# Stormwater Program Effectiveness Assessment Survey

# Summary Report

**Prepared For:**

California Stormwater Quality Association (CASQA)



**Prepared by:**

Eisenberg, Olivieri and Associates, Inc
1410 Jackson St.
Oakland, CA 94612

and

Larry Walker Associates
707 Fourth Street
Davis, CA 95616

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**CALIFORNIA STORMWATER QUALITY ASSOCIATION**

Stormwater Program Effectiveness Assessment Survey
*Summary Report*

## INTRODUCTION

Effectiveness assessments are integral for the development and implementation of successful stormwater management programs. Program effectiveness assessments are a fundamental component of the iterative process that is employed by stormwater programs to determine how successful a program has been in complying with NPDES permit requirements, increasing awareness, changing behavior, decreasing inputs of target pollutants to the environment and/or improving water quality. Assessments typically include a variety of effectiveness measurements such as tracking and analyzing the number of inspections completed and associated outcomes, the number of public education and outreach activities conducted or materials distributed, the number and success of training events conducted, and the pollutant loads reduced or avoided.

Currently, stormwater program managers struggle with applying assessment measures that are useful, valid and cost effective. To assist managers in conducting effectiveness assessments, the California Stormwater Quality Association (CASQA) will begin developing *Guidance for Evaluating Stormwater Program Effectiveness* in late 2005. In preparation, CASQA developed a web-based survey that was intended to: 1) compile information on how agencies are currently measuring effectiveness; and, 2) identify stormwater program needs for conducting future effectiveness assessments. This Summary Report describes the survey methods, results and conclusions.

## METHODS

In March 2005, the CASQA Subcommittee on Program Effectiveness (Subcommittee) reviewed and revised a draft seven-question web-based survey (Appendix A). The survey was designed to be brief and easy to complete. It asked for basic information from respondents in three ways:

- Check-the-box type questions, including "check all that apply" type questions;
- Forced ranking in which respondents were asked to rank predefined categories based on priority; and,
- Narrative open ended comments in which the respondent was able to add additional comments to clarify or add to their answers.

The Subcommittee estimated that the number of potential survey respondents was roughly 100, which included CASQA members (of which the vast majorities are Municipal Phase I Programs) and staff from the Regional Water Boards. Based on these estimates, the Subcommittee set two goals for the survey: 1) receive survey responses from at least 25% of the potential survey respondents (i.e., Municipal Phase I and II, Industrial and Regional Water Boards), and 2) receive responses from a variety of stormwater agencies that geographically represent the State of California.

The CASQA Executive Director emailed the web address for the finalized survey to all CASQA member agencies and the State Water Resources Control Board (SWRCB) Stormwater Program Supervisor, who in turn forwarded it to the appropriate stormwater program contacts at the nine Regional Water Quality Control Boards (Regional Water Boards) and municipal stormwater Phase II programs. The survey was also announced on the CASQA web-site home page. The survey ended 21 days after the announcement was posted and sent to potential respondents.

## RESULTS

Twenty-five (25) responses were received from respondents representing four stormwater program categories; Municipal Phase I, Municipal Phase II, Industrial and Regional Water Quality Control Boards (Table 1). Respondents were geographically located throughout the State, but generally represented the four largely urbanized regions of California; Los Angeles/Organ County, San Diego, San Francisco Bay Area and Sacramento/Central Valley (Appendix B).

**Table 1.  Number of responses from each respondent category.**

| Respondent Category | Number of Respondents |
|---|---|
| Municipal Phase I | 15* |
| Municipal Phase II | 3* |
| Industrial | 2 |
| Regional Water Boards | 4 |
| Total | 25 |

\* Includes both individual City/County Programs and County-wide Programs

Results are organized by question and presented in Figures 1 through 13 and Tables 2 and 3. Additional respondent information is included in Appendix B and the results of narrative responses to survey questions are provided in Appendix C.

**ANALYSIS**

The following is an analysis of the survey results. The analysis is separated into two sections based on the two objectives of the survey. The first section focuses on analyzing responses to questions related to how agencies currently measure effectiveness. The second section analyzes responses to questions focused on identifying program areas and measurements that should receive highest priority when CASQA develops guidance for evaluating stormwater program effectiveness.

Because only a limited number of responses were received from each of the Municipal Phase II, Industrial, and Regional Water Board categories, concern arose regarding the representativeness of these responses. Therefore, figures presented in this Summary Report only included results from Municipal Phase I Programs. Results from other categories are presented in the narrative.

*SECTION I:    HOW AND WHY DO STORMWATER AGENCIES CURRENTLY MEASURE EFFECTIVENESS?*

**Question #1:    What type(s) of requirements are currently in your agency's stormwater NPDES permit(s) related to evaluating the effectiveness of your program or program components?**

All Municipal Phase I Programs who responded to the survey (n=15) indicated that their agency's permit(s) contain at least one type of requirement related to conducting effectiveness assessments. Most indicated more the one type of requirement. In contrast, responses from the three categories other than Municipal Phase I (n=10) indicated that fewer requirements related to evaluating the effectiveness were currently in their permits or the permits their agency issues. Specifically, only one of four Regional Water Board respondents indicated that requirements related to evaluating effectiveness were in the stormwater permit(s) they oversee.

Overall, direct and indirect measurements of effectiveness, survey/questionnaires and measurable goals are the most frequent types of requirements in Phase I permits (Figure 1).
Respondents also indicated that the following "other" types of requirements were currently in their agency's permit:

- Measuring behavior change related to Public Information and Participation efforts;
- General requirement to assess effectiveness of all program elements as part of Annual Reports;
- Development of reporting and tracking criteria are included within the BMP implementation schedule for each of the six minimum control measures. Reporting and tracking criteria will include parameters to measure program effectiveness; and,
- Illicit Connection and Illicit Discharge (IC/ID) response within 24 hours.

**Figure 1.**    The percentage of Municipal Phase I respondents (n=15) that indicated a specific type of effectiveness assessment requirement is required by their current NPDES Permit.
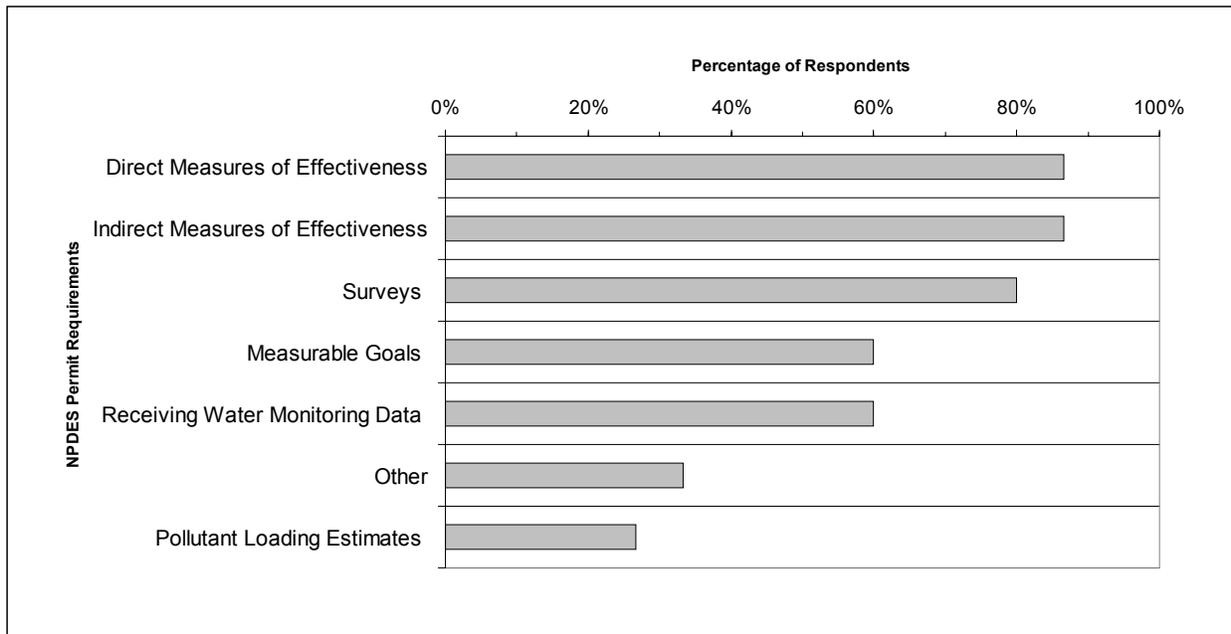
**Question #2:** **What methods are currently used to evaluate the effectiveness of your agency's overall stormwater management programs and major program elements?**

To analyze the results from questions 2 and 3, methods used to evaluate the effectiveness of stormwater management programs, major program elements and specific activities have been grouped into the following three general categories:

- Program Implementation[1] - assessment methods used that evaluate the level of success in implementing programs and activities. Includes; 1) verifying permit compliance, 2) tracking the level of program implementation and 3) assessing trends in program implementation.

- Target Audience Implementation/Change[2] – assessment methods used to evaluate change in behaviors, attitudes or implementation of 3rd parties (e.g., commercial businesses, construction sites and the general public). Includes: 1) surveys/questionnaires, 2) Tracking the number of BMPs implemented, 3) tracking the number of enforcement actions taken, 4) tracking compliance rate of third parties, and 5) quantifying pollutant loads avoided/reduced.

- BMP/Environmental Monitoring[3]– assessment methods that evaluate the condition and change in water quality through environmental data collection. Includes: 1) stormwater discharge monitoring, 2) receiving water monitoring and 3) BMP effectiveness studies.

*Overall Stormwater Program*

The methods most frequently used by Municipal Phase I programs to evaluate the effectiveness of their overall stormwater management programs fell into all three general categories described above. Methods frequently used include, 1) verifying compliance with NPDES permit requirements (73%), 2) receiving water monitoring (40%), 3) surveys/questionnaires (33%) and 4) tracking the number of enforcement actions taken by their agency (33%). The quantification of pollutant loads reduced, tracking the number of BMPs implemented and conducting BMP effectiveness studies are used less commonly (Figure 2).

Responses from Municipal Phase II programs, Industrial programs and Regional Water Board staff were similar to those of Municipal Phase I Programs. Emphases are put on verifying compliance with permit provisions and tracking program level implementation more than any other methods. Additionally, respondents from the Regional Water Boards also indicated that they frequently use the number of enforcement actions taken by their agency to assess effectiveness.

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[1] Includes assessment outcome level 1) Compliance with Activity-based Permit Requirements.
[2] Includes assessment outcome levels 2) Changes in Knowledge/Awareness/Attitudes; 3) Behavioral Change/BMP Implementation; and 4) Load Reductions.
[3] Includes assessment outcome levels 5) Changes in Urban Runoff/Discharge Quality and 6) Changes in Receiving Water Quality.

**Figure 2.** The percentage of Municipal Phase I respondents who use a specific type of effectiveness assessment method to evaluate the effectiveness of their overall stormwater program (n=15). Methods are grouped into the following three categories, 1) Program Implementation (Black); 2) Target Audience Implementation/Change (Gray); and 3) BMP/Environmental Monitoring (White).
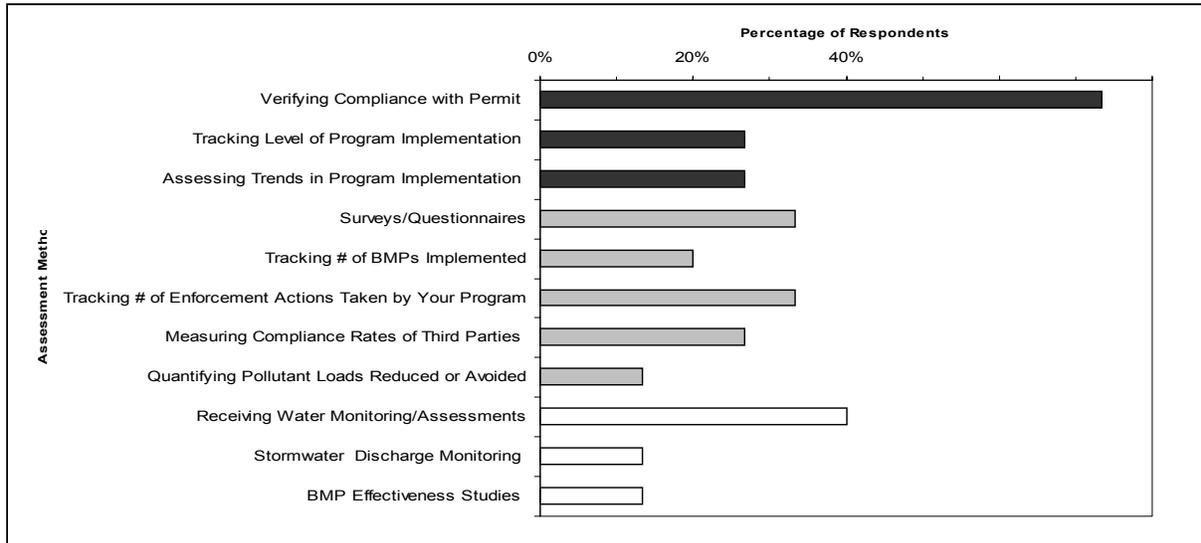


*Public Education/Outreach, Involvement and Participation Programs*

Evaluation methods used to determine the effectiveness of public education/outreach and public participation/involvement programs are similar among Municipal Phase I respondents. As illustrated in Figures 3 and 4, methods in the program implementation category (e.g., verifying permit compliance) and those that measure changes in the behavior of target audiences (i.e., conducting surveys/questionnaires) are the most utilized methods for evaluating these programs. BMP/Environmental Monitoring measurements (i.e., stormwater discharge or receiving water monitoring) are not used by any of the respondents to measure the effectiveness of these program elements. Respondents also indicated that tracking the "number of impressions" is also used to evaluate the effectiveness of their public education/outreach, involvement and participation programs.

**Figure 3.** The percentage of Municipal Phase I respondents who use a specific type of effectiveness assessment method to evaluate the effectiveness of their Public Education and Outreach Program (n=15). Methods are grouped into the following three categories, 1) Program Implementation (Black); 2) Target Audience Implementation/Change (Gray); and 3) BMP/Environmental Monitoring (White).

**Figure 4.** The percentage of Municipal Phase I respondents who use a specific type of effectiveness assessment method to evaluate the effectiveness of their <u>Public Participation and Involvement Program</u> (n=15). Methods are grouped into the following three categories, 1) Program Implementation (Black); 2) Target Audience Implementation/Change (Gray); and 3) BMP/Environmental Monitoring (White).



*Industrial/Commercial Facility Inspection and Illicit Discharge Control Programs*

The methods most frequently used by Municipal Phase I programs to evaluate the effectiveness of their Industrial/Commercial Facility Inspection Programs and Illicit Discharge Control Programs generally fall into two categories, measuring program implementation and measuring target audience implementation. The percentage of respondents indicating that they use methods based on program implementation were similar to other program elements. Specifically, verifying compliance with NPDES permit provisions received the highest percentage of responses (87%) for both program elements (Figures 5 & 6).

Respondents also indicated that tracking the number of enforcement actions taken by their program and measuring compliance rates of third parties are frequently used to evaluate the effectiveness of both their Commercial/Industrial Inspection and Illicit Discharge Control Programs. Conversely, BMP/environmental monitoring based methods are not used frequently to evaluate these programs. Very few respondents (<15%) use BMP/environmental monitoring based methods to determine the effectiveness of their Illicit Discharge Control Programs, and no respondents use these types of methods to evaluate their facility inspection programs.

Responses from Municipal Phase II programs, Industrial programs and Regional Water Board staff were similar to those of Municipal Phase I Programs. Emphasis is put on verifying compliance with permit provisions and tracking program level implementation more than other methods.

**Figure 5.** The percentage of Municipal Phase I respondents who use a specific type of effectiveness assessment method to evaluate the effectiveness of their <u>Industrial/Commercial Facility Inspection Program</u> (n=15). Methods are grouped into the following three categories, 1) Program Implementation (Black), 2) Target Audience Implementation/Change (Gray), and 3) BMP/Environmental Monitoring (White).
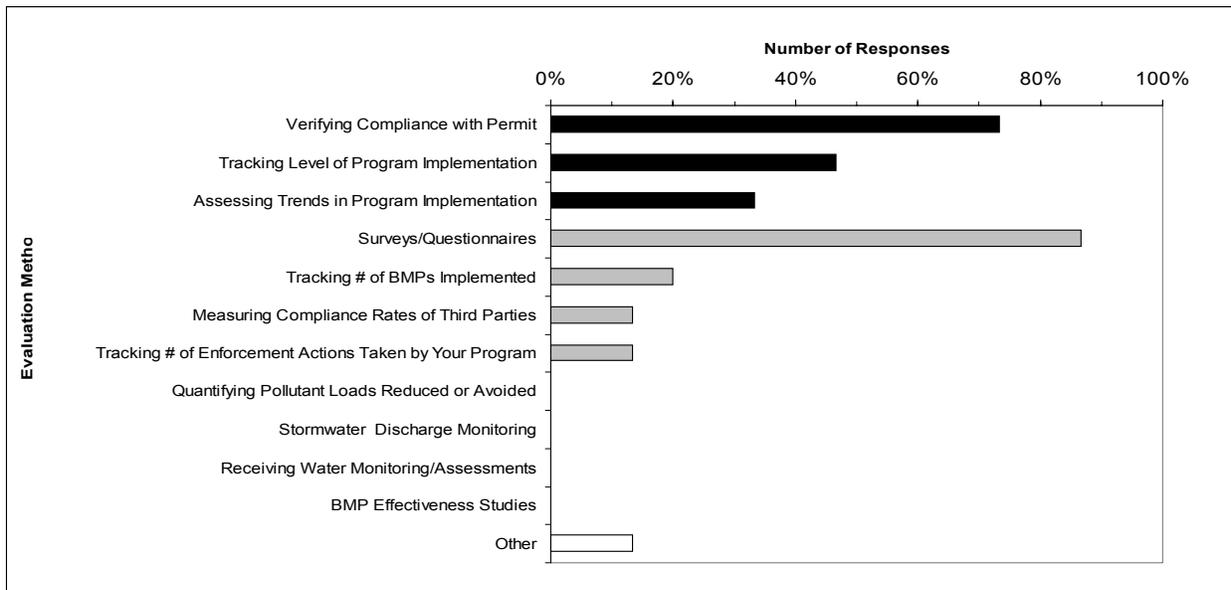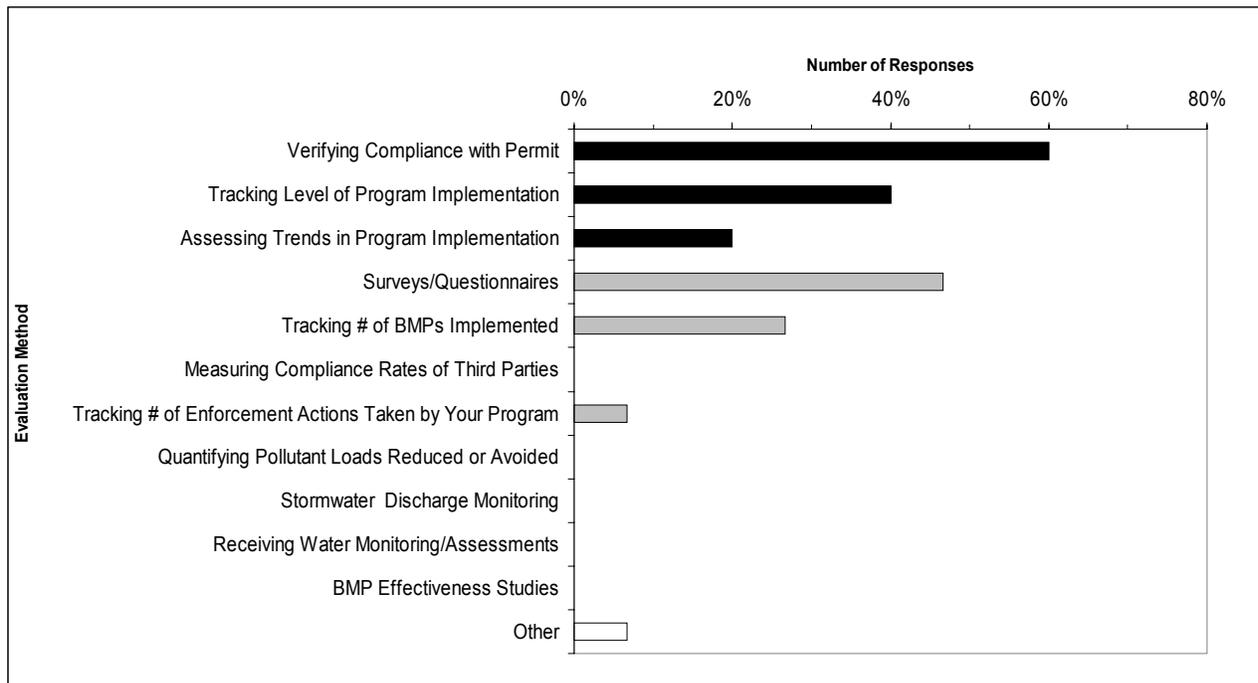


**Figure 6.** The percentage of Municipal Phase I respondents who use a specific type of effectiveness assessment method to evaluate the effectiveness of their <u>Illicit Discharge Control Program</u> (n=15). Methods are grouped into the following three categories, 1) Program Implementation (Black); 2) Target Audience Implementation/Change (Gray); and 3) BMP/Environmental Monitoring (White).
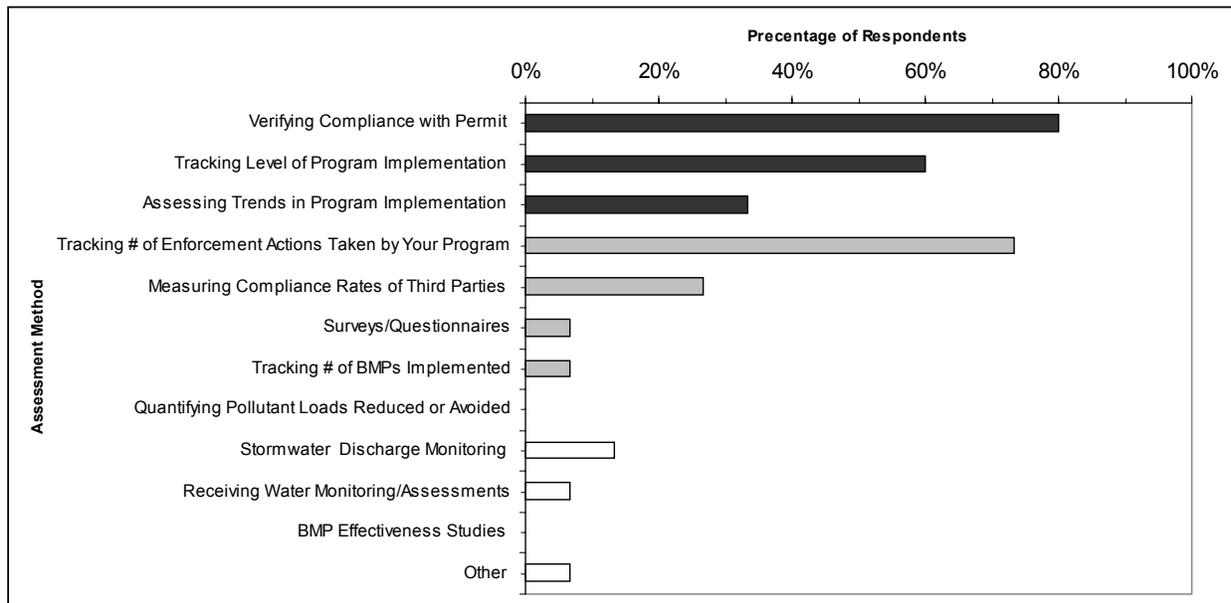
*Construction Site Runoff and Post –Construction Runoff Control Programs*

Similar to other program elements, the methods most frequently used by Municipal Phase I Programs to evaluate the effectiveness of Construction Site and Post-Construction Control Programs Control generally fell into two categories, measuring program implementation and measuring target audience implementation. All Municipal Phase I respondents (n=15) indicated that they evaluate the effectiveness of their Construction Site Runoff Control Program by tracking the level of implementation at construction sites (Figure 7). Additionally, 80% of Phase I programs track the number of enforcement actions taken by their program to determine the effectiveness of this program element. Conversely, only one respondent indicated that their agency uses a BMP/environmental monitoring based method (i.e., receiving water monitoring) to evaluate the effectiveness of their construction site program.

As illustrated in Figure 8, the most frequently cited methods used by Municipal Phase I programs with regards to Post-Construction Site Runoff Control Programs include, verifying compliance with their NPDES Permit (87%), tracking the number of BMPs implemented (53%), and tracking the level of program implementation (47%). Unlike other program elements, BMP effectiveness studies were also a commonly used method to assess the effectiveness of Post-construction runoff control programs. In contrast, other BMP/environmental monitoring based methods were not consistently used by respondents for this program element.

Responses from Municipal Phase II programs, Industrial programs and Regional Water Board staff were similar to those of Municipal Phase I Programs. Emphasis is put on verifying compliance with permit provisions and tracking program level implementation more than any other method.

**Figure 7.** The percentage of Municipal Phase I respondents who use a specific type of effectiveness assessment method to evaluate the effectiveness of their <u>Construction Site Runoff Control Program</u> (n=15). Methods are grouped into the following three categories, 1) Program Implementation (Black); 2) Target Audience Implementation/Change (Gray); and 3) BMP/Environmental Monitoring (White).
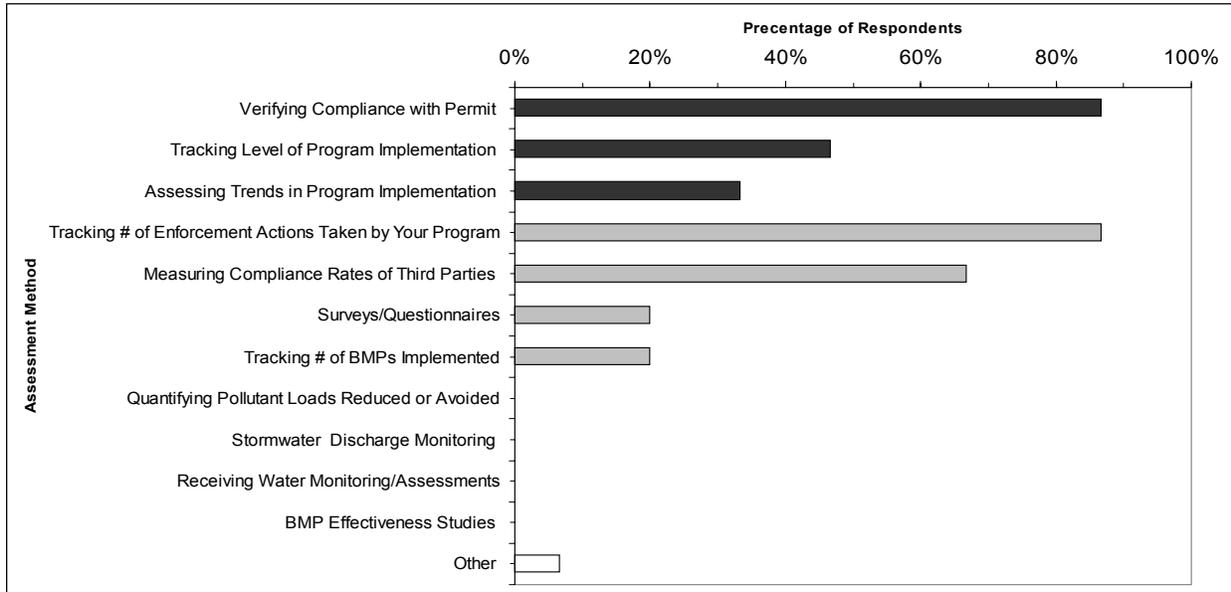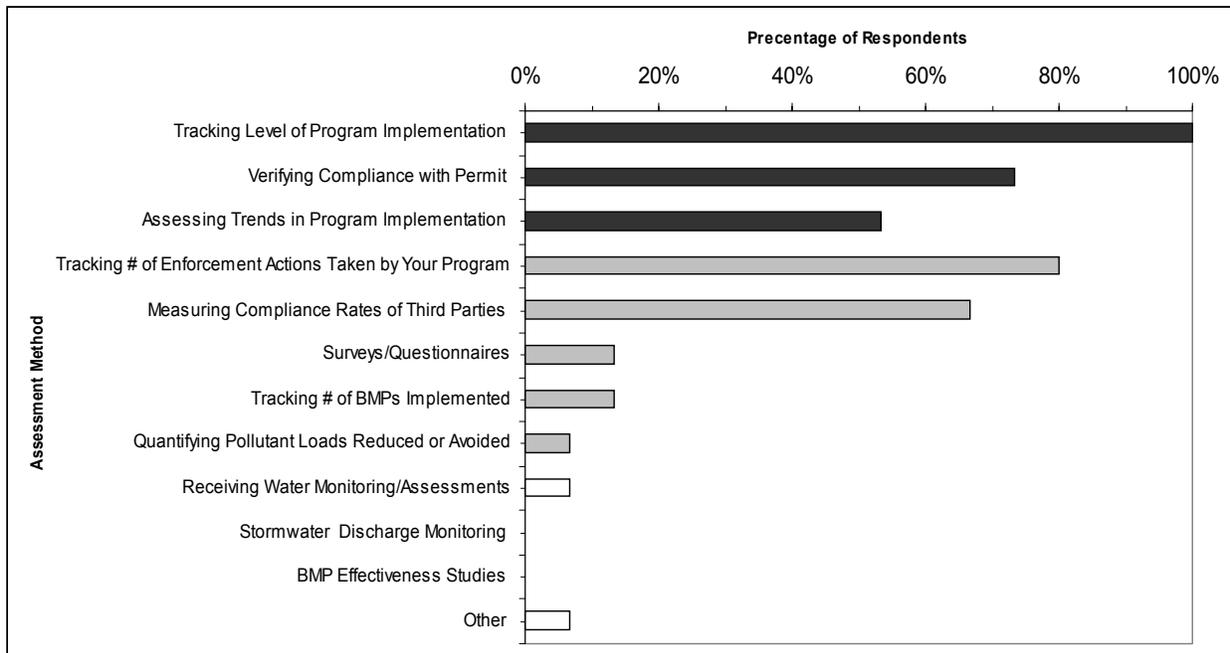
**Figure 8.** The percentage of Municipal Phase I respondents who use a specific type of effectiveness assessment method to evaluate the effectiveness of their <u>Post-Construction Site Runoff Control Program</u> (n=15). Methods are grouped into the following three categories, 1) Program Implementation (Black); 2) Target Audience Implementation/Change (Gray); and 3) BMP/Environmental Monitoring (White).
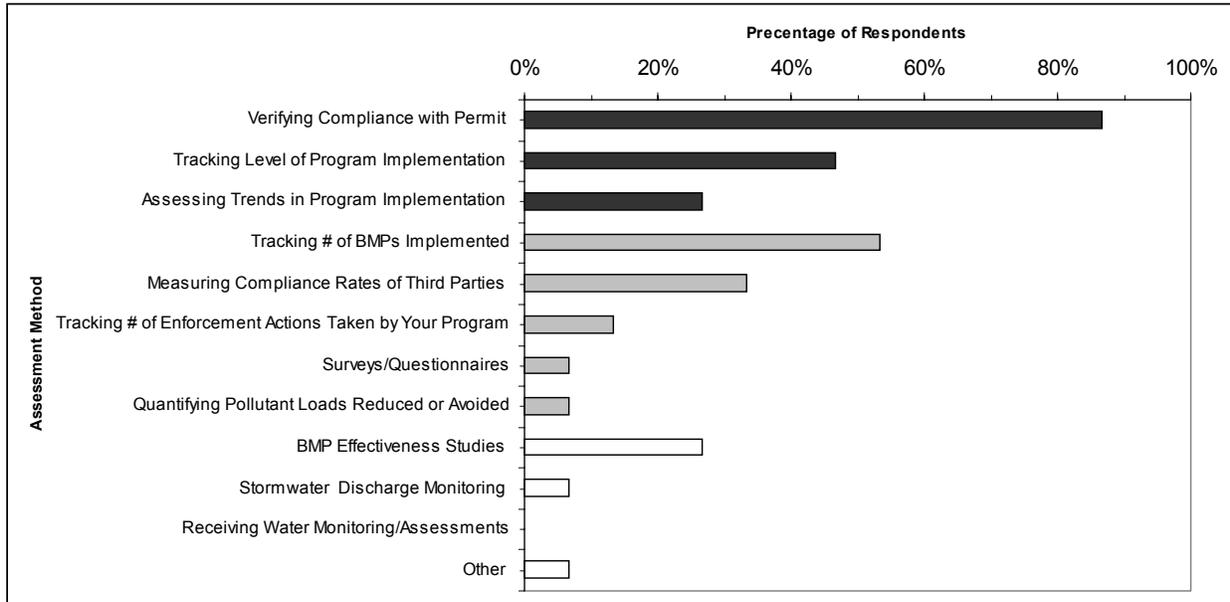


## Municipal Government Operation and Maintenance Control Programs

The methods most frequently used by Municipal Phase I programs to evaluate the effectiveness of Municipal Government Operation and Maintenance Control Programs generally fell into one category, measuring program implementation. Municipal Phase I programs indicated that verifying compliance with NPDES Permit requirements, tracking the level of, and assessing trends in program implementation are used far more frequently than other assessment methods (Figure 9). Other methods used to a lesser degree include, tracking BMPs implemented, quantifying pollutant loads reduced and BMP effectiveness studies.

Responses from Municipal Phase II programs, Industrial programs and Regional Water Board staff were similar to those of Municipal Phase I Programs. Emphasis is put on verifying compliance with permit provisions and tracking program level implementation more than any other method.

**Figure 9.**  The percentage of Municipal Phase I respondents who use a specific type of effectiveness assessment method to evaluate the effectiveness of their <u>Municipal Government Operation and Maintenance Control Program</u> (n=15). Methods are grouped into the following three categories, 1) Program Implementation (Black); 2) Target Audience Implementation/Change (Gray); and 3) BMP/Environmental Monitoring (White).
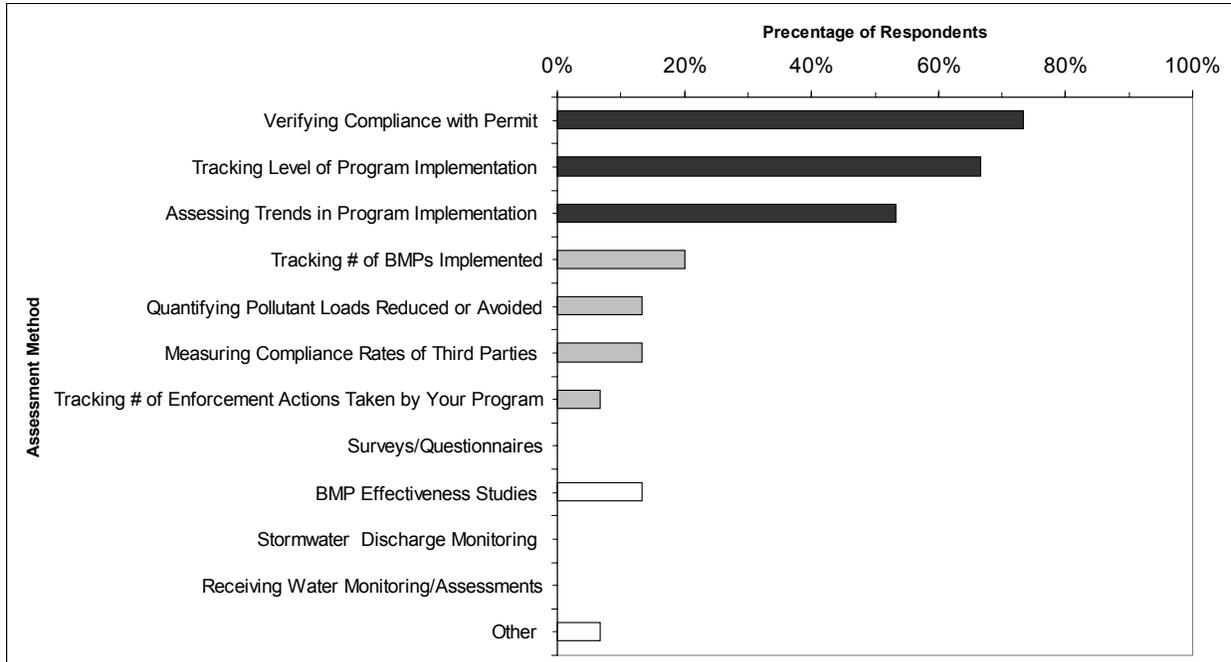


**Question #3:   What methods are used to evaluate the effectiveness of specific activities (e.g., street sweeping, media campaigns and inspections)?**

*Public Outreach Events, Trainings or Workshops and Media Campaigns*

As illustrated in Figures 10, 11 and 12, the methods most frequently used by Municipal Phase I Programs to evaluate the effectiveness of Public Outreach Events, Trainings/Workshops and Media Campaigns generally fell into two categories, measuring program implementation and measuring target audience implementation. Like all program elements and activities, methods falling into the "measuring program implementation" category generally received the highest number responses. Aside from these methods, surveys are the most readily used assessment method to measure the effectiveness of public education events, trainings/workshops and media campaigns. Conversely, no respondents indicated that their agency uses a BMP/environmental monitoring based method (i.e., receiving water monitoring) to evaluate the effectiveness of these activities.

Responses from Municipal Phase II programs, Industrial programs and Regional Water Board staff were similar to those of Municipal Phase I Programs. Emphasis is put on verifying compliance with permit provisions and tracking program level implementation more than any other method.

**Figure 10.** The percentage of Municipal Phase I respondents who use a specific type of effectiveness assessment method to evaluate the effectiveness of their <u>Public Education and Outreach Events</u> (n=15). Methods are grouped into the following three categories, 1) Program Implementation (Black); 2) Target Audience Implementation/Change (Gray); and 3) BMP/Environmental Monitoring (White).
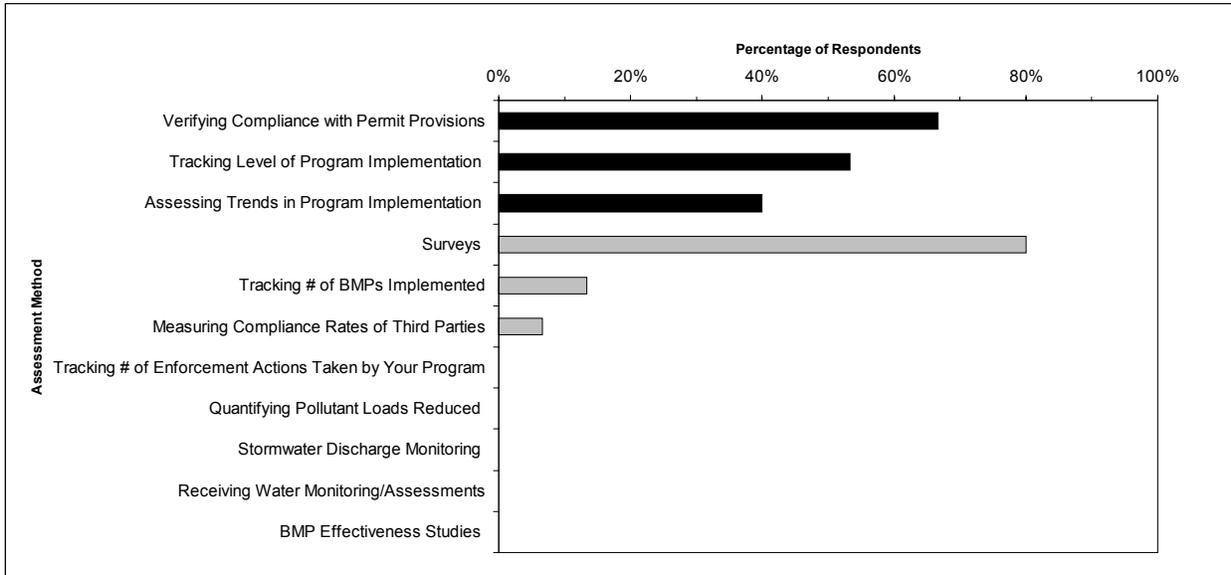


**Figure 11.** The percentage of Municipal Phase I respondents who use a specific type of effectiveness assessment method to evaluate the effectiveness of their <u>Trainings or Workshops</u> (n=15). Methods are grouped into the following three categories, 1) Program Implementation (Black); 2) Target Audience Implementation/Change (Gray); and 3) BMP/Environmental Monitoring (White).

**Figure 12.** The percentage of Municipal Phase I respondents who use a specific type of effectiveness assessment method to evaluate the effectiveness of their <u>Media Events</u> (n=15). Methods are grouped into the following three categories, 1) Program Implementation (Black); 2) Target Audience Implementation/Change (Gray); and 3) BMP/Environmental Monitoring (White).
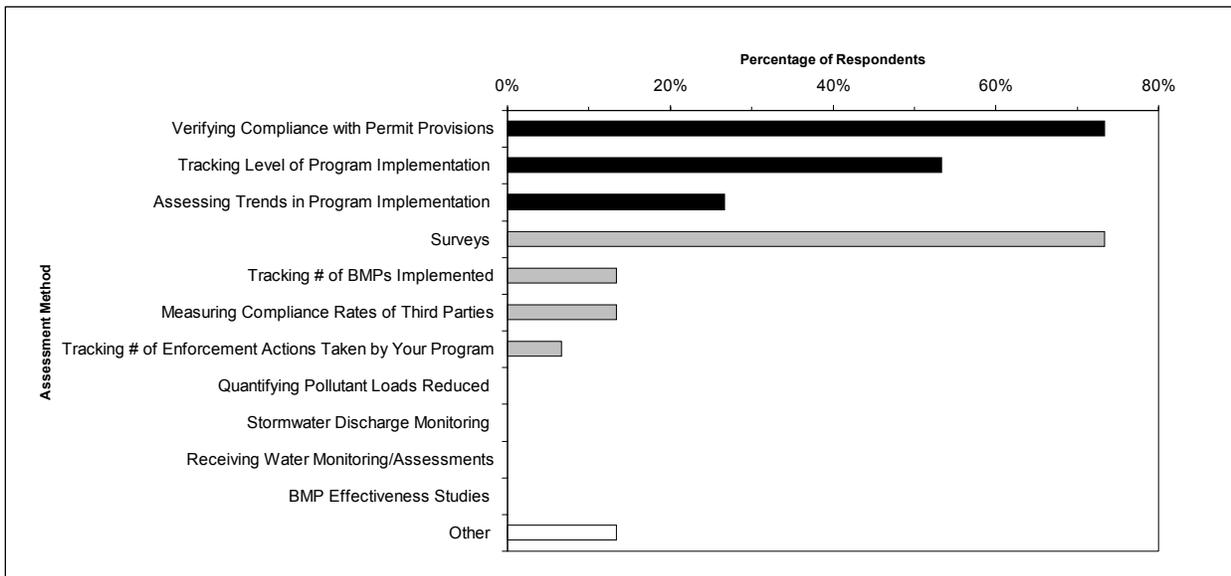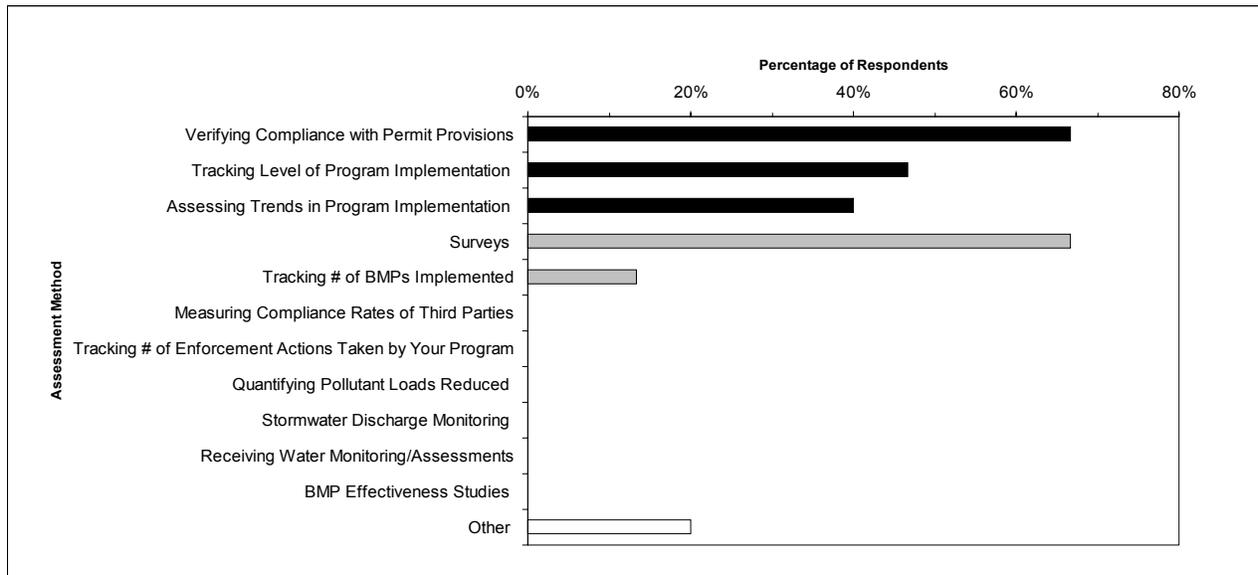


### Treatment Control BMPs, Inspections and Illicit Discharge Response

As illustrated in Figures 13, 14 and 15, the methods most frequently used by Municipal Phase I Programs to evaluate the effectiveness of Treatment Control BMPs, Inspections and Illicit Discharge Response Programs generally fell into two categories, measuring program implementation and measuring target audience implementation. Like all program elements and activities, methods falling into the "measuring program implementation" category generally received the highest number of responses.

Additionally, respondents indicated that other methods are frequently used to measure the effectiveness of these activities. Results suggest that tracking the number of BMPs implemented and BMP effectiveness studies are used by greater than 25% of the respondents to measure the effectiveness of treatment control BMPs (Figure 13). Additionally, methods measuring third party implementation/change (e.g., third party compliance, tracking enforcement actions and surveys) are also used frequently for commercial/industrial business inspection and illicit discharge control programs. To a similar but slightly lesser degree, respondents also indicated that stormwater discharge and receiving water monitoring are used to evaluate the effectiveness of their illicit discharge control programs

Responses from Municipal Phase II programs, Industrial programs and Regional Water Board staff were similar to those of Municipal Phase I Programs. Emphasis is put on verifying compliance with permit provisions and tracking program level implementation more than any other method.

**Figure 13.** Type of effectiveness assessment methods used for <u>Treatment Control BMPs </u> as indicated by the percentage of all Municipal Phase II respondents (n=15). Assessment methods based on implementation of programs are presented in black, indirect measures of change are presented in gray, and those measuring BMP/environmental monitoring are presented in white.
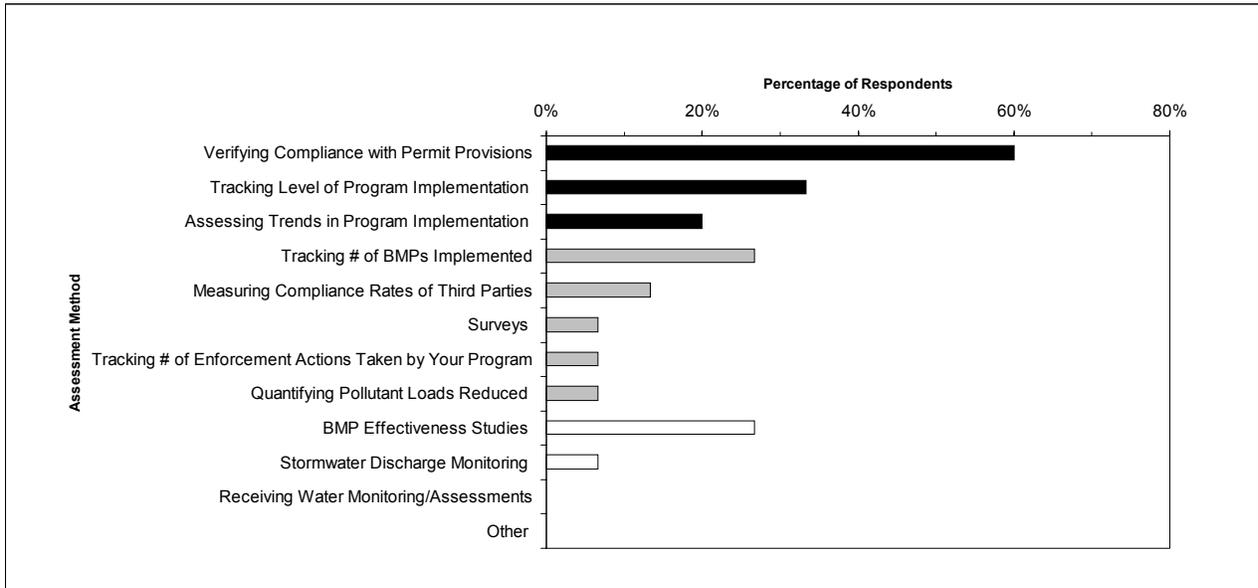


**Figure 14.** Type of effectiveness assessment methods used for <u>Commercial/Industrial Business Inspection Programs </u> as indicated by the percentage of all Municipal Phase II respondents (n=15). Assessment methods based on implementation of programs are presented in black, indirect measures of change are presented in gray, and those measuring BMP/environmental monitoring are presented in white.

**Figure 15.** Type of effectiveness assessment methods used for <u>Illicit Discharge Control Programs</u> as indicated by the percentage of all Municipal Phase II respondents (n=15). Assessment methods based on implementation of programs are presented in black, indirect measures of change are presented in gray, and those measuring BMP/environmental monitoring are presented in white.
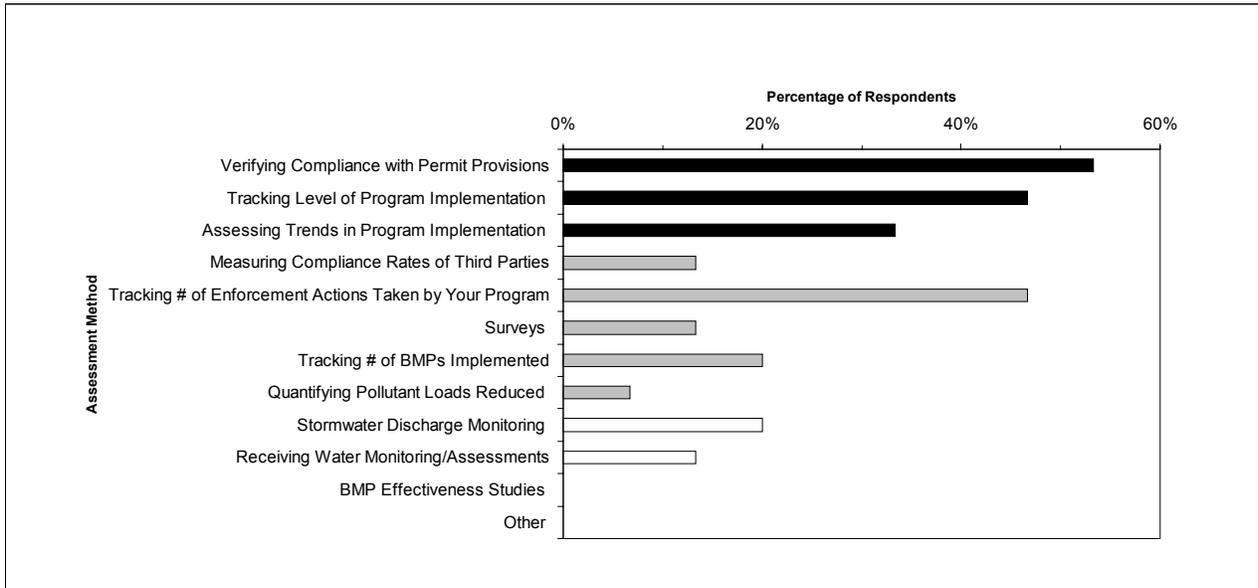


### Street Sweeping and Storm Drain Maintenance

As expected, results related to street sweeping and storm drain maintenance were similar to those from the municipal maintenance program element. The methods most frequently used by Municipal Phase I programs to evaluate the effectiveness of these activities generally fell into two categories, measuring program implementation and third party implementation/change (Figures 16 and 17). Municipal Phase I programs indicated that verifying compliance with NPDES Permit requirements is used far more frequently than other assessment methods. Additionally, other methods are also used frequently, including quantifying pollutant loads reduced and tracking the number of BMPs implemented.

Responses from Municipal Phase II programs, Industrial programs and Regional Water Board staff were similar to those of Municipal Phase I Programs. Emphasis is put on verifying compliance with permit provisions and tracking program level implementation more than any other method.

**Figure 16.** Type of effectiveness assessment methods used for <u>Street Sweeping</u> as indicated by the percentage of all Municipal Phase II respondents (n=15). Assessment methods based on implementation of programs are presented in black, indirect measures of change are presented in gray, and those measuring BMP/environmental monitoring are presented in white.
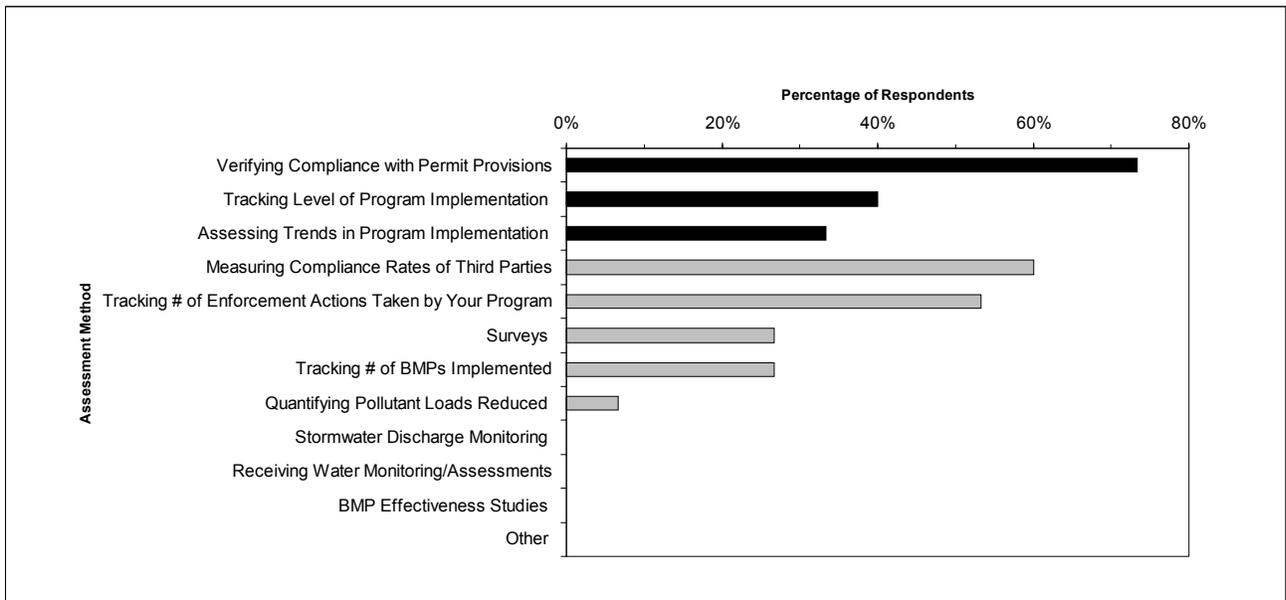


**Figure 17.** Type of effectiveness assessment methods used for <u>Storm Drain Maintenance</u> as indicated by the percentage of all Municipal Phase II respondents (n=15). Assessment methods based on implementation of programs are presented in black, indirect measures of change are presented in gray, and those measuring BMP/environmental monitoring are presented in white.
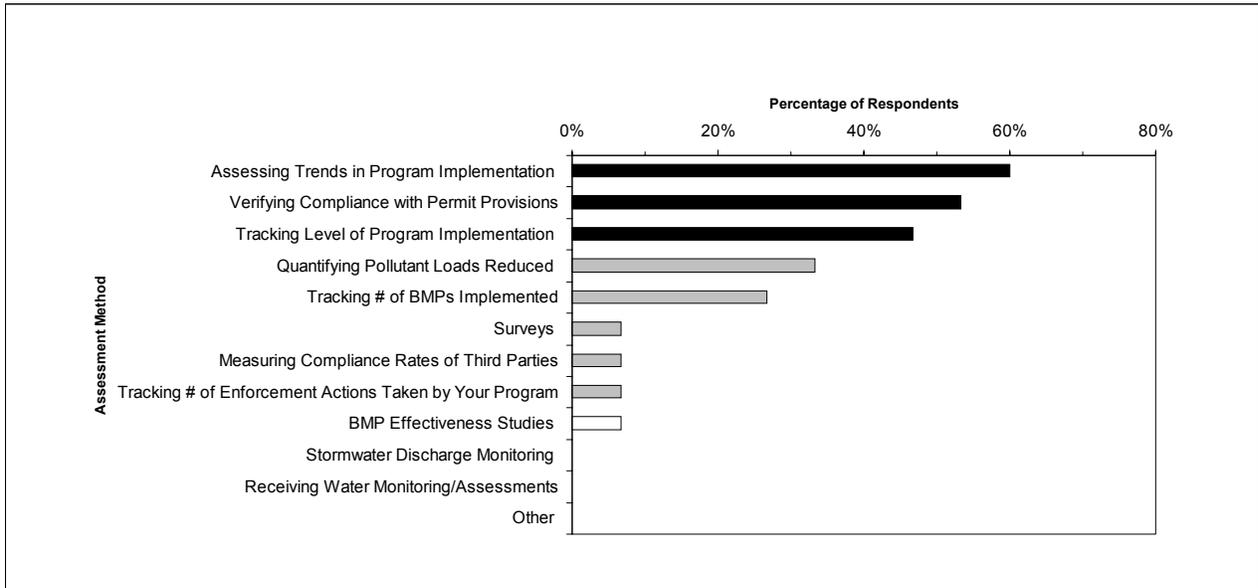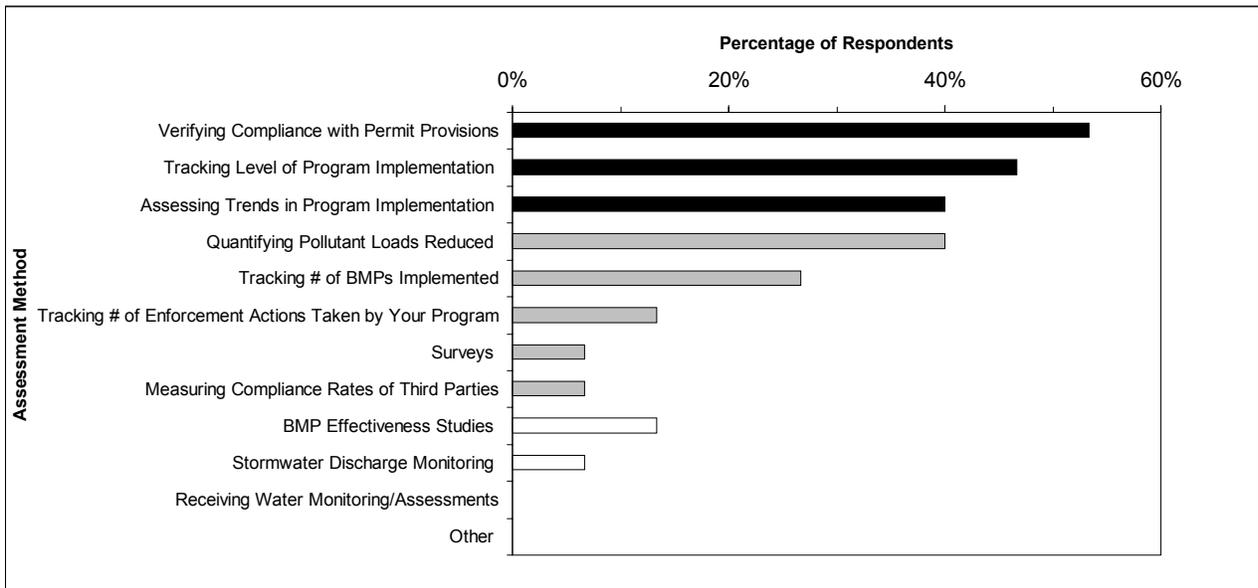
**Question #4:    How does your agency use information obtained from conducting effectiveness assessments?**

Nearly all Municipal Phase I Programs (93%) indicated that they use effectiveness assessment information to demonstrate compliance through annual reporting (Figure 18). To a similar but slightly lesser degree, survey results also show that stormwater programs use effectiveness information to plan future activities (73%) and evaluate stormwater program efficiency (67%). Results indicated that far fewer respondents (40%) use effectiveness information to obtain additional staffing or funding, compared to other uses. Results from Municipal Phase II programs, industrial programs and Regional Water Board staff were similar to Municipal Phase I programs.

**Figure 18.** Uses of effectiveness assessment results as indicated by the percentage of all Municipal Phase I respondents (n=15).
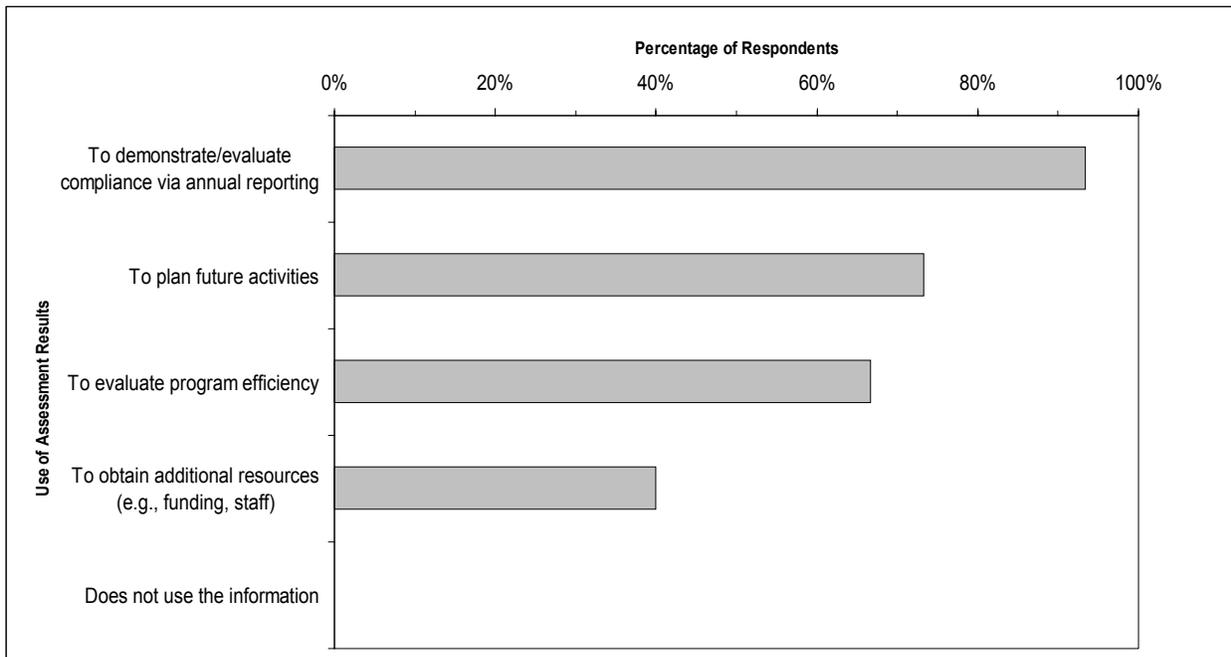
***SECTION II:*** ***WHAT INFORMATION WOULD BE THE MOST USEFUL TO ASSIST YOU IN INCORPORATING EFFECTIVENESS MEASUREMENTS INTO YOUR PROGRAM?***

**Question #5:** **Guidance for performing effectiveness assessments is needed most for which program areas.**

In answering this question, respondents were forced to rank all program elements with regard to the level of guidance needed (highest score = most guidance needed). As listed in Table 2, responses from Municipal Phase I Programs varied. The average ranking for each program element ranged between 5.6 and 3.8, with the most guidance needed on methods to assess the effectiveness of post-construction runoff control and monitoring/watershed assessment programs, and the least needed on public participation/involvement and municipal government operations/maintenance control programs.

**Table 2.** Summary of responses to survey question #5 received from Municipal Phase I respondents (n=11). Figure indicates the number of respondents that ranked each program element a specific ranking score (1-8; 8 being the highest). Mean and median scores for each program element are also shown.

| Ranking | Post-Construction Runoff Control | Monitoring & Watershed Assessment | Construction Site Runoff Control | Ind/Com Facility Inspection | Public Ed & Outreach | Illicit Discharge Control | Public Participation & Involvement | Muni. Gov. Op/Maint. Control |
|---|---|---|---|---|---|---|---|---|
| **8** | 3 | 3 | 0 | 2 | 2 | 0 | 0 | 1 |
| **7** | 2 | 0 | 3 | 0 | 2 | 2 | 1 | 1 |
| **6** | 2 | 3 | 1 | 1 | 0 | 1 | 2 | 1 |
| **5** | 1 | 0 | 2 | 3 | 1 | 2 | 1 | 1 |
| **4** | 1 | 2 | 2 | 0 | 0 | 2 | 2 | 2 |
| **3** | 0 | 0 | 2 | 2 | 2 | 1 | 3 | 1 |
| **2** | 1 | 3 | 0 | 3 | 2 | 1 | 0 | 1 |
| **1** | 1 | 0 | 1 | 0 | 2 | 2 | 2 | 3 |
| **Mean** | **5.6** | **5.1** | **4.7** | **4.5** | **4.3** | **4.1** | **3.9** | **3.8** |
| Median | 6.0 | 6.0 | 5.0 | 5.0 | 3.0 | 4.0 | 4.0 | 4.0 |

**Question #6:** **Guidance is needed most for which types of effectiveness assessment tools.**

Similar to question 5, respondents ranked the assessment tools that they believed needed the most guidance. Responses again varied and average ranking scores for each assessment tool ranged from 4.7 to 2.6 (Table 3). Municipal Phase I Programs indicated that of the six (6) assessment tools/outcomes, the most guidance is needed on measuring pollutant loads reduced and changes in public knowledge/awareness. Respondents indicated that the least amount of guidance was needed measuring compliance with permit requirements and changes in receiving water quality.

**Table 3.** Summary of responses to survey question #6 received from Municipal Phase I respondents (n=11). Figure indicates the number of respondents that ranked each assessment tool/outcome a specific ranking score (1-6; 6 being the highest). Mean and median scores for each program element are also shown.

| Ranking | Pollutant loads reduced | Changes in public knowledge or awareness | Behavioral changes & BMP implementation | Changes in stormwater discharge quality | Compliance with permit requirements | Changes in receiving water quality |
|---|---|---|---|---|---|---|
| **6** | 5 | 2 | 0 | 1 | 2 | 1 |
| **5** | 0 | 3 | 2 | 3 | 1 | 2 |
| **4** | 4 | 2 | 4 | 0 | 0 | 1 |
| **3** | 2 | 1 | 3 | 3 | 2 | 0 |
| **2** | 0 | 3 | 1 | 4 | 1 | 2 |
| **1** | 0 | 0 | 1 | 0 | 5 | 5 |
| **Mean** | **4.7** | **4.0** | **3.5** | **3.5** | **2.7** | **2.6** |
| Median | 4.0 | 4.0 | 4.0 | 3.0 | 2.0 | 2.0 |

## CONCLUSIONS

The levels of participation in the survey generally met the initial goals and the survey should be considered an overall success. It has provided valuable information on the current state of stormwater program effectiveness assessments in California. Survey results have also identified 1) specific stormwater program areas for which guidance on conducting effectiveness assessments is needed, and 2) outcome levels for which easy-to-use measurement tools can be established through the development of CASQA's *Guidance for Evaluating Stormwater Program Effectiveness*.

The following paragraphs briefly describe the findings and general conclusions drawn from survey responses:

**Finding #1:** **Although most current stormwater NPDES permits require the utilization of direct measures to assess effectiveness, indirect measurements are used more often by stormwater management programs.**

Responses to question #1 indicate that nearly all Phase I Municipal Stormwater NPDES Permits (80%) have provisions requiring the identification of direct and indirect measurements of effectiveness[4]. However, respondents indicated in their responses to question #2 that indirect measurements such as verifying permit compliance and tracking BMP implementation are overwhelmingly used more frequently than direct BMP/environmental monitoring measurements to evaluate the effectiveness of municipal stormwater management programs (Table 3). Likely reasons direct measurements are not typically used to assess effectiveness are, 1) because pollutants in stormwater discharges and receiving waters are likely to originate from diffuse sources and 2) concentrations are highly variable between runoff events. Consequently, it is difficult to relate direct BMP/environmental monitoring measurements to stormwater management practices. As well designed long-term monitoring programs begin to yield important datasets, improvements may be better linked to stormwater management program implementation.

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[4] Direct measurements are those that evaluate the effect of program implementation directly in the receiving water body, as in water quality monitoring, or assessing other parameters with a well-established nexus to changes in water quality, such as biological monitoring. Indirect measurements are those that quantify the amount of program implementation activities or third party implementation/change that has occurred.

**Table 4.** Number of Municipal Phase I Programs (n=15) that indicated at least one type of direct or indirect measurement is used to assess the effectiveness of their overall stormwater management programs or major program elements.

| Program Elements | Direct Measurement[1] | Indirect Measurement[2] |
|---|---|---|
| Overall Stormwater Management Program | 7 | 11 |
| Public Education & Outreach Program | 0 | 14 |
| Public Participation & Involvement Program | 0 | 12 |
| Industrial/Commercial Facility Inspection Program | 0 | 14 |
| Illicit Discharge Control Program | 2 | 13 |
| Construction Site Stormwater Runoff Control Program | 2 | 14 |
| Post-Construction Stormwater Runoff Control Program | 4 | 13 |
| Municipal Government Operations/Maintenance Control Program | 2 | 12 |
| **Total** | **17** | **103** |

[1]Direct measurements are those that evaluate the effect of program implementation directly in the receiving water body, as in water quality monitoring, or assessing other parameters with a well-established nexus to changes in water quality, such as biological monitoring.

[2]Indirect measurements are those that quantify the amount of program implementation activities or target audience implementation/change that has occurred.

**Finding #2:    The most common reason stormwater management programs conduct effectiveness assessments is to demonstrate compliance with NPDES permit requirements.**

Survey responses to Questions #2 and #4 indicate that the most common reason that Municipal Phase I & II stormwater management programs conduct effectiveness evaluations is to demonstrate compliance with NPDES permit requirements. However, effectiveness assessment is a fundamental and necessary component of developing and implementing any successful stormwater program. A well-executed assessment element may not only demonstrate compliance, but provide managers the feedback necessary to determine whether their programs are achieving intended outcomes such as increasing public awareness, reducing pollutant loads and improving receiving water quality. Additionally, effectiveness assessments can inform program managers on which program elements and activities are unsuccessful, which allows programs to adapt, evolve and become more efficient and effective in the future.

**Finding #3:    CASQA guidance is needed on assessing the effectiveness of various program elements and specific outcome levels.**

Survey responses suggest that guidance is needed on conducting effectiveness assessments. Although results indicate that guidance is needed on all program elements and outcome levels, higher priorities were identified. Respondents ranked post-construction stormwater runoff and water quality monitoring and watershed assessment as elements with the greatest need. Additionally, guidance is needed on methods to measure pollutant load reductions and changes in public knowledge/awareness.

# Appendix A

CASQA
Stormwater Program Effectiveness
Assessment Survey
(Web-Based)

# CASQA Survey
## Stormwater Program Effectiveness Assessments

Effectiveness assessments are integral for the development and implementation of successful stormwater management programs. Additionally, program effectiveness assessments are a fundamental component of the iterative process that is employed by stormwater programs and are generally used to determine how successful a program has been in complying with NPDES permit requirements, increasing awareness, changing behavior, decreasing inputs of target pollutants to the environment and/or improving water quality. Assessments typically include a variety of effectiveness measurements that may include tracking and analyzing: the number of inspections (e.g., construction site) completed and outcomes, the number of public education and outreach activities conducted or materials distributed, the number and success of training events conducted, and the pollutant loads reduced or avoided.

Currently, stormwater program managers struggle with applying assessment measures that are useful, valid and cost effective. To assist managers in conducting effectiveness assessments, the California Stormwater Quality Association (CASQA) will begin developing Guidance for Evaluating Stormwater Program Effectiveness in late 2005. In preparation, CASQA has developed the following survey that is intended to:

- Compile information on how your agency is currently measuring effectiveness; and,
- Identify stormwater program needs for conducting future effectiveness assessments.

Please answer the 7 short questions below to the best of your knowledge. Your help will assist CASQA in preparing guidance that will be an invaluable asset to all stormwater programs throughout California. Thank you in advance for your participation.

**Name of Agency**

**Type of Agency/Permittee**

☐ Phase I MS4

☐ Phase II MS4

☐ Industrial Stormwater

☐ Construction Stormwater

☐ State/Federal Regulatory Agency

    ☐ EPA

    ☐ SWRCB

    ☐ RWQCB (specify region)

☐ other:

**Number of years your stormwater program has been in place**

**Contact Person and Information**

Name: [                    ]

Title: [                    ]

Phone #: [      ] [      ]  ext [      ]

e-mail: [                    ]

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**THE FOLLOWING QUESTIONS PERTAIN TO HOW YOUR AGENCY IS CURRENTLY MEASURING EFFECTIVENESS.**

**QUESTION #1:** Are there specific requirements in your current NPDES Permit (or Permit that your Agency issues) pertaining to measuring the effectiveness of your overall stormwater management program, program elements or specific activities?

○ No

○ Yes (check all that apply)

☐ Identification of direct measures of effectiveness (i.e., measures that evaluate the effect of program implementation directly in the receiving water body, as in water quality, such as biological monitoring)

☐ Identification of indirect measures of effectiveness (i.e., measures that quantify the amount of program implementation activities that have occurred. Quantification of the "level of effort")

☐ Utilization of surveys or equivalent

☐ Utilization of pollutant loading estimates or equivalent

☐ Utilization of receiving water monitoring data or equivalent

☐ Measurable goals

☐ Other (please explain) [                    ]

Additional Comments

**QUESTION #2:** Programs/Agencies conduct varying degrees of effectiveness evaluations using different methods. What methods do you use to **evaluate the effectiveness of your overall stormwater management program and major program elements**? (check all that apply)

| Program Elements | Evaluation Methods | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Verification of Compliance with Permit Provisions | Surveys/ Questionnaires | Tracking or Estimating Number of BMPs Implemented | Measuring Compliance Rates of Third Parties (e.g., Construction Sites and Industrial Facilities) | Tracking Number of Enforcement Actions Taken by Your Program | Quantification of Pollutant Loads Reduced or Avoided | Stormwater Discharge Monitoring | Receiving Water Monitoring/ Assessment | Tracking Level of Program Implementation | Assessing Trends in Program Implementation (e.g., changes in number of curb miles swept) | BMP Effectiveness Studies | Other (please specify): |
| Overall Stormwater Management | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Public Education and Outreach | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Public Participation and Involvement Program | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Industrial/Commercial Facility Inspection Program | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Construction Site Stormwater Runoff Control Program | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Illicit Discharge Control Program | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Post-Construction Stormwater Runoff Control Program | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Municipal Government Operations/Maintenance Control Program | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Other (please specify): | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Other (please specify): | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

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## CASQA Survey
### Stormwater Program Effectiveness Assessments

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**QUESTION #3:** What methods do you use to evaluate the effectiveness of **specific activities** (e.g., street sweeping, media campaigns and inspections) that are conducted by your program/agency? (check all that apply)

| Specific Activities | Evaluation Methods | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Verification of Compliance with Permit Provisions | Surveys/ Questionnaires | Tracking or Estimating Number of BMPs Implemented | Measuring Compliance Rates of Third Parties (e.g., Construction Sites and Industrial Facilities) | Tracking Number of Enforcement Actions Taken by Your Program | Quantification of Pollutant Loads Reduced or Avoided | Stormwater Discharge Monitoring | Receiving Water Monitoring/ Assessment | Tracking Level of Program Implementation | Assessing Trends in Program Implementation (e.g., changes in number of curb miles swept) | BMP Effectiveness Studies | Other (please specify): |
| Public Outreach Events | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Trainings/Workshops | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Media Campaigns | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Treatment Control BMPs | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Inspections | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Illicit Discharge Response | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Street Sweeping | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Storm Drain Maintenance (e.g., catch basin cleaning) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Other (please specify): | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Other (please specify): | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**QUESTION #4:** How does your program/agency use information obtained from conducting effectiveness assessments (check all that apply)?

- ☐ To demonstrate/evaluate compliance via annual reporting
- ☐ To plan future activities
- ☐ To evaluate program efficiency
- ☐ To obtain additional resources (e.g., funding, staff)
- ☐ Does not use the information
- ☐ Other (please explain) _____

**THE FOLLOWING QUESTIONS PERTAIN TO WHAT INFORMATION WOULD BE THE MOST USEFUL TO ASSIST YOU IN INCORPORATING EFFECTIVENESS MEASUREMENTS INTO YOUR PROGRAM.**

**QUESTION #5:** The following is a list of typical municipal stormwater management program areas. CASQA would like to know the program areas for which your program/agency would like to have effectiveness assessment guidance. Please rank each program area according to your program's/agency's priority for guidance? *(Place a "1" next to the program area that needs the most guidance, a "2" next to program area that needs the next most guidance, and so on. Remember, no two program areas can have the same ranking)*

- Public Education and Outreach Program
- Public Participation and Involvement Program
- Industrial/Commercial Facility Inspection Program
- Illicit Discharge Control Program
- Construction Site Stormwater Runoff Control Program
- Post-Construction Stormwater Runoff Control Program
- Municipal Government Operations/Maintenance Control Program
- Monitoring/Watershed Assessment Program
- Other (please explain) _____

**QUESTION #6:** The following is a list of type(s) of effectiveness assessment tools used by stormwater management programs. CASQA would like to know the types of tools for which your program/agency would like to have guidance. Please rank each type of assessment according to your program's/agency's priority for guidance? *(Place a "1" next to the type of assessment that needs the most guidance, a "2" next to type of assessment that needs the next most guidance, and so on. Remember, no two types of assessments can have the same ranking).*

- Measuring compliance with activity-based permit requirements (i.e., determining if your program has complied with permit requirements)
- Measuring changes in public knowledge/awareness of stormwater issues/BMPs
- Measuring behavioral changes and BMP implementation
- Measuring pollutant loads reduced/avoided (as a result of BMPs that have been implemented)
- Measuring changes in stormwater discharge quality
- Measuring changes in receiving water quality
- Other (please explain) _____

**QUESTION #7:** Please describe any additional assessment needs not addressed in questions 5 or 6 above. Identify specific program elements, activities and assessment tools in which you are interested.

# Appendix B
## Stormwater Program Effectiveness Assessment
## Survey Respondents

| Respondent | Staff | Position |
|---|---|---|
| **Municipal Phase I** | | |
| San Mateo Countywide STOPPP | Robert Davidson | Program Coordinator |
| Los Angeles County Department of Public Works | Melinda Barrett | Head of Environmental Affairs |
| City of Downey | Gerry Greene | Senior Civil Engineer, Water Resources Control Specialist |
| RCFC&WCD | Jason Uhley | Senior Civil Engineer |
| City of San Diego, Storm Water Pollution Prevention Division | Drew Kleis | Storm Water Specialist |
| City of Hemet Public Works Department | Linda Nixon | Management Assistant |
| Fresno Metropolitan Flood Control District | Daniel Rourke | Environmental Resources Manager |
| Sacramento County | Kerry Schmitz | Senior Civil Engineer |
| County of San Diego | Jon Van Rhyn | Water Quality Program Manager |
| Santa Clara Valley Urban Runoff Pollution Prevention Program | Jill Bicknell | Assistant Program Manager |
| City of Modesto | John Rivera | Environmental Compliance Supervisor |
| City of Santa Rosa | Colleen Ferguson | Supervising Engineer |
| City of Livermore | Steven Aguiar | Environmental Compliance Supervisor |
| County of Orange | Chris Crompton | Manager, Environmental Resources |
| County of Los Angeles Department of Public Works | Nardy Drew | Senior Civil Engineer |
| **Municipal Phase II** | | |
| City of Monterey | Jennifer Gonzalez | Associate Civil Engineer |
| United Water - Burbank | Jeanne Edwards | Illicit Stormwater Program Coordinator |
| Lake County Watershed Protection District | Alex Straessle | Assistant Water Resources Engineer |
| **Industrial** | | |
| San Diego County Regional Airport Authority | Richard Gilb | Environmental Affairs Manager |
| United Water, City of Burbank | Jeanne Edwards | Illicit Stormwater Program Coordinator |
| **Water Boards** | | |
| San Diego RWQCB | Carole N. Crowe | Engineering Geologist |
| Los Angeles RWQCB | Xavier Swamikannu | |
| San Francisco Bay RWQCB | Selina Louie | Water Resource Control Engineer |
| Central Valley (North) RWQCB | John Phillips | |

**Appendix C**
*Additional Comments Received*

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**QUESTION #1:  Are there specific requirements in your current NPDES Permit (or Permit that your Agency issues) pertaining to measuring the effectiveness of your overall stormwater management program, program elements or individual activities?**

**Comments**

Our Permit requires us to do pre and post assessments for our school education programs, i.e., test the kids before we conduct our program and again afterward.  It also required us to submit a strategy for measuring the effectiveness of our outreach and education in changing the polluting behaviors of the public.

The City of Monterey is still trying to gain permit coverage under the Phase II permit. We anticipate that we may end up with effectiveness measures beyond what are required by the General Permit, but they have not been defined yet.

As part of our current MS4 permit, an attached  Monitoring and Reporting Program requires the District to include tracking and quantifying the following areas 1)Illicit Discharges, 2)Spills, 3)Construction and Industrial Inspections.

The plan also requires the District to include a brief discussion in the annual report of the effectiveness of pollution control activities described in our SWMP.

Permit specifies requirements for "Long-term" assessment strategies.  Co-permittees have divided efforts into short-term (annual) and long-term (every fifth year).

The City of Burbank is a co-permittee with the County of Los Angeles.  NPDES Permit No. CAS004001 includes several measures of effectiveness.

The City of Livermore is member of the Alameda Countywide Cleanwater Program, which consists of 17 member agencies. A good deal of the evaluation is done at the "Program" level.  Most municipality involvement in the measurement of effectiveness involves the utilization of surveys to assess specific efforts, such as public outreach events.

Lake County Watershed Protection District is not a Phase II municipality. The District is acting as program manager for the County of Lake which was designated.

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**QUESTION #2: Agencies conduct varying degrees of effectiveness evaluations using different methods. What methods do you use to evaluate the effectiveness of your <u>overall stormwater management program and major program elements</u>? (check all that apply)**

**Additional Program** Elements Listed - Watershed Monitoring, Pesticide Management, School Education and Mercury Pollution Prevention

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**QUESTION #3: What methods do you use to evaluate the effectiveness of <u>specific activities</u> (e.g., street sweeping, media campaigns and inspections) that are conducted by your program? (check all that apply)**

**Additional Evaluation Methods Listed** - T**rash collection/street sweeping data, calls to hotline, website hits, tracking impressions, tracking responses to campaigns and materials distributed and/or attendance at events**

**Additional Activities Listed - Regional Monitoring, Pesticide use reduction, distribution of BMP NPDES information, Hazardous Materials Response by Fire Dept.**

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**QUESTION #4: How does your agency use information obtained from conducting effectiveness assessments (check all that apply)?**

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**Comments**
Not yet in a position to perform effectiveness assessments, still developing program.

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**QUESTION #5: The following is a list of typical municipal stormwater management program areas. CASQA would like to know the program areas for which your agency would like to have effectiveness assessment guidance. Please rank each program area according to your agency's priority for guidance? (*Place a "1" next to the program area that needs the <u>most guidance</u>, a "2" next to program area that needs the next most guidance, and so on. Remember, no two program areas can have the same ranking*)**

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**Other Program Areas Listed -** GCASP/GIASP Monitoring Program Compliance, Residential

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**QUESTION #6: The following is a list of type(s) of effectiveness assessment tools used by stormwater management programs. CASQA would like to know the types of tools for which your agency would like to have guidance. Please rank each type of assessment according to your agency's priority for guidance? (*Place a "1" next to the type of assessment that needs the <u>most</u> guidance, a "2" next to type of assessment that needs the next most guidance, and so on. Remember, no two types of assessments can have the same ranking*).**

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**Other Tools Listed** - Effectiveness of BMPs in meeting CTR standards at NPDES Permitted facilities

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**QUESTION #7: Please describe any additional assessment needs not addressed in questions 5 or 6 above. Identify specific program elements, activities and assessment tools in which you are interested**

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If regional Boards are going to demand Iterative BMPs to the CTR, then we need to know which BMPs produce this level of water quality and how much they cost to construct.

Developing measurable goal language

I would like CASQA to study certain types of BMPs with evaluation measures that determine the overall effectiveness of the chosen BMP. For example, say if I inspect all industrial sites once every 3 years, what would I expect the compliance and pollutant reduction rate to be, if I send out fact sheets to a targeted business, what type of behavioral change would I expect versus holding a workshop or conducting site assessments or compliance inspections. CASQA can then pass this along to all, thus saving the drudgery of data collection of multiple evaluation measures - Remember "Not everything that counts can be counted and not everything that can be counted counts" add to that, everybody does not need to count everything all the time, just a few indicators.

Long-term need is guidance on integrating lower level outcomes with higher level outcomes (water quality, etc.).

Measures of integration of water quality, with water supply, water conservation, open space, multiuse parks and other benefits

CASQA is doing a great project!  If agencies would develop effectiveness measures early on, they would be able to do some assessment.  All too often, agencies just do performance measures and make blanket statements without any data to back them up.  For example, "We believe that our program has reduced pollutants to the MEP."

Right now our RWQCB staff is most interested in monitoring as a tool for demonstrating effectiveness and for gathering data that can be used to guide the storm water management program.  I don't know of any comprehensive monitoring program that does this well.