RMP Special Study Proposal: RMP Stormwater Monitoring Strategy and Trends Monitoring

Summary: PCB and Hg loading data collected in eight watersheds have supported estimates of single watershed loads, regional load estimates, and estimates of land-use-specific concentrations and yields. However, to date, only data collected on the Guadalupe River are suitable for trend assessment for a single watershed and at least 5 years of data in a minimum of three watersheds covering a range of land uses and management efforts are needed to calibrate the regional trends model being developed by the RMP. In addition, other RMP workgroups have a need for concentration or loading data for suspended sediment and contaminants of emerging concern. A Supplemental Environmental Project has been given to the RMP to carry out flow and sediment monitoring at four locations for two water years (2020 and 2021). This project proposes to provide funding for one wet season of sampling for PCBs and Hg at three sampling locations in line with trends modeling needs. The outcome of this study will be quality assured data on PCBs and Hg for one, two or three field locations provided to the public via the online RMP CD3 tool and a short technical report. This study would also provide a platform for coordinated sample collection by other workgroups in future years.

Estimated Cost: $56.1k (1 sampling site);
$97.2k (2 sampling sites);
$136.4k (3 sampling sites)

Oversight Group: STLS/ SPLWG
Proposed by: Lester McKee, Alicia Gilbreath, Jennifer Hunt, and Jing Wu (SFEI)
Time Sensitive: Yes - this project will build upon a SEP that has a finite time line of sampling during the wet seasons of 2020 and 2021.

Proposed Deliverables and Timeline

Deliverable	Due Date
Coordination meeting and 5-year sampling plan	10/ 2019
Field sampling during storms	04/2020
Data quality assurance and management	12/2020

Background

Since the early 2000s, the Sources Pathways and Loadings Workgroup (SPLWG) has conceived of and overseen a number of stormwater monitoring projects using both intensive loads monitoring methods (multiple analytes) (McKee et al., 2015) and watershed characterization reconnaissance monitoring methods (mostly PCB and Hg) (Gilbreath et al., 2019). This sustained effort has generated relatively reliable estimates of stormwater loads in eight small tributary watersheds (Marsh Creek, North Richmond Pump Station, San Leandro Creek, Zone 4 Line A in Hayward, Coyote Creek in San Jose, Guadalupe River, Sunnyvale East Channel, and Pulgas Creek Pump Station South in San Carlos). Loads have also been measured on the Sacramento River at Mallard Island to estimate contributions from the Central Valley. In addition, a number of regional-scale estimates of loads have been computed, the most recent using the

Regional Watershed Spreadsheet model (RWSM), which also provides estimates of land-use specific concentrations and yields (Wu et al., 2018). Watershed characterization reconnaissance monitoring has been collected during one or more storms at another nearly 80 small tributaries to characterize concentrations of PCBs and Hg to support management prioritization of sub-watersheds and source properties.

Despite good progress on addressing management questions at the individual watershed and regional scale and moderate progress on identification of new high leverage small tributaries, there has been little progress on assessing trends in concentrations and loads. As a result, the RMP embarked upon a new direction in 2015 and funded the development of a trends component of the small tributaries loading strategy (STLS). For this effort, a set of three refined management sub-questions on trends was developed:

1. What are the trends in source control, use patterns, or mass removal in tributary watersheds?
2. What are the trends in concentration or loads at small tributary locations?
3. What are the current and projected trends in concentration or loads in relation to specific management actions?

To develop a trends assessment methodology for single watersheds, existing data from the Guadalupe River were evaluated. Accounting for climatic variability, the results indicated no discernible trend in PCB loads for the period 2003-2014 and that a sampling design of four samples collected during four storms every second year would have 80% power to observe a decline of >25% over a 20-year period (Melwani et al., 2018). Workgroup members were concerned about the cost of a similar level of effort at a sufficient number of watersheds to support a regional-scale trend estimate and recognized the need for a mechanism to scale-up trends measurements in a few places for assessing regional-scale trends.

In 2018, the RMP funded a project to further explore this topic, which resulted in an update of the STLS Trends Strategy to include regional model development (Wu et al., 2018). The initial product of the trends modeling strategy was a multi-year workplan (Wu and McKee, 2019). This workplan highlighted the need for at least three empirical monitoring stations to support calibration of the trend model. It was reasoned that data collected over a minimum of three watersheds over five years would provide a good balance of cost and sensitivity, and cover enough of a variety of watershed characteristics, climatic variation, and variation in management effort to support the model calibration for estimating regional-scale trends (Wu and McKee, 2019). However, only the existing Guadalupe River dataset fits these criteria. A minimum of two additional monitoring stations need to be established to support model development and provide empirical evidence on load reductions and improved environmental quality resulting from management actions.

In January 2019, the RMP was awarded a Supplemental Environmental Project to develop an urban-focused flow and sediment monitoring program. The funding supports sampling at four monitoring locations for two years and provides the opportunity to support monitoring for PCB and Hg concentrations and loads at some of these locations.

Study Objectives and Applicable RMP Management Questions

This study will provide information essential to understanding the loads and concentrations of a variety of stormwater pollutants. It aims to support collection of stormwater samples needed to support regional trend evaluations. The objectives of the project and how the information will be used are shown in Table 1 relative to the RMP STLS's high-level management questions.

Table 1. Study objectives and questions relevant to RMP management questions.

Management Question	Study Objective	Example Information Application
Q1: What are the loads or concentrations of Pollutants of Concern (POCs) from small tributaries to the Bay?	Carry out repeat sampling at a minimum of three watersheds for PCBs and Hg. Likely candidate watersheds are Marsh Creek, North Richmond Pump Station, San Leandro Creek, Zone 4 Line A in Hayward, Coyote Creek in San Jose, Guadalupe River, Sunnyvale East Channel, and Pulgas Creek Pump Station South in San Carlos. But others might be considered.	Support improved estimates of: ● Flow from urban areas of differing microclimates ● Sediment loads from areas of differing climate and erosiveness ● PCB and Hg loads from additional sites of interest
Q2: Which are the "high-leverage" small tributaries that contribute or potentially contribute most to Bay impairment by POCs?		
Q3: How are loads or concentrations of POCs from small tributaries changing on a decadal scale?		The data generated will: ● Support the calibration of a regional-scale dynamic simulation model ● Support trends analysis in single watersheds of interest ● Support the first assessment of regional- scale trends

Q4: Which sources or watershed source areas provide the greatest opportunities for reductions of POCs in urban stormwater runoff?		
Q5: What are the measured and projected impacts of management action(s) on loads or concentrations of POCs from small tributaries, and what management action(s) should be implemented in the region to have the greatest impact?		

Approach

There are three main tasks in this project. A field work task to carry out sampling during wet weather events, a task to complete laboratory analysis, quality assurance, and a data management to provide for future data retrieval, and a reporting task.

Task 1. Field work.
Review weather forecasts against sampling criteria and make decisions to deploy field teams, calibrate field equipment, and carry out wet season sampling during one wet season (Water Year 2020; note however, that if 2021 budget is allocated the study would continue in 2021). Following appropriate clean techniques for each analyte, safely collect water samples for laboratory analysis during storms, log appropriate metadata in field sheets, download data from onsite logging equipment, maintain field equipment to ensure proper function, and send samples to labs following appropriate sample holding times using previously verified sampling techniques (e.g., Gilbreath et al., 2015; Gilbreath et al., 2019).

Task 2. quality assurance and data management.
Complete quality assurance of the data following RMP protocols (Yee et al., 2018) and complete data management tasks and provide data through the online RMP CD3 web tool (https://www.sfei.org/rmp/data#sthash.Jad1dhya.dpbs).

Task 3. Draft and final report
Draft a short concise technical report that describes the field methods and results. Have this short report reviewed internally and then by SPLWG and finalized ready for web publishing.

Budget

The following budget represents estimated costs for this special study (Table 2). The project and budget are highly scalable. We have provided an estimate for one, two, or three field sampling sites. Since a sampling design of four samples collected during four

storms every second year has been proposed for Guadalupe River in order to see trends of a desirable magnitude, with a desirable certainly over a reasonable period of time (Melwani et al., 2018), we recommend a revolving effort that aims to sample three watersheds twice over a six-year period. Since we have not repeated the power analysis carried out by Melwani in other watersheds, we are left to assume, at this time, that a design of 4 storms, 4 samples per storm, sampled every second year would be suitable for all watersheds.

Table 2. Proposed budget.

Activity	**Estimated cost**		
	(1 sampling site)	**(2 sampling sites)**	**(3 sampling sites)**
Task 1			
Season set up	$1,800	$3,600	$5,400
Field labor	$11,200	$22,400	$33,600
Task 2			
Data Technical Services	$6,720	$13,440	$20,160
CGS AXYS Analytical	$17,430	$34,860	$52,290
MLML	$1,596	$3,192	$4,788
Equipment	$200	$400	$600
Accommodation	$250	$500	$750
Shipping	$1,900	$3,800	$3,800
Task 3			
Draft report	$11,200	$11,200	$11,200
Internal review	$2,160	$2,160	$2,160
Address review comments	$1,120	$1,120	$1,120
Publish	$560	$560	$560
Grand Total	$56,136	$97,232	$136,428

Budget Justification

Wet season set up Costs: Previous experience with similar SPLWG and STLS projects

Field Costs: Previous experience with similar SPLWG and STLS projects. We assume four storms plus one false start and 4 samples per storm.

Laboratory Costs: Laboratory quotes based on 16 samples per site and appropriate QA samples.

Data Management Costs: Previous experience with similar SPLWG and STLS projects

Shipping Costs: Previous experience with similar SPLWG and STLS projects

Reporting costs: Previous experience with similar SPLWG and STLS projects

Reporting

Reporting for this effort will include:

a) Data stored and provided publically using the RMP CD3 tool
b) A draft and final report

References

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