



Southern California Stormwater Monitoring Coalition

DRAFT

Annual Report 2015-2016

Prepared by:

J. Michael Trapp, PhD

Michael Baker International

Carlsbad, California

This page intentionally left blank

EXECUTIVE SUMMARY

Collaboration is a powerful tool for achieving common goals. The Southern California Stormwater Monitoring Coalition (SMC) has exemplified collaboration over the past 15 years filling foundational gaps in knowledge about how to improve stormwater management. Creating monitoring infrastructure, deciphering stormwater mechanisms and processes, and assessing receiving water impacts have brought tremendous leaps in how dischargers and regulators address the challenging issues of urban runoff. Cumulatively, the SMC and its project partners has expended over \$7M to fill these data gaps.¹

The SMC Annual Report provides an opportunity for the member agencies to present and describe the projects they are working on with other member agencies. Likewise, this report provides a brief overview of projects active during the reporting year and summarizes projects either recently completed or planned for the upcoming year. Each project summary presented in this report includes the lead agency managing the project, the partner agencies, sources of funding, and a list of prepared publications.

The 2015-2016 reporting year included projects covering a wide range of environmental and water quality disciplines. Member agencies were involved in their second five-year regional bioassessments of stream health, began a multi-year monitoring and assessment project on Low Impact Development, and implemented the SMC's first ever toxicity testing laboratory inter-calibration exercise.

During Fiscal Year (FY) 2015-2016, a new five-year SMC Master Agreement was developed and ratified. As part of this agreement, funding was set aside for dedicated staff to act as an Administrative Officer to reflect the growth of the work the SMC is conducting. Additionally, the new SMC Master Agreement set forth increased definition into the governance, project participation, and funding within the SMC.

¹ Southern California Stormwater Monitoring Coalition 2014 Research Agenda. 2014. K Schiff, ED Stein, S Aminzadeh, A Boehm, G Hildebrand, L Honeybourne, I Nasser, P Ode, S Taylor, D Senn, J Smith, C Sommers, E Strecker. Technical Report 828.

TABLE OF CONTENTS

	Page
EXECUTIVE SUMMARY	iii
1 INTRODUCTION	1-1
1.1 OVERVIEW OF THE 2015-2016 ANNUAL REPORT	1-1
2 STORMWATER MONITORING COALITION OVERVIEW	2-1
3 PROJECTS COMPLETED DURING REPORTING TERM	3-1
3.1 APPROVAL OF SMC MASTER AGREEMENT WITH ALTERNATE PROGRAM FUNDING APPROACH.....	3-1
4 ONGOING PROJECT ACCOMPLISHMENTS.....	4-1
4.1 IMPLEMENTATING A NEW 5-YEAR REGIONALLY CONSISTENT AND INTEGRATED FRESHWATER STREAM BIOASSESSMENT MONITORING PROGRAM	4-1
<i>Project-related Publications</i>	4-2
4.2 LOW IMPACT DEVELOPMENT PROJECT (SMC CLEAN)	4-3
<i>Task 1: Form and Coordinate a Project Technical Advisory Committee</i>	4-3
<i>Task 2: Research Existing Data</i>	4-4
<i>Task 3: Implement initial monitoring procedures in a beta test phase</i>	4-4
<i>Task 4: Summarize Monitoring Data, Provide Recommendations, and Update the LID Manual</i>	4-4
<i>Task 5: Ongoing Collaboration with Project Partners</i>	4-4
4.3 TOXICITY TESTING LABORATORY INTERCALIBRATION	4-5
<i>Project-related Publications</i>	4-7
4.4 STORMWATER RETENTION CREDIT FRAMEWORK/ ALTERNATIVE COMPLIANCE STRATEGIES	4-7
<i>Water Quality Equivalency (WQE) Guidance Development</i>	4-7
<i>Application and Testing of Water Quality Equivalency Guidance</i>	4-8
<i>Update</i>	4-9
5 PROJECTS PLANNED FOR 2016-2017.....	5-1
5.1 STANDARDIZED MS4 MONITORING PROGRAMS	5-1
<i>Background</i>	5-1
<i>Objectives and Products</i>	5-1
<i>Project-related Publications</i>	5-2
5.2 WATER QUALITY INDEX AND VISUALIZATION	5-3
<i>Background</i>	5-3
<i>Objectives and Products</i>	5-3
<i>Project-related Publications</i>	5-4

LIST OF TABLES

	Page
Table 2-1. List of Member Agencies in the Stormwater Monitoring Coalition.....	2-1
Table 3-1. SMC Master Agreement Project.....	3-1
Table 4-1. 2015-2019 Regional Freshwater Stream Bioassessment Monitoring Project.....	4-1
Table 4-2. Low Impact Development Project.....	4-3
Table 4-3. Toxicity Testing Laboratory Intercalibration Study.....	4-5
Table 4-4. Summary of laboratory comparability scoring for <i>Ceriodaphnia dubia</i> (6-8 day) survival and reproduction, <i>Hyalella</i> survival, <i>Strongylocentrotus</i> embryo development, or <i>Mytilus</i> embryo development tests.	4-6
Table 4-5. Stormwater Retention Credit Framework/ Alternative Compliance Project	4-7
Table 5-1. Standardized MS4 Monitoring Program Summary	5-1
Table 5-2. Water Quality Index and Visualization Project	5-3

LIST OF FIGURES

	Page
Figure 3-1. Perennial stream condition was evaluated with four biological indicators: benthic macroinvertebrates, diatoms, soft algae, and riparian condition.....	3-2
Figure 3-2. Extent of perennial streams in good biological condition for all four indicators.....	3-3

ACRONYMS AND ABBREVIATIONS

CASQA	California Storm Quality Association
LID	Low Impact Development
NPDES	National Pollutant Discharge Elimination System
PSA	Perennial Stream Assessment
SCCWRP	Southern California Coastal Water Research Project
SETAC	Society for Environmental Toxicity and Chemistry
SMC	Southern California Stormwater Monitoring Coalition

1 INTRODUCTION

The goal of the Southern California Stormwater Monitoring Coalition (SMC) is to develop the technical information necessary to better understand stormwater mechanisms and impacts, and then develop the tools that will effectively and efficiently improve stormwater decision-making. The SMC develops and funds cooperative projects to improve the knowledge of stormwater quality management and reports on the progress of those projects on an annual basis.

The 2015-2016 Annual Report represents an opportunity to report on the status of collaborative projects that are being worked on by member agencies. This report is intended provide a brief overview of projects active during the reporting year and summarize projects either recently completed or planned for the upcoming year. Each project summary presented in this report includes the lead agency managing the project, sources of funding, and a list of prepared publications.

1.1 OVERVIEW OF THE 2015-2016 ANNUAL REPORT

Member agencies are involved in multiple projects or individual projects that have different times for completion and are at various implementation stages. Project information is presented in several sections of this report depending on the implementation status. Recently completed projects, active projects, and projects planned for the upcoming year are provided in Section 3 to Section 5. The 2015-2016 Annual Report outline is as follows:

Section 3: SMC member agencies completed several projects during the 2015-2016 reporting year including:

- Implementation of an updated SMC Master Agreement with an alternate funding approach

Section 4: SMC projects that were active during the 2015-2016 reporting year included:

- Implementing the 2015-2019 Regionally Consistent and Integrated Freshwater Stream Bioassessment Monitoring Program
- Starting the SMC California LID Evaluation and Analysis Network (SMC CLEAN) Project
- Implementation of a toxicity testing laboratory inter-calibration exercise
- Continued work on the Water Quality Equivalency (WQE) Guidance Development

Section 5: The SMC also has the following projects planned to potentially begin in the 2016-17 reporting period including:

- Development of standardized MS4 monitoring programs
- Development of a water quality index and visualization method

2 STORMWATER MONITORING COALITION OVERVIEW

As a result of an increasing regulatory focus and limited scientific knowledge base, both stormwater regulators and municipal stormwater management agencies throughout Southern California have formed a collaborative working relationship to improve the science of stormwater management. The goal of this relationship is to develop the technical information necessary to better understand stormwater mechanisms and impacts, and then develop tools to effectively and efficiently improve stormwater decision-making. There was early recognition that these issues are often not localized but typically cross watershed and jurisdictional boundaries. This relationship culminated in a formal letter of agreement, signed in 2000, 2009, and again in 2015 by all Phase I municipal stormwater National Pollutant Discharge Elimination System (NPDES) lead permittees and the NPDES regulatory agencies in Southern California to create the Stormwater Monitoring Coalition (SMC). The SMC is directed by a Steering Committee consisting of member agencies' program managers who are the lead representatives for their respective organizations (Table 2-1).

Table 2-1. List of Member Agencies in the Stormwater Monitoring Coalition

Agency	Lead Representative ^(a)
California Department of Transportation, Caltrans	Bhaskar Joshi
City of Long Beach	Anthony Arevalo
City of Los Angeles, Watershed Protection Division	Charlie Yu
City of San Diego	Ruth Kolb
County of Orange, OC Public Works	Chris Crompton, Chair
County of San Diego Stormwater Management Program	Jo Ann Weber
Los Angeles County Flood Control District	Geremew Amenu
Riverside County Flood Control and Water Conservation District	Art Diaz
San Bernardino County Flood Control District	Marc Rodabaugh
Southern California Coastal Water Research Project	Ken Schiff, Vice-Chair
Ventura County Watershed Protection District	Arne Anselm
California Regional Water Quality Control Board, Los Angeles Region	Ivar Ridgeway
California Regional Water Quality Control Board, San Diego Region	Bruce Posthumus
California Regional Water Quality Control Board, Santa Ana Region	Milamol Gaslan
State Water Resources Control Board	Greg Gearheart
US Environmental Protection Agency, Office of Research and Development	Mike Borst

(a) List current as of June 2015

The value of the SMC to its member agencies is at least four-fold, including:

- The ability to share costs for implementing projects.
 - Cost reductions for SMC member agencies can be significant since collaborative projects can reduce costs by more than 90% relative to financing alone. In addition, the majority of projects have non-member agency cost matching. Since its inception, non-member cost matching has totaled nearly \$3.5 million, which is an almost 2:1 match of member costs.
- The ability to stretch member agencies' skill bases.
 - Stormwater management requires a wide variety of knowledge, including regulatory policy, engineering, hydrology, biology, chemistry, toxicity, and microbiology, to name a few. Many member agencies have limited staff and, by working together, garner the additional skills that are not sustainable within each agency.
- The ability to communicate.
 - Discussions among member agencies provide context and a richness of ideas for application to local issues. Similarly, discussion between regulatory and regulated agencies in an informal setting leads to more effective implementation of management activities.
- Projects conducted under the SMC umbrella have nearly always resulted in management action.
 - Often, it is difficult for a single agency to affect the current course of regulatory management. Because SMC projects are initiated and vetted through the regulated and regulatory management agencies, the results are adopted quickly into the management framework, including alterations to NPDES permits. In turn, these collaborative relationships help regulated agencies meet compliance with their MS4 Phase I permits.

3 PROJECTS COMPLETED DURING REPORTING TERM

This section provides an overview of the SMC member agencies' projects that were completed during the 2015-16 reporting year. This overview briefly summarizes each project, identifies some key study questions, and lists publications produced from the project efforts.

Information on past annual project updates reported in the SMC Annual Report are available on the SMC website at the following link:

- [SoCal SMC Annual Reports](http://www.socalsmc.org/Reports.aspx) (<http://www.socalsmc.org/Reports.aspx>)

3.1 APPROVAL OF SMC MASTER AGREEMENT WITH ALTERNATE PROGRAM FUNDING APPROACH

Table 3-1. SMC Master Agreement Project

Lead Agency	<i>County of Orange</i>
Report Year Project Started	<i>2013-2014</i>
Status	<i>100% Complete</i>
Project Budget	<i>\$300,000 per year for four years</i>
Project Partners:	
<i>California Department of Transportation, Caltrans</i>	<i>Los Angeles County Flood Control District</i>
<i>City of Long Beach</i>	<i>Riverside County Flood Control and Water Conservation District</i>
<i>City of Los Angeles, Watershed Protection Division</i>	<i>San Bernardino County Flood Control District</i>
<i>City of San Diego</i>	<i>Southern California Coastal Water Research Project</i>
<i>County of Orange, OC Public Works</i>	<i>Ventura County Watershed Protection District</i>
<i>County of San Diego Stormwater Management Program</i>	
Technical Lead	<i>Chris Crompton, OC Public Works</i>
Key Words: stormwater retention, wet weather runoff, BMP effectiveness	

The Steering Committee received the first draft of the next Master SMC Agreement in February 2013. It was finalized and signed January 15, 2016. The previous SMC Master Agreement expired June 4, 2013, and the new agreement mimics the previous agreement with three additions:

- i. Insertion of a budget and workplan process for SMC projects to expedite projects that currently require implementation agreements;

- ii. Establishment of a budget manager from the SMC members to collect and distribute annual budget funds; and,
- iii. Establishment of an Administrative Officer through an RFP process to assist the elected officers in the management of SMC activities and sponsored projects.

The budget and workplan process is meant to increase the efficiency and timeliness of the SMC to build upon the successful projects already completed. The agreement, however, still contains the provision for each agency to pay only for projects in which they choose to participate. Therefore, the budget is not necessarily split evenly among agencies, and participation in a given project is not mandatory for any member agency. One goal is to fund the smaller, ongoing projects (i.e., intercalibration, regional monitoring coordination, etc.) without constantly needing new agreements created. The agreement still contains language for supplemental implementation agreements to fund larger, one-time, partnered projects based on individual member agency needs and implementation of the research agenda.

Based on the proposed agreement structure, with multiple parties committing to an annual budget, the SMC requires a Treasurer to receive and disburse funds, issue invoices, and manage the budget. SCCWRP has been chosen to serve as the SMC Treasurer. SCCWRP will be allocated up to five percent of the annual budget for administrative support.

The new agreement also creates a rotating Chairperson position with an allocated budget for an Administrative Officer to organize meetings, prepare minutes and the Annual Reports, write agreements, and provide overall continuity in the day-to-day operations of the organization. Yearly elections were held at the last SMC Steering Committee meeting of the year on June 7, 2016 for the new officers. Arne Anselm of Ventura County Watershed Protection District was elected SMC Chairperson, and Grant Sharp of County of Orange, OC Public Works was elected Vice Chair. Their positions were effective immediately. Additionally, at this meeting Michael Trapp of Michael Baker International was selected as the Administrative Officer as part of the open bid RFP process.

4 ONGOING PROJECT ACCOMPLISHMENTS

This section provides an overview of the SMC member agencies' active projects along with a brief summary describing the intent of each project, some key study questions, the regional motivation behind the projects, and a list of publications produced from project efforts. While a brief overview is provided in the Annual Report, detailed information can be obtained from the list of technical publications provided at the end of each section or by contacting the Technical Leads.

4.1 IMPLEMENTATING A NEW 5-YEAR REGIONALLY CONSISTENT AND INTEGRATED FRESHWATER STREAM BIOASSESSMENT MONITORING PROGRAM

Table 4-1. 2015-2019 Regional Freshwater Stream Bioassessment Monitoring Project

Lead Agency	<i>SCCWRP</i>
Report Year Project Started	<i>2014-2015</i>
Status	<i>15% Complete</i>
Project Budget ⁽¹⁾	<i>\$426,350</i>
	<i>\$85,265 per year All SMC Member Agencies</i>
External Project Partners:	<i>Surface Water Ambient Monitoring Program</i>
	<i>California Dept. Fish & Wildlife</i>
Technical Lead	<i>Raphael Mazor, SCCWRP</i>

Key Words: bioassessment, freshwater stream biology, aquatic life stressors

Notes: (1) The project budget listed does not include sample analysis costs or funding contributions provided by the Water Boards.

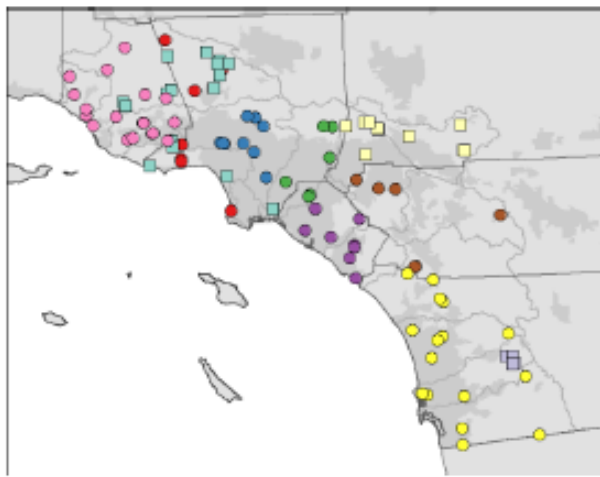
In 2015, the SMC initiated the first year of its redesigned stream bioassessment survey, sampling 102 sites and implementing several major changes to address information gaps identified in the initial five-year survey, including:

- **Inclusion of non-perennial streams in the survey.** Whereas non-perennial streams were previously excluded from sampling, they are now included among the 55 “condition” sites (i.e., sites selected in a probabilistic way to represent the typical condition of streams in the region) where bioassessment occurs. By shifting the sampling period earlier in the season (starting as early as March), intermittent streams that dry up before May are more likely to be represented in the survey.
- **Improved trend detection through site revisits.** Forty-seven “trend” sites that were sampled in the first cycle of the survey were revisited in 2015. With a sufficient number of revisits, analysis of the survey results will enable determination of the extent of stream-miles

that are improving or degrading over time and identification of factors associated with these trends.

- **A change in analytes and indicators measured at each site.** In order to focus on new priorities and concerns, SMC participants sampled new indicators (highlighted elsewhere in this report), such as hydromodification impact potential, aquatic invasive vertebrate occurrences, hydrologic state, cellular bioassays, and non-target analysis of chemicals of emerging concern. Assessment of sediment contamination, although part of the updated survey workplan, was deferred so that a pilot study in limited areas could be completed in 2016.

Changes in cost from the first cycle were minimized, as certain indicators (i.e., toxicity, metals, and pyrethroids in the water column) were dropped based on recommendations by the SMC workgroup. Priority indicators that were retained, such as benthic macroinvertebrates, algae, riparian wetlands (i.e., CRAM), physical habitat, nutrients, and major ions, were sampled at every site.



Sampling effort in 2015 by agency.

Stormwater agencies	Condition (# sites)	Trend (# sites)	Total (# sites)
Ventura County	10	8	18
Los Angeles County	5	2	7
Los Angeles WMP	3	6	9
San Gabriel RMP	2	4	6
Orange County	5	3	8
Riverside County	3	3	6
San Diego WMAs	12	4	16
Water boards			
RB4	9	7	16
RB8	4	6	10
RB9	2	4	6
Total	55	47	102

Project-related Publications

RD Mazor. 2015. *Bioassessment Survey of the Stormwater Monitoring Coalition- Workplan for Years 2015 through 2019* Version 1.0. Technical Report 849. Southern California Coastal Water Research Project Authority. Costa Mesa, CA.

4.2 LOW IMPACT DEVELOPMENT PROJECT (SMC CLEAN)

Table 4-2. Low Impact Development Project

Lead Agency	<i>San Bernardino County Flood Control District</i>
Report Year Project Started	<i>2015-2018</i>
Status	<i>30% Complete</i>
Initial Project Budget	<i>\$370,000</i>
Technical Lead	<i>Marc Rodabaugh, San Bernardino County Flood Control District Dan Apt Michael Trapp Matt Yeager</i>

Key Words: stormwater retention, wet weather runoff, BMP effectiveness

The SMC California LID Evaluation and Analysis Network (SMC CLEAN) is designed to understand the effectiveness of LID BMPs through:

- The development of specific LID research questions,
- Research of existing LID monitoring data,
- Development of a standard methodology for monitoring LID BMPs including coordination with other SMC projects reviewing monitoring methodology,
- Coordination of ongoing LID monitoring,
- Implementation of LID monitoring through the standard methodology developed,
- Summary and analysis of monitoring data, and
- Development of recommendations and update of the Southern California LID Manual.

The primary purpose of the SMC CLEAN Project is to understand the effectiveness of various LID BMPs with different designs and configurations so that design, construction, maintenance, and monitoring recommendations can be made in an updated LID Manual to ensure LID BMPs are implemented in the most effective manner. The 2016 SMC CLEAN Project activities, according to each of the five tasks, are summarized below.

Task 1: Form and Coordinate a Project Technical Advisory Committee

SMC CLEAN TAC Meetings were held on February 25, May 25, and October 6, 2016. Discussions with the SMC CLEAN TAC identified two primary needs associated with the project. The first is a short-term need for quantification of LID performance in Southern California, necessary to provide empirical data for calibrating estimates for compliance measures such as the recently developed watershed programs (i.e., EWMPs, WQIPs, etc.) and their associated watershed/water quality models

(i.e., RAA, RAS). The second is a long-term need to serve as a collaboration entity and clearinghouse of LID monitoring data to understand the effectiveness of various LID BMPs overtime and how the differences in design, construction, and maintenance affect performance.

TAC meetings in 2016 focused on project branding, the project work plan, the updated work plan, targeted research questions, and the standard LID project data-information list. Additionally, through TAC discussion, it was decided that the project will focus on bioretention and biofiltration BMPs, as they are the primary LID BMPs being implemented.

Task 2: Research Existing Data

This task focused on the research of existing LID monitoring data. Research of existing data included networking with project partners and identified LID sites to obtain LID monitoring data. Collaboration also occurred with the SWRCB to obtain existing data from grant-funded projects. Additionally, coordination with SCCWRP, Cloud Compli, and Eco Layers assisted in understanding how data could be gathered in the future with a data submittal tool to obtain data in a federated approach by pulling data from existing databases. Obtained data was analyzed to identify data gaps and help inform targeted research questions and development of an initial monitoring protocol.

Task 3: Implement initial monitoring procedures in a beta test phase

Coordination with existing monitoring sites happened during the first part of the wet season in 2016. A draft standard monitoring protocol was developed that will be used for project monitoring and coordinated with the SWRCB with potential to be integrated into future SWRCB grant projects.

Task 4: Summarize Monitoring Data, Provide Recommendations, and Update the LID Manual

Activity for this task in 2016 was a re-review of the SMC Manual and identification of sections that will need updating or addition, such as a monitoring protocol section and updates to maintenance and design related to results of the SMC CLEAN recommendations.

Task 5: Ongoing Collaboration with Project Partners

Collaboration with project partners succeeded throughout 2016 to obtain data and coordinate on future monitoring. This included coordination with Orange County Public Works, Riverside County Flood Control and Water Conservation District, USCD Scripps, UCI Irvine and PIRE, Council for Watershed Health, and SWRCB.

4.3 TOXICITY TESTING LABORATORY INTERCALIBRATION

Table 4-3. Toxicity Testing Laboratory Intercalibration Study

Lead Agency	<i>SCCWRP</i>	
Status	90% Complete	
Project Budget	\$65,000	
External Project Partners:		
<i>Aquatic Bioassay & Consulting Laboratory</i>	<i>Marine Pollution Studies Laboratory</i>	
<i>Aquatic Testing Laboratories</i>	<i>MBC Applied Environmental Services</i>	
<i>Aquatic Toxicity Lab (University of California, Davis)</i>	<i>Nautilus Environmental</i>	
<i>City of Los Angeles Environmental Monitoring Laboratory</i>	<i>Pacific Ecorisk</i>	
<i>Los Angeles County Sanitation District</i>		
Technical Lead	<i>Ken Schiff, SCCWRP</i>	
Key Words: toxicity test, <i>Ceriodaphnia dubia</i>		

Aquatic toxicity testing has become a standard measurement in stormwater management. Field samples are evaluated in the laboratory by exposing test organisms and documenting their response. Responses range from lethality to critical life stage development or reproduction success, and response is measured with highly uniform and repeatable methods. Cumulatively, stormwater management agencies in Southern California spend nearly \$1 million annually conducting toxicity tests.

One of the goals of the SMC is to combine data sets for comparing watersheds over time. One challenge to using toxicity testing is that the various SMC member agencies currently utilize different test species and a variety of endpoints. Although standardized methods are used by the multiple contract laboratories who conduct SMC toxicity testing, the method protocols typically have options or interpretations left to the laboratory, potentially leading to different test outcomes. This uncertainty is compounded by concerns about the toxicity test's inherent variability within each laboratory.

As a result of these challenges, the SMC decided to conduct a laboratory intercalibration study to assess comparability. The goal was to identify key recommended test species and endpoints, quantify intra- and inter-laboratory variability for each test, and make recommendations for how to minimize that variability, where applicable. An advisory committee was created to help design, implement, and interpret the intercalibration study, then construct the recommendations in this guidance manual.

The recommended test species included two freshwater species (*Ceriodaphnia dubia* 6-8 day chronic survival and reproduction test; *Hyalella azteca* 96-hour acute survival test) and two marine species (*Strongylocentrotus purpuratus* and *Mytilus galloprovincialis* short-term chronic larval development tests) based on commonality to current monitoring requirements and maintaining existing trends, sensitivity

to toxicants, ease of testing/cost, and other criteria. Two iterations of laboratory intercalibrations were conducted. Each iteration was comprised of four samples delivered blind to each laboratory, lab dilution water, lab dilution water spiked with copper, a runoff sample created with artificial rainfall, and a duplicate. Comparability was evaluated on three factors:

- Test acceptability (negative control and reference toxicant response),
- Intra-laboratory precision (duplicate sample response), and
- Inter-laboratory precision (among lab response).

Up to ten laboratories participated, including contract labs, municipal monitoring labs, and research labs. All laboratories were certified by the State of California for toxicity testing.

After two intercalibration iterations, nearly all laboratories scored comparable (moderate to very high comparability) for three of the four species (four of five endpoints), including both marine species, *Hyalella* (the newest method), and the survival endpoint for *Ceriodaphnia* (Table 4-4). Approximately half the laboratories, however, scored moderate or better comparability for the *Ceriodaphnia* reproduction test, and these laboratories were not consistent between intercalibration rounds. While intra-laboratory precision was generally comparable for *Ceriodaphnia* reproduction, there was a range of responses among laboratories to each sample, including the lab dilution water. The best inter-laboratory precision for the *Ceriodaphnia* reproduction test was observed for the runoff sample.

Based on these results, a final project report will be completed for SMC approval during FY 2016-17. The main report findings will be all four species can be recommended for future use as part of the SMC monitoring programs. Specific guidance for stormwater testing will be provided for potential variable-inducing steps, including hardness of dilution water, feeding, sample handling and water renewals, and aging of organisms. Additionally, intercalibrations will be recommended specifically for the *Ceriodaphnia* reproduction test to assess sources of variability in both stormwater and laboratory dilution water.

Table 4-4. Summary of laboratory comparability scoring for *Ceriodaphnia dubia* (6-8 day) survival and reproduction, *Hyalella* survival, *Strongylocentrotus* embryo development, or *Mytilus* embryo development tests.

Lab	<u><i>Ceriodaphnia</i></u> Survival		<u><i>Ceriodaphnia</i></u> Reproduction		<u><i>Hyalella</i></u> Survival		<u><i>Strongylo-</i></u> <u><i>centrotus</i></u> Development	<u><i>Mytilus</i></u> Embryo Development
	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2	Round 1 ^a	Round 1 ^a
A	Moderate	High	Very High	Low	Low	High	Moderate	- ^b
B	Very High	High	Moderate	High	Low	High	-	-
C	Low	High	Low	High	Low	Very High	-	-
E	Moderate	-	Moderate	-	-	-	-	Very High
F	Moderate	High	Moderate	Low	Low	Very High	Moderate	Low
G	High	-	High	-	-	-	-	-
H	Low	-	Low	-	-	-	-	-
I	High	Moderate	High	Low	Moderate	Very High	High	Very High
J	Low	High	Low	Low	High	Very High	Moderate	Moderate

^a Only tested in Round 1

^b - indicates sample not tested

Project-related Publications

- Gossett, R. and Schiff, K. 2010. [Stormwater Monitoring Coalition Laboratory Guidance Document](#), 3rd Edition. Southern California Coastal Waters Research Project, Technical Report 615.
- Gossett, R. and Schiff, K. 2006 [Stormwater Monitoring Coalition Laboratory Guidance Document](#), 2nd Edition. Southern California Coastal Waters Research Project, Technical Report 521.
- Gossett, R. Renfrew, D. and Schiff, K. 2004 [Stormwater Monitoring Coalition Laboratory Guidance Document](#), 1st Edition. Southern California Coastal Waters Research Project, Technical Report 420.

4.4 STORMWATER RETENTION CREDIT FRAMEWORK/ALTERNATIVE COMPLIANCE STRATEGIES

Table 4-5. Stormwater Retention Credit Framework/Alternative Compliance Project

Lead Agency	<i>County of San Diego</i>
Status	<i>50% Complete</i>
Project Budget	<i>\$441,176</i> <i>\$441,176 SMC Member Agencies (8)</i>
Technical Leads	<i>Eric Stein, SCCWRP</i> <i>Matt Yeager, Independent Consultant</i>

Key Words: Water quality equivalency, regional LID, offsite mitigation

The project focus is to develop model program guidance for Permittees and other stakeholders to facilitate implementation of approvable “alternative compliance” options (Options) for Priority Development Projects (PDPs)², where applicable. The project will also apply and test the model guidance by developing a model Alternative Compliance Program (ACP) for the Fletcher Basin and Legacy Campus Plan areas in Orange County.

This is a joint project being conducted by the San Diego and Orange County Stormwater Programs. The project has two primary tasks, each with multiple subtasks, which are as follows:

Water Quality Equivalency (WQE) Guidance Development

- Background research
- Equivalency determination
- Develop equivalency guidance document

² PDPs are defined according to the San Diego Regional Municipal Permit (ORDER NO. R9-2013-0001) at Section E.3.b.

Application and Testing of Water Quality Equivalency Guidance

The application and testing project phase includes two pilot projects to test methodologies, examine potential benefits or impacts, and perform effectiveness assessments. The two pilot project locations are:

- **Fletcher Basin:** Using a detailed case study approach, the project will apply quantitative metrics, including the WQE Guidance methodology, to:
 - Evaluate and compare the water quality,
 - Evaluate local potable water supply augmentation,
 - Assess ecological, species and habitat, and property value-related benefits of installing selected combinations of the four types of LID BMPs, and
 - Assess site-by-site benefits on selected parcels presumed to be classified as PDP sites in the Fletcher Basin subwatershed.

The project will quantify the benefits expected from development and operation of a single regional stormwater retention basin retrofitted to accept urban stormwater runoff. The Fletcher Basin retrofit analysis will examine the opportunities and challenges of individual site-by-site LID BMP implementation versus large-scale, multi-jurisdictional cooperative stormwater capture projects, including identification of key water rights issues.

- **Legacy Campus Plan Project (Legacy CPP):** This project task will conduct a case study benefit and cost analysis for the Legacy CPP, located within the City of Orange. The Legacy CPP consists of an approximately 25-acre site that will be developed for commercial (medical) and residential uses by integrating existing and new building areas, and includes opportunities for regional stormwater capture within areas near and adjacent to Santiago Creek (which is outside of the Legacy CPP contributing area). The Legacy CPP will examine opportunities and challenges for public-private partnerships in stormwater management. Through evaluation of the Legacy CPP, the proposed SMC project can determine the optimum mixture of on-site and regional stormwater BMPs that can be installed and maintained for the least cost while providing maximum benefits.

The results of the Fletcher Basin and Legacy CPP benefit cost analyses will be combined with existing information on engineering feasibility of LID BMP use in Orange County to establish a model in-lieu program framework and recommended fee structure, including the quantitative basis for appropriate in-lieu fees. Within such a framework, PDPs in the applicable areas could comply with the requirement to manage 100% of the Design Storm runoff by funding off-site or alternative LID/retention/stormwater treatment BMPs at a level deemed equivalent to managing the Design Storm obligation on-site.

To support alternative compliance program options that meet MS4 permit obligations, the proposed project will identify and analyze the institutional (contractual and legal) agreements necessary for implementing options, including regional BMP development, green street development, water quality

credit trading, and in lieu fees. By combining the economic, regulatory, institutional/ legal, and technical feasibility issues that need to be addressed to establish an alternative compliance program, the proposed project will serve as a model approach for watershed-based LID BMP implementation and optimization in Orange County. The work products will help decision makers to optimize the location, benefits, and costs of installing LID BMP-type stormwater management facilities in Orange County, while maintaining compliance with MS4 permit requirements and providing flexibility to project designers and developers.

Update

The potential implementation of alternative compliance approaches for development projects under the MS4 Permits in Southern California is of particular interest to the SMC. Alternative compliance for development projects includes water quality credit trading programs, in lieu fee programs, and other regional or off-project approaches. The determination of a water quality “currency” and an allocation and accounting method have been identified as critical needs for evaluating the feasibility of alternative compliance implementation. Although not funded by the SMC, this project is being conducted by several SMC members and is the most comprehensive alternative compliance evaluation effort in California.

Water Quality Equivalency (WQE) Guidance Development

The San Diego, Orange, and Riverside County Copermittees, interested stakeholders, and members of the public completed the Water Quality Equivalency (WQE) Guidance Document, which was accepted for use by the San Diego Regional Board in December 2015. The project developed model program guidance that forms the regional and technical basis to calculate the water quality benefits associated with development projects implemented as part of an alternative compliance program. From the acceptance letter:

“An alternative compliance program allows priority development projects that are required to include numerically-sized structural pollutant control and hydromodification management best management practices (BMPs) onsite to implement all or part of the structural BMPs offsite. A priority development project can participate in an alternative compliance program if it is offered by the local jurisdiction and if the proposed offsite project provides a greater water quality benefit to the watershed than implementing the structural BMPs onsite.”

Application and Testing of Water Quality Equivalency Guidance

The companion cost/benefit project conducted case studies to apply the San Diego WQE and Project Valuation Techniques to the Legacy Campus Plan Project and Fletcher Basin Watershed. The project conducted proof-of-concept evaluations on hypothetical alternative compliance implementation scenarios based on the two existing project sites in Orange County. The Fletcher Basin project is a centralized regional alternative credit-generating facility, whereas the Legacy Campus Plan includes distributed surface retention BMPs. The project team has completed a draft report: “Model MS4 Alternative Compliance Program Benefit Cost Analysis for Orange County, California;” and respective project site technical memoranda, which are currently under agency review.

5 PROJECTS PLANNED FOR 2016-2017

The summaries reported in this section represent strategic planning efforts or new projects that have been identified as supporting a SMC priority and have received member agency support to be implemented during the 2016-2017 reporting year.

5.1 STANDARDIZED MS4 MONITORING PROGRAMS

Table 5-1. Standardized MS4 Monitoring Program Summary

Lead Agency	<i>Ventura County Watershed Protection District</i>
Technical Leads	<i>Arne Anselm, Ventura County Watershed Protection District Ken Schiff, SCCWRP</i>
Project Budget	<i>\$123,293 to develop project work plan</i>
Key Words: regional comparability, standardized monitoring	

Background

In May 2012, the SMC held a workshop to identify the similarities and differences in stormwater monitoring among member agencies. The ultimate outcome was that existing SMC member agency monitoring and reporting requirements were inconsistent, leading to incompatible sampling programs and incomparable data and information across programs. The result is a large potential for redundancy, inefficiency, and ineffective outcomes. This is exacerbated by our already limited resources for assessing receiving water environmental health and end-of-pipe compliance.

The technical report developed from the workshop findings established a resource guidance document for stormwater monitoring programs. Likewise, the workshop helped to further highlight the many barriers that program manager faces in implementing changes in established monitoring programs. These barriers are coupled with agencies having limited resources, a need to navigate numerous practical considerations and a need to continue existing trend monitoring designs. All of these considerations lead to the workshop concluding that development an effective stormwater monitoring guidance document intended to create regional consistency will require the collaboration and inputs from stormwater agencies and the Regional Water Quality Control Boards. The guidance document is perceived as providing value as a resource for writing and renewing permits, planning or negotiation monitoring requirements during permit renewals, and providing a consistent technical foundation when planning special studies or TMDL monitoring programs.

Objectives and Products

The technical report from the May 2012 workshop included a series of recommendations on next steps for creating an effective stormwater monitoring guidance manual. The next steps include the SMC members endorsing several foundational management questions to serve as a starting point for creating greater regional comparability namely:

1. Identify and prioritize management questions.

2. Identify scales (regional, local) and runoff types (dry, wet) that apply to each management question.
3. Identify factors that impede addressing each of the management questions. This is likely where the survey and workshop outcomes described in this report will be most helpful.
4. Develop stormwater monitoring guidance that addresses the specific needs of each management question, including the concept of a minimum set of requirements that all SMC member agencies would hold in common.

The goal of this planned SMC project is to develop a uniform monitoring approach that will lead to regional consistency in demonstrating trends, identifying stressors, identifying sources and evaluating effectiveness of management measures. The first phase of the project to develop a Technical Guidance Manual for a Uniform Approach to Stormwater Monitoring (UASM). The objective of Phase I is to provide an updated inventory of stormwater monitoring programs in the region, and detail the needed steps in the following phases to create the needed change that will allow the final UASM to be implemented across the SMC region. The overall effort will detail the process for implementing changes in municipal stormwater monitoring requirements through engaging stakeholders, especially Regional Board staff, and to reach consensus on how stormwater monitoring will be addressed in future permits and monitoring plans. The standardized MS4 monitoring program project is intended to be model guidance for adoption by stormwater NPDES permit monitoring and reporting programs, through consideration of the following;

- Monitoring questions,
- Design criteria,
- Sampling and analysis protocols and methods,
- Database and QA/QC rules
- Reporting formats.

It is anticipated that the sampling approach will contain the three-part model framework developed by the SMC which including core monitoring, regional monitoring, and special studies. After the first iteration of the model program, SMC member agencies should evaluate the efficacy of the monitoring recommendations, and update model program requirements as needed.

Project-related Publications

Sercu, B., Anselm, A., Schiff, K. *Regional Stormwater Monitoring Coalition and Evaluation: Survey, Workshop, and Research Priorities*. Southern California Stormwater Monitoring Coalition. January 2013.

Bernstein, B.B.; et. al. *Model Monitoring Program for Municipal Separate Storm Sewer Systems in Southern California*. Southern California Stormwater Monitoring Coalition. August 2004.

5.2 WATER QUALITY INDEX AND VISUALIZATION

Table 5-2. Water Quality Index and Visualization Project

Lead Agency	<i>OC Public Works</i>
Technical Leads	<i>Grant Sharp, OC Public Works Ken Schiff, SCCWRP</i>
Project Budget	<i>\$210,000</i>
Key Words: regional comparability, standardized reporting, water quality index	

Background

Assessments of water quality and aquatic ecosystem condition are the crucial part of many regulatory, management, and citizen monitoring programs and have provided information important in identifying and prioritizing problems and tracking trends and progress over time. However, many assessments use different indicators and/or different methods for combining indicators into overall measures of condition. While some progress has been made toward standardizing assessment approaches at regional scales, there is no widely applicable system in the Southern California region (or at state and national scales) for integrating multiple assessments into overall measures of aquatic ecosystem health. Nor is there a readily accessible means of communicating assessment results to managers and the public in ways that highlight areas where risk or the need for protection is greatest risk and to help set priorities for management actions such as pollutant source reduction or natural resource restoration.

A number of initiatives have prioritized the development of aggregated water quality and aquatic ecosystem indices and related visualization tools, providing the basis for a coordinated effort to develop such tools for use in Southern California. In September, 2014, a group of interested parties representing a number of MS4 programs, Regional Water Boards, and SCCWRP held a workshop to discuss the potential wider application of existing index and online data visualization tools being developed and/or applied separately by a number of programs in Southern California and the Central Coast. The technical report from the workshop captured participants' agreement on the value of a coordinated effort that would broaden the applicability of the approaches discussed at the workshop, with the goals of improving abilities to measure condition and track trends, reducing development costs, and enhancing regional assessments. Such a project would build on related efforts by the SMC and others to standardize monitoring designs and protocols, develop regional assessments, and improve the communication of results to a wider range of audiences.

Objectives and Products

Discussion at the workshop identified two priority areas critical to accomplishing these goals: 1) defining the structure of one or more indices and how they would be applied in synthesizing and interpreting monitoring results, and 2) defining how online visualization tools could support these activities. The two goals of this project, thus, are to:

- Develop a common set of water quality and aquatic ecosystem indices for Southern California that would aggregate a number of separate condition indicators, and
- Identify design criteria for data visualization and analysis tools.

The workshop report identified a number of current efforts in the region and statewide that would be expected to provide starting points, alternative concepts, and useful input to the proposed effort. Of particular interest is the approach the California Central Coast Healthy Watersheds Project has taken to create a web-based data navigator and report card system that can be used for efficient aquatic assessments to guide resource management. The first of a two part final report was released in November 2015, describing the selection of aquatic life and human health thresholds, parameter scoring, methods to combine multiple parameters into health indices, and status and trends assessment at the site level for parameters and indices.

Project-related Publications

The published report that supports the development of the SMC's Water Quality Index and Visualization project was prepared by SWAMP in November 2015.

Worcester, K.R.; Paradies, D.M.; Hunt, J.W.; California Central Coast Healthy Watersheds Project – Part 1: *Reports Cards for Scoring Water Quality Data to Characterize Health and Change*. Prepared for the California Surface Water Ambient Monitoring Program. November 2015.

The report is available at the following website:

http://www.waterboards.ca.gov/water_issues/programs/swamp/docs/workplans/rb3_methods_paper.pdf