River Reach 7 on 2002 303(d) list)	SCL	Los Angeles	403M05758
RB4	Santa Clara River Reach 5 (Blue Cut gaging station to West Pier Hwy 99 Bridge) (was named Santa Clara River Reach 7 on 2002 303(d) list)	SCL	Los Angeles	403SCVARD
RB4	Santa Clara River Reach 5 (Blue Cut gaging station to West Pier Hwy 99 Bridge) (was named Santa Clara River Reach 7 on 2002 303(d) list)	SCL	Los Angeles	SMC09564
RB4	Santa Clara River Reach 5 (Blue Cut gaging station to West Pier Hwy 99 Bridge) (was named Santa Clara River Reach 7 on 2002 303(d) list)	SCL	Los Angeles	SMC09564
RB4	Santa Clara River Reach 6 (W Pier Hwy 99 to Bouquet Cyn Rd) (was named Santa Clara River Reach 8 on 2002 303(d) list)	SCL	Los Angeles	403S14156
RB4	Santa Clara River Reach 6 (W Pier Hwy 99 to Bouquet Cyn Rd) (was named Santa Clara River Reach 8 on 2002 303(d) list)	SCL	Los Angeles	403STC019
RB4	Santa Clara River Reach 6 (W Pier Hwy 99 to Bouquet Cyn Rd) (was named Santa Clara River Reach 8 on 2002 303(d) list)	SCL	Los Angeles	SMC17056
RB4	Santa Clara River Reach 6 (W Pier Hwy 99 to Bouquet Cyn Rd) (was named Santa Clara River Reach 8 on 2002 303(d) list)	SCL	Los Angeles	SMC04956
RB4	Santa Clara River Reach 6 (W Pier Hwy 99 to Bouquet Cyn Rd) (was named Santa Clara River Reach 8 on 2002 303(d) list)	SCL	Los Angeles	403S34646
RB4	Santa Clara River Reach 6 (W Pier Hwy 99 to Bouquet Cyn Rd) (was named Santa Clara River Reach 8 on 2002 303(d) list)	SCL	Los Angeles	403S11084
RB4	Santa Clara River Reach 6 (W Pier Hwy 99 to Bouquet Cyn Rd) (was named Santa Clara River Reach 8 on 2002 303(d) list)	SCL	Los Angeles	403FCA038
RB4	Santa Clara River Reach 6 (W Pier Hwy 99 to Bouquet Cyn Rd) (was named Santa Clara River Reach 8 on 2002 303(d) list)	SCL	Los Angeles	403SCSARB
RB4	Santa Clara River Reach 11 (above Santa Felicia Dam)	SCL	Ventura	403S16332

Region	Waterbody Name	Watershed	County	Site code
RB4	Santa Clara River Reach 11 (above Santa Felicia Dam)	SCL	Ventura	403STC009
RB4	Santa Clara River Reach 11 (above Santa Felicia Dam)	SCL	Ventura	PC_RM16-01
RB4	Santa Clara River Reach 11 (above Santa Felicia Dam)	SCL	Ventura	SMC05296
RB4	Santa Clara River Reach 11 (above Santa Felicia Dam)	SCL	Ventura	403M01625
RB4	Santa Clara River Reach 11 (above Santa Felicia Dam)	SCL	Los Angeles	403WE0534
RB4	Santa Clara River Reach 11 (above Santa Felicia Dam)	SCL	Los Angeles	403R4S216
RB4	Santa Clara River Reach 11 (above Santa Felicia Dam)	SCL	Los Angeles	403M05795
RB4	Santa Clara River Reach 11 (above Santa Felicia Dam)	SCL	Los Angeles	403S07024
RB4	Santa Clara River Reach 11 (above Santa Felicia Dam)	SCL	Los Angeles	PC_RM3-0
RB4	Santa Clara River Reach 11 (above Santa Felicia Dam)	SCL	Los Angeles	403S01136
RB4	Santa Clara River Reach 11 (above Santa Felicia Dam)	SCL	Los Angeles	403STC083
RB4	Santa Clara River Reach 11 (above Santa Felicia Dam)	SCL	Los Angeles	403PRCAFF
RB4	Santa Clara River Reach 11 (above Santa Felicia Dam)	SCL	Los Angeles	PC_RM1-0
RB8	Peters Canyon Wash (Orange County)	LSA	Orange	801S02947
RB8	Peters Canyon Wash (Orange County)	LSA	Orange	801M12713
RB8	Peters Canyon Wash (Orange County)	LSA	Orange	801XXX305
RB8	Peters Canyon Wash (Orange County)	LSA	Orange	SMC09091
RB8	Peters Canyon Wash (Orange County)	LSA	Orange	801PCW048
RB8	Peters Canyon Wash (Orange County)	LSA	Orange	SMC00899
RB8	Peters Canyon Wash (Orange County)	LSA	Orange	801S19286
RB8	Peters Canyon Wash (Orange County)	LSA	Orange	801PCW171
RB8	Peters Canyon Wash (Orange County)	LSA	Orange	SMC05379
RB8	San Diego Creek Reach 1	LSA	Orange	SMC14211
RB8	San Diego Creek Reach 1	LSA	Orange	801M12649
RB8	San Diego Creek Reach 1	LSA	Orange	SMC06019
RB8	San Diego Creek Reach 1	LSA	Orange	801SDC178
RB8	San Diego Creek Reach 1	LSA	Orange	801SDC418
RB8	San Diego Creek Reach 1	LSA	Orange	SMC13187
RB8	San Diego Creek Reach 1	LSA	Orange	801SDC180

Region	Waterbody Name	Watershed	County	Site code
RB8	San Diego Creek Reach 1	LSA	Orange	SMC01923
RB8	San Diego Creek Reach 1	LSA	Orange	SMC38853
RB8	San Diego Creek Reach 2	LSA	Orange	801SDC504
RB8	San Diego Creek Reach 2	LSA	Orange	801S19399
RB8	Serrano Creek	LSA	Orange	801S10259
RB8	Serrano Creek	LSA	Orange	801M12665
RB8	Bonita Creek	LSA	Orange	No samples collected by SMC program
RB8	Perris Valley Storm Drain	MSA	Riverside	802PVD243
RB8	Perris Valley Storm Drain	MSA	Riverside	SMC04749
RB8	Perris Valley Storm Drain	MSA	Riverside	SMC32897
RB8	San Jacinto River, Reach 1 (Lake Elsinore to Canyon Lake (Railroad Canyon Reservoir)	SJC	Riverside	802S26909
RB8	San Jacinto River, Reach 1 (Lake Elsinore to Canyon Lake (Railroad Canyon Reservoir)	SJC	Riverside	802SJR116
RB8	San Jacinto River, Reach 1 (Lake Elsinore to Canyon Lake (Railroad Canyon Reservoir)	SJC	Riverside	802S27709
RB8	Santa Ana River, Reach 2	LSA	Orange	SMC21822
RB8	Santa Ana River, Reach 2	LSA	Orange	801SAR528
RB8	Santa Ana River, Reach 2	LSA	Orange	SMC24222
RB8	Santa Ana River, Reach 2	LSA	Orange	SMC05230
RB8	Santa Ana River, Reach 2	LSA	Orange	SAR-12
RB8	Santa Ana River, Reach 3	MSA	Riverside	801WE0989
RB8	Santa Ana River, Reach 3	MSA	Riverside	801PFB019
RB8	Santa Ana River, Reach 3	MSA	Riverside	801FC1089
RB8	Santa Ana River, Reach 3	MSA	Riverside	801SAROCR
RB8	Santa Ana River, Reach 3	MSA	Riverside	801RB8356
RB8	Santa Ana River, Reach 3	MSA	Riverside	SMC01341
RB8	Santa Ana River, Reach 3	MSA	Riverside	SAR-8
RB8	Santa Ana River, Reach 3	MSA	Riverside	801RB8594
RB8	Santa Ana River, Reach 3	MSA	Riverside	801RB8312
RB8	Santa Ana River, Reach 3	MSA	Riverside	801SAR351
RB8	Santa Ana River, Reach 3	MSA	Riverside	801RB8450
RB8	Santa Ana River, Reach 3	MSA	Riverside	801WE1032
RB8	Santa Ana River, Reach 3	MSA	Riverside	801M16916
RB8	Santa Ana River, Reach 3	MSA	Riverside	801RB8294
RB8	Santa Ana River, Reach 3	MSA	Riverside	801RB8191
RB8	Santa Ana River, Reach 3	MSA	Riverside	801SAR165

Region	Waterbody Name	Watershed	County	Site code
RB8	Santa Ana River, Reach 3	MSA	Riverside	801RB8494
RB8	Santa Ana River, Reach 3	MSA	Riverside	801M17028
RB8	Santa Ana River, Reach 3	MSA	Riverside	SAR-7
RB8	Santa Ana River, Reach 3	MSA	Riverside	801SAR110
RB8	Santa Ana River, Reach 3	MSA	Riverside	SMC06653
RB8	Santa Ana River, Reach 3	MSA	Riverside	SAR-6
RB8	Santa Ana River, Reach 3	MSA	Riverside	801RB8361
RB8	Santa Ana River, Reach 3	MSA	Riverside	801SAR151
RB8	Santa Ana River, Reach 3	MSA	Riverside	SAR-5
RB8	Silverado Creek	LSA	Orange	SMC01155
RB8	Silverado Creek	LSA	Orange	801SCLCRx
RB8	Silverado Creek	LSA	Orange	801SCASxx
RB8	Silverado Creek	LSA	Orange	SMC16169
RB8	Silverado Creek	LSA	Orange	SMC00105
RB9	Agua Hedionda Creek	CSD	San Diego	904AHC004
RB9	Agua Hedionda Creek	CSD	San Diego	904AHC003
RB9	Agua Hedionda Creek	CSD	San Diego	904AHC002
RB9	Agua Hedionda Creek	CSD	San Diego	904AHC001
RB9	Agua Hedionda Creek	CSD	San Diego	904AHC000
RB9	Agua Hedionda Creek	CSD	San Diego	904AHCSAx
RB9	Aliso Creek	SJU	Orange	SMC00910
RB9	Aliso Creek	SJU	Orange	901S02702
RB9	Aliso Creek	SJU	Orange	ACJ01
RB9	Aliso Creek	SJU	Orange	901S06798
RB9	Aliso Creek	SJU	Orange	901M14126
RB9	Aliso Creek	SJU	Orange	901S01811
RB9	Aliso Creek	SJU	Orange	901ACPPDx
RB9	Aliso Creek	SJU	Orange	SMC01987
RB9	Aliso Creek	SJU	Orange	ALC04
RB9	Aliso Creek	SJU	Orange	SMC03011
RB9	Aliso Creek	SJU	Orange	ALC at Trabuco
RB9	Aliso Creek	SJU	Orange	901M14156
RB9	Arroyo Trabuco Creek, Lower	SJU	Orange	SMC01934
RB9	Arroyo Trabuco Creek, Lower	SJU	Orange	901ATCDOS
RB9	Arroyo Trabuco Creek, Lower	SJU	Orange	901PS0057
RB9	Arroyo Trabuco Creek, Lower	SJU	Orange	SMC00206
RB9	Arroyo Trabuco Creek, Lower	SJU	Orange	901M14170
RB9	Arroyo Trabuco Creek, Lower	SJU	Orange	SMC00963
RB9	Arroyo Trabuco Creek, Lower	SJU	Orange	901M14138
RB9	Arroyo Trabuco Creek, Lower	SJU	Orange	901ATCAPx
RB9	Arroyo Trabuco Creek, Lower	SJU	Orange	901M14134
RB9	Arroyo Trabuco Creek, Lower	SJU	Orange	901M14118

Region	Waterbody Name	Watershed	County	Site code
RB9	Arroyo Trabuco Creek, Lower	SJU	Orange	901M14150
RB9	Arroyo Trabuco Creek, Lower	SJU	Orange	901TCSMP1
RB9	Buena Vista Creek	CSD	San Diego	904S02201
RB9	Buena Vista Creek	CSD	San Diego	904CBBVR4
RB9	Buena Vista Creek	CSD	San Diego	SMC03929
RB9	Buena Vista Creek	CSD	San Diego	904M21784
RB9	Carroll Canyon	CSD	San Diego	SMC00710
RB9	Carroll Canyon	CSD	San Diego	SMC04806
RB9	Escondido Creek	MBSD	San Diego	904CBESC8
RB9	Escondido Creek	MBSD	San Diego	904S00537
RB9	Escondido Creek	MBSD	San Diego	904WE1131
RB9	Escondido Creek	MBSD	San Diego	904CBESC6
RB9	Escondido Creek	MBSD	San Diego	904CBESC5
RB9	Escondido Creek	MBSD	San Diego	904S08089
RB9	Escondido Creek	MBSD	San Diego	904M21729
RB9	Escondido Creek	MBSD	San Diego	904S12185
RB9	Escondido Creek	MBSD	San Diego	904WE1125
RB9	Escondido Creek	MBSD	San Diego	SMC00921
RB9	Escondido Creek	MBSD	San Diego	SMC05017
RB9	Escondido Creek	MBSD	San Diego	904M21713
RB9	Escondido Creek	MBSD	San Diego	SMC03737
RB9	Escondido Creek	MBSD	San Diego	SMC02417
RB9	Escondido Creek	MBSD	San Diego	904M21782
RB9	Forester Creek	MBSD	San Diego	SMC08150
RB9	Forester Creek	MBSD	San Diego	SMC04054
RB9	Forester Creek	MBSD	San Diego	SMC09174
RB9	Forester Creek	MBSD	San Diego	907SDFRC2
RB9	Forester Creek	MBSD	San Diego	907FC0001
RB9	Forester Creek	MBSD	San Diego	SMC02006
RB9	Forester Creek	MBSD	San Diego	SMC10198
RB9	Forester Creek	MBSD	San Diego	907S02774
RB9	Forester Creek	MBSD	San Diego	907M23325
RB9	Forester Creek	MBSD	San Diego	907M23379
RB9	Green Valley Creek	CSD	San Diego	905SDGVC2
RB9	Green Valley Creek	CSD	San Diego	SMC03222
RB9	Laguna Canyon Channel	SJU	Orange	SMC01555
RB9	Laguna Canyon Channel	SJU	Orange	901S00531
RB9	Laguna Canyon Channel	SJU	Orange	LC-133
RB9	Loma Alta Creek	NSD	San Diego	904CBLAC3
RB9	Loma Alta Creek	NSD	San Diego	904M21764
RB9	Los Penasquitos Creek	CSD	San Diego	906LPLPC6
RB9	Los Penasquitos Creek	CSD	San Diego	906M21738

Region	Waterbody Name	Watershed	County	Site code
RB9	Los Penasquitos Creek	CSD	San Diego	906M21802
RB9	Los Penasquitos Creek	CSD	San Diego	SMC04294
RB9	Los Penasquitos Creek	CSD	San Diego	SMC00198
RB9	Los Penasquitos Creek	CSD	San Diego	906LPLPC5
RB9	Los Penasquitos Creek	CSD	San Diego	906S02246
RB9	Rose Creek	MBSD	San Diego	906M23318
RB9	Rose Creek	MBSD	San Diego	906M23430
RB9	Rose Creek	MBSD	San Diego	SMC05702
RB9	Rose Creek	MBSD	San Diego	906LPRSC4
RB9	Rose Creek	MBSD	San Diego	SMC01606
RB9	Salt Creek (Orange County)	SJU	Orange	901M14137
RB9	Salt Creek (Orange County)	SJU	Orange	SC-MB
RB9	San Diego River (Lower)	MBSD	San Diego	907SDR1xx
RB9	San Diego River (Lower)	MBSD	San Diego	907M23408
RB9	San Diego River (Lower)	MBSD	San Diego	907SDRS2x
RB9	San Diego River (Lower)	MBSD	San Diego	907M23385
RB9	San Diego River (Lower)	MBSD	San Diego	SMC03110
RB9	San Diego River (Lower)	MBSD	San Diego	907SDRMTx
RB9	San Diego River (Lower)	MBSD	San Diego	907SSDR11
RB9	San Diego River (Lower)	MBSD	San Diego	SMC04134
RB9	San Diego River (Lower)	MBSD	San Diego	907M23401
RB9	San Diego River (Lower)	MBSD	San Diego	907SDSDR9
RB9	San Diego River (Lower)	MBSD	San Diego	SMC12246
RB9	San Diego River (Lower)	MBSD	San Diego	907SDSDR8
RB9	San Diego River (Lower)	MBSD	San Diego	SMC07126
RB9	San Diego River (Lower)	MBSD	San Diego	SMC19552
RB9	San Diego River (Lower)	MBSD	San Diego	907SDR000
RB9	San Diego River (Lower)	MBSD	San Diego	SMC32718
RB9	San Dieguito River	CSD	San Diego	905M21725
RB9	San Dieguito River	CSD	San Diego	SMC04934
RB9	San Dieguito River	CSD	San Diego	SMC00473
RB9	San Juan Creek	SJU	Orange	901S12942
RB9	San Juan Creek	SJU	Orange	901M14153
RB9	San Juan Creek	SJU	Orange	901SJSJC9
RB9	San Juan Creek	SJU	Orange	901M14145
RB9	San Juan Creek	SJU	Orange	901S39498
RB9	San Juan Creek	SJU	Orange	901S06030
RB9	San Juan Creek	SJU	Orange	901S11685
RB9	San Juan Creek	SJU	Orange	901S45253
RB9	San Juan Creek	SJU	Orange	901SJC74x
RB9	San Juan Creek	SJU	Orange	SJC-74
RB9	San Juan Creek	SJU	Orange	901SJMS1x

Region	Waterbody Name	Watershed	County	Site code
RB9	San Juan Creek	SJU	Riverside	901S04409
RB9	San Juan Creek	SJU	Riverside	901S00313
RB9	San Luis Rey River, Lower (west of Interstate 15)	NSD	San Diego	903M20214
RB9	San Luis Rey River, Lower (west of Interstate 15)	NSD	San Diego	SMC00153
RB9	San Luis Rey River, Lower (west of Interstate 15)	NSD	San Diego	SMC01881
RB9	San Luis Rey River, Lower (west of Interstate 15)	NSD	San Diego	SMC02905
RB9	San Luis Rey River, Lower (west of Interstate 15)	NSD	San Diego	903M20230
RB9	San Luis Rey River, Lower (west of Interstate 15)	NSD	San Diego	SMC00857
RB9	San Luis Rey River, Lower (west of Interstate 15)	NSD	San Diego	SMC02457
RB9	San Luis Rey River, Lower (west of Interstate 15)	NSD	San Diego	903SLRRMR
RB9	San Luis Rey River, Lower (west of Interstate 15)	NSD	San Diego	SMC01689
RB9	San Luis Rey River, Lower (west of Interstate 15)	NSD	San Diego	SMC00665
RB9	San Luis Rey River, Lower (west of Interstate 15)	NSD	San Diego	903M20328
RB9	San Luis Rey River, Lower (west of Interstate 15)	NSD	San Diego	903SLSLR6
RB9	San Luis Rey River, Lower (west of Interstate 15)	NSD	San Diego	903M20280
RB9	San Luis Rey River, Lower (west of Interstate 15)	NSD	San Diego	903M20296
RB9	San Luis Rey River, Lower (west of Interstate 15)	NSD	San Diego	SMC02933
RB9	San Marcos Creek, Upper (above San Marcos Lake)	CSD	San Diego	904CBSAM3
RB9	San Marcos Creek, Upper (above San Marcos Lake)	CSD	San Diego	SMC00729
RB9	Santa Margarita River (Lower)	NSD	San Diego	902SMRDSx
RB9	Santa Margarita River (Lower)	NSD	San Diego	902SMRCPx
RB9	Santa Margarita River (Lower)	NSD	San Diego	902S00117
RB9	Segunda Deshecha Creek	SJU	Orange	901M14124
RB9	Segunda Deshecha Creek	SJU	Orange	901S00997
RB9	Segunda Deshecha Creek	SJU	Orange	SD-AP

Region	Waterbody Name	Watershed	County	Site code
RB9	Sweetwater River, Lower (below Sweetwater Reservoir)	SSD	San Diego	SMC01258
RB9	Sweetwater River, Lower (below Sweetwater Reservoir)	SSD	San Diego	SMC08426
RB9	Sweetwater River, Lower (below Sweetwater Reservoir)	SSD	San Diego	909SSWR08
RB9	Sweetwater River, Lower (below Sweetwater Reservoir)	SSD	San Diego	SMC01962
RB9	Sweetwater River, Lower (below Sweetwater Reservoir)	SSD	San Diego	SMC17918
RB9	Sweetwater River, Middle (between Sweetwater and Loveland Reservoirs)	SSD	San Diego	909SWR94x
RB9	Sweetwater River, Middle (between Sweetwater and Loveland Reservoirs)	SSD	San Diego	909SWRDWN
RB9	Sweetwater River, Middle (between Sweetwater and Loveland Reservoirs)	SSD	San Diego	909SWRUPx
RB9	Sweetwater River, Middle (between Sweetwater and Loveland Reservoirs)	SSD	San Diego	909M24951
RB9	Tecolote Creek	CSD	San Diego	SMC13062
RB9	Tecolote Creek	CSD	San Diego	906LPTEC3
RB9	Tecolote Creek	CSD	San Diego	SMC06918
RB9	Tecolote Creek	CSD	San Diego	906M23380
RB9	Tecolote Creek	CSD	San Diego	906M23302
RB9	Buena Creek	CSD	San Diego	SMC01049
RB9	Buena Creek	CSD	San Diego	SMC04121
RB9	Carmel Valley Creek	CSD	San Diego	906M21790
RB9	Chollas Creek	SSD	San Diego	908CLCANB
RB9	Chollas Creek	SSD	San Diego	908M24952
RB9	Chollas Creek	SSD	San Diego	908CCTNFA
RB9	Cottonwood Creek (San Marcos Creek watershed)	CSD	San Diego	No samples collected by SMC program
RB9	Encinitas Creek	CSD	San Diego	904ENCGVR
RB9	Encinitas Creek	CSD	San Diego	904PS0034
RB9	Encinitas Creek	CSD	San Diego	904ENCRSF
RB9	English Canyon	SJU	Orange	No samples collected by SMC program
RB9	Lusardi Creek	CSD	San Diego	905M21789
RB9	Lusardi Creek	CSD	San Diego	905M21721
RB9	Lusardi Creek	CSD	San Diego	905M21737
RB9	Moosa Canyon Creek	NSD	San Diego	SMC00457

Region	Waterbody Name	Watershed	County	Site code
RB9	Moosa Canyon Creek	NSD	San Diego	903M20165
RB9	Moosa Canyon Creek	NSD	San Diego	903SLMSA2
RB9	Murphy Canyon	MBSD	San Diego	SMC09286
RB9	Murphy Canyon	MBSD	San Diego	907M23348
RB9	Murphy Canyon	MBSD	San Diego	907M23412
RB9	Murphy Canyon	MBSD	San Diego	SMC01990
RB9	Murrieta Creek	NSD	Riverside	902MCGSxx
RB9	Murrieta Creek	NSD	Riverside	902LMC778
RB9	Murrieta Creek	NSD	Riverside	SMC01013
RB9	Murrieta Creek	NSD	Riverside	902UMC804
RB9	Otay River	SSD	San Diego	910M24924
RB9	Otay River	SSD	San Diego	910OTYA
RB9	Otay River	SSD	San Diego	910OTYLWR
RB9	Otay River	SSD	San Diego	910M24979
RB9	Otay River	SSD	San Diego	910OTYPBK
RB9	Otay River	SSD	San Diego	910OTYMDL
RB9	Otay River	SSD	San Diego	910OTYUPR
RB9	Rainbow Creek	NSD	San Diego	902RCBWGR
RB9	Rainbow Creek	NSD	San Diego	902RCWGRx
RB9	Rainbow Creek	NSD	San Diego	902RC0001
RB9	Rainbow Creek	NSD	San Diego	902M20173
RB9	Rainbow Creek	NSD	San Diego	902RNBI15
RB9	Rainbow Creek	NSD	San Diego	902M20161
RB9	Santa Margarita River (Upper)	NSD	San Diego	902S05173
RB9	Santa Margarita River (Upper)	NSD	San Diego	902SMRDRx
RB9	Santa Margarita River (Upper)	NSD	San Diego	902M20273
RB9	Santa Margarita River (Upper)	NSD	San Diego	902FB1xxx
RB9	Santa Margarita River (Upper)	NSD	San Diego	902SSMR05
RB9	Santa Margarita River (Upper)	NSD	San Diego	902S00565
RB9	Santa Margarita River (Upper)	NSD	San Diego	SMC04661
RB9	Santa Margarita River (Upper)	NSD	San Diego	902RB1xxx
RB9	Santa Margarita River (Upper)	NSD	San Diego	902M20301
RB9	Santa Margarita River (Upper)	NSD	San Diego	902S02293
RB9	Santa Margarita River (Upper)	NSD	San Diego	902SMRWGR
RB9	Santa Margarita River (Upper)	NSD	Riverside	902M18893
RB9	Santa Margarita River (Upper)	NSD	Riverside	902MWD1xx
RB9	Santa Margarita River (Upper)	NSD	Riverside	902GG1xxx
RB9	Santa Margarita River (Upper)	NSD	Riverside	SMC33179
RB9	Santa Margarita River (Upper)	NSD	Riverside	902USM828
RB9	Santa Ysabel Creek (below Sutherland Reservoir)	CSD	San Diego	905M21756
RB9	Soledad Canyon	CSD	San Diego	906M21770

Region	Waterbody Name	Watershed	County	Site code
RB9	Soledad Canyon	CSD	San Diego	906LPSOL2
RB9	Temecula Creek	NSD	Riverside	SMC05109
RB9	Temecula Creek	NSD	Riverside	902LTC777
RB9	Tijeras Canyon	SJU	Orange	901M14134
RB9	Tijeras Canyon	SJU	Orange	SMC00873
RB9	Tijeras Canyon	SJU	Orange	SMC01257
RB9	Tijeras Canyon	SJU	Orange	901M14155
RB9	Tijuana River	SSD	San Diego	No samples collected by SMC program
RB9	Wood Canyon (Orange County)	SJU	Orange	901WCEOTx
RB9	Wood Canyon (Orange County)	SJU	Orange	901WC2MMx
RB9	Wood Canyon (Orange County)	SJU	Orange	901M14149
RB9	Wood Canyon (Orange County)	SJU	Orange	901WCCRTx
RB9	Wood Canyon (Orange County)	SJU	Orange	901M14169