Summary of the CASQA Source Contribution Tools and Methodologies Survey

Effectiveness Assessment Subcommittee

California Stormwater Quality Association

Task 1 Memorandum

November 2017

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION®

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Memorandum

LARRY WALKER ASSOCIATES

DATE: November 5, 2017

TO: California Stormwater Quality Association – Program Effectiveness Assessment, Best Management Practices, Watersheds and Impaired Waters Subcommittees

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SUBJECT: **Summary of the CASQA Source Contribution Tools and Methodologies Survey (Task 1)**

The California Stormwater Quality Association (CASQA) is conducting a comprehensive review of existing approaches and tools for use in evaluating source contributions (outcome level 4) from key source categories and target audiences. This work effort is being coordinated amongst three CASQA subcommittees (Effectiveness Assessment, Best Management Practices, and Watershed and Impaired Waters) and consists of the following tasks:

1) Conduct surveys/literature reviews to identify existing approaches and tools used for evaluating source contributions as well as key materials for further evaluation;
2) Evaluate the tools and methodologies identified as part of Task 1, determine the applicability based on pollutant type, sources, and target audiences, phase of program planning/implementation and identify how the tools may be used by the municipalities; and
3) Update the CASQA effectiveness assessment web portal, as needed.

This technical memorandum summarizes the results of the survey/literature reviews that were conducted as a part of Task 1.

SURVEY APPROACH AND QUESTIONS

In early summer 2017, CASQA developed a draft survey to determine how stormwater professionals evaluate source contribution and control methods and what tools they use. In order to ensure that the survey was of high value and would obtain the desired results, it was conducted via phone interviews with eight individuals (one consultant, one Regional Water Quality Control Board staff person, one Phase II program manager, and five Phase I program managers) prior to its release

to the public. Based on the feedback received during the phone interviews, the survey was modified and then broadly distributed via Survey Monkey to the CASQA distribution list.

In general, the survey requested information related to the participants, sources, source controls for load reduction, pollutants of concern, source contribution determination or assessment tools, and challenges encountered when performing source assessments and estimating load reductions. The full survey is provided in **Attachment 1**.

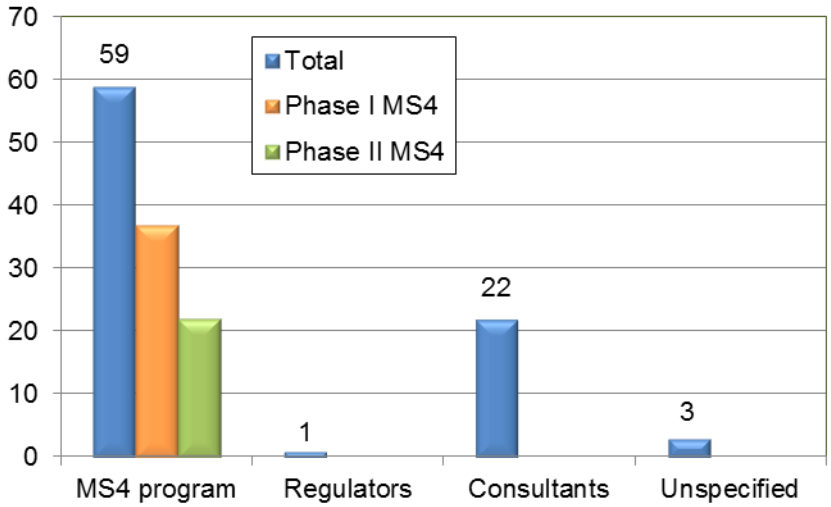
A total of 85 surveys were received and evaluated as a part of this memorandum. Detailed information regarding each of the responses and how this information will be used as a part of the next task is presented below.

PARTICIPANT INFORMATION

The responses to participant information are shown in the **Table 1**.

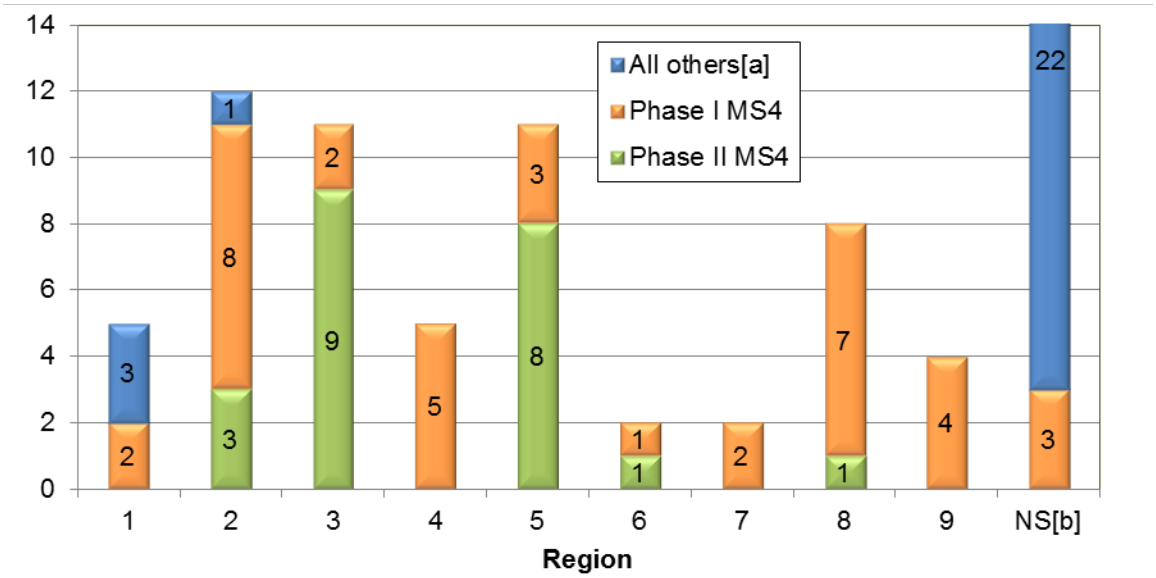
Table 1. Participant and Agency/Organization Information

Self-Identified Participant Type	Number	Percent
Municipal Stormwater Program	59	69%
Phase I Municipal Program (includes Caltrans)	37	
Phase II Municipal Program	22	
Regulators	1	1%
Regional Board – North Coast	1	
Third Parties	22	26%
-CSU Sac Office of Water Programs		
-Sandia National Laboratories Research & Development (federally funded)	2	
Consultant or private contractor	20	
Unspecified	3	4%
Total Participants	**85**	



Survey Participants and Type of MS4 Program

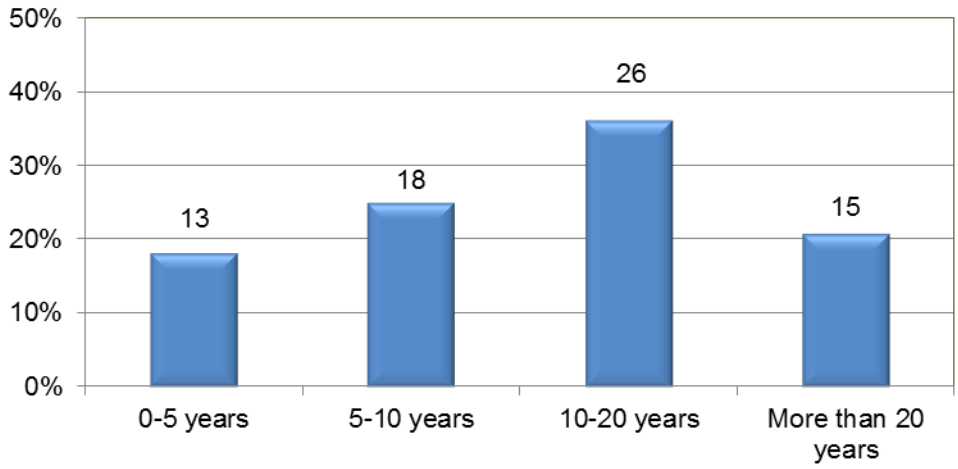
Participants from 59 Municipal Separate Storm Sewer Systems (MS4) programs responded, including municipalities from all California regions (North Coast, San Francisco Bay, Central Coast, Los Angeles, Central Valley, Lahonton, Colorado River, Santa Ana and San Diego). The regional breakdown of MS4 programs is shown below.



[a] All others include regulators, third parties, and unspecified participants.
[b] NS stands for Not Specified (the participant did not specify their region).

MS4 Program Types by Region

The number of years participants have been involved in the stormwater management field is shown below. Thirteen participants did not indicate the duration of their involvement. Over half of the responding participants have worked in the stormwater field for more than 10 years.



Number of Years in Stormwater Management

QUESTIONS ABOUT SOURCES

1. What types of sources are the highest priority for you to be able to characterize with respect to load contributions? (Identify all that apply)

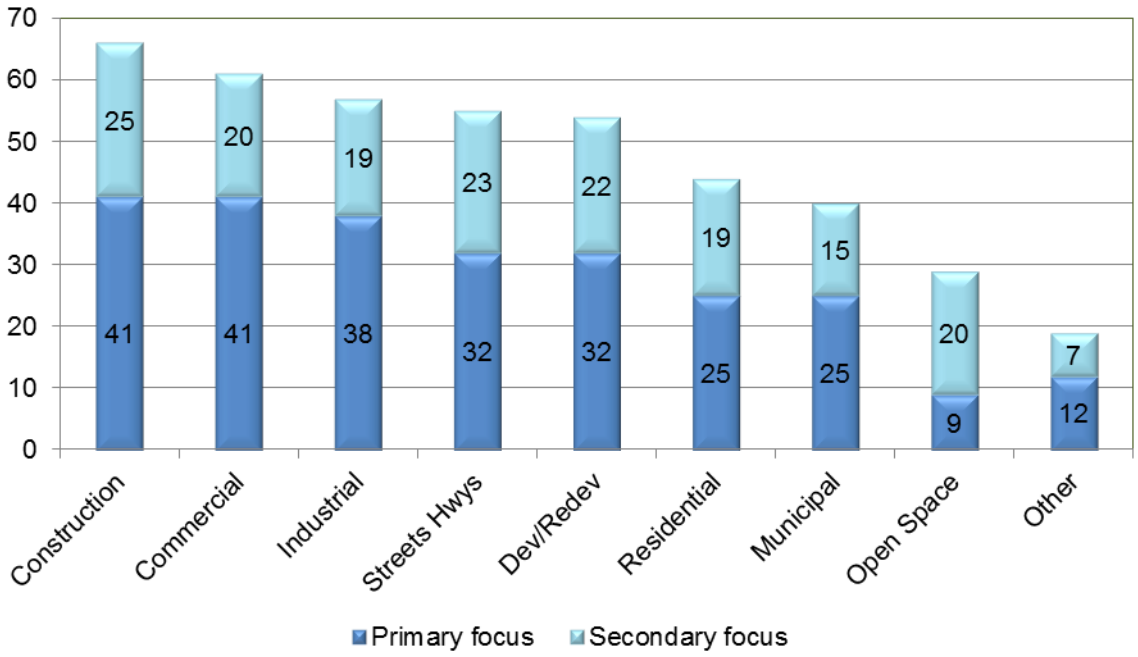
2. What types of sources may also be useful to characterize with respect to load reduction, but are not necessarily the focus for the agency? (Identify all that apply)

3. Other comments about sources

The results of the questions about sources are shown in **Table 2**. Each participant selected an average of three options for the primary focus, and an average of two options for the secondary focus. Construction, commercial and industrial sources were selected as the primary source most frequently.

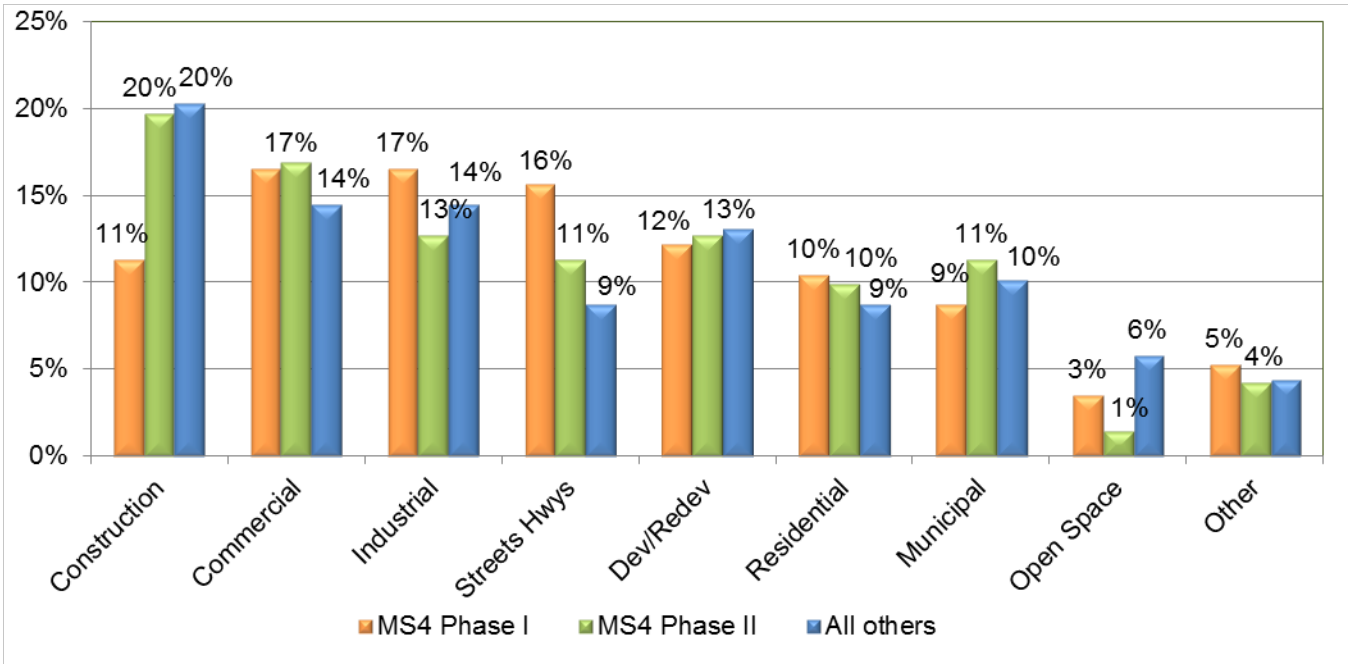
Table 2. Sources Selected as Priority

Source	Primary Focus	Percent	Secondary Focus	Percent	Total
Construction Sites	41	16%	25	15%	66
Commercial Sites	41	16%	20	12%	61
Industrial Sites	38	15%	19	11%	57
Streets, Highways	32	13%	23	14%	55
Development / Redevelopment Projects	32	13%	22	13%	54
Residential Areas	25	10%	19	11%	44
Municipal Facilities	25	10%	15	9%	40
Open Space	9	4%	20	12%	29
Other	12	5%	7	4%	19
Specify other:	• Agricultural (4); • Existing development; • Chemical products and pathways (2); • Railroads and utilities; • Homeless encampments (2); • Non-jurisdictional, categorical, and wind-blown sediment; • Parking lots		• Agricultural (2); • Demolition/renovation sites; • Homeless encampments; • Parking lots • Priority pollutants		



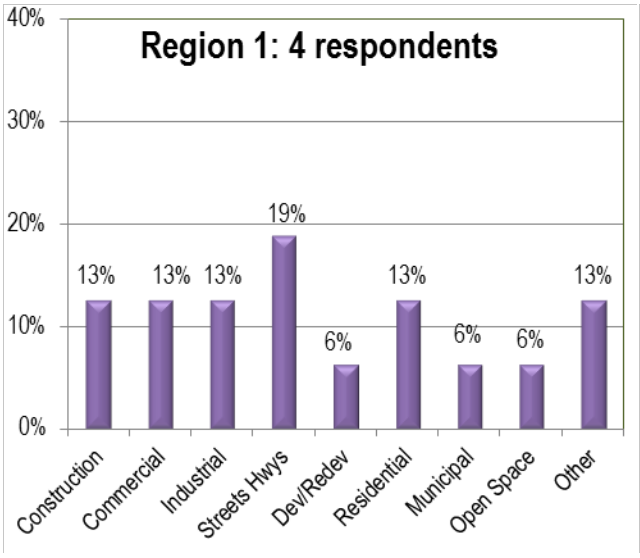
Selected Primary and Secondary Sources by all Participants

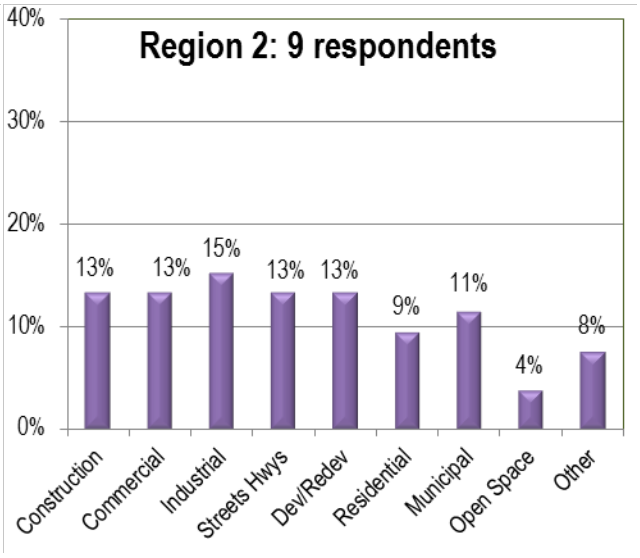
The percent breakdown of primary priority sources selected by MS4 Phase I and Phase II programs is shown below. Construction sites were selected as a priority source by MS4 Phase II programs more frequently than by Phase I, while Phase I programs selected industrial sites and streets/highways more frequently than Phase II.

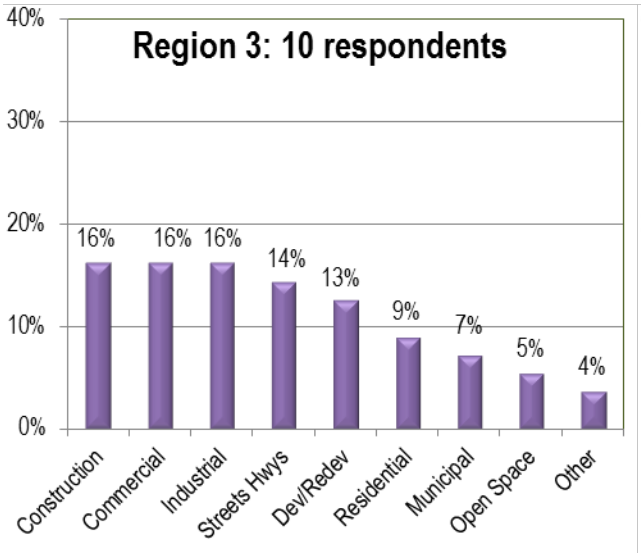


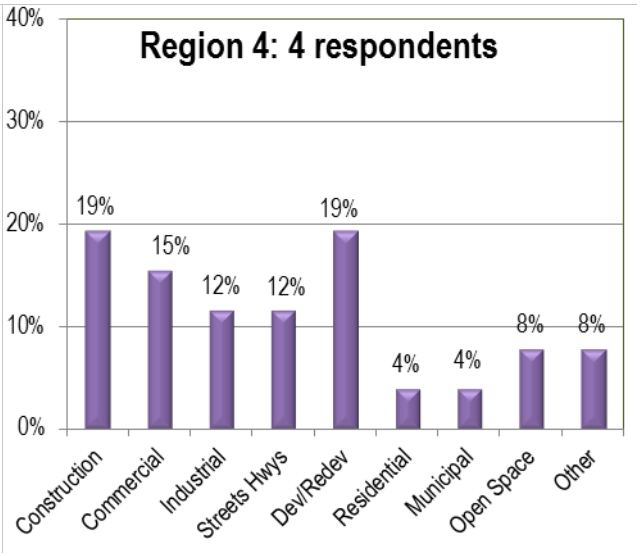
Primary Priority Sources Selected, by Program Type

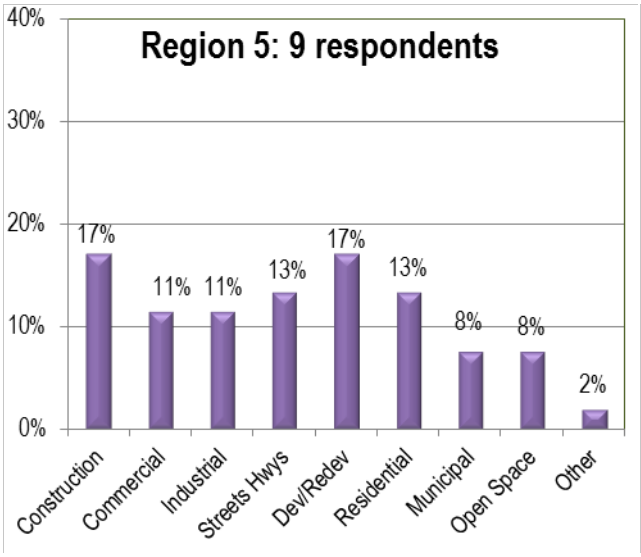
The percent breakdown of combined primary and secondary priority sources selected by region is shown below.

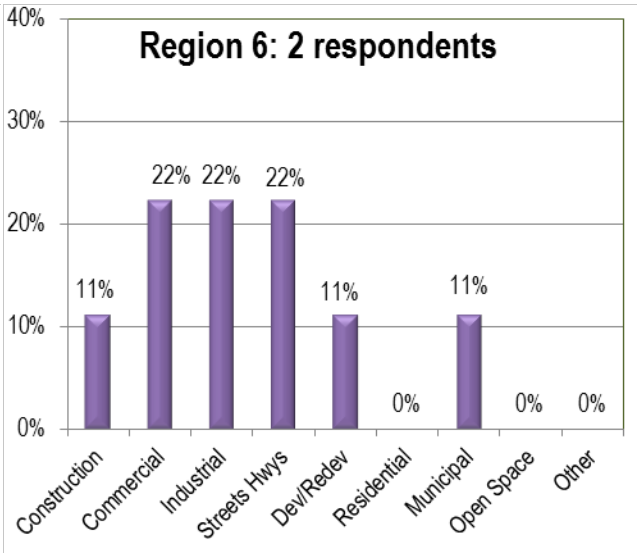

Region 1: 4 respondents
40%
30%
20%
10%
0%
13% 13% 13% 19% 6% 13% 6% 6% 13%
Construction
Commercial
Industrial
Streets Hwys
Dev/Redev
Residential
Municipal
Open Space
Other

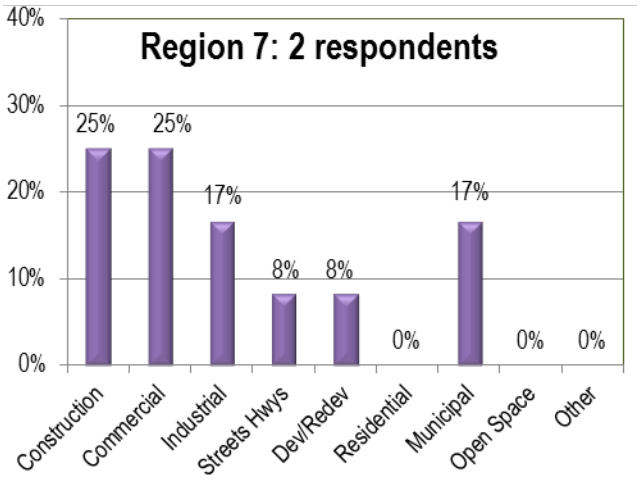

Region 2: 9 respondents
40%
30%
20%
10%
0%
13% 13% 15% 13% 13% 9% 11% 4% 8%
Construction
Commercial
Industrial
Streets Hwys
Dev/Redev
Residential
Municipal
Open Space
Other

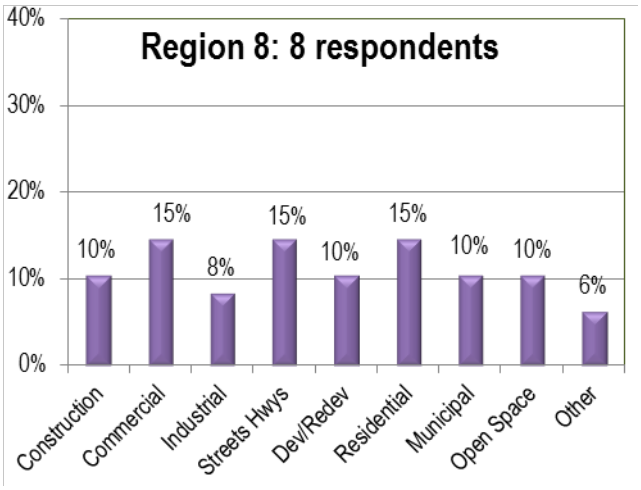

Region 3: 10 respondents
40%
30%
20%
10%
0%
16% 16% 16% 14% 13% 9% 7% 5% 4%
Construction
Commercial
Industrial
Streets Hwys
Dev/Redev
Residential
Municipal
Open Space
Other

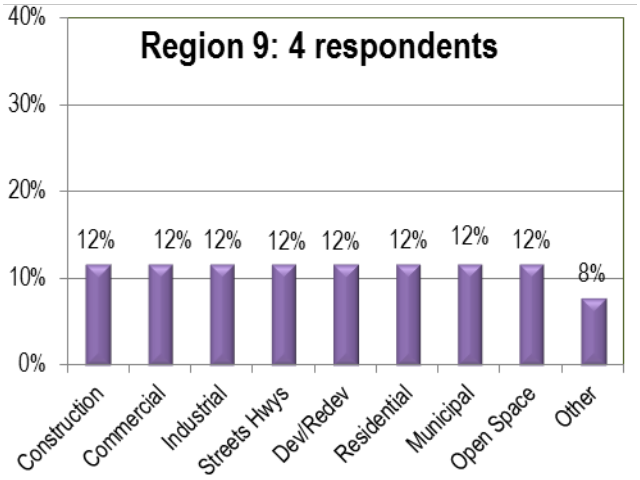

Region 4: 4 respondents
40%
30%
20%
10%
0%
19% 15% 12% 12% 19% 4% 4% 8% 8%
Construction
Commercial
Industrial
Streets Hwys
Dev/Redev
Residential
Municipal
Open Space
Other


Region 5: 9 respondents
40%
30%
20%
10%
0%
17% 11% 11% 13% 17% 13% 8% 8% 2%
Construction
Commercial
Industrial
Streets Hwys
Dev/Redev
Residential
Municipal
Open Space
Other


Region 6: 2 respondents
40%
30%
20%
10%
0%
11% 22% 22% 22% 11% 0% 11% 0% 0%
Construction
Commercial
Industrial
Streets Hwys
Dev/Redev
Residential
Municipal
Open Space
Other







Region	Highest Priority Source
1	Streets/highways
2	Industrial
3	Const/Comm/Ind
4	Const/Dev/Redev
5	Const/Dev/Redev
6	Comm/Ind/Streets
7	Const/Comm
8	Comm/Streets/Res
9	All but “other”

Combined Primary and Secondary Priority Sources Selected, by Region

Additional comments were provided, as follows:

- Several participants indicated that their priority sources depend on the pollutant of concern. It was considered difficult to prioritize based on land use, as multiple pollutant of concern result in multiple sources spanning a broad range of land uses.
- Additional sources described included the MS4 (bacteria), brick buildings (dissolved zinc), transformers (PCBs), warehouses, trucking, meat processing, and trash.
- It was suggested that CASQA focus on education, and on sub-populations within these source categories which represent the highest load contributions.
- One participant anticipates a change in the responses to these questions when outfall monitoring identifies the sources of pollutants.
- Critical responses to the question included rephrasing to describe “land use” instead of “sources,” and a claim that the question was too broad for a specific response.

QUESTIONS ABOUT SOURCE CONTROLS

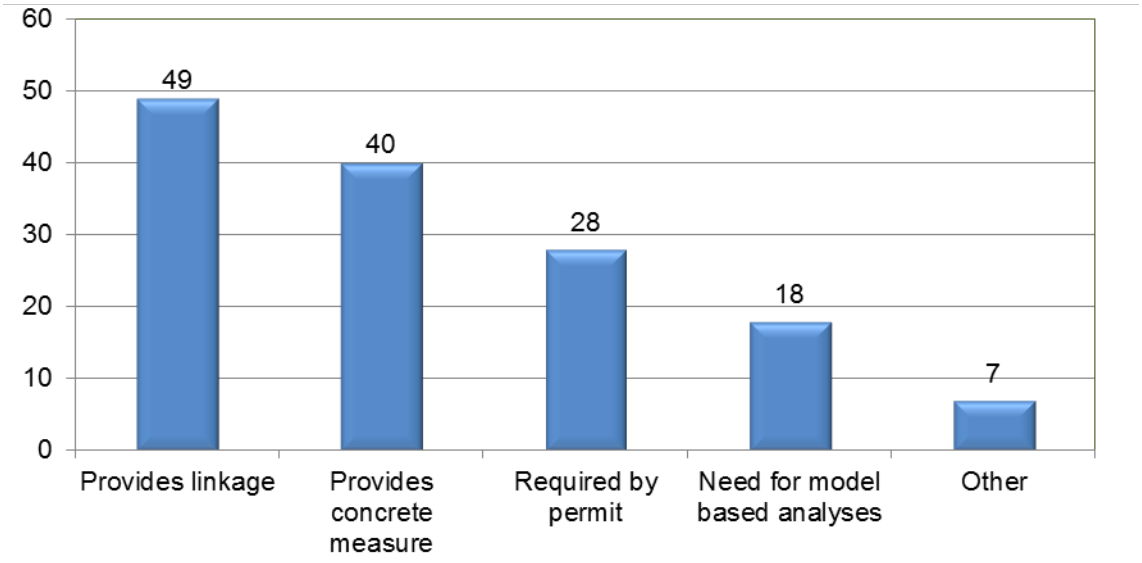
1. How are assessments of load reductions that may be achieved through the use of source controls useful for your program? (Check all that apply)

The responses to question 1 about load reduction assessments are shown in **Table 3**. The option "provides linkage" was selected most frequently by all agencies. An equal number of MS4 Phase II programs selected "required by permit" as "provides linkage", while more Phase I programs indicated a need for model-based analysis.

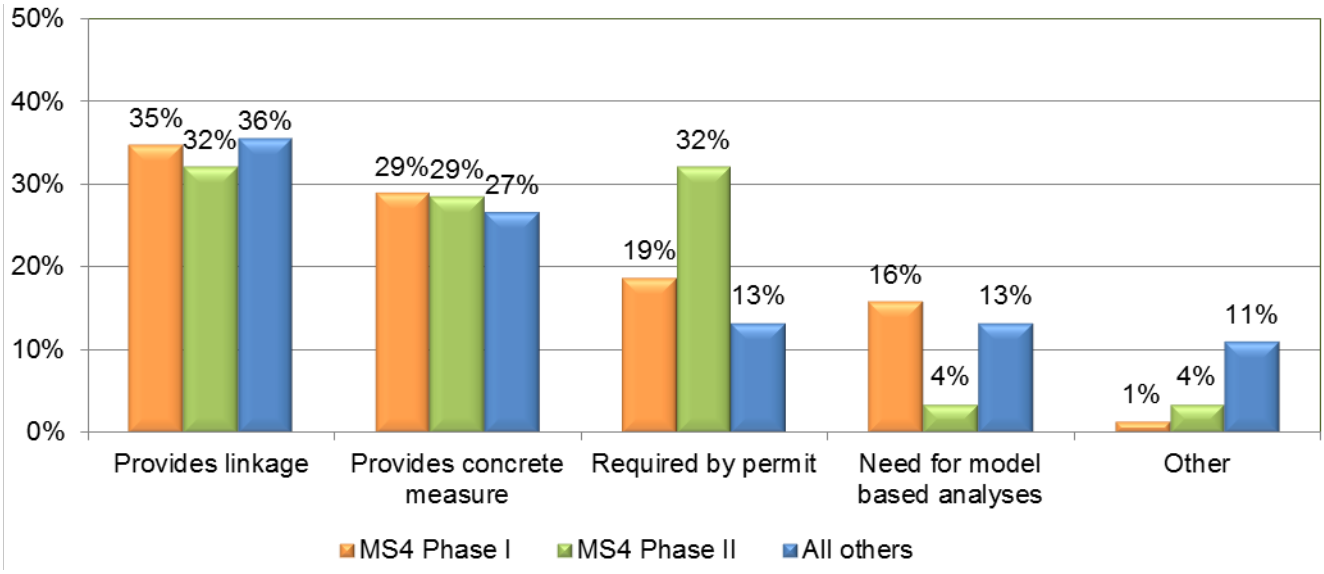
Table 3. How are Assessments of Load Reductions Useful?

Response Option[a]	Number	Percent
Provides linkage between program elements/non-structural BMPs and water quality results	49	35%
Provides concrete measure of effectiveness for program elements/non-structural BMPs	40	28%
Required by my permit	28	20%
Need load reductions for inputs for RAA or for other model based analyses	18	13%
Other: • To demonstrate that less treatment is needed, which reduces costs • To address known water pollution, TMDL compliance, avoiding 303(d) listings/TMDLs, improve water quality, habitat, meet the interests of public policy leaders in state/city, • They provide a high return on investment • Will need to make sure the controls can provide a direct link to effectiveness, not just a change in how business is done • They are important to Phase II MS4s for trash • Depends on source control measure • They are not useful	7	5%

[a] The response "Not sure" was also offered, but none of the participants selected it.



Reasons for Usefulness of Load Reduction Assessment to all Participants



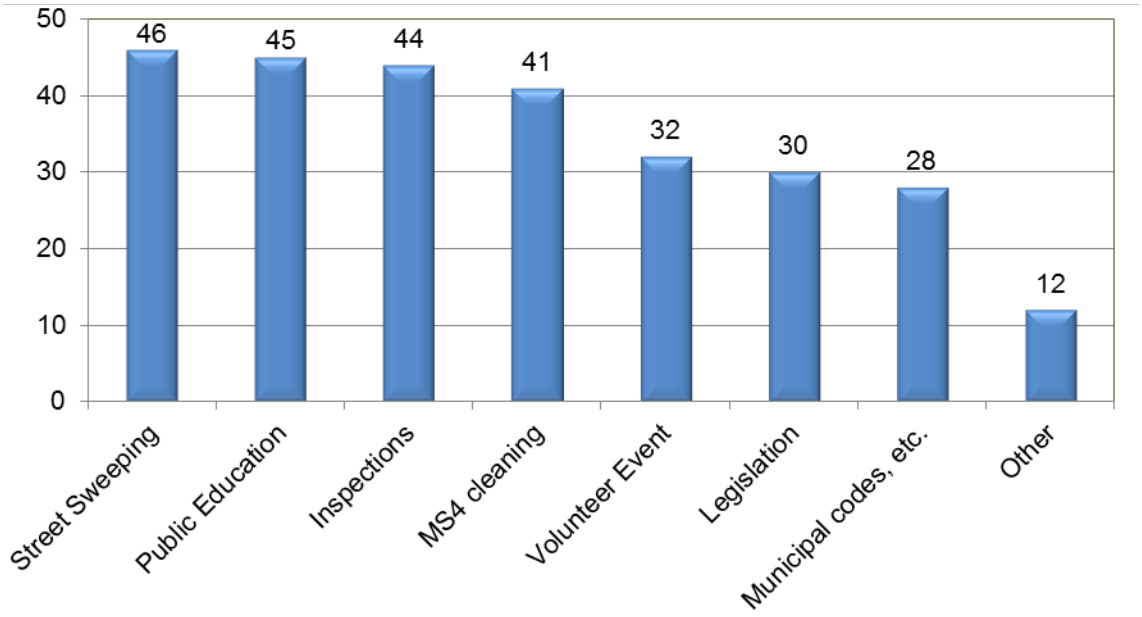
Reasons for Usefulness of Load Reduction Assessment, by Program Type

2. What types of source controls are you most interested in evaluating? (Identify all that apply)

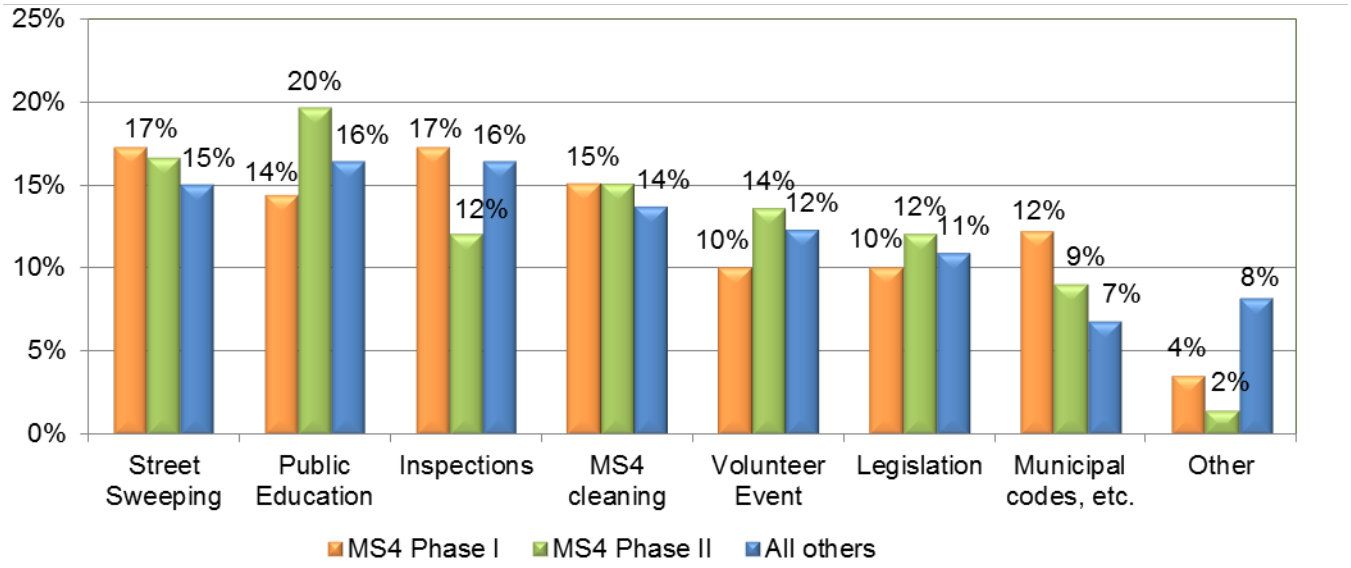
The responses to question 2 about interest in types of source control are shown in **Table 4**. Overall, street sweeping, public education, inspections and MS4 cleaning were selected the most frequently. Among MS4 programs, public education was of higher interest to Phase II programs, while inspections was of higher interest to Phase I programs.

Table 4. What Types of Source Controls are you Interested in Evaluating?

Response Option	Number	Percent
Street Sweeping	46	17%
Public Education - Education Material Distribution	45	16%
Inspections	44	16%
MS4 cleaning (e.g. inlet structure cleanings)	41	15%
Volunteer Event (e.g. clean ups)	32	12%
Legislation	30	11%
Municipal codes, ordinances, preferential purchasing policies, and contracts	28	10%
Other: • Product replacement, systematic source tracking and elimination, [cleaning up from] homeless; • Structural BMPs; • Ground crew land cleanups; • Pre-treatment BMPs; • Air pollution reduction and aerial deposition; • Centralized treatment: low flow diversion to WWTP; • Legislation and Public Education should be combined (consistent with this comment, 21 participants indicated they would like to evaluate or are already evaluating both legislation and public education); • Regulatory: consistency of WB/EPA/DTSC levels of cleanup, and prompt implementation of cleanups	12	4%



Source Controls of Interest to all Participants



Source Controls of Interest, by Program Type

3. Do you use a % reduction credit or assumed reduction for a specific source control(s) or for a category/group of source controls or sources (e.g. municipal operations, industrial, etc.)?

Twelve participants responded positively to this question, indicating that they use a % reduction credit or assumed reduction. Thirty participants indicated that they do not use a % reduction credit or assumed reduction. Five of the positive responses included more than one control description. Three participants cited the same reduction for bag use, two from Region 2 (the third did not indicate their region). Two participants cited trash specifically, while three more cited trash-related items (bags, plastic). These responses are shown in **Table 5**.

Table 5. Description of Responses to % Reduction Credit Question

Region	Source/ Control	% Reduction	Source for Justification
1	Construction	-	Construction reduction credit worksheet
2	Trash	-	Bay Area SCVURPPP[1] [Santa Clara Valley Urban Runoff Pollution Prevention Program]
	PCBs/Mercury in progress	-	
-	Trash: Full Trash Capture devices	-	-
2	Single-use bag ordinance	7%	Effectiveness assessments conducted in FY 13-14.
	Expanded polystyrene food service ware ordinance	5%	Trash reduction assessments conducted by the cities of Los Altos and Palo Alto.
2	Bag ban	5%	MRP allows maximum 10% combined for product bans.
	Polystyrene Ban	5%	
-	Plastic Bag Ban	6%	-
	Styrofoam Ban	4%	-
2	Derived/estimated land-use-based yields for referrals (of parcels loading PCBs to the MS4, or land-uses assumed to be loading a certain amount) or green infrastructure on various land-uses assumed to be loading a certain amount	-	Approved interim accounting methodology that could be updated with new information.
	Ordinance for demolition of buildings meeting certain criteria, credit	-	
4	Institutional controls	5%	Appendix C8 USCR EWMP[2]
-	Sediment in dry/wet basins	21%	-
-	Quantitative load reductions from the legislative source control measure	-	CASQA Brake Pad copper reduction report[3]
-	Flow	-	Visual estimates of flow volume

[1] http://scvurppp-w2k.com

[2] Upper Santa Clara River Enhanced Watershed Management Program DRAFT. June 2015.

[3] CASQA, 2016. *Estimated Urban Runoff Copper Reductions Resulting from Brake Pad Copper Restrictions*. April 13, 2016.

4. Other comments regarding determining loads/load reductions for source controls.

Additional comments about determining loads and load reductions for source controls shown below. The comments written in negative responses to Question 3 are also included.

Precision/accuracy needed: 6 responses

- We have only used estimates. [Load reductions are] very hard to characterize.
- Baseline and loading estimates are frighteningly imprecise. Methods for valuing/crediting all source controls do not exist currently. Non-Jurisdictional and lands directly discharging provide a large data gap in loading estimate.
- I do not feel an "assumed % reduction" for certain source control activities (catch basin cleaning, street sweeping) is a legitimate way to address this. Not scientifically based.
- Accuracy
- Too subjective
- We don't evaluate load reduction. We do track how much we recover out of drain inlet cleaning, sweeping, ditch clean out, etc. We also have monitoring stations on the river that flows through the town at the start and at the end. There are too many influences to determine what is the best bang for your buck.

Additional studies/monitoring/data needed: 6 responses

- There is a lack of monitoring data to substantiate assumed load reductions
- Lack of funding for sufficient monitoring
- Trash Amendment is currently set up to quantify conveyed trash. Encampments in waterways are a much more significant source that isn't recognized in the regulation as written. No loading rates exist for this source.
- Source reduction credits are best based on scientific studies examining the source contributions and effectiveness of the control strategy. The method is described in two WERF studies[4].
- We do not assume any % reduction for source controls in place. We determine % reductions through data results.
- In future, load reduction will be based on estimates from international BMP database.

Pollutant or site-specific: 3 responses

- Load reduction from source control is entirely determined by the pollutant. This survey isn't structured in a way that will allow reasonable comparisons. My answers are related to local TMDL requirements. I doubt this will be the same for other types of TMDLs (nutrients, PCBs, pathogens, mercury, etc.)
- Load restrictions need to be specific to type of site, status of construction and cost... provide most effective and cost reflective to get most bang for buck.
- Not capturing those POCs that are most harmful to aquatic environment and/or persist in the environment.

Miscellaneous: 5 responses

- The Lake Tahoe TMDL has performance-based metrics verified by condition assessments.
- Assumed reductions are included in watershed planning efforts (and to a lesser extent in jurisdictional program planning), but I'm not familiar with the specific metrics.
- Uncertain of modeling details.

[4] WERF 2001. *Controlling Pollution at its Source: Wastewater and Stormwater Demonstration Projects*. Betsy Elzufon, Larry Walker Associates. Water Environment Research Foundation. Project 98-WSM-2.

WERF 2000. *Tools to Measure Source Control Program Effectiveness*. Betsy Elzufon, Larry Walker Associates. Water Environment Research Foundation. Project 98-WSM-2.

QUESTIONS REGARDING POLLUTANTS OF CONCERN

1. Identify the highest priority water quality constituents that the program is focused on. These constituents would be included in an assessment of water quality and/or program effectiveness. (Identify all that are considered high priority)

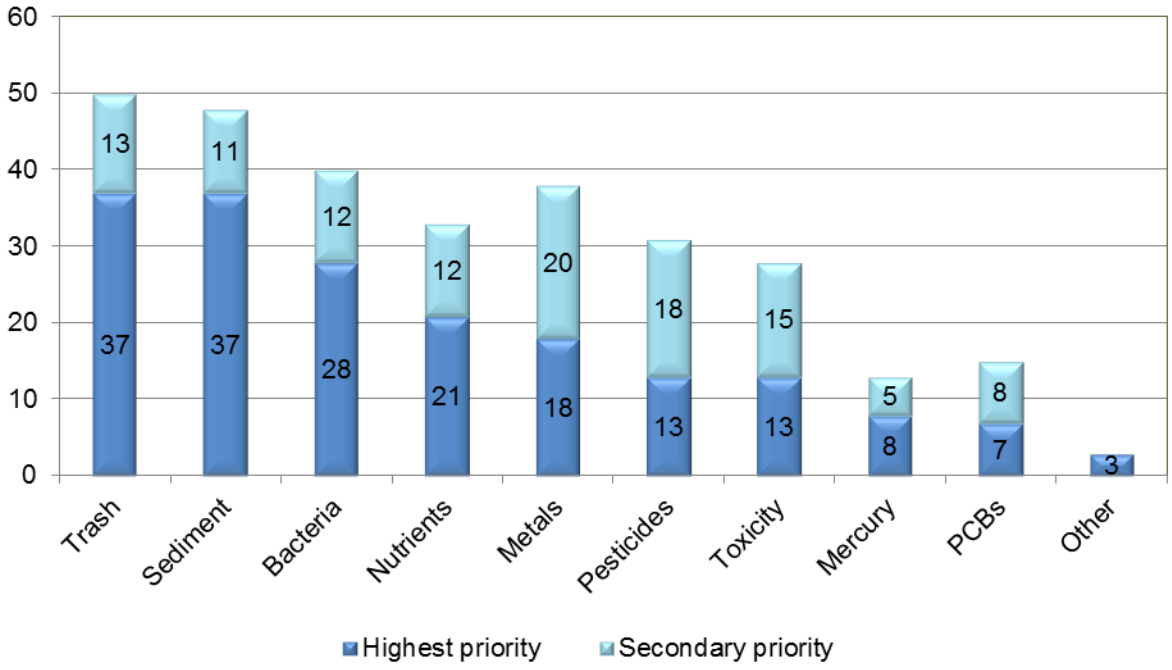
2. Identify if there are additional water quality constituents that would be of interest. These constituents may be included in an assessment of water quality and/or program effectiveness, but are not necessarily the focus for the agency. (Identify all that are of interest and not selected in question 1.)

The responses to the first two questions are shown in **Table 6**. The highest priority POCs for all agencies were trash, sediment and bacteria. The second highest priority were metals, pesticides and toxicity. Among MS4 programs, trash and sediment were of highest priority for Phase II programs, while mercury, PCBs, and other POCs were lower priority.

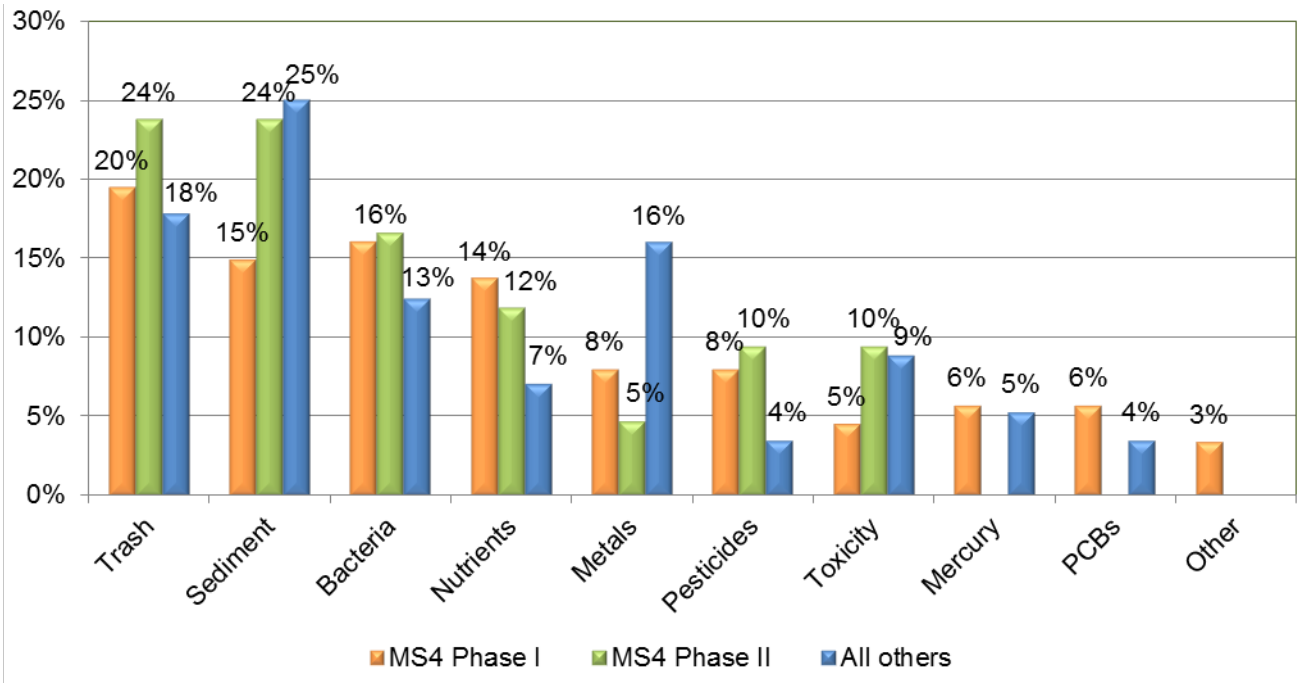
Table 6. Priority Pollutants of Concern

Pollutant of Concern	Highest Priority	Percent	Secondary Priority	Percent	Total
Trash	37	20%	13	11%	50
Sediment	37	20%	11	9%	48
Pathogen Indicators / Bacteria	28	15%	12	10%	40
Nutrients	21	11%	12	10%	33
Metals (copper, aluminum, zinc, lead, cadmium, nickel)	18	10%	20	17%	38
Pesticides	13	7%	18	16%	31
Toxicity	13	7%	15	13%	28
Mercury	8	4%	5	4%	13
Polychlorinated Biphenyls (PCBs)	7	4%	8	7%	15
Other [a]: • pH (2) • Oil & grease • Turbidity • Salts	3 [a]	2%	0	0%	5

[a] Three “other” responses were recorded, however some responses listed multiple POCs.

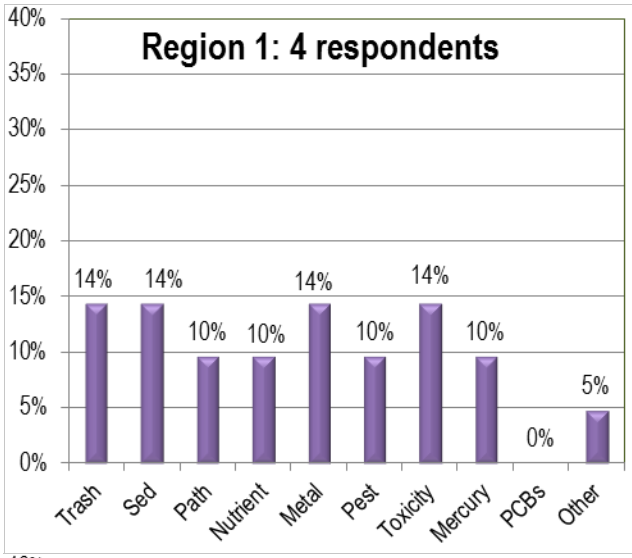


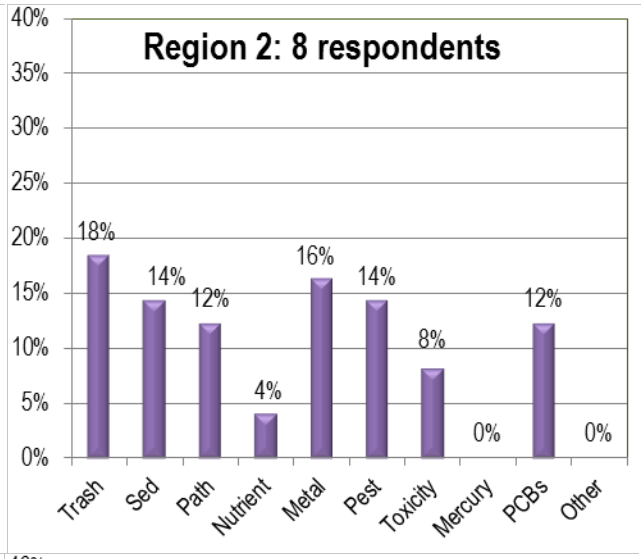
Priority Pollutants of Concern to all Participants

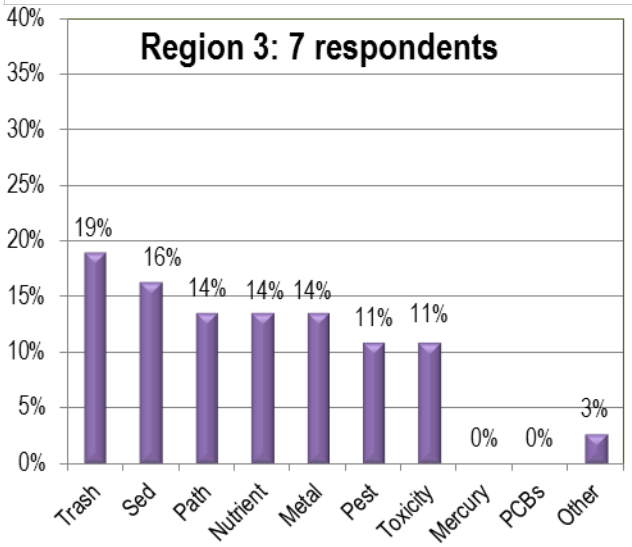


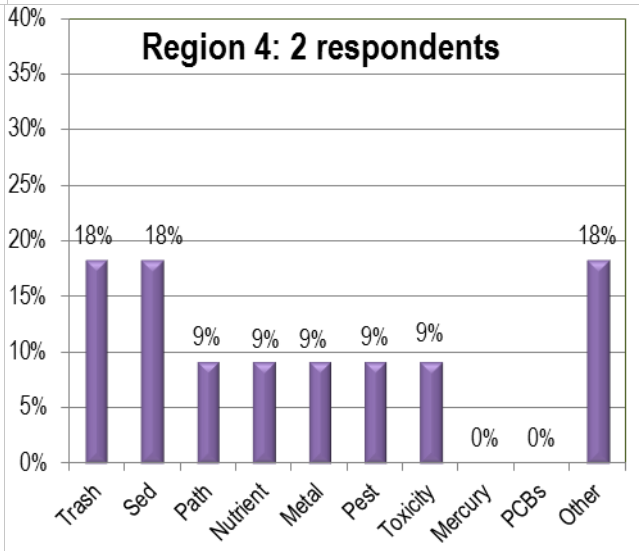
Priority Pollutants of Concern (Highest Priority), by Program Type

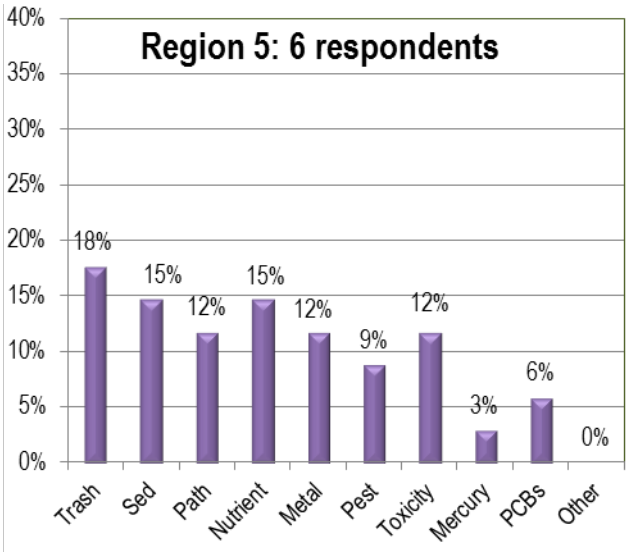
Priority pollutants of concern were also reviewed by region, after combining the primary and secondary priority pollutants selected.

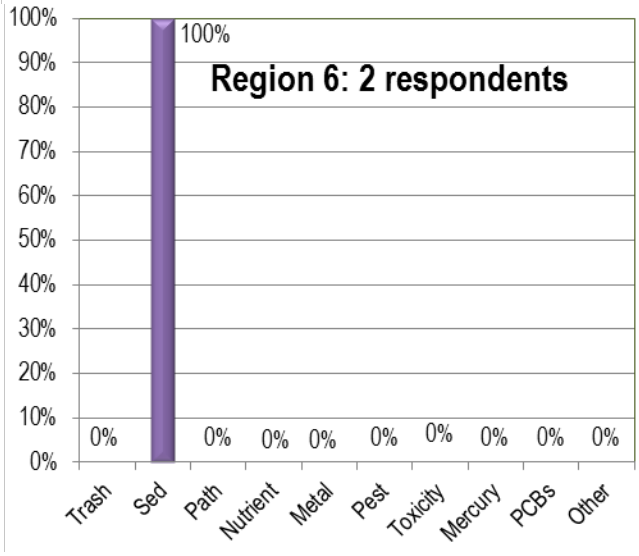

Region 1: 4 respondents
40%
35%
30%
25%
20%
15%
10%
5%
0%
14%
14%
10%
10%
14%
10%
14%
10%
0%
5%
Trash
Sed
Path
Nutrient
Metal
Pest
Toxicity
Mercury
PCBs
Other


Region 2: 8 respondents
40%
35%
30%
25%
20%
15%
10%
5%
0%
18%
14%
12%
4%
16%
14%
8%
0%
12%
0%
Trash
Sed
Path
Nutrient
Metal
Pest
Toxicity
Mercury
PCBs
Other


Region 3: 7 respondents
40%
35%
30%
25%
20%
15%
10%
5%
0%
19%
16%
14%
14%
14%
11%
11%
0%
0%
3%
Trash
Sed
Path
Nutrient
Metal
Pest
Toxicity
Mercury
PCBs
Other


Region 4: 2 respondents
40%
35%
30%
25%
20%
15%
10%
5%
0%
18%
18%
9%
9%
9%
9%
9%
0%
0%
18%
Trash
Sed
Path
Nutrient
Metal
Pest
Toxicity
Mercury
PCBs
Other


Region 5: 6 respondents
40%
35%
30%
25%
20%
15%
10%
5%
0%
18%
15%
12%
15%
12%
9%
12%
3%
6%
0%
Trash
Sed
Path
Nutrient
Metal
Pest
Toxicity
Mercury
PCBs
Other


Region 6: 2 respondents
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0%
100%
0%
0%
0%
0%
0%
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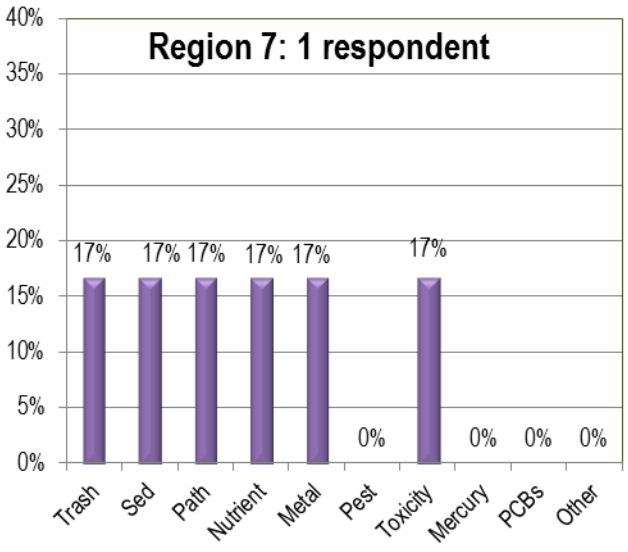
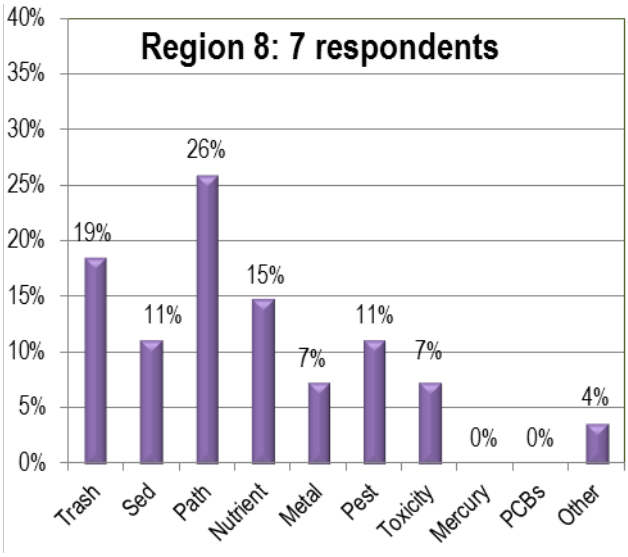
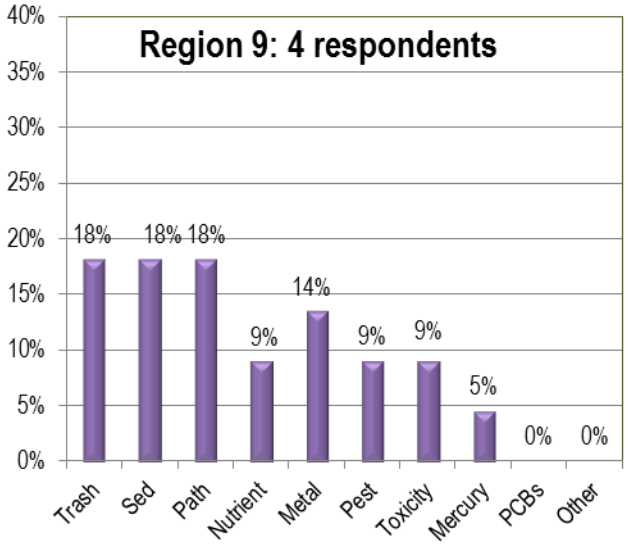
Trash
Sed
Path
Nutrient
Metal
Pest
Toxicity
Mercury
PCBs
Other







Region	Highest Priority POC
1	Trash, sediment, metals, toxicity
2	Trash
3	Trash
4	Trash, sediment, other
5	Trash
6	Sediment
7	Trash, sediment, pathogens, nutrients, metals, toxicity
8	Pathogens
9	Trash, sediment, pathogens

Priority Pollutants of Concern (Highest & Secondary) by Region

3. If a surrogate(s) were to be used, which surrogate(s) would you recommend and which constituents would they be used as a surrogate for?

Nine participants responded to this question. The responses included the following:

- TSS/sediment – 6 responses, as a surrogate for metals, bacteria, sediment (TSS), PCBs, mercury, metals and pesticides (% TSS removal)
- Flow and volume – 1 response, for wet weather bacteria
- Bifenthrin or a pyrethroid – 1 response, for urban pesticides
- A surrogate is inappropriate for source control, though it may be useful for treatment/conveyance controls. It must have the same sources/conveyances and the same fate & transport properties to serve as a surrogate.

4. Other comments regarding pollutants of concern.

The following comments were provided:

- By eliminating or controlling washing type operations, one will likely minimize or eliminate the non-visibles.
- We don't know what we don't know. There are so many things in stormwater and we only sample a small fraction of them. Hard to know what the priorities are since we have such a limited view of the universe.
- Not every pollutant is a candidate for source control. Some are better managed by collection or even runoff treatment. This is particularly true in small-scale situations, e.g., industrial facilities. It is important to not try to make source control a panacea.
- While not currently included in an assessment of water quality and/or program effectiveness, we have been gearing up for the trash requirements for the last year and it is a high priorirty.
- [Consider] pesticides and emerging contaminants.
- Toxicity and pesticides are commonly connected and seasonal.
- [What about] hydrologic conditions?

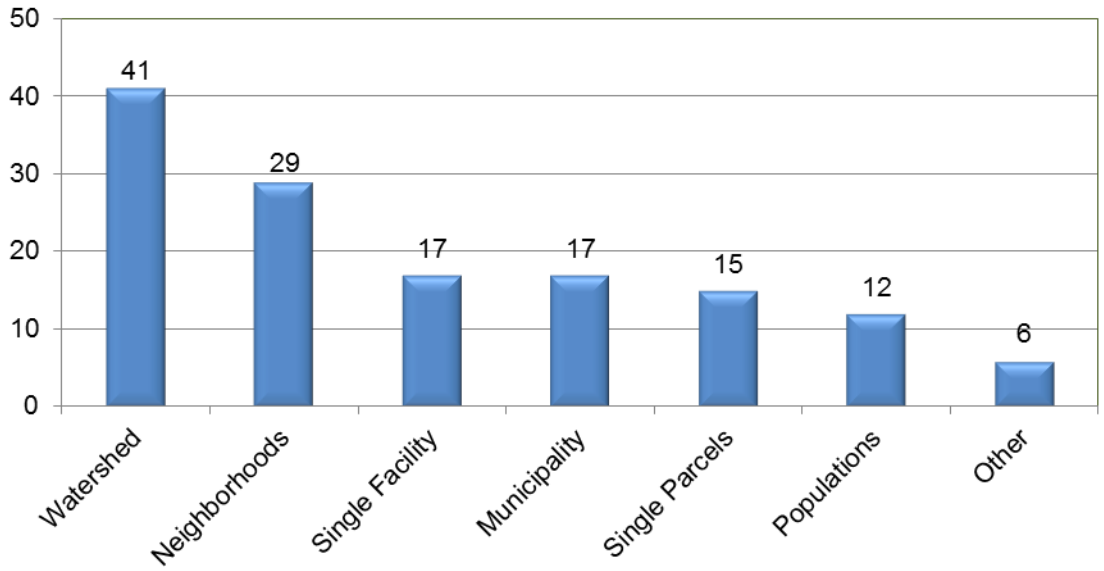
QUESTIONS ABOUT TOOLS:

1. What scales are you most interested in for your assessments?

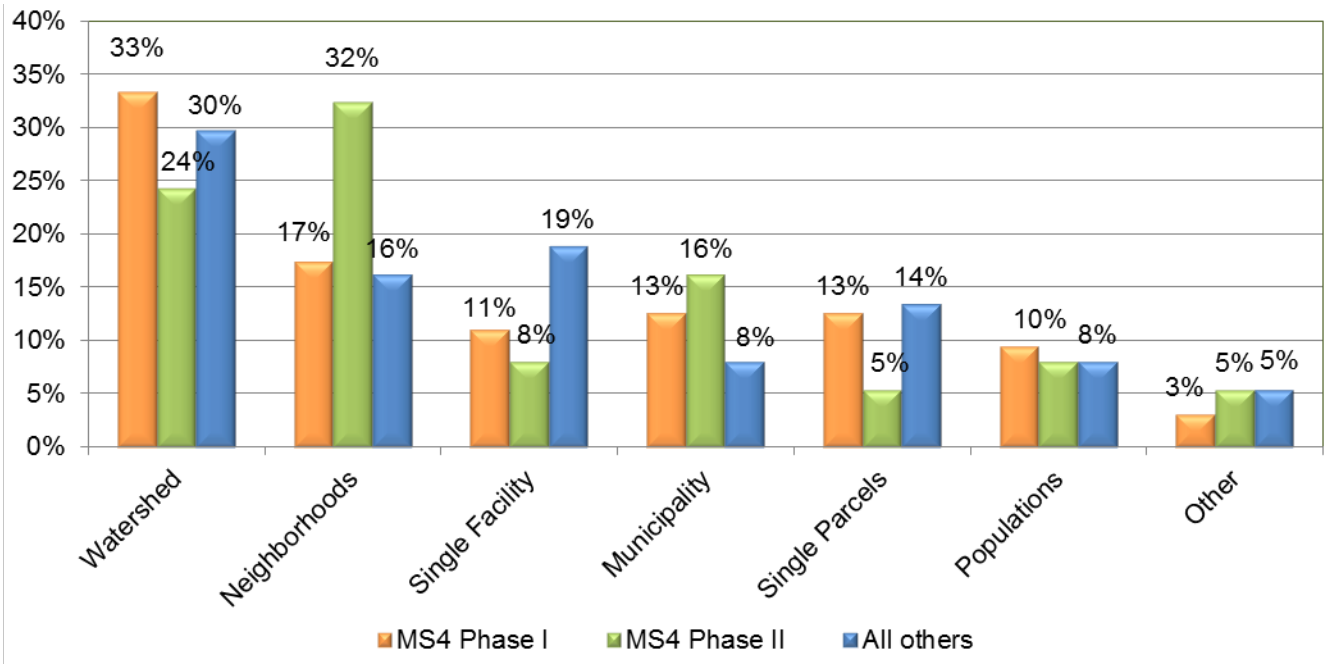
The scales of interest selected by participants are shown in **Table 7**. The most popular scale was the watershed/subwatershed level, although this was driven by Phase I MS4s. Phase II MS4 programs most frequently selected the neighborhood/small drainage area scale.

Table 7. Scales of Interest for Assessments

	All participants		MS4	
Scale	**Number**	**Percent**	**Phase I**	**Phase II**
Watershed / Subwatershed	41	30%	33%	24%
Neighborhoods / Small Drainage Areas	29	21%	18%	32%
Single Facility (business, home, etc.)	17	12%	11%	8%
Municipality	17	12%	13%	16%
Single Parcels	15	11%	13%	5%
Populations (employees, residents, etc.)	12	9%	8%	8%
Other: • Statewide • Industrial operations • Land use & zoning • Campus (2 responses) • All scales	6 total	4%	3%	5%



Scales of Interest to all Participants



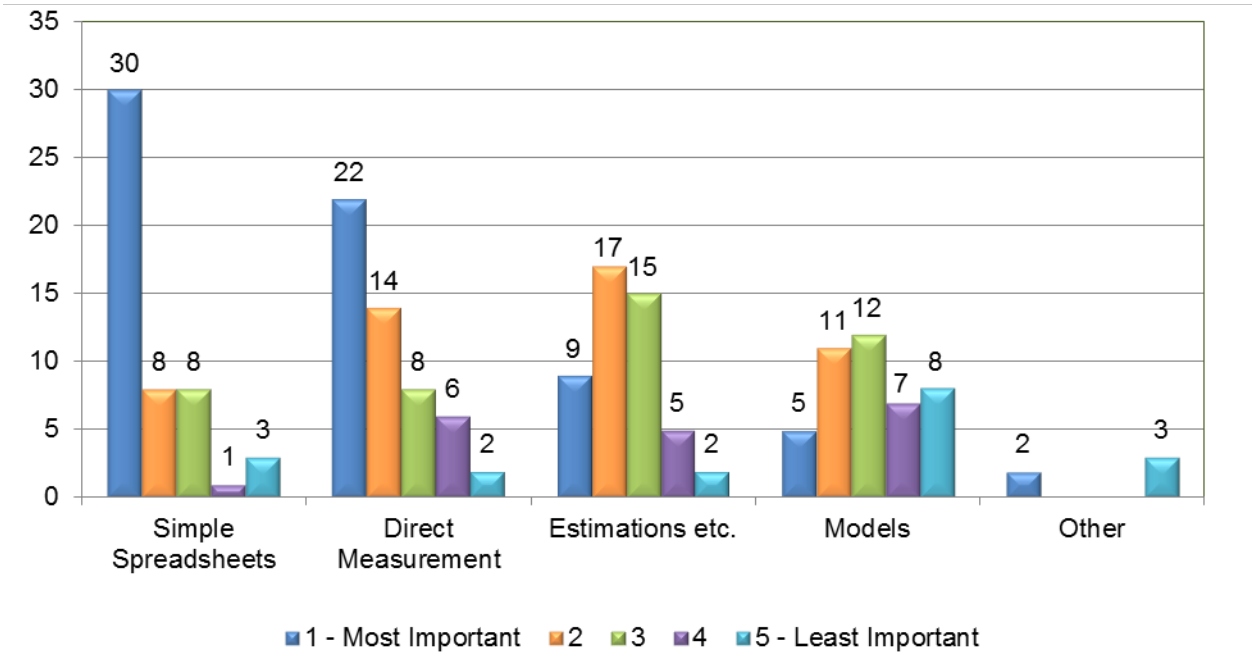
Scales of Interest, by Program Type

2. What types of tools are you most interested in using for your stormwater program for measuring source reduction? (Models or Other)

The options provided for this response were ranked from 1 (most important) to 5 (least important), as shown in **Table 8**. Simple spreadsheet models were considered the most important, direct measurement the next, then estimations, and finally models.

Table 8. Interest in Tools for Measuring Source Reduction

Tool	1 - Most Important	2	3	4	5 - Least Important
Simple Spreadsheets/Models	30	8	8	1	3
Direct Measurement	22	14	8	6	2
Estimations/Loading Factors/ Survey Information	9	17	15	5	2
Models	5	11	12	7	8
Other (not specified)	2	0	0	0	3



Interest in Tools for Measuring Source Reduction

Specific models used were mentioned by 15 participants. The specific models are listed below:

- ICM (Integrated Catchment Modeling) – 1 response
- SWMM (Storm Water Management Model) – 2 responses
- MIKE Urban (MIKE powered by DHI technologies) – 1 response
- TELR (Tool to Estimate Load Reductions) – 3 responses
- SBPAT (Strategic BMP Prioritization and Analysis Tool) – 1 response
- LSPC (Loading Simulation Program in C++) – 1 response
- WMMS (Watershed Management Modeling System) – 1 response

- SUSTAIN (System for Urban Stormwater Treatment and Analysis IntegratioN) – 1 response
- WinSLAMM (Source Loading and Management Model for Windows) – 2 responses
- 3rd party model software – 1 response
- Load reduction model that factors in hydrology and asset management data – 1 response

Comments about the models included:

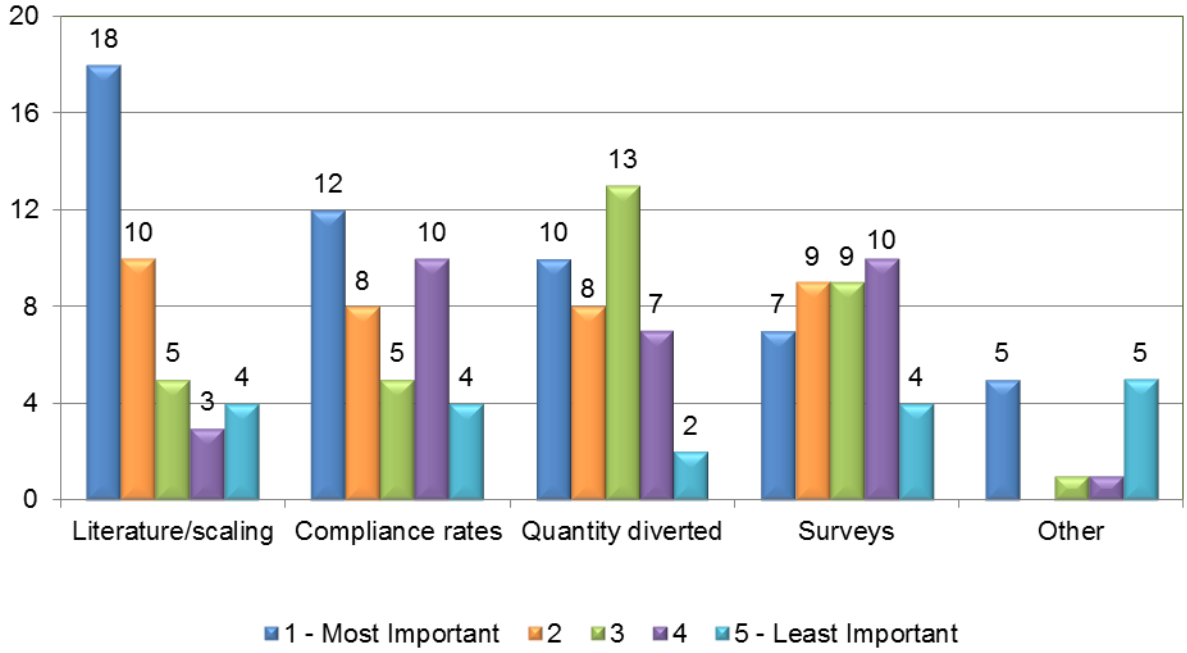
- There are a variety of specialty models, none of which really have the inherent capacity to address the relationship between pollutant product sources and urban runoff. Custom models have been created for pesticides (California DPR [Department of Pesticide Regulation]) and brake pads (Brake Pad Partnership). This is an important management gap.
- There is a scale issue with the models. Models are better than the data inputs, so simpler methods probably better for now.

3. If you use estimations/loading factors, what methods are you most interested in (or do you find most useful) to characterize runoff/source loadings?

The options provided for this response were ranked from 1 (most important) to 5 (least important), as shown in **Table 9**. Literature values and scaling characteristics were considered the most important, compliance rates the next, then quantity of waste diverted, and finally surveys.

Table 9. Interest in Methods for Performing Estimations and Loading Factors

Methods for Estimation/Loading Factors	1 - Most Important	2	3	4	5 - Least Important
Literature values and scaling to local characteristics (e.g. metals levels in retail parking lots x sq.ft. of parking lots in area, runoff per Single Family Residence x number of parcels)	18	10	5	3	4
Compliance rates (e.g. # of illicit discharge reports/yr., industrial inspection results, etc.)	12	8	5	10	4
Quantity of waste diverted (e.g. collection at HHW facilities, street sweeping collection)	10	8	13	7	2
Surveys of behavior and extrapolation to full service area	7	9	9	10	4
Other	5	0	1	1	5



Interest in Methods for Performing Estimations and Loading Factors

Additional comments regarding load reduction tools and methodologies include the following:

- [Use] WinSLAMM loading factors.
- [Collect] monitoring data to develop better estimates.
- [Perform] monitoring at limited number of centralized locations.
- [We] currently use BMP pollutant removal efficiencies determined through Intl BMP database.
- The above are all crucial tools that can only be ranked within the specific context of their intended use.
- Always start with a source identification study using information from the scientific and product literature. Until this step is complete, it's not possible to know if estimates are in the right ballpark. Most studies done by other methods have been inaccurate.

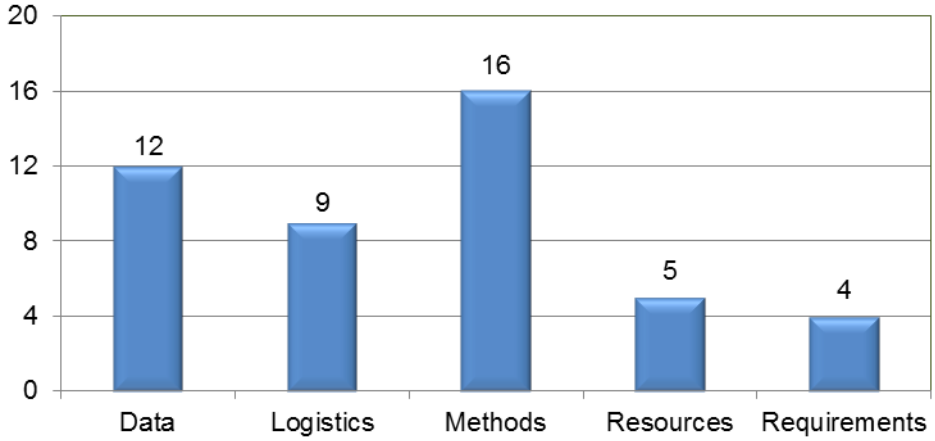
QUESTIONS ABOUT CHALLENGES:

1. What are your biggest challenges with source assessments?

Thirty-four participants responded to this question, some with multiple comments. The narrative responses are summarized in **Table 10**, with the number of times each response was provided.

Table 10. Biggest Challenges with Source Assessments

Category	Challenge and number of times it was listed
Data – 12 responses	
	Collection of data (issues with costs, time, quality/usefulness, reliability, quantity) - 8
	Low rainfall/storm infrequency for data collection - 2
	Data variability - 2
Logistics – 9 responses	
	Lack of source knowledge for monitoring - 3
	Monitoring location selection/access - 3
	Improving BMP Education for source control - 1
	Ag influence - 1
	Agencies and organizations seem to be reluctant to do the scientific groundwork to identify and understand pollutant sources. I think the talent exists in academia and scientific consulting firms, but managers have not brought this talent to bear except in rare instances. Ideally, this would be a broadly known skill set. One of the biggest barriers seems to be that our industry doesn't seem to be doing a good job of creating senior (Ph.D. level) scientist-engineer partnerships to tackle these problems.
Methods – 16 responses	
	Uncertainty in the absence of quantification - 2
	Extrapolating/estimating loads and load reductions - 5
	Accuracy and/or reliability of assumptions - 3
	Methodology: selection or questionability - 4
	Determining effectiveness over time - 1
	As with PCB and Mercury reductions with Green Infrastructure, we are to assume in old industrial areas and old urban areas, that there exists a PCB presence of X grams per acre and if we treat with Green Infrastructure we recieve credit for removing X grams of PCBs and Mercury per acre. What is frustrating is there is no way to know whether or not PCB's and Mercury actually exists in the specific area we are treating or if it does what the concentrations are and how successful the implementation of installing Green Infrastructure is in reducing PCBs and Mercury in the field rather than in theory.
Resources – 5 responses	
	Staffing, time and funding - 5
Requirements – 4 responses	
	Cumbersome unrealistic regulations
	Permit-required monitoring program is disconnected from reporting requirements
	Permit requirements
	Assumptions in Basin Plans and CTR



Types of Challenges with Source Assessments

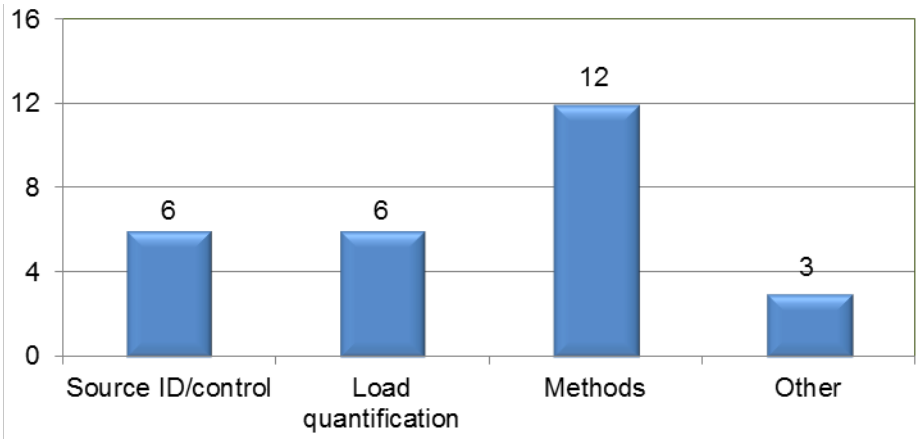
2. What information would be most helpful to you?

Twenty-seven participants responded to this question, some with multiple comments. The following information was described as likely to be the most helpful.

Table 11. Information that Would be most Helpful

Category	Helpful Information
Source identification/Source control – 6 responses	
	Identify source and pathway of chemicals in commercial use that end up in stormwater and cause impairments.
	Create a web page of pollutant-specific resources with information about sources and source control strategies for public use.
	Real data, identification of non-conveyed sources, and template calculation methods.
	Numbers of sources/people, discharge character and rate, rates of BMP implementation, and factors influencing them.
	Regulating electrical utilities, making them provide information and correctly and transparently label and replace old PCBs containing (to WB levels) devices; giving them a WLA in a discharge permit.
	Targeted monitored single-activity source control implementation.
Load Quantification – 6 responses	
	Quantification of load reductions – 2 responses
	Loading rates and loading rate adjustments for source control BMPs.
	Guidance on quantifying source control load reductions based on local conditions and factors.
	Seasonal generation rates by land use including commercial areas, residential areas (multi-family, estate, golf communities, etc. by area, not individual sites).
	Develop a standard, scientifically-defensible methodology that can be used to quantify load reductions, acceptable to local and state regulators.

Category	Helpful Information
Methods – 12 responses	
	Tried and tested tools and methodologies.
	Create standard SWB-approved methodologies for analyzing the effectiveness of management strategies.
	Methods and methodologies to minimize discharges or what can be done to achieve similar results without discharges.
	Develop defensible ways to scale up the data for assessments.
	A workshop to go over model basics such as necessary model inputs and resulting outputs.
	A list of the best equipment to use for field analysis, past studies that determine which sweepers are the best for which types of land use, past success stories regarding load reductions.
	A table of effectiveness of various BMPs.
	Reliable assumptions that regulators can agree to that can be pointed to for cost savings by reducing the amount of treatment required.
	Ways to test for the presence of PCBs and Mercury in our old urban and old industrial areas to verify its presence before we spending millions to install GI.
	How to use non-structural BMPs to help meet our RAA requirements.
	How to equate enhanced street sweeping, on-land cleanups, and other alternative methods to full trash capture equivalency.
	How / what / outcomes.
Other – 3 responses	
	Barriers to achieving 100% compliance with local regulations.
	Focus on regional SW solutions and public education.
	Continued work from CASQA. Thank you!



Types of Information That Would Be Most Helpful

3. Do you have additional thoughts or comments regarding this project?

The following eight additional comments were made.

- Pollutant source identification is perceived as too daunting and expensive for most individual agencies to tackle at a level that would lead to real solutions. There is a big role for a statewide organization (e.g., CASQA or the envisioned Water Board-MS4 JPA) to tackle source identification work. Support from academia is going to be important in these next steps. Academia partnerships have played a key role in related programs at other agencies (e.g., DTSC, DPR).
- Have a call out for cities willing to be a test lab for source reduction tracking.
- Timing is of the essence. Also, how will this project overlap with the State Board's RAA efforts?
- Nutrient offset and low tech solutions need to be focuses of this work.
- Dry weather monitoring is a really good measurement for success of a SW program implementation.
- In general, in my observation, there has been minimal benefit from the 'detailed' evaluation of source contribution estimates.
- It is almost too technical for what I do. I would be interested in learning more.

4. Do you have an existing report or a study that describes the development and/or use of load reduction estimates for sources/source control?

The following ten additional studies were described.

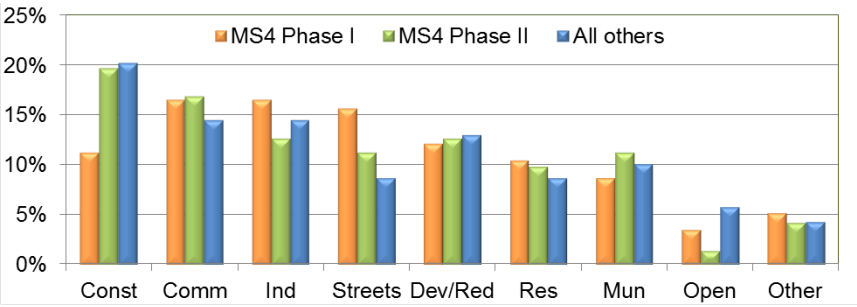
- CASQA brake pad and zinc reports on the CASQA website: https://www.casqa.org
- Brake Pad Partnership materials: http://suscon.org/technical-resources
- LWA has prepared two relevant reports for the SF Bay Area Clean Estuary Partnership, one on copper and one on PCBs.
- EWMPs, WQIPs (Water Quality Improvement Plans) for San Diego and Los Angeles RWQCBs
- Appendix C8 Upper Santa Clara River Enhanced Watershed Management Plan http://greensantaclarita.com/calendar/enhanced-watershed-management-plan/
- Lake Tahoe TMDL (Total Maximum Daily Load) Pollutant Reduction Opportunity Report: http://www.trpa.org/wp-content/uploads/Q
- TMDL_Executive_Summary.pdf
- Road Operations and Maintenance Practices Effectiveness Testing: http://www.2ndnaturellc.com/wp-content/uploads/2015/11/Final_ROM_TechnicalReport.pdf
- TELR - Tool to Estimate Load Reduction - a GIS-based model that quantifies pollutant load reductions (for sediment and runoff volume) for small catchments throughout Region 3.
- Probably, but would need time to identify. Could this be a separate follow-up request?

SURVEY CONCLUSIONS AND RECOMMENDATIONS

In general, the participants reported a number of challenges with source assessment and identified tools that would be helpful.

Of the 85 participants, 69% were MS4 programs, which represented all regions. More than half of the participants (57%) have worked in stormwater management for more than 10 years.

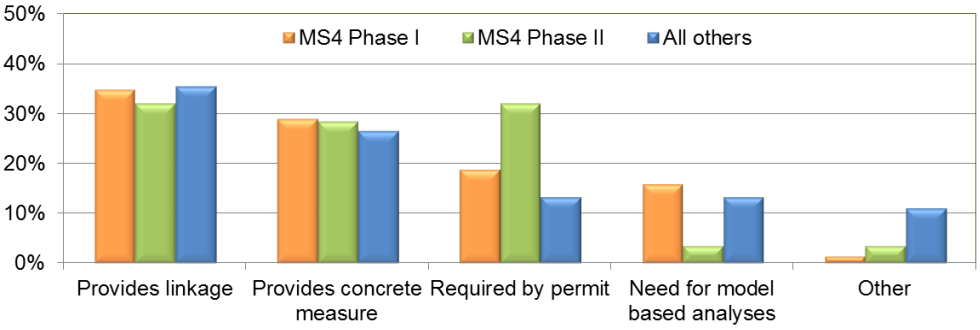
The highest priority and secondary priority sources selected by participants were construction, commercial and industrial sources, with streets/highways and development/redevelopment close behind. Phase I MS4s ranked construction sites below the others, while non-MS4s ranked construction sites well above any of the others. Residential, municipal, open spaces and "other" were not ranked high by any program type.



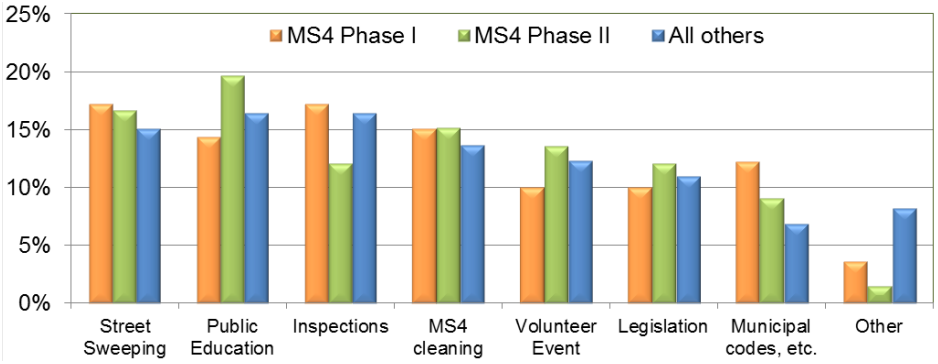
The highest ranking priority sources by region are shown below.

Region	Highest priority source
1	Streets & highways
2	Industrial
3	Construction/Commercial/Industrial
4	Construction/Development/Redevelopment
5	Construction/Development/Redevelopment
6	Commercial/Industrial/Streets & highways
7	Construction/Commercial
8	Commercial/Streets & highways/Residential
9	All but "other"

Load reduction assessments were considered useful primarily because they provide linkage between program elements or non-structural BMPs and water quality results. They were also considered useful for providing a concrete measure of effectiveness. The exception to this pattern was MS4 Phase II programs, which considered the fact that load reduction assessments are required by permit to be equally important as providing linkage.

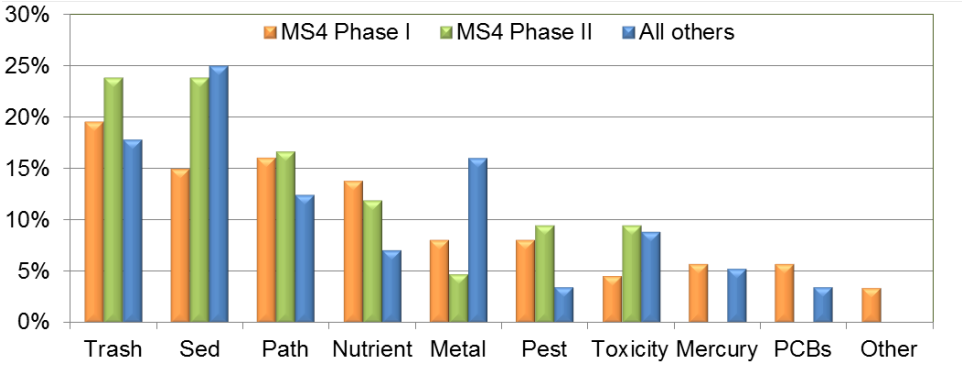


The source controls of highest interest were street sweeping, public education, inspections and MS4 cleaning. MS4 Phase II programs considered public education of highest interest, and ranked volunteer events above inspections.



Twelve participants indicated that they use a percent reduction credit or assumed reduction, and specified the source control, category or source. Most of the sources described were trash or plastics.

The pollutants of highest concern overall were trash and sediment, especially to MS4 Phase II programs. MS4 Phase I programs ranked bacteria above sediment, and nutrients equal to sediment in importance. Non-MS4 programs ranked sediment significantly above all other POCs, and ranked metals as high importance as well.

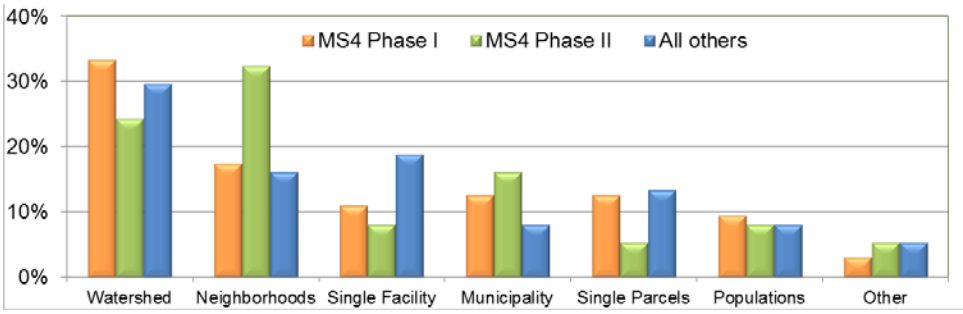


The highest ranking pollutants of concern, combining the highest interest and secondary priority POCs, are shown by region below.

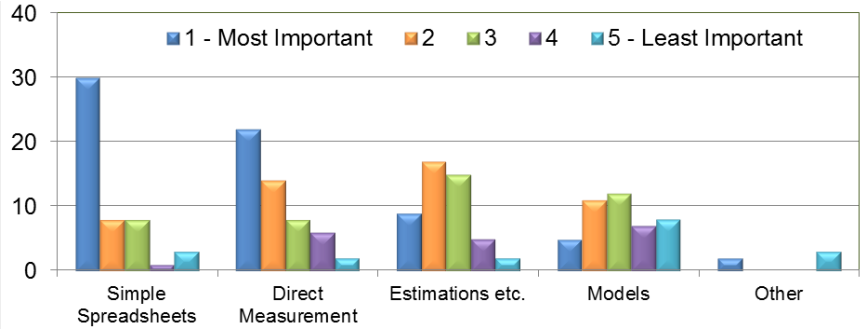
Region	Highest priority POC
1	Trash, sediment, metals, toxicity
2	Trash
3	Trash
4	Trash, sediment, other
5	Trash
6	Sediment
7	Trash, sediment, pathogens, nutrients, metals, toxicity
8	Pathogens
9	Trash, sediment, pathogens

Six participants recommended using TSS or sediment as a surrogate for metals, bacteria, PCBs, mercury, metals and pesticides.

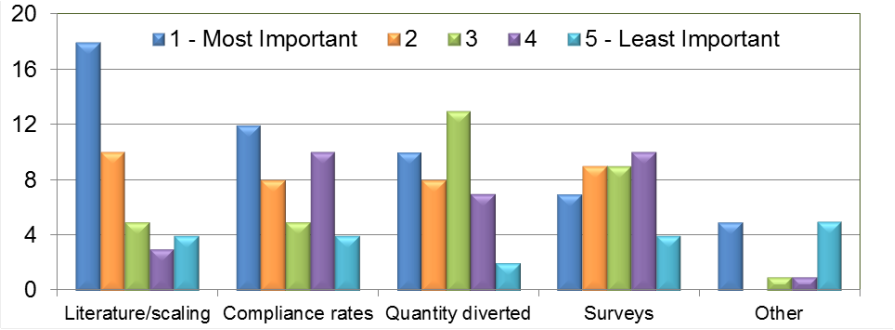
The watershed scale was of primary interest except among MS4 Phase II programs, where the neighborhood scale was primarily selected.



Simple spreadsheets were selected by the largest number of participants as the most important tool for measuring source reduction. Direct measurement was selected next, then estimations/loading factors/survey information, and finally models. Fifteen participants described specific models they have used.



Literature values and scaling to local characteristics was selected by the largest number of participants as the most important method for performing estimations and determining loading factors.



Thirty-four participants described their biggest challenges with source assessments, and the responses were grouped by type.

- Sixteen responses were related to methods, such as uncertainty, extrapolating or estimating, accuracy or reliability, methodology selection, and determining effectiveness.
- Twelve responses were related to data collection difficulties or lack of available data.
- Nine responses described issues with logistics, such as monitoring location selection or access, BMP education and the influence of agriculture.
- Five responses described a lack of resources including staff, time and funding, and four described difficulties with program requirements.

Twenty-seven participants described information likely to be the most helpful, and the responses were grouped by type.

- Twelve responses described method-type information. These included providing standardized methods for analyzing effectiveness, minimizing discharges, and scaling up data for assessments. Standard tables of BMP effectiveness, recommended field analysis equipment and reliable assumptions were requested, and workshops for method and model training. Methods on equating BMP actions to full trash capture equivalency were specifically requested.
- In addition to method-type information, six responses requested source identification or source control information, including pollutant-specific resources, real data with identification of sources and template calculation methods, and others.
- Six responses requested load quantification information, including tables of load reductions, loading rates and rate adjustments for source control BMPs, guidance on quantifying load reductions, and seasonal rates by land use.

This evaluation of tools and methodologies will be used in the next task to determine the applicability of the tools and methodologies based on pollutant type, sources, and target audiences, phase of program planning/implementation, and to identify how the tools may be used by the municipalities. The final task will involve updating the CASQA effectiveness assessment web portal, as needed.

Attachment 1

Interview / Survey on Source Contribution Tools and Methodologies

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California Stormwater Quality Association (CASQA)
Interview / Survey on Source Contribution Tools and Methodologies

Introduction

The California Stormwater Quality Association (CASQA) is implementing a project to identify the tools and methodologies that may assist stormwater practitioners in evaluating *source contributions*. Source contributions (CASQA Outcome Level 4) are those flows and/or pollutants that come from a particular source type – municipal facilities, residential areas, industrial/commercial, construction, etc. Source contributions provide a crucial linkage between target audience behaviors and MS4 discharge quality, therefore, it is important to understand how we can measure or estimate source loadings and/or source load reductions, prior to entering the MS4. This project will identify the tools and approaches that are currently available as well as their applicability so that they may be used as a part of the assessment of stormwater program effectiveness. The results of the project will be available on the CASQA website[1].

To ensure that this project provides valuable information and resources for the stormwater community, we would like to understand what would be most useful for its primary users. Your input will help to refine the focus of the project and meet user expectations and needs. Please take a few moments to answer the questions below. **Your responses will be kept confidential.**

You may direct any questions to Karen Ashby at karena@lwa.com or (530) 753-6400 x232. Thank you in advance for your participation.

Participant Information [#1 and #2 are Optional – this information will be kept confidential]

1. Participant Name :_____
    a. Title :_____
    b. Phone Number :_____
    c. Email :_____
2. Name of Agency/Organization : _____
3. Type of Agency/Organization
    a. Municipal Stormwater Program
        i. Phase I MS4
        ii. Phase II MS4
    b. State/Federal Regulatory Agency
        i. EPA
        ii. State of (Specify State):_____
        iii. California Regional Water Quality Control Board (Specify Region):_____
        iv. Other (Specify) :_____
    c. Non-Governmental Organization (Specify):_____
    d. Other (Specify): _____
4. Number of years involved in the stormwater management field:_____

[1] https://www.casqa.org/effectiveness_assessment

Sources

1. What types of sources are the highest priority for you to be able to characterize with respect to load contributions [Identify all that apply]?
    a. Development / Redevelopment Projects
    b. Construction Sites
    c. Commercial Sites
    d. Industrial Sites
    e. Municipal Facilities
    f. Residential Areas
    g. Streets, highways
    h. Open Space
    i. Other (specify):_____
2. What types of sources may also be useful to characterize with respect to load reduction, but are not necessarily the focus for the agency [Identify all that apply]?
    a. Development / Redevelopment Projects
    b. Construction Sites
    c. Commercial Sites
    d. Industrial Sites
    e. Municipal Facilities
    f. Residential Areas
    g. Streets, highways
    h. Open Space
    i. Other (specify):_____
3. Other comments regarding sources

Source Controls

1. How are assessments of load reductions that may be achieved through the use of source controls useful for your program? (check all that apply)
    a. Provides linkage between program elements/non-structural BMPs and water quality results.
    b. Provides concrete measure of effectiveness for program elements/nonstructural BMPs.
    c. Required by my permit
    d. Need load reductions for inputs for RAA or for other model based analyses
    e. Other:_____
    f. Not sure

2. What types of source controls are you <u>most interested</u> in evaluating? [Identify all that apply]

	currently evaluate loads	Would like to evaluate loads
a. Street Sweeping		
b. MS4 Cleaning (e.g., inlet structure cleanings)		
c. Volunteer Events (e.g., clean ups)		
d. Public Education – Educational Material Distribution		
e. Inspections		
f. Legislation		
g. Municipal codes, ordinances, preferential purchasing policies, and contracts		
h. Other (Specify):_____		

3. Do you use a % reduction credit or assumed reduction for a specific source control(s) or for a category/group of source controls or sources (e.g., municipal operations, industrial, etc.)?
    a. Yes (specify the control, the % reduction, and the source for the justification) _____
    b. Yes (specify the control, the % reduction, and the source for the justification) _____
    c. Yes (specify the control, the % reduction, and the source for the justification) _____
    d. Yes (specify the control, the % reduction, and the source for the justification) _____
    e. No
4. Other comments regarding determining loads/load reductions for source controls

Pollutants of Concern

1. Identify the <u>highest priority water quality constituents</u> that the program is focused on. These constituents would be included in an assessment of water quality and/or program effectiveness [Identify all that are considered high priority].
    a. Mercury
    b. Metals (copper, aluminum, zinc, lead, cadmium, nickel)
    c. Nutrients
    d. Pathogen Indicators / Bacteria
    e. Pesticides
    f. Polychlorinated Biphenyls (PCBs)
    g. Sediment
    h. Toxicity

   i. Trash
   j. Other (specify):_____

2. Identify if there are <u>additional water quality constituents</u> that would be of interest. These constituents may be included in an assessment of water quality and/or program effectiveness, but are not necessarily the focus for the agency [Identify all that are of interest and not selected in 1.].
   a. Mercury
   b. Metals (copper, aluminum, zinc, lead, cadmium, nickel)
   c. Nutrients
   d. Pathogen Indicators / Bacteria
   e. Pesticides
   f. Polychlorinated Biphenyls (PCBs)
   g. Sediment
   h. Toxicity
   i. Trash
   j. Other (specify):_____
3. If a surrogate(s) were to be used, which surrogate(s) would you recommend and which constituents would they be used as a surrogate for?
4. Other comments regarding pollutants of concern

Tools and Methodologies

1. What scales are you most interested in for your assessments? [Identify all that apply]
   a. Single facility (business, home, etc.)
   b. Single parcels
   c. Neighborhoods / small drainage areas
   d. Municipality
   e. Watershed/ subwatershed
   f. Populations (employees, residents, etc.)
   g. Other (specify):_____
2. What types of tools are you most interested in using for your stormwater program for measuring source reduction? [Rank the items listed below in the order of most important (1) to least important (5)]
   a. Simple Spreadsheets / Models
   b. Models (specify):_____
   c. Direct Measurement
   d. Estimations / Loading factors / Survey information
   e. Other (specify):_____

3. If you use estimations/loading factors, what methods are you most interested in (or do you find most useful) to characterize runoff / source loadings? [Rank the items listed below in the order of most important (1) to least important (6)
    a. Literature values and scaling to local characteristics (e.g., metals levels in retail parking lots x sq. ft of parking lots in area, runoff per Single Family Residence x number of parcels)
    b. Compliance rates (e.g., # of illicit discharge reports/yr, industrial inspection results, etc.)
    c. Quantity of waste diverted (e.g., collection at HHW facilities, street sweeping collection).
    d. Surveys of behavior and extrapolation to full service area
    e. Other (specify):_____

5. Other comments regarding load reduction tools and methodologies

General Comments

1. What are your biggest challenges with source assessments?

2. What information would be most helpful to you?

3. Do you have additional thoughts or comments regarding this project?

4. Do you have an existing report on a study that describes the development and/or use of load reduction estimates for sources/source control (provide the citation or where the report can be accessed).