Evolution of Stormwater Permitting and Program Implementation Approaches

Workshop Report and Recommendations for Program Improvement

Report Date: May 17, 2018

Prepared for:

U.S. Environmental Protection Agency
Region 9

75 Hawthorne Street
San Francisco, CA 94105

Prepared by:

PG Environmental

14555 Avion Parkway, Suite 200
Chantilly, VA 20151

EPA Contract No. EP-R9-16-02

ACKNOWLEDGEMENTS

EPA Region 9 appreciates its partnership with the State of California and thanks the State for hosting and co-sponsoring the workshop. This workshop was intended to advance efforts by EPA and the State to improve permitting, promote water technology innovation, and help enhance the effectiveness and long-term viability of urban water management programs. It would not have been possible without the financial support of EPA Headquarters' Office of Science and Technology (OST) and Office of Wastewater Management (OWM). EPA also acknowledges PG Environmental's work in supporting the workshop and developing this report.

Special thanks must also be extended to the workshop participants from across the country who energetically and thoughtfully engaged in the workshop and in the preparation of this report.

DISCLAIMER

The material presented in this document is intended solely for informational purposes. The recommendations and possible actions described in this document do not represent binding commitments by EPA or other parties. This document is not intended, nor can it be relied on, to create any rights enforceable by any party in litigation with the United States. This document may be revised or updated without public notice.

Mention of trade names or commercial products in this document does not constitute an endorsement or recommendation for use.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The Clean Water Act (CWA) Amendment of 1987 set forth a phased approach to regulating urban stormwater runoff through National Pollution Discharge Elimination System (NPDES) permits. Starting in 1990, certain municipal separate storm sewer systems (MS4s) were required to apply for NPDES permits, and the universe of MS4 permittees continues to grow with expanding populations in urbanized areas.

Photos (top to bottom): EPA, PG Environmental, stock

Since the inception of the MS4 program, EPA and several states, tribes, and water trade associations have issued documents with recommendations for improving local program implementation. These have been primarily informed by the experiences of permitting authorities, permit holders, and compliance auditors. However, in the nearly 30 years of the MS4 program's existence, there has not been an overall evaluation focused on improving program implementation and MS4 permitting practices and approaches. In December 2017, EPA Region 9, in partnership with the State of California and EPA Headquarters, convened a small group of stormwater professionals from across the country for a workshop designed to address this need.

The workshop—titled *Improving Stormwater Permitting and Program Implementation Approaches*—engaged 29 national experts from EPA, state CWA permitting agencies, local stormwater programs, national associations, consulting firms, and nonprofit organizations in facilitated discussions to identify tangible ways to enhance permit efficiency and effectiveness to help build state and local program capacity. Sessions focused on stormwater program implementation requirements in permits, including minimum control measures (MCMs), and water-quality-based control requirements. A follow-on workshop in March 2018 assessed stormwater program monitoring, evaluation, tracking, and reporting provisions.

This report aims to provide a synthesis of participant ideas and contributions along with other existing research to identify the most impactful opportunities for strengthening MS4 permits and program implementation. The document is organized by workshop session and includes an overview of the discussion, specific actions, case studies, summaries of known efforts related to the recommendations, and some indication of commitment by groups to make progress related to a given recommendation. The table on the following pages presents a brief synopsis of these recommendations.

EPA, the State of California, and participating organizations plan to build upon workshop conversations through broad outreach to partners and stakeholders, and continued dialogues surrounding these important issues. This iterative, inclusive approach allows for objective evaluation of program progress to date, assessment of opportunities for program adjustment to better meet CWA goals, and identification of specific actions necessary to enable new, innovative permitting approaches across the nation.

Cross-Cutting Recommendations for Capacity Building and Program Support

- **Establish National Stormwater Program Implementation Expectations**. Identify common characteristics of well-functioning local programs to focus guidance development and research investments to improve program capacity. (Section 3.1.1)
- **Advocate for and Build Capacity Related to Stormwater Program Funding**. Build local program skills and capacity to successfully advocate for funding at the state and local levels, prepare long-term financial plans, and improve awareness of state or federal funding sources available for stormwater-related projects. (Section 3.1.2)
- **Increase Research and Enhance Guidance on BMP Performance and Cost**. Improve overall data and information for structural and non-structural BMP (best management practice) performance, effectiveness of pollutant removal, and lifecycle costs. (Section 3.1.3)
- **Build Capacity for Asset Management**. Incentivize and support the development of asset management programs (AMPs) for stormwater and encourage communities to embrace these approaches. (Section 3.1.43.1.3)
- **Highlight Benefits of Different Planning Approaches and the Importance of Program Planning**. Create guidance that identifies the benefits and implications of various long-term planning and implementation approaches being used locally in the MS4 program. Consider implications of requiring permitting agency approval of program plans. (Section 3.1.5)
- **Foster Coordination Across Water Programs**. Facilitate integrated municipal stormwater, wastewater, and drinking water planning for a more cost-effective, strategic approach to urban water management. (Section 3.1.6)

Cross-Cutting Permitting Recommendations

- **Clarify MS4 Permitting Requirements and Expectations**. Revise national permitting regulations and/or policy guidance to clarify and standardize permitting expectations in each of the basic program areas covered by MS4 permits for increased focus on the most effective stormwater control strategies and practices. (Section 3.2.1)
- **Consolidate Phase I and II Requirements**. Eliminate the program categories of "Phase I" and "Phase II" in order to clarify that minimum program requirements apply to all MS4s, and to encourage improved collaboration between them. (Section 3.2.2)
- **Provide Flexibility in MCM Requirements.** Clarify that permitting authorities have the flexibility to adjust MCM (minimum control measure) requirements to increase focus on measures that yield tangible benefits and reduce emphasis on those that yield little ongoing benefit. (Section 3.2.3)
- **Explore Options to Provide Longer Planning Timeframes for Permittees**. Develop a compendium of compliance schedules in MS4 permits, including information about how they were calculated and applied. (Section 3.2.4)
- **Develop Transparent Compliance Assessment Expectations**. Encourage the development of a more transparent compliance strategy and issuance of permits that help programs understand how they will be evaluated. (Section 3.2.5)
- **Improve Monitoring and Reporting Approaches.** Evaluate and improve program monitoring, tracking, and reporting requirements to enable methods that reflect evolving program implementation priorities, information needs, and strategies. (Section 3.2.6)

Making Public Outreach and Involvement Work for the Program

- **Coordinate Efforts at Various Scales**. Establish national, regional, and local education and outreach programs as options for fulfilling local permit requirements for public education and outreach. (Section 3.3.1)
- **Increase Flexibility and Encourage Targeted Efforts**. Allow for greater flexibility in developing education and outreach programs to focus on approaches that meaningfully advance local program implementation. (Section 3.3.2)
- **Improve Stormwater Messaging Programs.** Develop strategies and tools specifically designed to help local programs educate the public about the services they provide that the public values, and the costs of supporting a sustainable program. (Section 3.3.3)

Tailoring IDDE to Fit Local Needs
• **Enable a More Focused Approach to Outfall Screening**. Support more targeted outfall screenings by distinguishing between the activities of new and continuing permit holders and targeting sectors or land uses of concern. (Section 3.4.1) • **Establish Clear Guidance on Addressing Elevated Bacteria Levels in Stormwater**. Create new approaches to target and address human-related pathogens and ensure these methods become an elevated priority for IDDE (illicit discharge detection and elimination) programs. (Section 3.4.2)
Tailoring Industrial/Commercial Programs to Fit Local Needs and Align with Industrial Permits
• **Reduce Overlap Between Industrial Stormwater Permits and Municipal Stormwater Permits.** Clarify relationships between industrial stormwater permit requirements and MS4 program requirements in future permitting actions and reduce regulatory redundancy. (Section 3.5.1) • **Merge Industrial/Commercial Oversight Activities into the IDDE Program**. Where appropriate, merge IDDE program requirements with associated industrial/commercial program requirements to align program requirements and support strategic and targeted surveillance efforts. (Section 3.5.2) • **Shift to Targeted Inspections**. Provide guidance on standard methods and commonly available tools for reconnaissance and verification to support a more targeted inspection approach for high-priority industrial and commercial sources. (Section 3.5.3)
Improving Programs to Address Public Agency Activities and Municipal Housekeeping
• **Incentivize Asset Management**. Accelerate development of AMPs in stormwater programs by recommending or requiring in MS4 permits. (Section 3.6.1) • **Improve Municipal Facility Management/Housekeeping Program Guidance and Capacity**. Establish a mechanism for ensuring that municipal housekeeping guidance materials remain current and that building staff capacity is an ongoing priority. (Section 3.6.2) • **Adjust Focus of Facility Inspections**. Enable local programs to reduce frequency of inspections where they add little value in detecting problems, targeting inspections in higher risk areas or on pollutants of greatest concern. (Section 3.6.3)
Streamlining and Strengthening Local Post-Construction-Related Practices
• **Compile Relevant Local Requirements in One Place.** Develop a comprehensive resource on local stormwater requirements to support efficient project planning. (Section 3.7.1) • **Incorporate Smart Stormwater Design into Municipal Planning Practices**. Encourage multi-objective stormwater management in project planning to maximize public benefits. (Section 3.7.2) • **Create Guidance on Off-site Stormwater Crediting**. Create guidance on crediting programs to ensure equitable, legal, financial, managerial, and technical integrity of the approaches employed. (Section 3.7.3) • **Continue to Build Capacity for BMP Maintenance**. Build capacity at the local level to ensure the efficacy of structural BMPs (traditional, green infrastructure, and regional-scale facilities). (Section 3.7.4) • **Continue to Build Capacity for Green Infrastructure Approaches.** Develop an educational platform for all levels of staff interacting with green infrastructure to help build capacity within the program. (Section 3.7.5)

Supporting Water-Quality-Based and TMDL-Based Requirements
• **Clarify Water-Quality-Based Approaches and Progression**. Better define and communicate the various water-quality-based approaches being used across the country. (Section 3.8.1) • **Strengthen Incorporation of TMDLs into MS4 Permits**. Create guidance that identifies various options and pathways to incorporating TMDLs (total maximum daily loads) into MS4 permits. (Section 3.8.2) • **Improve Transparency and Accountability When Using Models.** Illustrate the range of reasonable assurance analysis (RAA) applications and provide additional guidance to help provide some level of consistency in RAA implementation. (Section 3.8.3) • **Increase Understanding of Multiple Benefit Projects**. Improve awareness of a triple-bottom-line approach that evaluates the environmental, financial, and social aspects of a project. (Section 3.8.4) • **Create Guidance on Stream Restoration Crediting**. Establish guidance on credits for stream restoration efforts to ensure they are rigorous and used appropriately. (Section 3.8.5)

ABBREVIATIONS AND ACRONYMS

ACWA	Association of Clean Water Administrators
AMP	asset management program
BMP	best management practice
CFR	Code of Federal Regulations
CWA	Clean Water Act
EPA	U.S. Environmental Protection Agency
IDDE	illicit discharge detection and elimination
MCM	minimum control measure
MS4	municipal separate storm sewer system
NMSA	National Municipal Stormwater Alliance
NPDES	National Pollution Discharge Elimination System
NRC	National Research Council
O&M	operation and maintenance
PCBs	polychlorinated biphenyl
RAA	reasonable assurance analysis
RDA	residual designation authority
STEPP	Stormwater Testing and Evaluation for Products and Practices Initiative
SWMP	stormwater management program
TMDL	total maximum daily load
WEF	Water Environment Federation
WLA	wasteload allocation
WRF	Water Research Foundation

1 INTRODUCTION

Photo: EPA

As the Municipal Separate Storm Sewer System (MS4) Program approaches its fourth decade of implementation, urban stormwater is still a growing pollution source in many areas across the United States (WEF, 2015). Our understanding of urban water quality concerns requiring attention is also growing, and many permitting authorities and permit holders believe there are still significant opportunities to improve implementation approaches and institutional support related to municipal stormwater management.

Mindful of this, EPA convened a small group of stakeholders for a workshop to re-envision the future of stormwater management. The forum was designed to stimulate dialogues that would identify the most impactful opportunities for strengthening MS4 permits and program implementation.

> "Stormwater is the only growing source of water pollution in many watersheds across the country. With urban populations expected to grow to nearly 70 percent by 2050, and more frequent and intense storms occurring across the country, there is ever-increasing pressure on stormwater systems and water infrastructure" (WEF, 2015).

Recent publications such as the Water Environment Federation's (WEF's) *Rainfall to Results: The Future of Stormwater* and Andrew Reese's "Ten Emerging Stormwater Management Best Practices" commonly cite the following priorities for the municipal stormwater sector:

- **Asset Management Programs.** Seen as a key tool for documenting and proactively tracking and maintaining stormwater system components to improve their performance and plan for new infrastructure over time.
- **Innovative governance**. Can be a means to overcome institutional barriers (e.g., insufficient resources, inflexible regulations) to maximize the effectiveness of stormwater programs.
- **Public engagement**. Should go beyond "public education and outreach" and "public involvement and participation" minimum control measures to embrace stakeholder-driven processes and target outreach to voters and elected decision-makers to support local program funding.

These priorities squarely align with the opportunities for improvement that workshop participants raised. This report provides a synthesis of participant ideas and contributions along with other existing research. The full set of recommended improvements is presented in Section 3 and includes an overview of the discussion, specific actions, case studies, and some indication of commitment by groups to make progress related to a given recommendation. Inclusion of a recommendation in Section 3 does not necessarily indicate the support of all participants; rather, it provides an opportunity for further discussion, inquiry, and possible progress.

1.1 MS4 Program Background and Context

The MS4 program is designed as a flexible framework under the Clean Water Act in which states (and EPA in certain states[1]) develop permit requirements to reduce the discharge of pollutants from MS4s. Federal regulations establish the program framework and baseline expectations, while permitting authorities (states and EPA) define requirements to meet the federal permit standard—"require controls to reduce the discharge of pollutants to the maximum extent practicable, including management practices, control techniques and system, design and engineering methods, and such other provisions as the Administrator or the State determines appropriate for the control of such pollutants" (CWA Section 402(p)(3)(B)(iii)).

Though they are based on the same foundation, MS4 permits vary significantly across the country in specificity of requirements, length (e.g., Minneapolis' permit is 48 pages and the Los Angeles County permit is more than 1,000 pages), and the relationships between permittees and regulators. While some of this variability was envisioned by the federal regulations and may appropriately persist given the diversity of urbanized areas across the United States, there may be opportunities to increase consistency at this point in the program's history.

The MS4 program was rolled out in two phases starting in the early 1990s. Phase I targeted medium and large communities, and industrial facilities, while Phase II addressed smaller communities and other non-municipal entities in U.S. Census defined urbanized areas.[2] Some MS4 programs have now been functioning for almost 30 years.

Phase	Year Effective	Applicability	Total Coverage
Phase I	1990	Medium and large MS4s serving ≥ 100,000 residents and MS4s designated by the state	~850 MS4s
Phase II	1999	Small MS4s in U.S. Census Bureau–defined urbanized areas, including non-traditional MS4s such as public universities, departments of transportation, hospitals, and prisons[3]	~6,700 MS4s

Source: EPA, 2017b

Most Phase I MS4 communities are covered by *individual* permits tailored to the specific settings and needs of the jurisdiction, while Phase II communities tend to be covered under *general* permits developed for similar dischargers within the state. Phase I and Phase II permits both address a set of base stormwater management elements (typically referred to as "minimum control measures," or MCMs, in the Phase II program).

Minimum Control Measures (MCMs)

1. Public education and outreach
2. Public participation/involvement
3. Illicit discharge detection and elimination (IDDE)
4. Construction site runoff control
5. Post-construction runoff control
6. Pollution prevention/good housekeeping

[1] EPA is currently the permitting authority for facilities in four states (Massachusetts, New Hampshire, New Mexico, and Idaho), territories, tribal lands, and the District of Columbia.

[2] Some Phase I MS4 permits also address small communities within a county-wide or regional setting.

[3] Some communities outside urbanized areas are also covered by MS4 permits.

In addition, Phase I permits typically include (1) requirements for addressing discharges from industrial and commercial facilities, (2) provisions to monitor water quality, and, (3) in many cases, requirements for municipal facilities and operations that are beyond the standard pollution prevention/good housekeeping MCM requirements.

Phase I and Phase II MS4 permits typically have specific requirements related to addressing water quality impairments and implementing wasteload allocations (WLAs) established in TMDLs. Permittees are also required to submit periodic reports (typically annually) detailing MS4 program implementation and compliance activities. The permitting authority conducts report reviews, screenings, inspections, and audits to evaluate the entity's compliance with the permit requirements throughout the course of the permit term.

1.2 The State of Municipal Stormwater Permitting

Municipal stormwater management has always been challenging as precipitation and runoff are highly variable, and stormwater pollution comes from an array of sources that may be difficult to control. Many aspects of the regulatory framework applied to municipal stormwater were derived from regulation of municipal wastewater, which is generally less variable and more controlled than stormwater. For more than 20 years, permitting authorities, municipal programs, and other stakeholders have labored to make this regulatory framework function effectively.

Photo: PG Environmental

Permitting authorities and permit holders alike have learned a great deal since the MS4 program was first added to the Clean Water Act in 1987 and started implementation in the 1990s. While many MS4 program elements and permit requirements have remained relatively consistent throughout this period, most states have issued three to four iterations of MS4 permits for certain municipalities. Permits have evolved in response to various factors—new water quality challenges, updated requirements, shifting local priorities for stormwater management, and lessons learned from prior approaches. However, many people involved in the stormwater sector have expressed a belief that MS4 permits must evolve even further to enable program improvements and adequately protect water quality.

Clear, measurable, and enforceable. Since 2010, EPA has actively encouraged permit writers to craft MS4 permit language that is "clear, specific, measurable and enforceable," and EPA's 2010 *MS4 Permit Improvement Guide* has helped to advance that effort (p. 5). EPA's 2016 *MS4 General Permit Remand Rule* made this a federal requirement for Phase II MS4 permits by requiring that permit terms and conditions "be expressed in clear, specific, and measurable terms" (40 CFR 122.34(a)). Although limited in force and effect to the Phase II program, the Remand Rule can be a driving force for the improvement of permit language across the national program. Many permitting authorities remain unclear as to whether these provisions should be applied in Phase I permits.

To assist permit writers in implementing the Remand Rule, EPA published a series of compendium documents that spotlight examples of MS4 permit language that qualify as "clear, specific, and measurable." For example, through excerpts from existing permits, the 2016 *Compendium of MS4 Permitting Approaches Part 1: Six Minimum Control Measures* illustrates the types of permit provisions

addressing the MCMs that are considered clear, specific, and measurable requirements under the final Remand Rule.

Focused, flexible, and effective. While having clear permit requirements is extremely important to permitting agencies and permittees, there is also a need to further consider the effectiveness of those requirements. Some commenters on the Remand Rule suggested that expecting permit requirements to be "focused, flexible, and effective" would help facilitate improvements in program effectiveness. Flexibility in environmental regulations and permits has long been a topic of discussion and has proven difficult to achieve while ensuring requirements are clear, measurable, and enforceable.

Outcome-based with multiple benefits. In recent years, there has been an increasing focus on pursuing approaches to urban stormwater and infrastructure management that are watershed-based and driven by specific outcomes. The focus on outcomes appears to stem from an increasing interest in ensuring that program activities are effective in protecting and improving water quality. This shift encourages achievement of multiple objectives with a greater emphasis on water quality, water supply augmentation, reduction in flood risk, and improvements in infrastructure and amenities. In "Ten Emerging Stormwater Management Best Practices," Andrew Reese identifies resiliency planning as the greatest present driver in the sector. This holistic approach has the potential to deliver important co-benefits, "creat[ing] economic resurgence in some sectors, capital investment, and neighborhood revitalization" (Reese, 2016, p. 13).

Photo: PG Environmental

Recognizing local program resource issues and regulatory inflexibility. Local programs' ability to implement changing regulatory requirements and expanding management objectives is often constrained by resource limitations. This is further complicated by the common practice of incorporating additional permit requirements over successive permit terms without reducing or modifying existing program requirements that may be less impactful. This practice of adding new requirements without removing or revising preexisting obligations is sometimes justified based on anti-backsliding or other concerns but, in some cases, can also be attributed to permitting habits and inertia. In some cases, permitting authorities have preferred not to make significant changes when reissuing MS4 permits, asserting that their existing permits are stable and require minimal adjustments. This approach may be appropriate in some cases, but workshop participants identified many areas in which permit revisions should be considered to address new challenges and enable improvements in program performance. EPA, states, and local programs have a shared interest in ensuring that programs (and associated permit requirements) focus on the most productive approaches for positive environmental outcomes.

2 MS4 Workshop Overview

In December 2017, EPA Region 9, with assistance from EPA Headquarters and in partnership with the State of California, invited 29 stormwater experts from across the country to Oakland, California, for a two-day workshop titled *Improving Stormwater Permitting and Program Implementation Approaches* (full list of workshop participants included in Appendix A). The workshop was designed to explore the effectiveness of various program elements and requirements to identify possible changes to permitting approaches that would support more effective program implementation.

Through facilitated dialogues, participants were asked to reflect on their own first-hand experiences with MS4 permitting and program implementation. To promote honesty and openness, participants agreed that the viewpoints expressed would not be attributed to individuals in this resultant report.

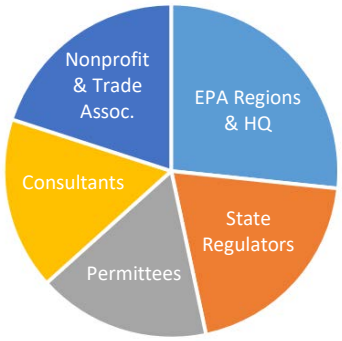

Figure 1. Relative distribution of workshop participants across the sector.

2.1 Pre-Workshop Questionnaire

In advance of the workshop, participants were polled to gauge their attitudes toward specific aspects of the permitting program by responding to a series of hypotheses. Twenty-nine submissions were received in total. Respondents overwhelmingly agreed that MS4 permits and programs had high potential for improvement to realize cost-effective positive environmental outcomes. The elements identified as having the greatest potential were:

	Significant or Some Potential	Little or No Potential
Water-quality-based and TMDL-based permit requirements	97 percent	3 percent
Monitoring and evaluation	97 percent	3 percent
New/redevelopment and post-construction controls	90 percent	10 percent

There was unanimous consensus for the following statements on the pre-workshop questionnaire:

- "Many stormwater programs lack sufficient funding and program implementation capacity."
- "To be fully effective, local stormwater programs need to invest in sound long-term planning incorporating asset management and funding plans."
- "Some MCMs and other program elements should be tailored and scaled to emphasize productive activities and deemphasize less productive activities."

Respondents were also asked to elaborate on key areas in which MS4 permits and programs can be improved in the future. Select responses follow.

"Improving decision-making through informative monitoring and evaluation and adaptive management."	*"Municipalities are of all different sizes and issues; the MS4 program requirements should be able to scale accordingly."*	*"[Wider adoption of] asset management, including of green stormwater infrastructure (with effectiveness tracking, maintenance tracking, and targeted pollutant reduction monitoring)."*	*"Programs need to be allowed to adjust to known pollutants and should not be a one-size-fits-all…."*

Additional questionnaire findings are incorporated throughout the report, where applicable; Appendix C summarizes questionnaire results.

2.2 Workshop Format

Through a facilitated dialogue, invited representatives from federal, state, and local government, as well as sector stakeholders (e.g., permit holders, trade associations, nonprofit organizations), evaluated MS4 implementation approaches to inform possible changes in NPDES permit provisions and opportunities to improve MS4 programs. Though EPA, state, and local representatives attended from around the country, a majority of participants were from California. That made the discussion California-centric at times, but this report is intended to present ideas that will be relevant across the country. The workshop included 10 sessions over two days in a format designed to efficiently identify recommendations specific to various MS4 program elements (full agenda included in Appendix B).

Workshop Sessions

1. Learning from Program Evolution Over Time
2. Building Program Capacity
3. Building Multi-Objective Vision
4. Public Education, Outreach, and Involvement
5. Illicit Discharge Detection and Elimination
6. Industrial/Commercial Program Requirements
7. Municipal Operations and Maintenance Programs
8. New/Redevelopment and Post-Construction Requirements
9. Water-Quality-Based and TMDL-Based Requirements
10. Alternative Approaches to Achieving Water-Quality-Based Requirements

Each workshop session followed the same general structure:

- **Conversation starter**. Five- to 10-minute overview by a speaker to outline the regulatory context, summarize evolution over time, or share a brief example case study.
- **Hypotheses review**. Presentation of pre-workshop questionnaire responses to help identify the degree of agreement concerning key lessons learned and improvement opportunities.
- **Discussion.** In-depth facilitated group reflection.
- **Recommendations**. Important findings and specific actions discussed to strengthen and improve the corresponding MS4 program/permit element.

The workshop concluded with a recap of findings to identify areas of agreement and divergence as well as issues needing further evaluation.

This report captures the essence of these conversations so that others may benefit from the collective expertise. EPA plans to continue working with various partners and stakeholders to refine and implement the most promising ideas for strengthening MS4 programs and enabling new, innovative permitting approaches.

Figure 2. Workshop participants discussing MS4 program improvements in Oakland, CA.

3 RECOMMENDED PROGRAM AND PERMIT IMPROVEMENTS

During the workshop, facilitators encouraged participants to identify tangible ways to enhance program implementation and permit efficiency and effectiveness to protect water quality. These conversations generated a wide range of recommendations under the following broad headings:

Photo: EPA

- **Cross-Cutting Recommendations for Capacity Building and Program Support** (Section 3.1)
- **Cross-Cutting Permitting Recommendations** (Section 3.2)
- **Making Public Outreach and Involvement Work for the Program** (Section 3.3)
- **Tailoring IDDE to Fit Local Needs** (Section 3.4)
- **Tailoring Industrial/Commercial Programs to Fit Local Needs and Align with Industrial Permits** (Section 3.5)
- **Improving Programs to Address Public Agency Activities and Municipal Housekeeping** (Section 3.6)
- **Streamlining and Strengthening Local Post-Construction-Related Practices** (Section 3.7)
- **Supporting Water-Quality-Based and TMDL-Based Requirements** (Section 3.8)

The set of recommendations presented in this report is not definitive nor is it exhaustive; rather, this report is intended to serve as an inspiration for further discussions and follow-on actions. References to select projects or organizations are incorporated throughout to serve as case studies and examples of related efforts.

In the pre-workshop questionnaire, participants were asked to describe **key elements of MS4 program effectiveness**. The following are select responses.

"Putting available resources toward the most cost-effective activity that will result in the greatest environmental benefit."

"Permits allow stormwater management programs to be tailored to watershed-specific characteristics and pollutant sources and to be flexible to address emerging issues…"

"Clarity. Enforceability. Linkage to water quality outcomes."

"Clearly established goals with corresponding performance metrics…"

3.1 Cross-Cutting Recommendations for Capacity Building and Program Support

Workshop facilitators structured the workshop around MS4 program elements; however, participants also raised strategies that apply to multiple elements—or transcend them altogether. Collectively, the following cross-cutting strategies could improve overall MS4 program effectiveness and water quality outcomes.

3.1.1 Establish National Stormwater Program Implementation Expectations

During the workshop, participants discussed the need to develop a national baseline for program implementation expectations. This section focuses on the need to better define national implementation expectations within the current regulatory and permitting environment; a subsequent section (Section 3.2.1) focuses more on achieving greater consistency through regulatory and permit requirement revisions.

Though MS4 permits are all based on the foundation of federal requirements, they very significantly across the country in their attributes and requirements—and thus program implementation approaches vary widely as well. Clearer expectations for national stormwater programs would significantly improve understanding of the intent of regulatory requirements and encourage consistency of permits and implementation where appropriate. This could also serve to focus investments in guidance development and research to improve program capacity.

Workshop participants identified a need for clear expectations regarding demonstrating program effectiveness and a need for a common set of metrics for evaluating the health and performance of the stormwater program itself. A critical first step in establishing these expectations would be defining the characteristics and elements of a professional, successful stormwater program (e.g., long-term financial stability, community support).

In discussing the need for clearer program expectations, workshop participants noted a potential dichotomy between seeking clearer, more standardized expectations and the desire for flexibility to tailor programs to meet local needs and interests. It would be difficult to reconcile this potential tension between the desires for specificity and flexibility. However, the group generally identified a need to clarify program expectations, including articulating areas in which permitting authorities and local programs have greater or lesser flexibility in delineating requirements and approaches.

The recommendations presented in this report can serve as a foundation for developing implementation expectations in several critical areas:

- Long-term program planning and priority setting.
- Sustainable funding strategy and funding portfolios.
- Asset tracking and management planning.
- Effective governance structure.
- Public engagement and support, including targeted outreach to voters and key decisionmakers.

3.1.2 Advocate for and Build Capacity Related to Stormwater Program Funding

An urgent need to improve funding for municipal stormwater programs was a common theme during workshop discussions and review of recent publications focusing on stormwater program improvement. As noted above, local programs' ability to carry out the current program requirements, future regulatory requirements, and expanding management objectives has often been constrained by resource limitations. Workshop participants identified several programmatic changes and capacity-building strategies needed to support sustainable funding of stormwater programs. There is a need at both the state and national level to advocate for reliable stormwater program funding, and improve awareness of federal, state, and innovative public-private funding sources and financing strategies available for stormwater-related projects and programs.

100 percent of pre-workshop questionnaire respondents agreed or strongly agreed with the statement "***many stormwater programs lack sufficient funding and program implementation capacity***."

For various reasons, many communities have not been able to develop successful funding mechanisms for their stormwater programs. In most communities, the public lacks basic understanding of stormwater management and of the valuable services stormwater programs provide. Some workshop participants suggested that the vagueness of the MEP standard and inconsistency of MS4 permit requirements across the country can hinder community efforts to secure adequate, dedicated funding. General funds, grants, and other readily available sources rarely provide sufficient resources to sustain local programs. State or local laws make it challenging to establish stormwater utility fees or other dedicated funding sources in some areas. In addition, many localities simply have not been able to effectively communicate the needs and benefits of a well-funded and well-functioning stormwater management program to garner the local support needed to secure funding.

One possible model for a stormwater funding mechanism is **community-based public-private partnerships** like the Clean Water Partnership. Implemented in 2015 by Prince George's (a Phase I permittee in Maryland), this is a 30-year agreement between the municipality and the private sector to retrofit 15,000 acres of impervious surfaces for improved stormwater management. The relationship is designed to lower the costs of regulatory compliance through innovative technology, finance, and shared risk.

Forming a stormwater utility is often a key step in obtaining adequate funding. The number of stormwater utilities (most with dedicated fees) has almost tripled over the past 10 years (see Figure 3; Campbell, Dymond, Key, & Dritschel, 2017). However, even now less than one quarter of stormwater programs are organized as formal utilities, and those without utilities often have difficulty competing for funding with other formally recognized local departments (e.g., wastewater, drinking water, transportation). Moreover, many stormwater utilities have been unable to obtain support for adequate fees to fund ongoing operations and/or repayment of loans or bonds that fund capital expenditures. Finally, some workshop participants noted that there are pros and cons to setting up separate stormwater utilities as compared to integrating stormwater, wastewater, and/or drinking water governance. Participants indicated that additional guidance on design of utilities and fee funding programs would greatly assist communities in addressing these funding needs.

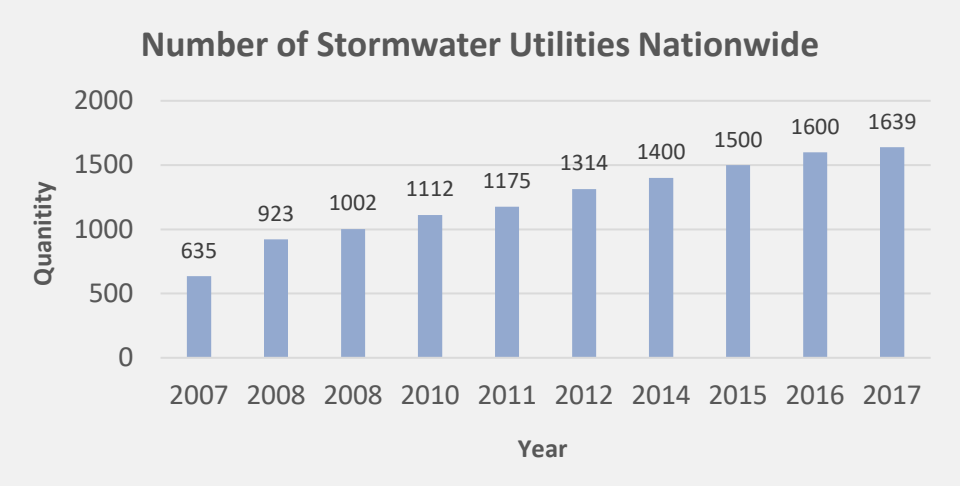

Figure 3. Graph depicting the growth of stormwater utilities across the country since 2007.

For many programs, identifying a sustainable funding source is a crucial prerequisite for many of the recommended program improvements outlined in this report. While EPA, some states, and other organizations have conducted outreach to help familiarize local program managers with funding options, workshop participants indicated that more needs to be done.

Participants noted that local programs would benefit from additional training and guidance on effective outreach and communication methods to build local support and assemble necessary funding. Local programs (and smaller programs in particular) urgently need assistance in building their skills in explaining to the voting public and elected officials the vital roles of local stormwater programs in protecting water quality, reducing flooding risk, augmenting water supply, greening urban streetscapes and landscapes, and achieving other urban water management objectives.

3.1.3 Increase Research and Enhance Guidance on BMP Performance and Cost

Photo: EPA

There is acknowledgement in the stormwater sector that performance of structural and non-structural BMPs[4] (both green and gray) needs to be better measured and reported for existing approaches and new technologies as they come to market. Workshop participants noted that lack of reliable and accessible to performance, effectiveness, and cost information is a hindrance to the stormwater program. Available data and information are particularly limited concerning effectiveness and costs of non-structural BMPs such as public education, illicit discharge controls, and inspections of municipal, commercial, and industrial facilities. Improving data and information about BMP performance and costs is needed to improve the capacity of local programs, public agencies, and private parties responsible for stormwater management to

[4] In the stormwater program there is often overlap and ambiguity in the terms used to describe practices to control the volume and/or quality of stormwater runoff (e.g., post-construction BMPs, permanent stormwater controls, structural BMPs, non-structural BMPs). For simplicity and consistency, this report uses "BMPs" to include these types of control measures in both gray and green infrastructure applications.

select the right BMP approaches to target local conditions and pollutant problems.

Some initial efforts are underway already to improve BMP testing and validation. For example, WEF is developing the National Stormwater Testing and Evaluation for Products and Practices (STEPP) Initiative, aimed at validating the performance of innovative stormwater management technologies to accelerate widespread adoption. Meanwhile, the Water Research Foundation, or WRF (formerly the Water Environment and Reuse Foundation) and other sponsors continue to advance their International BMP Database, which is well-positioned to help disseminate findings from STEPP. However, workshop participants noted a need for more research and information sharing to improve coverage in BMP effectiveness reporting.

WRF has identified stormwater as a priority research area and provides funding and technical support for related efforts. Its **International BMP Database**, supported by EPA, the Federal Highway Administration, the American Public Works Association, and the Environmental and the American Society of Civil Engineers, includes more than 600 studies on BMP performance and is designed to promote more effective stormwater solutions.

Permittees, regulators, and other interested parties alike need to have confidence that selected BMPs will provide the intended levels of performance. Workshop participants highlighted several challenges with the current state and use of BMP performance information.

- BMP cost is typically discussed in terms of design and construction/installation and does not generally include maintenance or a clear expectation of useful life. This makes it difficult, if not impossible, to weigh the costs and benefits of a chosen practice or potential alternatives and confounds efforts to perform effective long-term planning.
- BMP databases often lag in providing information about newly emerging stormwater management technologies and practices (e.g., real-time control methods). This makes it difficult for local programs to become aware of or endorse the use of new technologies for stormwater management.
- The effectiveness of BMP use in specific locations depends on watershed, hydrological, and community characteristics that BMP databases generally do not address.
- BMP databases are often so complicated that local program managers and designers may not use them.
- Frequent adjustments (based on updated data or analysis) to BMP performance or efficiency ratings have presented significant challenges for communities trying to demonstrate compliance with TMDL waste load allocations (WLAs) or other water quality requirements. Permittee representatives at the workshop suggested that BMP efficiency ratings used for TMDL WLA compliance should be maintained for a fixed period (e.g., 10 years) to provide continuity and give communities a reasonable planning time horizon.

Recent technological advances are offering a more dynamic means to manage stormwater runoff. **Real-time control** of stormwater assets is the application of remote sensors, wireless communications, and data platforms to achieve automated management of stormwater infrastructure in response to current and forecasted weather events.

In summary, overall data and information for BMP performance, effectiveness for pollutant removal, and lifecycle costs should be improved and continually updated to better address different

pollutants and hydrologic conditions, and to account for newly emerging technologies and methods that can help improve the cost-effectiveness of stormwater management investments.

3.1.4 Build Capacity for Asset Management

Workshop participants strongly believed that asset management approaches are applicable to many aspects of the stormwater program and significantly benefit communities. While asset management has been applied in the wastewater and drinking water sectors for many years, implementation in the stormwater sector is still relatively recent and has not been widely adopted in the sector. Some workshop participants attributed this to the fact that stormwater systems have not previously been viewed as an urban utility as are services for water, sewer, power, and communications. There is a need to incentivize and support the development of AMPs for stormwater and encourage communities to embrace these approaches.

> An asset management program (AMP) is a "strategic, comprehensive tool for managing a utility's stormwater […] system assets to help **minimize the long-term investment in each asset**, keeping expenditure at the lowest level that will maintain the desired performance and meet regulatory requirements" (EPA, 2017a, p. 2).

Capturing and using information on stormwater asset location, age, type, condition, maintenance history, and cost can help facilitate long-term planning and budgeting, staffing and workflow analyses, enhanced tracking and reporting, proactive maintenance, development of multi-benefit projects, and visual demonstration of progress with identified service levels. Stormwater management assets are particularly diverse and include traditional gray infrastructure, green infrastructure, and an array of human and capital resources used to implement minimum control measures. Stormwater management assets are widely dispersed within the municipal landscape and are often owned and operated by a complex mix of public and private agencies and landowners. Keeping track of these resources and ensuring their effective operations over time can be a daunting challenge in the absence of robust tracking and management tools.

Workshop participants observed that AMPs are not widely used within the MS4 program and that additional training, guidance, case studies, and other tools to build AMP capacity within the stormwater program are severely needed. Specifically, while considerable literature, case studies, and other tools concerning AMP exist within the wastewater and drinking water programs, there is a dearth of information relating specifically to stormwater. An example of this is the lack of a stormwater infrastructure line-item in the American Society of Civil Engineers' *2017 Infrastructure Report Card*, which rates other water-related asset classes such as wastewater and drinking water. Building capacity to incorporate AMP tools to guide stormwater program management and planning was viewed by workshop participants as one of the most important and promising opportunities to improve overall program operations.

Asset management for stormwater is further discussed in Section 3.6.1.

3.1.5 Highlight Benefits of Different Planning Approaches and the Importance of Program Planning

Communities typically develop a stormwater management program (SWMP) plan or similar document to identify how they will meet permit requirements and other broader stormwater planning objectives. However, regulatory obligations regarding plan development vary significantly

across the country—some permitting agencies require significant detail in SWMP plans, some view SWMP plans as an internal tool not subject to regulatory review/approval, and some may not require a SWMP plan at all. As a result, there is significant variability in the length, detail, and level of commitment represented in these documents. Workshop participants indicated that some variability is appropriate but acknowledged that it would be helpful to establish more consistent expectations and an understanding of the implications of various planning approaches.

Workshop participants noted that approaches to SWMP plan development also vary widely: some highly detailed plans surpass 200 pages and consume substantial program resources, while others may be less than 20. While shorter plans may be sufficient for meeting regulatory requirements, workshop participants indicated that some communities and regulators may expect more detail about the specific implementation actions. In particular, information about needed capital improvements, associated costs, and the anticipated public benefit may be of significant value to community decision-makers.

> Some permittees at the workshop reported developing multiple versions of their SWMP plans for different audiences: one for regulators, one to communicate with elected officials and citizens, and one for internal use. When combined with other planning requirements (e.g., TMDL implementation plan, watershed plan), this represents a significant time commitment that may not result in the creation of well-integrated, long-term plans that effectively guide program development and implementation over time.

For regulators, plan review and approval can be resource- and time-intensive, sometimes taking more than a year. In such cases, the permittee can find itself in "regulatory limbo," uncertain whether its submitted plan should be implemented or if it must follow a previous iteration. MS4 program auditors that encounter this issue have likewise reported it is unclear which version to use for compliance evaluation.

Workshop participants acknowledged that the Remand Rule creates new expectations for more clarity and transparency in stormwater plans. Participants expressed a need for guidance on the implications of pursuing different approaches. Specifically, they requested more information about the various planning and analytical approaches, how the various plan elements work, examples of successful plans, and the pros and cons of various options. There was general agreement that permits should more clearly identify necessary plan details, the purposes they are intended to serve, necessary implementation commitments, performance measures, and associated assessment and reporting expectations. The permits should also describe how plan components address different program elements (e.g., minimum control measures, water-quality-based requirements) and how they would be used by permitting agencies to evaluate compliance.

Last, many participants believed communities could be incentivized to develop plans that are "funded, long-term, [and] multi-benefit" by offering greater regulatory flexibility through tools such as compliance schedules as provided in 40 CFR 122.47. Other participants asserted that long-term plans would need enhanced analytical rationales and implementation commitments consistent with regulatory requirements for compliance schedules before increased regulatory flexibility or time schedules could be granted. Overall, the group recognized that more robust long-term plans containing specific short and long-term implementation commitments could assist in securing sustainable funding, building public support, guiding more thoughtful program implementation, and demonstrating the ability to comply with permit requirements over time.

3.1.6 Foster Coordination Across Water Programs

An integrated municipal water plan (stormwater, wastewater, and drinking water) that holistically considers all sources and uses for water within a watershed could be a more cost-effective approach to urban water management than the siloed management practices many communities now use.

Stormwater expert Andrew Reese suggests moving away from siloed management toward a "one water" governance model.

"If we change to system thinking and consider that **stormwater is part of a much larger water resources program**, then the idea of combining all water agencies into one 'Water Resource Department' is a natural consequence" (Reese, 2016, p. 12).

Workshop participants discussed illicit discharges related to wastewater as an example of an issue that often arises in the stormwater program but can require cross-program coordination to solve. Workshop participants expressed frustration with the lack of clarity related to illicit discharges and pollutant levels in stormwater systems caused by leakage from wastewater collection systems and other problems resulting from aging infrastructure. For example, some participants asserted that contributions from failing private sewer laterals, cross-connections, overflows during rain events, and damaged infrastructure are more significant sources of bacteria than conventional stormwater sources in many areas but cannot be adequately resolved through the MS4 program. They suggested that local utilities need more coordination to address such issues. This coordination is often complicated because, in many states, responsibility for wastewater and stormwater management resides in completely different agencies or in different departments of city governments.

To facilitate a more integrated approach, participants suggested that permitting authorities more clearly delineate the responsibilities of wastewater collection system operators and stormwater system operators to detect and correct collection system leakage, including leakage from private laterals that reaches storm drains. For example, California has a regulatory system and permitting program for wastewater collection systems that includes an AMP-driven approach to sewer system investigation, maintenance, and renewal. While stormwater program managers may properly bear responsibility for tracking down sources of illicit discharges to stormwater collection systems, most participants indicated that wastewater system managers should bear principal responsibility for remedying detected wastewater leakage/spill problems.

Wastewater flowing from a sanitary sewer access manhole to a nearby storm drain system inlet. Photo: PG Environmental

This wastewater-related issue was one of several cited examples of the difficulties stormwater managers face due to fragmented governance and program silos. Other examples included challenges of integrating stormwater program management with projects focusing on stormwater capture for water supply augmentation, green streets projects aimed at improving traffic management and urban amenities, and green infrastructure projects with multiple objectives. Participants expressed a need for stormwater permits to

Los Angeles County's MS4 permit creates an alternative compliance path for watersheds in which the jurisdictions are pursuing **long-term stormwater management strategies that address multiple objectives** in addition to water quality protection.

create flexibilities and incentives to encourage local program managers to pursue implementation strategies that yield multiple benefits while continuing to address water quality protection needs. Some participants also indicated that local programs would benefit from guidance or case studies that illustrate how programs can take advantage of multi-benefit stormwater management opportunities within the structure of an MS4 program.

Workshop participants also raised the value of coordinating with entities outside the water sector on efforts to reduce the amount of pollutants entering the environment through "true source control." Many pollutants (e.g., pesticides, metals associated with commercial uses, trash) cannot be practically or economically controlled at the end of pipe; green chemistry or more environmentally friendly alternatives that reduce or even eliminate contact of pollutants with stormwater are often more effective. For example, workshop participants noted that national initiatives to reduce the use of copper in brake pads and phosphates in lawn fertilizers have resulted in substantial reductions in these pollutants in urban stormwater, at a fraction of the costs of removing these pollutants at the end of the pipe. It was noted that progress on this approach will be most effective through work with agencies that regulate product formulation and use, and businesses that manufacture and sell these products at the regional or national scale. Legislation may ultimately be needed in some cases to enable true, meaningful source control.

3.2 Cross-Cutting Permitting Recommendations

As noted above, many permitting authorities and permit holders believe there are significant opportunities to improve permitting approaches to more efficiently protect water quality, pursue related management objectives, and improve understanding of compliance expectations. Workshop participants also identified a range of strategies for improving and strengthening permit requirements. Collectively, these recommendations seek to emphasize more effective approaches, deemphasize or eliminate ineffective activities, integrate stormwater management with broader urban water management objectives, and generally improve permit efficiency.

Workshop participants generally recognized that improvements in MS4 programs have been difficult to implement in part because permitting authorities have been slow to embrace the need for change. Many participants argued that MS4 permitting programs are understaffed and have devoted insufficient resources to providing technical and policy guidance, assisting permittees in program improvement, and issuing timely permitting decisions and compliance actions. Provision of adequate resources for EPA and state permitting offices will be critical to facilitating improvements in permitting and program development.

3.2.1 Clarify MS4 Permitting Requirements and Expectations

Workshop participants identified a need to clarify and standardize permitting expectations in each of the basic program areas covered by MS4 permits. Existing federal regulatory provisions identifying requirements for MS4 permits are brief and unclear. National guidance has helped articulate permitting expectations but has enabled neither permitting authorities nor permittees to develop a common, shared understanding of permit requirements. For example, permitting authorities and local programs continue to debate the meaning of "maximum extent practicable" and whether it constitutes a "ceiling" or a "floor" as a basis for permit requirements. As a result, different permitting authorities vary widely in how they write MS4 permits and how they interpret existing regulations and guidance. This has resulted in significant differences across the country (and even

Figure 4. Post-construction standards compendium.

within states) in the structure and effectiveness of permit-required program implementation, and in difficulty adjusting permit requirements to focus on the most effective implementation strategies.

As an example of an area with significant variation across the country, currently there is *not* a national design standard for post-construction BMP performance (a.k.a., permanent stormwater controls). Approaches to post-construction regulation vary widely, resulting in variability in the effectiveness of post-construction control practices. Establishing national design standards for post-construction could level the playing field for development, reduce downstream water quality impacts from development, and facilitate post-construction practices that yield multiple benefits (e.g., flood risk reduction, water supply augmentation, and improvement in urban amenities). EPA contemplated establishing nationwide performance standards to address runoff at new development and re-development sites and require some level of on-site retention and/or infiltration; however, that rulemaking effort was deferred in 2014.

Post-construction is an example of an area where some work has been done to raise national awareness of different approaches being used across the country. To help permitting authorities to understand various approaches being used across the country, in 2015–2017, EPA developed a compendium series of MS4 permitting approaches. Part 2 focused on post-construction performance standards. This compendium includes examples from existing MS4 permits from 26 states, Washington D.C., and Puerto Rico that have numeric, volume-based, or retention performance standards for newly developed and redeveloped sites (EPA, 2017a). WEF and other national and state-level organizations have also provided guidance and case studies to illustrate new approaches to implementing different facets of stormwater management programs.

While creation of guidance and compendia of examples has assisted permitting authorities and local programs in making improvements, more needs to be done. Most workshop participants believed national regulations need to be clarified and harmonized to create a more coherent baseline expression of national program and permit expectations. Workshop participants understood that regulation changes would be difficult to implement and that there is potential for unintended consequences when regulations are revised. It may be feasible to make progress in clarifying permitting expectations through new or updated policy guidance, but regulatory revisions might be necessary to fully accomplish this objective.

Through a collaborative process, stakeholders created the *Minnesota Stormwater Manual* to help users better manage stormwater. The manual serves as guidance to communities that put recommendations into practice through local enforceable standards. The manual is maintained in an online wiki format and is often accessed by users.

3.2.2 Consolidate Phase I and II Requirements

Most workshop participants suggested that there may no longer be a need to maintain the distinction between Phase I and II MS4 communities. One participant noted that when the Phase II

regulations were adopted in 1999, it was envisioned that a seamless stormwater program with common expectations would emerge.

> "In developing an approach for today's final rule, numerous early interested stakeholders encouraged EPA to seek opportunities to integrate, where possible, the proposed Phase II requirements with existing Phase I requirements, thus facilitating a **unified storm water discharge control program**. EPA believes that this objective is met by using the NPDES framework" (NPDES—Regulations for Revision of the Water Pollution Control Program Addressing Storm Water Discharges, 1999, p. 68736).

In the pre-workshop questionnaire, 79 percent of respondents agreed or strongly agreed that "Requirements for larger (Phase I) and smaller (Phase II) communities should converge over time. In most cases, the Phase II permit requirements should be the consistent 'floor' for the Phase I permits."

The categories of "Phase I" and "Phase II" were conceived to define the initial rollout schedule; now that the programs have become firmly established, the rationale for maintaining this separation is less clear. Participants also highlighted potential difficulties (and sometimes benefits) of working with neighboring jurisdictions in a watershed who are often regulated under different permits with different requirements. To help foster better coordination and consistency, all programs, regardless of size or age, should work with similar requirements.

A few participants disagreed that Phase I and Phase II requirements should converge, arguing that the differences in jurisdiction issues, size, and capacity are too great to expect all permittees to meet consolidated requirements. Most participants agreed that some attributes of a larger program, such as extensive water quality monitoring, may not be appropriate for smaller communities, and in all cases, the permit and resulting program should be scalable to fit municipal/watershed characteristics.

Aligning permit requirements and eliminating the distinctions between Phase I and Phase II permits could assist local jurisdictions in developing cooperative, watershed-based implementation strategies with their neighbors (whether under the auspices of a single permit covering multiple jurisdictions, general permits, or separate individual permits). Moreover, as permitting agencies issue more watershed-scale and regional-scale Phase I permits that address all communities (including smaller Phase IIs) within a geographical area, keeping the two classes of community sizes may become increasingly inequitable. As discussed above, regulatory revisions and/or more detailed policy guidance would be necessary to carry out this consolidation of Phase I and Phase II programs.

3.2.3 Provide Flexibility in MCM Requirements

Workshop participants recognized that all MS4 permits need to include MCMs, but the group strongly believed that permits should provide increased flexibility in addressing MCM requirements. Concerns were raised that many MS4 permits provide little discretion in MCM implementation and do not enable permittees to adjust implementation based on local preferences and lessons learned over time. As discussed in detail under each of the MCM sections to follow, participants indicated that permittees should be able to tailor specific MCMs based on local settings, preferences, and pollution management objectives. Rules and/or guidance should be revised to clarify that permitting authorities have the flexibility to adjust MCM requirements to increase focus on measures that yield tangible benefits and reduce emphasis on MCMs that yield little ongoing benefit.

3.2.4 Explore Options to Provide Longer Planning Timeframes for Permittees

Managing stormwater over the long term can create opportunities for communities to rediscover rainwater as a resource, invest in resilient infrastructure, revitalize urban waterways, and introduce green space that make urban areas more livable (EPA, 2016a).

Stormwater permits under the NPDES program must be reissued at least every five years. This gives permitting authorities the opportunity to assess a program's progress toward water quality goals and to adjust implementation requirements. However, many permittees have expressed that this relatively short period can be a major planning impediment.

Workshop discussions indicated that it is difficult to strike an appropriate balance between long-term planning and implementation stability, on one hand, and short-term accountability to ensure prompt implementation of water quality controls, on the other. For many stormwater management projects, the five-year permit term is shorter than the time needed to secure funding, complete designs, obtain regulatory approvals, and carry out construction. Even for program elements that can be implemented more rapidly, it can be difficult to demonstrate the effectiveness of specific projects and programs in achieving water quality improvements and to evaluate compliance within that timeframe.

EPA Headquarters has embarked on a **Long-Term Stormwater Planning** pilot effort with several communities across the country. This voluntary effort is encouraging communities to think and plan beyond the five-year permit terms and identify strategies that may be as far-reaching as 20 to 30 years. With a focus on tangible benefits to the community, this effort is geared toward building local capacity over time to improve local water quality. A community's long-term stormwater plan (or aspects of it) may be incorporated into an MS4 permit.

Ongoing concerns that permit requirements may substantially change from permit to permit have made many municipal program managers reluctant to commit to long-term planning and implementation, including long-term financial planning. Many permittees have found it particularly challenging to plan and secure funding for controls to address water-quality-based requirements. Some participants indicated that financial limitations of municipal programs make it infeasible to demonstrate significant progress in stormwater control in any five-year permit term. Together, these concerns may have created disincentives for local programs to develop stable, long-term program plans; carry out the work necessary to secure sufficient, stable funding; and implement sufficient controls to meet water quality goals. Some workshop participants indicated that longer timeframes would result in greater stability and regulatory certainty; in some instances, it could also make project financing easier. Tools such as compliance schedules have been used in some stormwater permits to transcend the five-year term.

However, several workshop participants raised concerns about extending compliance timeframes. They suggested that to extend schedules would reward poor performance and slow implementation progress. Several participants cautioned against using compliance schedules unless very rigorous regulatory requirements for granting compliance schedules are met, including provision of specific interim implementation milestones.

Some participants suggested that requirements for providing compliance schedules for stormwater permits (and for considering financial capacity in assessing the need for compliance schedules) are unclear and that additional guidance is needed to inform development of workable compliance schedules. To support the possibility of creating the space for longer planning and implementation timeframes, some workshop participants called for the development of a compendium of

compliance schedules in MS4 permits, including information about how they were calculated and applied, and guidance explaining more clearly how compliance schedules could be appropriately created for MS4 permits.

3.2.5 Develop Transparent Compliance Assessment Expectations

Many MS4 permits across the country have expanded in length and complexity as new program elements and water-quality-based concerns have evolved over time. Similarly, many municipal programs have become more complex and now involve duties by multiple city departments and private parties. Some workshop participants noted that the complexity and number of permit requirements coupled with the need for multi-departmental participation increases the likelihood of non-compliance. Permitting agencies and permittees in the workshop expressed concerns about the difficulty of assessing compliance with these more complex permits and ensuring that local programs are doing what is necessary to stay in compliance. However, some participants also noted that assessing compliance with broad, vague, and/or discretionary permit provisions is also difficult.

During the workshop, there was also extensive discussion about the pros and cons of assessing permit compliance and program progress based on evaluation of water quality results, changes in discharge characteristics, and/or implementation of programs and practices designed to reduce runoff and pollutant loading. It was recognized that assessing compliance based solely on water quality results can be difficult for municipal stormwater due to its variable nature, the complexities of urban drainage systems and governance, and difficulties of associating stormwater control actions with water quality responses. Most participants agreed that receiving water monitoring, stormwater effluent monitoring, and program activity assessment are all critical components of a viable implementation and compliance assessment strategy. There was general agreement that more care needs to be taken in designing these assessment components and clarifying in permits how they would be used to support compliance evaluation.

Overall, many workshop participants expressed the need for clearer guidance about how compliance should or will be evaluated with increasingly complex MS4 permits (i.e., a clear compliance strategy). This, in turn, could help enable program managers to explain to elected officials and other funders why certain program resources are necessary to ensure the municipality complies with permit requirements.

Several participants discussed the benefits of a program auditing approach, through which the permitting authority periodically evaluates local program performance. Audits can enable permitting authorities and permittees to work together to identify issues and corrective actions. Participants noted that audit checklists help both permitting agencies and permittees understand the scope of audits in advance and assist permittees in achieving permit compliance.

Some participants urged a departure from the historical model of "permit issuance → implement → report → inspect → enforce" and instead envisioned a more collaborative strategy. Implementation of more collaborative approaches assumes both permitting authority and permittee have sufficient staff resources to support more intensive interaction and collaboration.

A possible strategy could emphasize the following steps early in the permit cycle:

- In-person meetings between permitting authorities and individual permittees or groups of permittees to discuss the requirements, set clear expectations and performance measures, and resolve ambiguity. Identify requirements or program areas that could present challenges.
- Through early implementation determine if unforeseen or predicted challenges materialize and work to collaboratively identify and promote solutions. Accomplish this through inspections, annual report reviews, or in-person meetings.
- Identify solutions and best practices and modify expectations, if needed and appropriate. Effectively disseminate information and meet with permittees individually or as a group to reset expectations.

Coupled with the compliance strategy is the need to adequately fund permitting authority oversight staff. With adequate funding, the oversight staff can stay abreast of program activities, successes, and challenges. They can meet with local program staff and have time to review annual reports, ask follow-up questions, and address questions form the permittee. They can also communicate important lessons learned by other stormwater programs to the broader permittee stakeholder group in a region. With adequate funding, oversight activities could help address issues before they lead to non-compliance, reduce the time for return to compliance, and help elevate the overall effectiveness of the stormwater program.

3.2.6 Improve Monitoring and Reporting Approaches

Throughout the workshop, participants repeatedly highlighted the important role of monitoring, tracking, and reporting in the MS4 program. In the pre-workshop questionnaire, 97 percent of respondents identified this aspect of the program as having "significant potential" or "some potential" for significant improvement (defined as cost-effective positive environmental outcomes). This topic was discussed in much greater detail in a similar workshop held in March 2018 and will be addressed in the forthcoming report about that workshop to be issued later in 2018.

3.3 Making Public Outreach and Involvement Work for the Program

An informed public can take steps to lessen their impact on local water quality through behavioral changes and may be more likely to support proposed stormwater initiatives (including financial support). Requirements for public education and outreach are included in both the Phase I and Phase II MS4 programs. The degree of permit specificity is highly variable across the country—some MS4 permits identify specific topics and actions for education and outreach, while others put the onus on the permittee to identify these components in their SWMP.

Photo: EPA

Overall, workshop participants characterized public education and outreach as one of the more frustrating and challenging aspects of the MS4 program. Participants also expressed some skepticism about potential for significant improvements to the public education and outreach program, with 34 percent of respondents in the pre-workshop questionnaire indicating that there was "little potential" for improving environmental outcomes through additional investments in public education.

Most participants agreed that traditional stormwater communication approaches are largely ineffective, except for a small percent of audiences, and that more work is needed to improve understanding among program managers about messaging methods and vocabulary that are more likely to work. Several noted a need for more research on the effectiveness of public outreach methods in improving water quality outcomes, as well as a need to disseminate information about the relative effectiveness of different outreach methods more widely.

3.3.1 Coordinate Efforts at Various Scales

Coordinated, strategic outreach and education can require significant investment. This is especially challenging for smaller communities with limited funding and staff (e.g., some Phase II permittees). Some program managers participating in the workshop suggested they take the same approaches year after year because they do not know how to make improvements and are concerned permitting authorities would not allow significant changes.

Surprisingly, a national campaign approach has not been used for stormwater public education. Area-wide programs and even state-wide programs have been developed, but the cost and performance advantages of a national stormwater quality campaign remain untapped (WEF, 2016).

Workshop participants suggested that scaling efforts up to the state, regional, or national level would allow permittees to pool resources for the collective good and could prove to be a more effective method for stormwater-related education and outreach than expecting individual jurisdictions to develop and implement their own overall public education efforts. A national-level campaign would have the benefit of consistent messaging about universal stormwater management concerns, which may be superior in effect to local programs using varied approaches and messages. At the workshop, a mix of national, regional, and local scale messaging approaches was discussed.

3.3.1.1 National Approach

Discussions during the workshop centered around large-scale partnerships as an approach that is potentially more cost-effective for nationally relevant messaging than locally or regionally focused efforts. Water trade associations tend to be well-versed in messaging and outreach, so there may be opportunities for collaborations with such organizations.

WEF's *Rainfall to Results* report lists community engagement as one of six national objectives for the stormwater sector to enhance "decision-making capacity and financial support needed for sustainable stormwater programs" (WEF, 2015, p. 45).

- The **National Municipal Stormwater Alliance (NMSA)**, an "alliance of state and regional groups made up of MS4 permittees," seeks to make stormwater programs more effective and help ensure clean water throughout the country. One of its primary missions is to "improve public understanding and engagement in stormwater solutions."
- The **Water Environment Federation (WEF)** trade organization has been increasingly involved in the stormwater sector in recent years, establishing a Stormwater Institute in 2015. In November 2017, it convened a small-group workshop of various stakeholders to focus specifically on "messaging" in the national stormwater program.
- **EPA Headquarters** and **EPA Region 9** have recently initiated efforts to improve understanding of effective stormwater program messaging and disseminating information to states and local programs about how to improve stormwater program communications.

Participants expressed support for aligning the activities of EPA, states, and permittee associations in developing stormwater communication tools and developing specific outreach and education tools and resources for use by local programs. To pull these various efforts together and develop a successful broad-scale stormwater education and outreach program, the following ingredients will likely be needed:

- A clear leading organization (e.g., national stormwater association, White House Ad Council).
- Collaboration among stakeholders across the sector and country including EPA, states, local programs, and interested research and permittee associations.
- A source of funding for program development and implementation (possibly resources from a national organization and/or permittees "buying into" the program); and/or
- Coordination with regulatory partners to create a compliance pathway that allows a permittee's participation to satisfy some or all its education and outreach requirements.

3.3.1.2 Regional/Local Approaches

As workshop participants acknowledged, outreach methods effective in one area may not work in another, so stormwater messaging needs to be sensitive to regional and/or local conditions, priorities, and values.

Some initial efforts at regional communications approaches are underway. In its MS4 Permit Improvement Guide, EPA has taken a first step in encouraging collaboration for adjacent Phase II communities: "EPA encourages permittees in a geographic area to establish cooperative agreements in implementing their stormwater programs" (2010, p. 7).

One concern raised for a collaborative approach is that public outreach and involvement expectations may vary between smaller Phase II communities and larger Phase I communities, yet little effective guidance is available to assist communities in determining the right level of investment in program communication efforts.

California's 2013 Phase II MS4 permit allows permittees to select whether to (1) contribute to a countywide stormwater program, (2) contribute to a regional outreach and education collaborative effort, (3) fulfill requirements on their own, or (4) implement a combination of these options.

3.3.2 Increase Flexibility and Encourage Targeted Efforts

An effective outreach campaign can help advance water quality goals by drawing awareness to stormwater issues with the right audiences. There was widespread interest at the workshop in changing the emphasis of current public outreach and involvement efforts toward higher priority concerns. Many participants indicated that if they had the flexibility to reshape their public outreach and involvement efforts, they would like to focus these efforts to help build support for their programs and understanding among voters and elected officials about the need to better fund stormwater programs and the importance of progressive stormwater management (e.g., to protect valued water uses, reduce flooding risk, augment water supply, and enhance urban quality of life). Participants noted that demonstrated public willingness to pay for stormwater services is an excellent indicator of the effectiveness of public outreach.

One MS4 participating in the workshop contends that it **could be more effective with greater flexibility to prioritize its public outreach approach**. Its permit stipulates education focus topics and metrics (e.g., number of school-aged children reached and citizen events held annually). Though the permittee would like to conduct targeted outreach to garner public and political will for passage of a stormwater utility fee, program time and resources are finite. The participant noted that the ultimate assessment of program effectiveness is whether stakeholders are willing to pay for it.

Improving opportunities for meaningful public involvement in program planning and decision-making was of interest to several participants as well, since they recognized the value of stakeholder inclusion in building political support for their programs.

Some participants also expressed a desire to enable local programs to target public outreach and education more specifically to pollutants and behaviors of particular concern (e.g., trash and littering) rather than continuing generic public outreach campaigns. Concern was expressed that it could be difficult to persuade permitting authorities to approve substantial narrowing of public communications to target specific issues and opportunities.

Workshop participants suggested that broad, general messaging at the local level tends to have limited effectiveness. Without being overly prescriptive, permits should encourage more targeted approaches with specific, locally relevant calls-to-action (e.g., practice responsible fertilizer and pesticide use, dispose of trash properly, support a fee funding initiative). Message repetition is also important; participants agreed that investments in public education and outreach need to be continued and adapted over time based on evaluation of successes achieved, lessons learned, and new challenges.

EPA has already expressed support for a flexible approach to public outreach, as the *MS4 Permit Improvement Guide* states:

> "EPA recommends that the permit be written to allow the permittee to identify priority issue(s) not listed that may contribute a significant pollutant load to stormwater. For Phase I, individual permits, it may be appropriate for the permit writer to specify the priority issues based on known issues, monitoring data, historical trends, etc. Phase II general permits will likely need to allow for more flexibility in selecting priority issues" (EPA, 2010, p. 21).

However, workshop participants indicated that this flexibility is not always incorporated into permits, or it is not expressed in a way that truly enables them to focus on their own priority area(s) without also addressing the general areas identified in the permit. In instances where a permittee demonstrates that a change in focus will not result in an overall reduction in effort and/or is likely to significantly more effective, a mechanism in permits such as an "off-ramp" or alternative compliance pathway could allow for development of alternate program investment priorities.

There was a strong sentiment expressed at the workshop that these challenges could be met by improving technical support for public outreach and education program design and targeting, and by sending clear signals to permitting agencies that these requirements can be substantially tailored to meet local interests, issues, and capabilities. Representatives from several national and state organizations and agencies expressed interest in cooperating to improve messaging tools and strategies, develop training to help local program tailor their messaging to address their highest priorities, and clarify flexibility in permitting regulations to facilitate adjustments in MS4 permit public outreach requirements.

3.3.3 Improve Stormwater Messaging Programs

Workshop participants expressed the strong view that public outreach approaches need significant improvement in how they communicate the need for and costs of implementing sound urban stormwater management. Investing in public education and outreach to change polluting behaviors and highlight the value of water has not yielded commensurate understanding of how stormwater systems work and how local programs deliver services and benefits that the public values (e.g., improved water quality, reduced flooding risk, urban greening, water supply augmentation). In most communities, there is little understanding of the costs of these services or the need for sufficient, stable funding. As a result, most local programs face severe difficulties in building sustainable program capacity.

Workshop participants identified an urgent need to develop improved messaging strategies and tools to help local programs build local understanding of stormwater management services, costs, and benefits, which will help secure public support for program funding initiatives. These tools should enable local programs to demonstrate how effectively use resources and implement projects that make meaningful differences to the community.

3.4 Tailoring IDDE to Fit Local Needs

Untreated and unpermitted flows to storm sewer systems have a negative impact on local water quality, which is amplified during dry weather without the diluting effect of runoff. Thus, Phase I and Phase II programs are both required to seek out and eliminate illicit discharges to their systems. Illicit discharge sources can be direct (e.g., improper disposal of waste, illegal connection) or indirect (e.g., infiltration through cracked pipes). Since such discharges are often episodic in nature, detection can be especially challenging.

Photo: EPA

Developing a storm sewer system map is a foundational requirement for identifying pipes and other system assets, characterizing existing flows, and enabling more efficient elimination of illicit discharges. Variables such as land use, precipitation, and system type (combined versus separate sanitary sewers) can influence whether certain areas are more likely to have issues with non-stormwater flows to the storm sewer system. Workshop participants underscored the need to perform system mapping, catchment delineation, and an initial systematic investigation of the system to detect system vulnerabilities and illicit discharges.

Urban Stormwater Management in the United States, a 2009 report by the National Research Council (NRC), estimates that **2 to 5 percent of all outfalls may be experiencing illicit discharges at any given time** (p. 413).

Workshop participants agreed that eliminating illicit discharges should be a continuing priority. There was also an acknowledgement that regional characteristics (e.g., age of system, climate) may have a significant bearing on the effectiveness of traditional IDDE program activities, such as dry weather outfall screening. In the pre-workshop questionnaire, 90 percent of respondents indicated agreement or strong agreement that some common elements of IDDE programs should be retained (e.g., system mapping, public complaint hotlines) even if system surveillance is reduced.

Workshop participants acknowledged that reducing the overall outfall inspection frequency could enable the program to increase IDDE activities in higher-risk areas or reallocate scarce program resources to other, more effective implementation activities. Workshop participants also generally agreed that permittees should have outfall screening frequencies should adoption of asset management planning systems would greatly assist assessment, planning, and implementation of IDDE program adjustment and targeting.

3.4.1 Enable a More Focused Approach to Outfall Screening

Workshop participants indicated that the emphasis of IDDE programs may need to change over time. After initial efforts to inspect the entire system, it may be appropriate to reduce inspection frequency in areas where illicit discharges are less likely or less potentially harmful. A new permittee would need to identify and characterize its system, whereas a permittee that is continuing coverage may have already established an adequate baseline for evaluating the effectiveness of outfall screening and system inspection activities in its jurisdiction.

Participants suggested that certain areas of a storm sewer system should be identified as screening priorities while others could be de-emphasized based on local characteristics identified during the initial system assessment and outfall monitoring. In areas where no issues have been identified over an extended period or where piping systems are relatively new, it was suggested, communities should be able to redirect their resources to other program activities rather than continuing to screen these locations at regular intervals.

All respondents to the pre-workshop questionnaire agreed or strongly agreed that some MCMs and other program elements should be tailored and scaled to **emphasize productive activities** and deemphasize less productive activities.

In its *MS4 Permit Improvement Guide*, EPA has indicated support of a strategic approach: "Regular field screening of outfalls for non-stormwater discharges needs to occur in areas determined to have a higher likelihood for illicit discharges and illegal connections" (EPA, 2010, p. 24). The guide recommends that permits require some level of dry weather screening activities in priority areas throughout a permit term. However, based on discussions with stakeholders during the workshop, it was clear that many MS4 permits do not provide enough flexibility or guidance on how to tailor screening activities to better balance effectiveness with resource expenditure.

In instances where screening efforts have proven effective, the permit writer could incorporate provisions to incentivize the continuation of these activities; otherwise, resources could be reallocated to support more impactful efforts areas of the program. For example, if a permittee has screened outfalls for years without identifying an illicit discharge, the program could have a permit pathway to substantially reduce outfall screening frequency and invest those resources in a more effective effort.

Participants indicated that while national guidance recognizes the validity of adjusting IDDE programs to focus on higher-risk areas, additional guidance is needed to prompt permit writers to work with permittees to make these changes in permits. Specific examples illustrating how to adjust permit requirements to provide flexibility in IDDE programs could help spur permitting authorities to implement such changes.

3.4.2 Establish Clear Guidance on Addressing Elevated Bacteria Levels in Stormwater

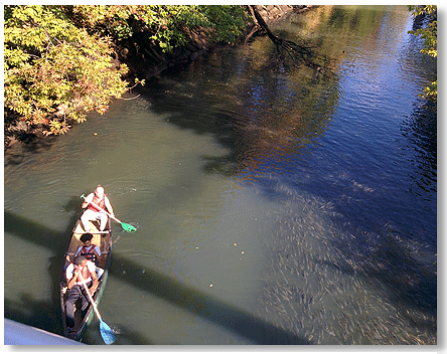

Photo: EPA

The significant health risk posed by human pathogens in stormwater and its link to leaking systems was raised as a significant concern during the workshop given challenges with efficient source identification/tracking. Many jurisdictions have found that high bacteria levels in stormwater discharges have cross-connections with sewage collection systems and laterals, as well as other local sources of human fecal bacteria (e.g., homeless encampments and illegal dumping of human waste).

Participants recommended the development and issuance of guidance materials to support improvements in two main areas: (1) effective methods/processes for identification of bacteria and (2) how to address bacteria sources associated with cross-connections.

During the workshop, participants described how several communities have effectively tailored their IDDE efforts to focus on human pathogen source tracking methods. Some participants suggested that EPA and/or States support development and endorse implementation of methods that effectively target human-related pathogen source detection and control and create permit language to facilitate these efforts. However, other participants noted that current national bacteria indicator criteria and beach action levels do not distinguish between animal and human sources of bacteria. Moreover, in cases where applicable state water quality standards do not distinguish between human and animal sources, a stormwater control strategy based solely on detecting and controlling human sources may not result in attainment of applicable standards.

The NRC report *Urban Stormwater Management in the United States* underscores the importance of IDDE program activities in identifying the presence of harmful human pathogens. It suggests prioritizing "***waters with a contact-recreation use designation that have had multiple exceedances of pathogen or indicator criteria in a relatively short period of time***" (NRC, 2009, p. 233).

EPA Region 1 (New England) has many jurisdictions with older sewer collection systems—in many cases with portions of combined sewers—that often have cross-connections between lines that convey sanitary waste and those that are intended for stormwater only. As part of the **Clean Charles Initiative**, EPA developed a methodology to detect sources of human-related illicit discharges through sampling for compounds normally found only in human waste (e.g., caffeine). This method has been incorporated into a new MS4 permit in the region. The new permit requires priority areas to be screened using this method within 5 years of permit issuance and all other areas within 10 years.

Local examples of approaches for targeting human sources of fecal bacteria for were briefly discussed during the workshop. When tests from water quality sampling activities return a high bacteria count, some local programs seek to identify the contamination type to determine the best intervention. The first step is to differentiate between human and animal sources (e.g., water fowl, raccoons, deer). Common assessment methodologies (e.g., microbial source tracking) can be difficult, labor-intensive, and expensive. Yet some participants view this chemical "fingerprinting" process as critical for source identification and implementing targeted mitigation strategies. Workshop participants noted that a compilation of available research and methods

addressing the advantages and disadvantages of human source targeting approaches would be useful to MS4 programs.

In instances where human pathogens are positively identified, workshop participants expressed the need for clearer guidance on methods that effectively address various sources (e.g., failing laterals, collection system leakage, illegal dumping, and homeless encampments). It can be difficult for stormwater program operators to compel controls on activities outside their current local regulatory authorities. For example, failing or poorly located private septic systems and sewer laterals have been identified in some areas as significant sources of high bacteria levels in stormwater collection systems during dry and wet weather. Participants indicated a need for clearer guidance about regulatory options for addressing these types of sources.

Scientists at Lawrence Berkeley National Laboratory have developed a new technology called **"PhyloChip"** which uses DNA analyses to identify bacterial species. This technology has been used in some stormwater source tracking efforts.

3.5 Tailoring Industrial/Commercial Programs to Fit Local Needs and Align with Industrial Permits

Industrial facilities across the country are required to obtain direct permit coverage from their NPDES permitting agencies to cover stormwater discharges from their process areas. The permitting agency then has authority to evaluate compliance with permit conditions and pursue enforcement, if needed. Note that these permits generally do not address non-process areas of industrial facilities (e.g., rooftops and parking lots) that may constitute significant sources of some stormwater contaminants.

Photo: PG Environmental

Meanwhile, Phase I MS4 communities (and some Phase II communities) are required to keep inventories of potential industrial and commercial sites within their jurisdictions, specify control requirements, perform oversight inspections and enforcement follow-up activities, and conduct on-site water quality sampling when warranted. The main discrepancy between Phase I and II program requirements is that Phase II programs are not typically required to carry out this level of regulatory oversight.

Overall, workshop participants believed EPA and permitting authorities need to do more to clarify and eliminate uncoordinated overlaps between MS4 and industrial permits, share examples of how industrial and commercial stormwater control strategies can be adjusted and aligned to target higher-risk areas, and explore melding of IDDE and industrial/commercial program elements.

3.5.1 Reduce Overlap Between Industrial Stormwater Permits and Municipal Stormwater Permits

Workshop participants stressed the importance of addressing overlap in permit coverage related to industrial facilities discharging to an MS4. In some instances, regulatory authority under the industrial or MS4 permits may not be clearly delineated, leading to either insufficient coverage or duplicative coverage of these facilities. Most participants suggested that both industrial and commercial sources of stormwater pollution need to be addressed as part of the MS4 program;

however, there was no consensus about what permitting approach would be most effective. A few participants strongly objected to creating any responsibility on the part of MS4 programs (and Phase II permittees in particular) to address industrial site discharges.

Seventy-two percent of pre-workshop questionnaire respondents indicated that clarifying relationships between industrial stormwater permit requirements and MS4 program requirements in future permitting actions would be helpful.

Participants highlighted concerns that current industrial permits may not (1) sufficiently address non-process areas of industrial facilities, or (2) adequately encompass commercial and institutional sources of stormwater pollution. Institutional sources include areas owned by other units of government (such as schools) that are often exempt from coverage by MS4 permits, although states are increasingly included such non-traditional sources in Phase II MS4 permits. Several environmental groups have petitioned for expansion of permitting coverage to require direct permitting of stormwater discharges from commercial, industrial, and institutional land uses.

MS4 permittees at the workshop also expressed frustration that their programs must expend resources to inspect industrial facilities that theoretically should already be covered directly by the NPDES permitting authority (i.e., state or EPA). There was not a clear consensus within the group on whether having MS4 permittees evaluate process areas of industrial facilities was an effective use of program resources. Some participants believed duplication of requirements between industrial and MS4 permits was not efficient, while others suggested that setting locally developed requirements for industrial permittees through the MS4 program adds value. In general, participants agreed that redundant requirements should be minimized and that regulatory approaches for non-process areas of industrial facilities should be clarified. Some participants suggested that the MS4 program should strategically target sources not covered by an industrial stormwater permit (e.g., commercial facilities, non-process areas of industrial facilities).

Workshop participants identified EPA's residual designation authority (RDA) as a potentially useful regulatory mechanism to address gaps in permit coverage. RDA allows for the issuance of NPDES permits on a case-by-case basis if an unregulated discharge is determined to pose a serious threat to water quality. Participants suggested that enhanced controls required by new permits in commercial, institutional, and non-process areas of industrial facilities could help attain water quality standards while also helping to satisfy the municipal requirement for pollutant reduction. However, permitting authorities are concerned about creating a new class of permits, which could stress the limited resources of regulatory agencies and add complexity to an already confusing permitting landscape.

Regardless of whether control requirements are implemented under industrial, MS4, or a new class of NPDES permit, improved coordination in how related permits operate could help achieve water quality outcomes if it ensures priority sources are adequately addressed under one or multiple permitting arrangements.

Recognizing differences in how Phase I and Phase II permits address industrial and commercial sources, workshop participants discussed whether these distinctions continue to make sense. Though Phase II permittees are often only required to address industrial and commercial discharges through their education and outreach programs, EPA's *MS4 Permit Improvement Guide* encourages them to consider the water quality impact from these sources. "EPA recommends that permit writers consider including requirements pertaining to stormwater discharges to the

In California, some Regional Water Board programs work with waterkeeper groups on tools to prioritize inspections of industrial sites.

MS4 from industrial sources in Phase II permits to further reduce stormwater pollutants from the MS4" (EPA, 2010, p. 85).

In the pre-workshop questionnaire, 76 percent of respondents disagreed or strongly disagreed with the statement, "having the MS4 permittees take on industrial site compliance makes sense for Phase I permittees but not Phase II permittees." During the workshop, the primary argument for Phase II MS4s to be exempt from industrial/commercial program requirements was the resource limitations often experienced by smaller municipalities. However, several participants asserted that the same requirements should apply to both Phase I and Phase II communities, suggesting that exempting Phase II MS4s from these requirements creates arbitrary distinctions in requirements based on population size and that most jurisdictions face resource constraints regardless of population.

3.5.2 Merge Industrial/Commercial Oversight Activities into the IDDE Program

The underlying goal of the industrial and commercial program element is to reduce or eliminate illicit discharges and stormwater pollution from industrial and commercial sites. Some workshop participants suggested that the illicit discharge program could be structured to incorporate private industrial and commercial sources based on existing tools and requirements. Below are some suggestions for how this could be accomplished.

Photo: PG Environmental

- An ordinance or other control mechanism could be used to (1) prohibit illicit discharges into the MS4 from privately owned industrial and commercial facilities, (2) ensure public staff access to these facilities to investigate potential illicit discharges, and (3) require implementation of BMPs to prevent stormwater pollution from the facilities.
- Potential illicit discharges from industrial and commercial facilities could be reported by the public through a reporting hotline (typically a requirement of the illicit discharge program), and the permittee could use its storm sewer system map (required under the illicit discharge program) to track illicit discharges upstream to industrial and commercial facilities.
- The program would also need to include a robust targeting strategy (based on pollutants of concern, geographic areas, land uses, etc.) and surveillance to proactively identify potential or actual illicit discharges from industrial and commercial sources.
- Permits could also include a separate requirement within the illicit discharge program element for permittees to report potential industrial stormwater permit "non-filers" to the appropriate permitting agency (e.g., state or EPA).

Under this scenario, the two program elements (industrial/commercial and IDDE) could largely be merged in part, with the intent of reducing the potential for illicit discharges through strategic and targeted surveillance efforts. Note that it still will be necessary to retain other elements of the industrial/commercial program that do not focus on illicit discharges.

3.5.3 Shift to Targeted Inspections

At the workshop, targeted facility inspections were described as more effective than a routine approach with set frequencies. In fact, 90 percent of pre-workshop questionnaire respondents

suggested that local programs that target specific pollutant sources (e.g., trash from restaurants, wash water from vehicle maintenance yards) are likely more effective than generic industrial and commercial programs. Therefore, participants recommended abandoning the standard annual inspection requirement (e.g., 20 percent of facilities per year such that all facilities are inspected during a five-year permit term) in favor of a risk-based approach, focusing more frequent inspections on sources more likely to discharge pollutants of concern.

Instead of a routine inspection program with set frequencies, a workshop participant described a program in Florida that has **implemented a targeted approach using aerial imagery**. They use Google Maps to assess land use and review aerial photography of industrial and commercial areas for illicit discharges. When potential hotspots are identified, they will conduct fence line and drive-by inspections to validate. If any issues are observed, they then perform an on-site facility inspection to evaluate and document pollutant sources and eliminate illicit discharges through communication with the discharger or a more formal enforcement action.

To support a more targeted inspection approach, workshop participants suggested that permitting authorities provide guidance and examples both of commonly used surveillance approaches and new, emerging methods and tools for reconnaissance and verification. Permittees expressed interest in emerging targeting techniques (e.g., aerial imagery, searches by business type and license status, targeting based on past illicit discharge activity, techniques for identifying non-filers) that can be used to prioritize targeted inspections for detecting illicit discharges or pollutants of concern. Likewise, these efforts can be combined with targeted public participation efforts (e.g., stream cleanups, litter removal, improved signage and public awareness campaigns) so that more comprehensive control strategies are concentrated in particular areas or on particular pollutants of concern. For example, high trash-generating areas can be targeted with more frequent commercial business inspections, public education campaigns, street sweeping, and installation of trash capture devices.

3.6 Improving Programs to Address Public Agency Activities and Municipal Housekeeping

Phase I and II programs are required to take steps to reduce pollutant runoff from municipal facilities and operations. In most communities, street and road maintenance are of greatest focus. Preventative elements include identifying municipal facilities that present an elevated risk of pollution and implementing an appropriate control plan, inspecting and maintaining stormwater infrastructure (e.g., catch basins, storm sewer pipes), and training staff in pollution prevention strategies. Workshop participants generally agreed that BMPs and procedures included in this program area are worthwhile. They indicated that the program could be further enhanced through increased emphasis on asset management, facility targeting, updated guidance, and better training.

3.6.1 Incentivize Asset Management

Seventy-six percent of survey respondents agreed or strongly agreed that requiring more holistic asset management enables tailoring of municipal MCM approaches to best support local asset mixes and issues.

Maintaining stormwater infrastructure is crucial for an effective MS4 program, yet basic tracking and upkeep can represent a significant expense for municipalities. More commonly implemented for wastewater and drinking water, AMPs can be an effective strategy for streamlining operation and maintenance (O&M) activities, supporting asset replacement and upgrade planning, and lowering long-term costs. Workshop participants familiar with the AMP approach indicated that

it is especially useful for planning, cost management, problem targeting, tracking, and reporting.

Participants indicated that additional training and support on how to incorporate asset management in stormwater programs would be very helpful. They recommended establishing a multi-entity workgroup specifically to focus on building AMP training capacity and development resources. Most participants believed permits should incentivize adoption of asset management capability by enabling permittees to show how AMPs address other permit requirements. EPA Region 9 representatives noted that the region now incorporates AMP requirements into MS4 permits it issues as some permittees interested in AMPs have indicated they can only invest in program tools required by the permit.

Images representing various MS4 program elements that could be included in an asset management approach. Photos: PG Environmental

Importantly, some participants envisioned that a broad AMP provision could effectively replace many of the current MCMs. For example, publicly owned facilities, streets, catch basins, outfalls, storm drainage and conveyance systems, parking lots, and permanent stormwater BMPs are all physical assets. AMPs generally include identification, mapping, periodic or strategic inspection, maintenance, and periodic replacement. These activities could be addressed through a holistic AMP requirement rather than as separate MCMs. Stretching this concept further, multiple assets—privately owned industrial and commercial facilities, permanent BMPs, streets, parking lots, green infrastructure, water and transportation infrastructure, and even construction sites—could be viewed as assets that manage stormwater with potential discharges to the MS4 and be embodied within an AMP.

Some participants stressed that creating incentives for expanded AMPs could simplify permits and encourage more cost-effective and impactful efforts by local programs. Additionally, aggregating individual MCM obligations within an AMP framework better aligns with commonly applied municipal operations and funding frameworks.

The **City of San Diego**, California, published its *Watershed Asset Management Plan* in 2013. The strategy was developed to address water quality through both structural (i.e., devices and other physical infrastructure) and non-structural (i.e., activities) approaches. Natural elements, such as receiving waters, are included as assets. The city also classifies public perception and citizen behavior as assets—and requires corresponding funding allocations. *All program elements were designed with direct ties to the city's MS4 permit.*

Given that the implementation of asset management is still relatively new to the stormwater sector, several entities are developing support tools and informational resources, however, more work needs to be done.

- EPA Region 9 has been a strong proponent of asset management. Its recent white paper, *Asset Management Programs for Stormwater and Wastewater Systems: Overcoming Barriers to Development and Implementation* (EPA Region 9, 2017a), identifies critical factors for AMP development and provides several real-world communities' perspectives through case study examples. EPA Region 9 is also planning to provide asset management training in 2018–2019 to build upon the strategies outlined in their publication.

- EPA Headquarters is likewise encouraging the adoption of asset management in stormwater programs as part of its long-term stormwater planning effort.
- University of Maryland's Environmental Finance Center, funded in part by EPA, launched the Municipal Online Stormwater Training (MOST) Center in 2015 to "bridge the gap in needed technical and financial stormwater management resources in the Chesapeake Bay watershed." It offers free online training, including the introductory course, "Asset Management for Stormwater."

3.6.2 Improve Municipal Facility Management/Housekeeping Program Guidance and Capacity

The stormwater sector is rapidly evolving as new information becomes available; however, workshop participants indicated that many program materials dealing with municipal housekeeping have not kept up (with some dating back to the 1990s). Workshop participants recommended establishing a formal mechanism for ensuring that guidance materials remain current. These updated guidance documents could be updated to enable tailoring of municipal housekeeping measures based on AMP provisions, local settings, land uses, and BMP performance. In turn, permits could provide flexibility in how jurisdictions receive credit for implementation activities and spend resources to target pollutants and/or land uses of concern.

Workshop participants indicated that more effective training is also needed to support program staff responsible for performing facility inspections to help maintain performance of BMPs and ensure compliance. Helpful training topics include inspection and maintenance approaches for both traditional structural assets and less conventional assets including green infrastructure. In addition, participants agreed that it would be helpful to highlight strategies that have resulted in accelerated correction of deficiencies for the full array of control practices. To ensure that maintaining or building staff capacity is an ongoing priority for communities, participants recommended finding ways to require and institutionalize regular staff training.

3.6.3 Adjust Focus of Facility Inspections

As municipalities have gained experience in implementing programs to manage stormwater from municipal facilities and assets, it has become evident that some approaches yield greater benefits than others. For example, several participants recommended that some types of facility inspections should be maintained or enhanced (e.g., vehicle maintenance facilities) while other inspections yielded less value after they had been done once or twice (e.g., storm sewer pipe inspections in dispersed residential areas). Several participants requested that permitting rules or guidance should be revised to clarify permitting flexibility to enable local programs to reduce frequency of inspections where they add little value in detecting problems, and targeting inspections in higher-risk areas or on pollutants of most concern.

3.7 Streamlining and Strengthening Local Post-Construction-Related Practices

Phase I and Phase II permittees are both required to address stormwater discharges from new and re-development, though the details of the applicable regulations for each differ somewhat. Some Phase I and Phase II permits include numeric post-construction design standards, and require permittees to adopt a regulatory mechanism to address post-construction runoff from these sources

Photos: PG Environmental

and to ensure adequate long-term O&M of post-construction stormwater control measures. In contrast, other Phase I and Phase II permits are less clear about post-construction control expectations. Phase I federal regulations lack the specificity of the Phase II regulations, and Phase I permits around the country vary widely in how they address post-construction requirements.

Over the past 10 to 15 years, substantial energy has been focused at the national level on emphasizing and improving post-construction stormwater control requirements through development of new permitting approaches and provision of technical guidance and training on green infrastructure and low impact development methods. EPA has issued guidance on post-construction controls, including the *Compendium of MS4 Permitting Approaches*, Part 2: "Post-Construction Standards" (EPA, 2016c). Many MS4 permits now incorporate numeric post-construction control requirements applicable to new/redevelopment projects and, in some cases, to planning for long-term urban retrofitting. These approaches have gained traction as a central component in MS4 permits and associated local programs because in many settings they have been demonstrated to be effective in reducing stormwater runoff volumes and pollutant loading and in delivering collateral benefits such as improved urban amenities.

All California MS4 permits (including the Small MS4 General Permit) have specific numeric design criteria for post-construction BMPs and include hydromodification requirements.

Workshop participants evaluated opportunities to build upon recent improvements in post-construction requirements and practices. While workshop participants generally viewed these recent initiatives as positive, several opportunities to streamline and improve implementation of post-construction controls at the local and national level emerged during discussions.

3.7.1 Compile Relevant Local Requirements in One Place

In Minnesota, many cities have successfully adopted the practice of assembling all stormwater ordinances, design standards, and local regulatory mechanisms into a single guide made available to all builders and project designers.

Municipalities commonly have multiple regulations or requirements that are relevant to stormwater (e.g., drainage and flood control standards, post-construction runoff control requirements), all of which site designers and engineers must consider during project design and review. Workshop participants suggested that permitting authorities and construction industry groups encourage communities to compile all applicable local requirements into a central design/requirements guide. This would help keep requirements clear and accessible early in project planning to ensure that stormwater concerns are addressed in a streamlined manner.

3.7.2 Incorporate Smart Stormwater Design into Municipal Planning Practices

In general, stormwater management (aside from flood prevention) has not been a main consideration for communities as they grew and developed over time, and alternative stormwater control approaches have not traditionally been viewed as methods for improving citizen quality of life. Workshop participants expressed a belief that this trend is changing due to a renewed focus on urban waterways and the advancement of green infrastructure and low impact development (which offer multiple benefits), leading to an increased focus on incorporating stormwater considerations into public projects.

In the workshop session focusing on public outreach and education, participants noted the importance of developing tools to communicate better about the multiple benefits of smart stormwater management in addition to water quality protection. The improvements in public outreach strategies should help ensure that consideration of stormwater management opportunities is integrated early in infrastructure planning processes. Workshop participants suggested that communities should incorporate multi-objective stormwater management considerations into the way a city "does business," folding smart stormwater design into standard city activities. For example, communities should look for potential stormwater system improvements as a matter of routine practice when doing roadway improvements, sidewalk enhancements, and work on other water-related systems (e.g., flood control, drinking water, wastewater).

3.7.3 Create Guidance on Off-site Stormwater Crediting

Due to hydrological, geotechnical, and/or financial constraints, implementing post-construction stormwater management projects at a development site may be infeasible or undesirable. Several workshop participants mentioned that some communities are exploring or have attempted to implement programs to authorize implementation of post-construction controls at alternative locations, usually within the same watershed. These programs normally involve creation of a crediting system through which developers can receive credit for off-site control projects and accountability for permit requirements can be maintained.

Many MS4 permits recognize that on-site controls may be infeasible and authorize off-site controls. However, few local stormwater crediting programs have been successfully implemented to date. Workshop participants suggested that more detailed guidance (with illustrative examples) on how to structure and operate a stormwater crediting program would help communities build more success with off-site controls, reduce program development costs, and receive credit for regional-scale projects. Participants were also interested in developing clearer permitting guidance, as existing MS4 permit provisions are often vague and provide insufficient controls on off-site crediting programs to ensure they operate smoothly and provide adequate accountability. Following the workshop, EPA Region 9 issued a new report, *Off-site Stormwater Crediting: Lessons from Wetland Mitigation*. This report discusses key considerations in implementing stormwater crediting programs and incorporating crediting program provisions in MS4 permits.

3.7.4 Continue to Build Capacity for BMP Maintenance

Ensuring long-term O&M of structural BMPs is vital for various reasons. From a water quality standpoint, structural BMPs (whether traditional gray infrastructure or green infrastructure) must be

maintained to ensure they provide pollutant reductions as designed. Likewise, models used to plan for or demonstrate pollutant reductions for compliance with a TMDL WLA use assumptions that deployed BMPs are functioning effectively (see Section 3.8.3). However, observations from MS4 program inspections across the country continue to identify post-construction BMP O&M as an area of struggle. Some programs do not know the location of each of their BMPs; others have fully mapped and integrated their controls into AMPs. A minority of programs are evaluating their controls' actual effectiveness.

Photo: EPA

Maintenance practices, obligations, and tracking for public and private BMPs vary considerably throughout the country; some programs are implementing comprehensive and effective "real time" maintenance programs while others perform little systemic maintenance. Workshop participants suggested improved guidance incorporating examples of more successful BMP tracking and management approaches is needed for communities to learn how to ensure installed BMPs operate as expected over time.

Several permittee representatives at the workshop brought up the question of whether it is feasible for public entities (MS4 permittees) to ensure proper O&M of private small-scale green infrastructure BMPs as the number of these practices continues to expand. They contended that it was not possible to oversee these practices with the resources typically available to an MS4 permittee, so there should be a size/scale threshold for private green infrastructure BMPs below which an MS4 permittee would not have O&M oversight responsibility. Other participants disagreed, suggesting that MS4 permittees would have ultimate responsibility for water quality outcomes whether BMPs are located on public or private property. Additional guidance on how to establish appropriate thresholds would be needed for permits to better address this type of local resource limitation.

Many post-construction permit provisions are silent or unclear concerning BMP maintenance requirements and lack any ongoing tracking, reporting, or evaluation provisions to help ensure proper maintenance occurs following BMP installation. Some workshop participants indicated that guidance on how to write and implement permit requirements concerning BMP tracking and maintenance would be helpful. A related issue is that following property transfers, new owners either are unaware of ongoing BMP maintenance obligations or have no legal obligation to maintain the BMP. It was noted that the concern about maintenance of BMPs on private land can also be addressed by creating or clarifying local requirements concerning BMP maintenance by land owners both before and after land sales.

WEF and DC Water founded the **National Green Infrastructure Certification Program** in 2016 to set national certification standards for green infrastructure construction, inspection, and maintenance workers.

Workshop participants noted the emergence of green infrastructure certification programs designed to provide training for the design, installation, and maintenance of commonly used stormwater controls. Consensus was reached that these programs are a positive step but that greater visibility, access, and potentially consistency are needed to ensure they are widely used and effective. There are

opportunities to either require or incentivize their use through MS4 permits as a mechanism to address the long-term BMP maintenance challenges.

Workshop participants stressed that capacity building is needed in the MS4 program overall to ensure the efficacy of BMPs (both traditional and green infrastructure) in both private and public domains. It was suggested that a compendium be developed to display the range of practices used for O&M of BMPs, including aspects such as inventories and tracking, construction inspections to ensure proper installation, maintenance inspections, maintenance techniques, tracking mechanisms, and enforcement approaches to correct identified issues.

3.7.5 Continue to Build Capacity for Green Infrastructure Approaches

Green infrastructure continues to gain momentum as a viable option for stormwater treatment and control in many areas of the country and has become increasingly attractive for the additional benefits that it may offer a community (e.g., aesthetics, air quality improvement, increased property values). However, workshop participants believed green infrastructure should not be viewed as a solution for all stormwater-related concerns.

Decentralized green infrastructure practices can lead to a proliferation in the number of BMPs in a community, increasing the challenges associated with inventorying, ensuring proper installation, and ensuring proper O&M of BMPs. Moreover, concerns were raised that when full life-cycle costs are considered in some settings, distributed green infrastructure approaches may be less cost-effective than more traditional control approaches and larger-scale infiltration facilities. Green infrastructure may not be effective in addressing certain pollutants (e.g., trash, some pesticides) that are not generally associated with diffuse runoff. More guidance would help communities evaluate life-cycle costs of green infrastructure and identify settings in which green infrastructure is likely most effective.

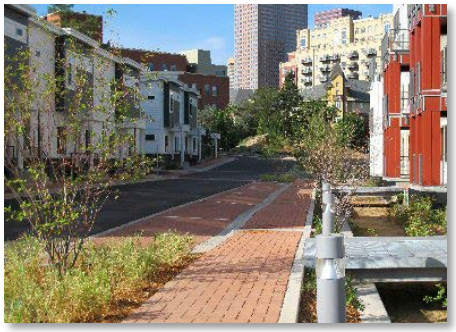

Photo: EPA

With stormwater capture and infiltration being basic tenets of green infrastructure design, workshop participants discussed issues about the actual water balance within urban areas. Participants suggested that additional research needs to be done in different watersheds to explore the impact of too much or too little infiltration on instream flows, groundwater level, and groundwater quality.

Workshop participants suggested that an overall educational platform be developed for all levels of staff interacting with green infrastructure (e.g., permit writers, planners, designers, inspectors) to help build capacity within the program and ensure success into the future. Participants also noted the need for vocational training and certification for green infrastructure workers who construct, inspect, and maintain green infrastructure projects.

3.8 Supporting Water-Quality-Based and TMDL-Based Requirements

The main purpose of municipal stormwater programs is to protect and restore water quality, yet many local programs were slow in the early years of stormwater permitting to take effective action to meet specific water quality goals. Many urban waters remain impaired by elevated pollutant levels

Photo: EPA

coming from polluted runoff (and other sources), and the damaging effects of urban runoff are accelerated by increases in impervious surfaces through urban development.

EPA and states have increasingly emphasized the use of the TMDL process to develop watershed-scale plans to target pollutant sources, slow urban runoff, and plan needed controls. Since the early 2000s, MS4 programs have evolved to begin implementing new approaches to controlling pollutants coming from urban runoff based on TMDLs.

Changing MS4 programs to address TMDLs has led many permitting authorities, permittees, and stakeholders to reevaluate traditional program elements (e.g., MCMs) because the effectiveness of these base program elements in controlling key pollutants and achieving water quality goals has been increasingly questioned over the past 10 years. Several observers suggest that actions by MS4 permittees to address water quality issues through targeted structural BMPs can have impacts that are longer-lasting and more quantifiable than some traditional "base program" activities in the MS4 program.

Some progress has been made in improving water quality outcomes but much remains to be done. Two key obstacles to implementing more effective water-quality-based controls are the difficulty of efficiently controlling pollutant discharges from diffuse sources, and the challenge of adding water-quality-based control strategies to base stormwater programs that are already resource-limited. Participants spent a significant part of the workshop discussing how MS4 programs (and associated permit requirements) can improve efforts to meet water quality goals expressed through TMDLs while adjusting base program approaches to focus on the most effective implementation strategies.

3.8.1 Clarify Water-Quality-Based Approaches and Progression

There is a wide range of practice used across the United States to implement water-quality-based requirements in MS4 permits and the monitoring associated with those requirements. These approaches are described in EPA's 2017 *Compendium of MS4 Permitting Approaches*, Part 3: "Water Quality-Based Requirements." Specifically, many MS4 permits identify relevant TMDLs and WLAs and include associated requirements such as numeric or narrative effluent or receiving water limits, implementation of specific controls and monitoring/modeling approaches, and related plan approval/annual reporting requirements. Implementation strategies have varied widely. Following are a few prominent examples.

- **Chesapeake Bay TMDL implementation** through the Virginia Phase II MS4 permit aims to reduce loadings of nitrogen, phosphorus, and total suspended solids (TSS) to the Bay and uses BMP "expert panels" to identify BMP pollutant removal efficiencies/credits for calculating permittees' progress. Individual jurisdictions have developed TMDL "action plans" that identify steps they will take over time to meet their WLAs and, ultimately, the water quality objectives the TMDLs were designed to achieve.
- The **Los Angeles County MS4 permit** (applicable to 86 co-permittees) includes numeric water-quality-based effluent limits (WQBELs) associated with multiple TMDLs. The permit

provides alternative compliance pathways including one based on implementation of multi-benefit regional projects that retain (infiltrate or capture and reuse) stormwater from the 85th percentile, 24-hour storm event. This permit approach has proven controversial, resulting in ongoing litigation from both environmental groups and several municipalities. Nonetheless, the approach has led to development of an involved modeling process to demonstrate "reasonable assurance" that pollutant reductions will be achieved through implementation of specified BMPs and projects. This "reasonable assurance analysis" method is further described below.

- To help meet the objectives of the Lake Tahoe TMDL, the **Lake Tahoe MS4 permit** requires reductions of discharges of fine sediment particles (FSP; 10 percent), total phosphorus (TP; 7 percent), and total nitrogen (TN; 7 percent) by each co-permittee during the permit term. The co-permittees have developed a quantitative, performance-based estimation and tracking approach called the "Lake Clarity Crediting Program" to guide implementation by individual landowners and document their attainment of TMDL pollutant load reductions.

There are also many jurisdictions across the country whose MS4 permits do not include specific water-quality-based requirements. As participants noted at the workshop, permitting authorities have substantial flexibility concerning incorporation of water-quality-based requirements in MS4 permits. Some permits reference TMDLs and WLAs and require development of an implementation plan following permit issuance but provide little detail about how and when TMDL requirements are to be met. In other cases, TMDLs have not been completed to address impaired waters and the permits establish vague, narrative implementation and adjustment requirements to meet water quality goals. Most workshop participants believed that more work remains to be done in most jurisdictions to improve approaches of MS4 permits and associated local programs to develop and implement effective water-quality-based controls. Participants identified a need for clearer guidance and sharing of successful approaches to assist improvements in permits and program design.

The graphic below presents a general continuum of water quality regulatory conditions and resultant requirements/actions contained in MS4 permits across the country. As one moves to the right, the level of requirements and potential complexity (and cost) of implementation increases.

Water Quality Regulatory Condition	*Water quality standard (WQS) not established*	*WQS established*	*Waterbody impaired (303d listed) but TMDL not completed*	*TMDL completed with stormwater WLAs*	*TMDLs and other watershed priorities exist (co-benefits)*
Water Quality-Based Permit Requirement/ Permittee Actions	*No/limited monitoring required, usually receiving water only*	*Receiving water and (sometimes) outfall monitoring required*	*Targeted pollutant monitoring required and potentially targeted BMPs required*	*Numeric or narrative limits backed by varied implementation terms:* *- specific BMPs* *- implementation plan development* *- control targeting based on modeling/ monitoring analysis*	*More flexible implementation plan requirements supported by enhanced modeling to include co-benefits*

Workshop participants stressed the need to better document and describe available water-quality-based approaches. Specifically, the rationale and progression from no, or limited, water-quality-based monitoring and analysis to enhanced modeling to guide specific long-term implementation planning needs to be better communicated. The applicability, process, objectives, and timelines for these various approaches are not well understood by most stakeholders. The lack of consistent terms, use of jargon, and lack of clear national standards or expectations concerning water-quality-based controls add to the confusion. Participants believed better definition and communication would lead to enhanced understanding and support by citizens, elected officials, MS4 program staff, and permit writers.

3.8.2 Strengthen Incorporation of TMDLs into MS4 Permits

TMDLs have become an increasingly important driver of change in MS4 permits and programs. Across the country there is wide variability in how TMDLs are developed and then subsequently incorporated into MS4 permits; this is documented in a couple of EPA publications. The 2017 *Compendium of MS4 Permitting Approaches,* Part 3: "Water Quality-Based Requirements" (EPA, 2017a) presents examples of various approaches by permitting authorities. An EPA Region 9 document memo, *Helpful Practices for Addressing Point Sources and Implementing TMDLs in NPDES Permits,* discusses the relationships between TMDLs and NPDES permits and identifies permitting practices that facilitate incorporate of TMDLs in permits in workable ways (EPA Region 9, 2015).

Workshop participants expressed a need for sharing lessons learned and creating specific guidance that identifies various options and pathways to incorporating TMDLs into MS4 permits. Workshop participants suggested that this effort should involve EPA, multiple states, and other stormwater-focused organizations (e.g., WEF, NMSA, Association of Clean Water Administrators [ACWA]) and should evaluate options and approaches for incorporating TMDLs and addressing water quality impairments. As for other efforts to improve program standards and guidance mentioned in this report, the results of projects to clarify water-quality-based approaches need to be articulated in a way that enables citizens, elected officials, MS4 program staff, and permit writers to better understand the various approaches, their pros and cons, and their objectives.

Participants noted that the national TMDL program has changed its priorities and is increasingly recognizing that water quality impairments can be addressed through approaches that do not include TMDL development. On one hand, using non-TMDL approaches may afford desirable flexibility in the design of local control strategies. On the other, it can be difficult to translate provisions of non-TMDL pollution management plans into effective and enforceable NPDES permit requirements. Participants recommended that new guidance on incorporating water-quality-based controls in MS4 permits address implementation of both TMDLs and non-TMDL alternatives.

3.8.3 Improve Transparency and Accountability When Using Models

Recent years have seen more modeling to support the identification and selection of stormwater management strategies and to demonstrate permit compliance; however, these approaches are not common across the spectrum of MS4 permits in the United States. This increase has, in part, been driven by the development of MS4 permitting frameworks that allow for this approach (generally termed "reasonable assurance analysis," or RAA) to address water quality protection requirements and restoration of waterbody beneficial uses.

> "From a regulatory perspective, **reasonable assurance** can be interpreted as the demonstration that the implementation of a watershed or stormwater management plan will, in combination with operation of existing system assets and programs, result in sufficient pollutant reductions or reduced stormwater impacts over time to meet TMDL wasteload allocations, WQBELs, or other targets specified in the MS4 permit or identified in the plan" (EPA Region 9, 2017b, p. 6).

When using an RAA approach, communities tend to be very engaged with the regulatory authority to develop the necessary processes, and longer planning horizons for on-the-ground project implementation that allow permittees to prioritize and pursue multi-benefit projects may be appropriate.

In many cases, the development of model-based, long-term planning approaches stemmed from concerns that imposing firm numeric limits with tight compliance timeframes gave MS4 programs insufficient time and flexibility to implement holistic, watershed-scale implementation plans. By committing to providing robust analysis to show the adequacy of long-term control plans in meeting TMDL-based water quality requirements, communities argue, they can focus on implementing specific controls and projects delineated in these plans and be less concerned about accountability for short-term water quality outcomes that are not within their control. Permitting authorities presumably gain from this approach because they obtain longer-term implementation assurances backed by solid modeling or monitoring analysis. This approach can be costly and time-consuming, but may be more cost-effective in the long run than traditional planning and adaptation processes.

During the workshop, there was substantial interest in and concern about this approach. In general, workshop participants identified a need to improve transparency and accountability when using models to predict BMP performance and project long-term needs, and to provide additional information and guidance that can help make model-based approaches more mainstream. There are examples of RAA approaches being used in at least four states (Virginia, California, Washington, and Massachusetts), and in 2017 EPA Region 9 developed a report titled *Developing Reasonable Assurance: A Guide to Performing Model-Based Analysis to Support Municipal Stormwater Program Planning*. This RAA guide discusses various aspects of RAA, including the role of RAA in stormwater management planning, changes in MS4 permits to enable RAA approaches, factors to consider when selecting RAA methods, performing RAAs, and moving from planning to implementation. Importantly, the guide notes the following:

> "…RAA can serve as an analytical tool supporting a range of engineering, asset management, and financial planning activities beyond the stormwater management plan. Linking the RAA with other water management, economic, and financial planning tools, the resulting evolving stormwater program planning framework can support quantitative assessment of the costs and benefits of stormwater projects to inform long-term planning objectives, as well as coupling of stormwater projects with other water resource project opportunities to capitalize on multiple project benefits and improve funding opportunities" (EPA Region 9, 2017b, p. 38).

Though the RAA guide provides a solid foundation, workshop participants identified a need to build on it to more fully articulate the RAA process and associated compliance pathways. This effort would illustrate the range of RAA applications and provide additional guidance to help increase the level of consistency in RAA implementation and the level of confidence that this approach will result in timely compliance.

A caution on the RAA approach is that it can be difficult to include non-treatment BMPs in the analysis. Accounting for benefits of public education, IDDE programs, pollution prevention, and good housekeeping approaches in watershed-scale water quality models is difficult. This challenge tends to lead municipalities to focus the solution on treatment BMPs that may or may not have the highest return on investment.

3.8.4 Increase Understanding of Multiple Benefit Projects

Photo: EPA

Capital limitations can represent a significant constraint for MS4 programs, and pursuing projects that deliver multiple benefits is one effective strategy for gaining broader stakeholder buy-in and, potentially, accessing more funding. For example, in addition to water quality improvements, green infrastructure installations can yield other tangible benefits that are attractive to a community (e.g., increased property value), increasing the political capital of local stormwater funding initiatives. While workshop participants recognized that multi-benefit projects and programs are appealing, they also noted that many state and local program managers are relatively unfamiliar with methods for incorporating multi-benefit planning perspectives into program operations. Permitting approaches designed to incentivize holistic multi-benefit program implementation are also poorly understood.

Greater cross-program coordination can help municipalities identify the projects that represent the most efficient use of resources and maximize positive environmental outcomes (e.g., water quality, water supply augmentation, reduction in flood risk, and improvements in infrastructure and amenities). AMPs can also be of great value in assisting cross-program coordination and in linking program planning with financing options. Workshop participants indicated that there needs to be greater understanding and awareness of a triple-bottom-line approach that evaluates the environmental, financial, and social benefits and difficulties of different stormwater project options.

Additional guidance would help both permitting agencies and local programs build capacity to pursue integrated urban water management approaches through stormwater program operations. It will be important to increase understanding of the need to consider life-cycle costs, including long-term O&M costs, in selecting among different management approaches. Engaging staff from across departments (e.g., road project managers, parks personnel) about the benefits of integrating green infrastructure and other multi-benefit approaches will be especially critical for securing buy-in, since other departments may bear responsibility for long-term maintenance. Workshop participants suggested that an important first step is compiling existing information and assessing resources that can help build capacity to pursue multi-benefit approaches (e.g., case studies).

3.8.5 Create Guidance on Stream Restoration Crediting

As discussed in Section 3.7.3, some communities are pursuing off-site stormwater crediting programs to help enable developers to meet post-construction requirements through off-site projects. Similarly, some communities are developing a variation on stormwater control crediting through which public and private landowners could satisfy pollution control requirements by financing stream restoration (which could increase the capacity of streams to assimilate pollutants

and support their designated uses). Stream restoration efforts and demand for "credits" for those efforts in lieu of on-site water quality treatment has become an issue of increased interest among urban stakeholders.

Photo: PG Environmental

Among workshop participants, there was some difference in opinion on whether stream restoration should be eligible as a means for a development/re-development project to satisfy water quality treatment requirements. One permittee representative at the workshop indicated their jurisdiction was trying to create a program to allow some credit for pollutant reduction through stream restoration. Another permittee representative indicated that stream restoration should be used as a retrofit approach, but developers should take care of water quality treatment issues on site for new and re-development projects.

During the workshop, it was recognized that determining the proper translators between pollutant loading or runoff reduction requirements and stream restoration measures would be difficult. There was some agreement among workshop participants that the best place to address stream restoration accounting, if and where appropriate, as a means of addressing a water quality impairment, is within the TMDL program. Nonetheless, participants suggested that guidance on restoration crediting programs would be helpful to ensure the equitability and legal, financial, managerial, and technical integrity of the approaches employed.

4 Opportunities and Next Steps

EPA Region 9, in partnership with the State of California and EPA Headquarters, convened the *Improving Stormwater Permitting and Program Implementation Approaches* workshop to catalyze change in how MS4 permits are written and stormwater programs implemented. Specifically, they seek to improve water quality by optimizing the use of scarce permitting and program implementation resources. Through facilitated dialogues, participants helped to identify permit and program practices that are viewed as less productive and highlighted more impactful, innovative approaches.

Photo: PG Environmental

> "While working at the watershed scale encompasses a broad range of partners, better cooperation is needed even within the water sector. Many communities are working to improve water quality under multiple Clean Water Act programs" (WEF, 2015, p. 23).

Key findings from this workshop and a follow-on workshop about stormwater program monitoring, evaluation, tracking, and reporting provisions will be broadly shared among EPA, state permitting agencies, local MS4 permitting agencies, permittee and research associations, and associated consultants and stakeholders. EPA anticipates working with these parties to conduct further program evaluations and identify specific actions for implementation. Collectively, these recommendations provide a strong foundation for improving programs and permits and, ultimately, water quality.

Workshop participants recommended multiple specific actions and strategies to address the issues and opportunities discussed at the workshop. The following table identifies these actions and strategies within relevant activity categories, and identifies organizations that may be best suited to carry out these recommendations.

Strategy/Action	Key Organizations	
REGULATION REVISION		
• Phase I and II requirement consolidation • MS4 implementation requirements • Alignment of MS4 and industrial stormwater permit requirements	☑ **ACWA** ☑ **Businesses** ☑ **Citizen groups** ☐ Consultants ☑ **EPA**	☑ **NMSA** ☑ **Permittee groups** ☑ **States** ☐ Universities ☐ WEF
POLICY GUIDANCE		
• MS4 program expectations • MCM flexibility • Compliance timeframes and schedules • Compliance evaluation criteria	☑ **ACWA** ☐ Businesses ☑ **Citizen groups** ☐ Consultants ☑ **EPA**	☑ **NMSA** ☑ **Permittee groups** ☑ **States** ☐ Universities ☑ **WEF**
TECHNICAL GUIDANCE		
• BMP performance and selection	☐ ACWA	☑ **NMSA**

• Water quality-based approaches • Monitoring design • Public outreach effectiveness • Bacteria analysis/control strategies	☐ Businesses ☐ Citizen groups ☑ **Consultants** ☑ **EPA**	☑ **Permittee groups** ☐ States ☐ Universities ☑ **WEF**
OPERATIONS GUIDANCE		
• Asset management planning • Long-term planning approaches • Finance planning • Stormwater and restoration crediting options	☑ **ACWA** ☐ Businesses ☐ Citizen groups ☐ Consultants ☑ **EPA**	☑ **NMSA** ☑ **Permittee groups** ☑ **States** ☐ Universities ☑ **WEF**
CASE STUDIES/BEST PRACTICES		
• MCM flexibilities • Water-quality-based control planning • True source control methods • Bacteria detection and control strategies • Post-construction streamlining • Multi-benefit approaches	☑ **ACWA** ☐ Businesses ☐ Citizen groups ☑ **Consultants** ☑ **EPA**	☑ **NMSA** ☑ **Permittee groups** ☑ **States** ☐ Universities ☑ **WEF**
RESEARCH		
• BMP effectiveness/costs/applicability • Public outreach methods • Multi-benefit management approaches	☐ ACWA ☐ Businesses ☐ Citizen groups ☑ **Consultants** ☐ EPA	☐ NMSA ☐ Permittee groups ☐ States ☑ **Universities** ☑ **WEF**
ADVOCACY		
• Program funding and utility formation • Cross-program coordination/governance alignment • True source control approaches • Multi-benefit management approaches	☑ **ACWA** ☑ **Businesses** ☑ **Citizen groups** ☐ Consultants ☐ EPA	☑ **NMSA** ☑ **Permittee groups** ☑ **States** ☐ Universities ☑ **WEF**
TRAINING		
• Funding options and outreach methods • Asset management planning • MCM targeting and flexibility • Water-quality-based approaches • BMP siting, tracking, and maintenance • Stormwater monitoring and assessment	☑ **ACWA** ☐ Businesses ☐ Citizen groups ☑ **Consultants** ☑ **EPA**	☑ **NMSA** ☑ **Permittee groups** ☑ **States** ☐ Universities ☑ **WEF**

REFERENCES

- American Society of Civil Engineers. (2017). *2017 infrastructure report card: A comprehensive assessment of America's infrastructure*. Retrieved from URL: https://www.infrastructurereportcard.org/
- Campbell, C. W., Dymond, R., Key, K. & Dritschel, A. (2017). *Western Kentucky University Stormwater Utility Survey 2017*. Retrieved from URL: https://www.wku.edu/seas/undergradprogramdescription/stormwaterutilitysurvey.php
- EPA (U.S. Environmental Protection Agency). (2017a). *Compendium of MS4 permitting approaches part 3: Water quality-based requirements*. (EPA Publication No. 830-S-17-001).
- EPA. (2017b). Stormwater discharges from municipal sources. Webpage: "NPDES Stormwater Program," linked from "National Pollutant Discharge Elimination System (NPDES)" at epa.gov. US EPA, Office of Water. Retrieved from URL: https://www.epa.gov/npdes/stormwater-discharges-municipal-sources
- EPA. (2016a). *Community solutions for stormwater management: A guide for voluntary long-term planning*, linked from "Green Infrastructure" at epa.gov. US EPA, Office of Water. Retrieved from URL: https://www.epa.gov/green-infrastructure/community-solutions-stormwater-management-guide-voluntary-long-term-planning
- EPA. (2016b). *Compendium of MS4 permitting approaches part 1: Six minimum control measures.* (EPA Publication No. EPA-810-U-16-001).
- EPA. (2016c). *Compendium of MS4 permitting approaches part 2: Post construction standards.* (EPA Publication No. EPA-810-R-16-017).
- EPA. (2014). *Post-construction performance standards & water quality-based requirements: A compendium of permitting approaches.* (EPA Publication No. 833-R-14-003).
- EPA. (2010). *MS4 permit improvement guide.* (EPA Publication No. 833-R-10-001).
- EPA. (2007). *MS4 program evaluation guidance.* (EPA Publication No. 833-R-07-003).
- EPA. (2005). Stormwater Phase II final rule: Small MS4 stormwater program overview. (EPA Publication No. 833-F-00-002).
- EPA Region 9. (2018). *Off-site stormwater crediting: Lessons from wetland mitigation.*
- EPA Region 9. (2017a). *Asset management programs for stormwater and wastewater systems: Overcoming barriers to development and implementation*, linked from "Sustainable Water Infrastructure" at epa.gov. US EPA, Office of Water. Retrieved from URL: https://www.epa.gov/sustainable-water-infrastructure/asset-management-programs-stormwater-and-wastewater-systems
- EPA Region 9. (2017b). *Developing reasonable assurance: A guide to performing model-based analysis to support municipal stormwater program planning*, linked from "NPDES Wastewater & Stormwater Permits" at.epa.gov/region9. US EPA, Pacific Southwest, Region 9. Retrieved from URL: https://www3.epa.gov/region9/water/npdes/stormwater.html
- EPA Region 9. (2015). *Helpful practices for addressing point sources and implementing TMDLs in NPDES permits*, linked from "NPDES Wastewater & Stormwater Permits" at.epa.gov/region9. US EPA, Pacific Southwest, Region 9. Retrieved from URL: https://www.epa.gov/npdes/helpful-practices-addressing-point-sources-and-implementing-tmdls-npdes-permits

- Fiorino, D. J. (2006). *The new environmental regulation*. Cambridge, MA: MIT Press.
- National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System General Permit Remand Rule, 40 CFR 122 (2016). Volume 81, No. 237.
- NPDES—Regulations for Revision of the Water Pollution Control Program Addressing Storm Water Discharges, 40 CFR 9, 122, 123, & 124 (1999). Volume 64, No. 235.
- NRC (National Research Council). (2009). *Urban stormwater management in the United States*. National Academies Press, Washington, D.C.
- New York City Department of Environmental Protection. (2017). *Innovative & integrated stormwater management*, linked from "Resources" at waterrf.org. The Water Research Foundation. Retrieved from URL: http://www.waterrf.org/resources/Pages/NYC-Stormwater-Report.aspx
- Reese, A. J. (2016). Ten emerging stormwater best management practices. *Stormwater Magazine, 17*(6), 8-17.
- Reese, A. J. (2001). Stormwater paradigms. *Forester Daily News*. Retrieved from URL: https://foresternetwork.com/daily/water/stormwater-management/stormwater-paradigms/
- WEF (Water Environment Federation). (2016). Moving stormwater public education to prime time. *The Stormwater Report*. Retrieved from URL: http://stormwater.wef.org/2016/07/moving-stormwater-public-education-prime-time/
- WEF. (2015). Rainfall to results: The future of stormwater. *The Stormwater Institute*. Retrieved from URL: http://wefstormwaterinstitute.org/rainfall-to-results/

APPENDIX A: WORKSHOP ATTENDEES

Name	Organization	Location
Randy Bartlett	Fairfax County	Fairfax, VA
Ellen Blake	EPA Region 9	San Francisco, CA
Eugene Bromley	EPA Region 9	San Francisco, CA
Geoff Brosseau	California Stormwater Quality Association	Menlo Park, CA
Sean Bothwell	California Coastkeeper Alliance	San Francisco, CA
Seth Brown	Water Environment Federation; Storm and Stream	Alexandria, VA
Steve Carter	Paradigm H2O	San Diego, CA
Chris Crompton	County of Orange	Santa Ana, CA
Matt Fabry	San Mateo County	Redwood City, CA
Steve Fleischli	Natural Resources Defense Council	Santa Monica, CA
Holly Galavotti	EPA Headquarters	Washington, DC
Wes Ganter	PG Environmental	Golden, CO
Greg Gholson	EPA Region 9	San Francisco, CA
Christopher Henninger	Arizona Department of Environmental Quality	Phoenix, AZ
Bobby Jacobsen	PG Environmental	Golden, CO
Drew Kleis	City of San Diego	San Diego, CA
Peter Kozelka	EPA Region 9	San Francisco, CA
Keith Lichten	San Francisco Bay Regional Water Quality Control Board	Oakland, CA
Thomas Mumley	San Francisco Bay Regional Water Quality Control Board	Oakland, CA
Thelma Murphy	EPA Region 1	Boston, MA
Randy Neprash	National Municipal Stormwater Alliance; Minnesota Cities Stormwater Coalition; Stantec, Inc.	St. Paul, MN
Mark Nuhfer	EPA Region 4	Atlanta, GA
Nell Green Nylen	University of California, Berkeley	Berkeley, CA
Jeff Odefey	American Rivers	Nevada City, CA
Renee Purdy	Los Angeles Regional Water Quality Control Board	Los Angeles, CA
Dominic Rocques	Central Coast Regional Water Quality Control Board	San Luis Obispo, CA
Abbey Stockwell	Washington Department of Ecology	Olympia, WA
Scott Taylor	National Municipal Stormwater Alliance; Michael Baker International	Carlsbad, CA
Robert van den Akker	City of Buckeye	Buckeye, AZ

APPENDIX B: WORKSHOP AGENDA

Overview

This first workshop will focus on the evolution of stormwater programs and permitting requirements, including minimum control measures, industrial/construction program requirements, and water quality based control requirements. A follow-on workshop is being planned to assess stormwater program monitoring, evaluation, tracking, and reporting provisions. Workshop feedback will be synthesized with other existing research to produce a white paper discussing opportunities to strengthen MS4 permits and implementation programs.

Structure

Throughout the workshop, participants will be encouraged to consider whether and how existing MS4 program requirements, including but not limited to minimum control measures (MCMs), continue to add value and to identify ways to improve program effectiveness. To enable these discussions, each session will follow the same general structure:

- ☐ **Conversation starter**. A guest speaker will provide a 5-10 minute overview, outlining the regulatory context, summarizing evolution over time, or sharing a brief example case study.
- ☐ **Hypotheses review**. Thank you for responding to the pre-meeting survey! We will summarize survey responses to help identify the degree of agreement or disagreement concerning key lessons learned and improvement opportunities.
- ☐ **Discussion.** The facilitator will then lead in-depth group discussion. For each permit element, we will consider 3 basic questions:
  1. How effective has this program element been in improving water quality and achieving other program objectives?
  2. How can implementation of this program element be improved in the future?
  3. How can permits be improved to facilitate improvement in how this element is implemented?
- ☐ **Findings/Recommendations**. Each session will be focused to solicit participant ideas concerning important findings and specific actions to strengthen and improve the corresponding MS4 program/permit element. The workshop will conclude with a recap in an effort to identify areas of agreement and disagreement and issues needing further evaluation before adjourning. The work we do at the workshop will inform preparation of a paper that will summarize our work and hopefully help guide future actions to help improve MS4 permits and programs in the future.

Agenda

TUESDAY, DECEMBER 5, 2017

9:00-9:45am	**Welcome and Overview of Workshop Agenda**
	Dave Smith, EPA Region 9 and Wes Ganter, PG Environmental ☐ Welcome ☐ Introductions ☐ Review of Workshop Purpose and Agenda
9:45-10:45 am	**Session 1: Learning from Program Evolution Over Time**
Conversation Starter: Tom Mumley, San Francisco Bay Regional Water Quality Control Board	
10:45-11:00 am	**Break**
11:00-11:45am	**Session 2: Building Program Capacity**
Conversation Starter: Randy Bartlett, Fairfax County, VA	
11:45-12:30	**Session 3 Building Multi-Objective Vision**
Conversation Starter: Drew Kleis, City of San Diego	
12:30-1:30pm	**Lunch**
1:30-2:30 pm	**Session 4: Public Education, Outreach, and Involvement**
Conversation Starter: Matt Fabry, San Mateo County	
2:30-3:15pm	**Session 5: Illicit Discharge Detection and Elimination**
Conversation Starter: Thelma Murphy, EPA Region 1	
3:15-3:30 pm	**Break**
3:30-4:15pm	**Session 6: Industrial/Commercial Program Requirements**
Conversation Starter: Robert Van Den Akker, Buckeye, AZ	
4:15-4:45	**Review of Day 1 and Initial Synthesis**

WEDNESDAY, DECEMBER 6, 2017

8:30-8:45	**Reset and Chart Day 2**
	Wes Ganter, PG Environmental
8:45-9:45 am	**Session 7: Municipal Operations and Maintenance Programs**
Conversation Starter: Chris Henninger, Arizona Department of Environmental Quality	
9:45-10:00 am	**Break**
10:00-11:00 am	**Session 8: New/Redevelopment and Post-Construction Requirements**
Conversation Starter: Randy Neprash, NMSA, MCSC, and Stantec	
11:00-12:00	**Session 9: Water Quality Based & TMDL Based Requirements**
Conversation Starter: Renee Purdy, Los Angeles Regional Water Resources Control Board	
12:00-1:00	**Lunch**
1:00-2:00 pm	**Session 10: Alternative Approaches to Achieving Water Quality Based Requirements**
Conversation Starter: Steve Carter, Paradigm Environmental	
2:00-4:00pm	**Session 11: Reflection, Synthesis, and Wrap Up**
☐ Identify areas of agreement, disagreement, or warranting more exploration. ☐ Review and fine tune findings and potential actions. ☐ Setting the stage for 2nd workshop (monitoring and effectiveness) (A break will be provided during this Session)	
4:00-4:30pm	**Meeting Evaluation and Closing**

APPENDIX C: PRE-WORKSHOP QUESTIONNAIRE RESULTS

1. The MS4 permits and programs have multiple elements or components. We have listed some of these components below. Assuming it is possible to make meaningful improvements for each of these components, how would you rate the potential for significant improvement (for cost-effective positive environmental outcomes) for each component?

	Significant potential for improvement	Some potential	Little potential	No potential	No opinion or insufficient knowledge	TOTAL	Significant or Some Potential	Little or No Potential
Public Education & Outreach	9	10	10	0	0	29	66%	34%
Illicit Discharge Detection & Elimination (IDDE)	6	16	7	0	0	29	76%	24%
Industrial/Commercial Programs	8	17	3	0	1	29	86%	10%
Municipal Operations & Maintenance	6	16	7	0	0	29	76%	24%
New/Redevelopment & Post-construction Controls	16	10	3	0	0	29	90%	10%
Water Quality-based & TMDL-based Permit Requirements	19	9	1	0	0	29	97%	3%
Monitoring & Evaluation	21	7	1	0	0	29	97%	3%
BMP Tracking & Reporting	12	11	6	0	0	29	79%	21%
Program Technical Assistance & Guidance for Permittees	16	9	4	0	0	29	86%	14%

2. What are the key elements of program effectiveness? (Actual responses; not edited)

- Permits allow stormwater management programs to be tailored to watershed-specific characteristics and pollutant sources and to be flexible to address emerging issues; implementation actions are informed by an up-front analysis that links them with desired water quality outcomes; and monitoring and tracking inform adaptive management. Permits allow stormwater management programs to be tailored to watershed-specific characteristics and pollutant sources and to be flexible to address emerging issues; implementation actions are informed by an up-front analysis that links them with desired water quality outcomes; and monitoring and tracking inform adaptive management.
- Greater emphasis on what CASQA calls true source control (pollution prevention); including TSS reduction and runoff reduction could make stormwater quality programs much more effective.
- Tangible water quality improvements or stabilization.

- Clearly established goals with corresponding performance metrics; effective and accurate data documentation; and periodic and consistent review/analysis of data. A lot of MS4 program requirements tend to be documentation of the completion of activities, not necessarily the evaluation of how effective those activities were to achieve a certain goal. The "WHY" is often missed in this process. This is an area for significant improvement to tie more to clear environmental, economic, and social "wins."
- Cost-effectively comply with clear, specific, and measurable permit requirements to (1) reduce pollutant loads in stormwater, (2) reduce discharges of pollutants to water bodies, (3) improve water quality in receiving waters, (3) reduce the quantity of stormwater discharged into water bodies (and related erosion / stream alteration), and (4) minimize flooding of urban areas. All of the elements/components listed in Question 1 are critical to achieving these goals.
- Clear identification of expectations regarding actions to be completed, or a process for developing and implementing actions, that addresses associated water quality problems, combined with a tracking and reporting mechanism and a process for continuous improvement/reflection about whether the program is thinking about and doing the right thing.
- Know the relative water quality value/benefit (e.g., pollution prevention, pollutant load reduction) of actions (i.e., BMPs) with consideration of costs, doability, and acceptability. Set performance measures (quantitative where possible or at least semi-quantitative) for categorical (program component) actions. Set realistic permit term performance measures for water quality drivers. Establish user-friendly action tracking mechanism: easy in, easy out.
- Measurable achievement of performance benchmarks or environmental outcomes.
- Need quantifiable metrics that can be tracked. Would be helpful to have common metrics for all permitees of a single permit.
- Measurable goals that are related to water quality, not widget counting that demonstrates a program was implemented. An effective program has the shortest distance between regulation and water quality.
- Short, clear permits with easy to understand compliance obligations. Monitoring to determine compliance with the permit terms, including WQSs. Enforceable permit obligations. Minimal but necessary data reporting to ensure permittees are held accountable.
- Measureable water quality improvements directly attributable to MS4 program activities.
- The key elements of program effectiveness are measurable reductions in stormwater pollutants reaching waterways, measurable improvements in sources control, and greatly improved understanding of stormwater pollution on the part of the public and elected officials.
- Putting available resources toward the most cost-effective activity that will result in the greatest environmental benefit.

- Pounds of pollutant removed/$$ spent; (2) were water quality goals clearly spelled out; (3) were water quality goals achieved and verified by monitoring/modelling; and (4) consideration of non-water quality benefits, recreation, habitat, and water supply.
- Having a designated permit coordinator/project manager staff in the MS4 with at least 50% or more of their time designated to stormwater compliance. Knowledgeable staff that have time to look at the compliance issues. Having buy-in from the top -- municipal manager on down and also from elected officials -- that the compliance activities are required. Regulatory authority and management buy-in to use that authority. Having a permitter that knows what is needed for permit compliance and for surface water quality protection and communicates that with their permittees, including providing a list of BMPs that are specific to the region. Having a permitter/permittee open forum for communication.
- Ability to comply with permits, ability to optimize use of urban stormwater, creation of stable resources and program capacity, integration of stormwater program with other water infrastructure programs, and capacity to deliver desired service levels in cost-efficient manner.
- Funding/resources and political will/support.
- We need to start looking at the receiving waters rather than the current blizzard of proxies that are expensive and can be confounding.
- Program effectiveness includes defined expectations, quantifiable end points, and ability to adapt based on new information.
- Good data; realistic, well-crafted study questions.
- Quantifiable metrics; clear time frames.
- The implementation requirements need to add value. It seems to me that there are many reporting requirements that add cost without providing real water quality benefits.
- It's a Clean Water Act program and should be about effectiveness in terms of water quality standards. Do MS4 discharges cause or contribute to exceedances of standards?
- Clarity. Enforceability. Linkage to water quality outcomes.
- Better understanding costs and effectiveness.

3. Have Programs and Permits Adequately Evolved To Address New Challenges?

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	TOTAL	Strongly Agree or Agree	Strongly Disagree or Disagree
We should continue on the current course of MS4 program improvement based on iterative implementation and adaptation of MCMs and management practices to the MEP. In some places, we just need to do a better job under the existing program.	5	7	2	12	3	29	41%	52%
Permitting based on implementation of minimum control measures and adaptive management has not been effective enough; new permitting and program implementation approaches are needed.	9	13	1	5	1	29	76%	21%
Some MCMs and other program elements should be tailored and scaled to emphasize productive activities and deemphasize less productive activities.	14	15	0	0	0	29	100%	0%
Many permit provisions have been insufficiently clear and enforceable; future permits need to include clearer, more measurable requirements.	13	10	3	3	0	29	79%	10%
It is more difficult to implement specific requirements (e.g. localized water quality issues) in general MS4 permits than in individual permits.	7	7	9	4	2	29	48%	21%
Requirements for larger (Phase 1) and smaller (Phase 2) communities should converge over time. In most cases, the Phase 2 permit requirements should be the consistent "floor" for the Phase I permits.	8	15	3	3	0	29	79%	10%
The needs and capabilities of Phase 1 and Phase 2 communities are fundamentally different and should have different permit requirements.	2	5	1	17	4	29	24%	72%

4. Developing Viable Stormwater Program Capacity.

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	TOTAL	Strongly Agree or Agree	Strongly Disagree or Disagree
Many stormwater programs lack sufficient funding and program implementation capacity.	24	5	0	0	0	29	100%	0%
The entire MS4 program would benefit from having EPA and States provide stronger technical/managerial/financial guidance, assistance, model ordinances/materials and oversight to support successful local MS4 program development.	12	10	3	3	1	29	76%	14%
To be fully effective, local stormwater programs need to invest in sound long-term planning incorporating asset management and funding plans.	22	7	0	0	0	29	100%	0%
Permits should be written to better assist and incentivize development of necessary local program capacity.	13	8	4	3	1	29	72%	14%
Substantial changes in requirements from permit to permit impedes development of stable programs.	8	7	6	8	0	29	52%	28%
Community financial capability and financing efforts should be considered in establishing permit implementation timeframes.	11	12	3	2	1	29	79%	10%
There should be a national initiative to promote the implementation of stormwater utilities.	12	9	6	1	1	29	72%	7%

5. Enabling a Broader Program Vision.

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	TOTAL	Strongly Agree or Agree	Strongly Disagree or Disagree
There is increasing interest in building programs that address water quality and other urban stormwater management goals (supply augmentation, flood control, green infrastructure, green streets, etc).	15	11	2	1	0	29	90%	3%
Additional guidance and technical assistance will be needed to help local programs build programs that address multiple objectives beyond water quality protection.	14	12	2	0	1	29	90%	3%
Permits should be improved to better support innovative approaches by incentivizing multi-objective program planning, enabling risk-sharing, and establishing clearer adaptation frameworks.	15	7	6	1	0	29	76%	3%
We should not expect too much from the MS4 permitting program. We should recognize the limits of water quality permitting and rely on other methods and programs to achieve some of the broader water quality goals.	2	4	7	12	4	29	21%	55%
Water quality based permitting is essential for municipal stormwater programs to improve and for urban water quality goals to be met.	16	7	3	2	1	29	79%	10%

6. Making Public Outreach and Involvement Work For The Program.

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	TOTAL	Strongly Agree or Agree	Strongly Disagree or Disagree
Broad public education/outreach efforts have had limited effectiveness.	8	13	2	6	0	29	72%	21%
More targeted public outreach and involvement will more effectively change key behaviors (e.g., trash control).	5	16	6	2	0	29	72%	7%
More targeted public outreach and involvement will more effectively build needed support for program funding and capacity building.	9	15	4	1	0	29	83%	3%
Providing meaningful opportunities for public involvement in program design assists in building public support and perceived program legitimacy.	9	14	3	3	0	29	79%	10%
One of the goals of MS4 public education has to be to reinforce local knowledge and understanding that is sufficient to support local compliance.	7	12	8	2	0	29	66%	7%

7. Tailoring IDDE to Fit Local Needs.

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	TOTAL	Strongly Agree or Agree	Strongly Disagree or Disagree
IDDE programs have been effective in identifying non-stormwater sources in industrial areas and in addressing household lateral issues.	0	15	11	3	0	29	52%	10%
IDDE efforts are less effective in addressing non-stormwater sources in areas with fewer industrial/commercial land uses.	2	9	13	4	1	29	38%	17%
IDDE efforts are less effective after initial system surveillance efforts are complete.	3	9	10	6	1	29	41%	24%
Some common elements of IDDE programs should be retained (e.g., system mapping, public complaint hotlines) even if system surveillance is reduced.	13	13	3	0	0	29	90%	0%

8. Tailoring Industrial/Commercial Programs and Aligning with Industrial Permits.

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	TOTAL	Strongly Agree or Agree	Strongly Disagree or Disagree
Some common elements of industrial/commercial programs (e.g. routine business inspections) have had limited utility for stormwater quality protection.	1	7	11	10	0	29	28%	34%
Relationships between industrial stormwater permit requirements and MS4 program requirements are often unclear and should be clarified in future permitting actions.	8	13	3	5	0	29	72%	17%
Local programs that target specific pollutant sources (e.g. trash from restaurants or metals from parking lots) are likely more effective than generic industrial/commercial programs.	7	19	2	1	0	29	90%	3%
Program evaluation approaches should be revamped to better evaluate effectiveness of local industrial and commercial programs.	6	16	6	1	0	29	76%	3%
Having the MS4 permittees take on industrial site compliance makes sense for Phase 1 permittees but not Phase 2 permittees.	1	3	3	16	6	29	14%	76%
Both Phase 1 and Phase 2 permittees should be responsible to assessing industrial site compliance.	6	11	6	4	2	29	59%	21%

9. Maintaining Solid Municipal Housekeeping That Adds Value.

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	TOTAL	Strongly Agree or Agree	Strongly Disagree or Disagree
Effectiveness of municipal housekeeping measures varies depending upon local settings and land uses (e.g. more effective where streets and municipal yards are significant pollutant sources).	4	19	4	2	0	29	79%	7%
This MCM should be reduced in scope (e.g., less frequent inspections and street sweeping) where shown to provide little water quality improvement.	9	13	3	4	0	29	76%	14%
Requiring more holistic asset management approaches facilitates tailoring of municipal MCM approaches to best support local asset mixes and issues.	12	10	7	0	0	29	76%	0%
Implementation of a more robust, standardized evaluation process would improve ability to verify effectiveness of municipal housekeeping measures.	4	12	13	0	0	29	55%	0%

10. New/Redevelopment and Post Construction.

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	TOTAL	Strongly Agree or Agree	Strongly Disagree or Disagree
Surrogate control measures (e.g., flow/rainfall retention and infiltration) are promising as they are easier to require, implement, and evaluate than stormwater quality responses.	8	15	4	2	0	29	79%	7%
New/redevelopment requirements are unlikely to yield substantial water quality improvements in fully built-out areas unless comprehensive retrofit plans are implemented.	14	11	0	1	3	29	86%	14%
Offsite crediting approaches are promising and should be encouraged.	8	12	6	2	1	29	69%	10%
Permitting language concerning offsite crediting programs should contain clearer program design requirements to ensure crediting programs operate effectively over the long term.	10	13	6	0	0	29	79%	0%
Post construction O&M requirements need to be more clearly and specifically expressed in permits.	7	14	4	4	0	29	72%	14%

11. Targeting Stormwater Controls To Remedy Water Quality Impairments.

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	TOTAL	Strongly Agree or Agree	Strongly Disagree or Disagree
There is increasing recognition of the need to better address specific water quality issues and TMDL implementation needs in MS4 permits.	11	12	2	2	2	29	79%	14%
It has been difficult to interpret many TMDL stormwater allocations in establishing workable MS4 permit limitations.	10	15	2	1	1	29	86%	7%
Permitting authorities and local programs need assistance in identifying methods to establish clearer, more reliable linkages between program actions and water quality outcomes.	12	14	2	1	0	29	90%	3%
Receiving water and end-of-pipe limitations alone have been ineffective in facilitating and showing effectiveness of stormwater management practice implementation.	8	10	7	3	1	29	62%	14%

12. Improving Accountability of BMP-Based Approaches to Water Quality Attainment.

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	TOTAL	Strongly Agree or Agree	Strongly Disagree or Disagree
Implementation of action based requirements (e.g. BMP implementation) to meet water quality requirements may be easier to evaluate than outcome-based measures (e.g., receiving water limits).	10	13	5	0	1	29	79%	3%
Establishing reliable cause-effect relationships between control strategies and water quality goals is challenging and may require difficult modelling or other analysis.	9	16	3	1	0	29	86%	3%
Robust modeling and planning frameworks can facilitate consideration of both water quality and non-water quality goals and constraints and support holistic program planning.	14	13	2	0	0	29	93%	0%
Alternative compliance approaches should provide for ongoing monitoring and evaluation to evaluate and verify model accuracy and control effectiveness.	11	13	4	0	1	29	83%	3%

13. Improving Monitoring, Evaluation, Tracking, and Reporting.

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	TOTAL	Strongly Agree or Agree	Strongly Disagree or Disagree
Monitoring requirements should be revised to make use of improved monitoring design and technology approaches.	14	13	1	1	0	29	93%	3%
Program evaluation would be improved if there were greater focus on program activity and practice tracking and evaluation to complement water monitoring.	7	9	8	5	0	29	55%	17%
Programs should develop asset management programs that enable real-time tracking and analysis of system condition and maintenance needs.	14	7	7	1	0	29	72%	3%
Reporting requirements should be revamped to reduce "paper" reporting and move toward electronic reporting of quantifiable program activity and water quality metrics.	15	11	3	0	0	29	90%	0%
Requiring every Phase 2 MS4 permittee to monitor is not a wise allocation of limited local resources that are better applied to local program implementation.	5	9	5	8	2	29	48%	34%
Phase 2 MS4 permittees should be expected to conduct monitoring and evaluation to assist in evaluating program effectiveness and permit compliance.	2	15	5	3	4	29	59%	24%
There is significant uncertainty associated with stormwater monitoring. There should be a national initiative to apply the known uncertainty quantification and analytic techniques to stormwater monitoring.	8	8	10	1	2	29	55%	10%

14. What are the key areas in which MS4 permits and programs can be improved in the future (please feel free to elaborate on issues/topics addressed above and/or to include issues/topic areas not addressed above). (Actual responses; not edited)

- Greater flexibility to tailor "traditional" stormwater program elements within permit requirements to address local issues; creating a stronger linkage between water quality drivers and program actions; improving decision-making through informative monitoring and evaluation and adaptive management; and development of stormwater quality asset management plans, CIPs, and financial strategies.
- Improved funding of stormwater utilities for watershed-based permitting with long-term consistency, well-designed monitoring programs, more emphasis on true source control, and the flexibility and incentives for creativity.
- Get rid of the requirements that are not working.
- Better messaging of WHY we are doing these activities and creating better capacity for relaying these benefits to the public. They have to have some level of understanding, ownership, and want for the activities to be willing to pay for them. Program funding and creating utilities still needs focus. This is a major constraint for the vast majority of programs. Didn't see much mention of "scalability" -- municipalities are of all different sizes and issues; the MS4 program requirements should be able to scale accordingly. Regionalization of efforts are probably worth further consideration, but while considering this, we need to be cognizant of how to evaluate compliance.
- Assess management, including of green stormwater infrastructure (with effectiveness tracking, maintenance tracking, and targeted pollutant reduction monitoring); encouraging multi-benefit green stormwater infrastructure through new/redevelopment requirements, etc.
- Coordinating MS4 permit requirements or goals with other programs and goals in the permitted areas (e.g., public and private infrastructure work, transportation funding and priorities, existing wastewater treatment plants (in separate sewer areas), and land use decisions).
- MS4 programs must be given a higher status by local governments such as through formation of utilities. Permits should include incentives for programs with dedicated high-level authority and funding, and, ultimately, require such.
- Metrics to evaluate effectiveness and tools to track metrics.
- Realistic goals -- too many times regulators think they can solve a problem by putting it in a permit. The homeless are contributing trash and bacteria, but it is a much larger issue to address and won't be solved through a stormwater quality program.

- Shorter, clearer permits. More focused reporting. Monitoring to determine compliance. If alternative compliance programs are going to be used, robust modeling needs to ensure WQSs are being met.
- Greater emphasis on surrogate control measures and development/redevelopment opportunities to modify urban catchments should be incentivized within MS4 permits as a means of ensuring long-term water quality results.
- MS4 permits and programs can be improved by tailoring them to the specific water quality issues of the receiving waters and improvements in source control specific to the MS4. Measurable metrics to track success are key to implementing an adaptive MS4 program.
- Need for green infrastructure for stormwater management is likely going to be more important for issues beyond water quality (e.g., climate change adaptation, flooding, etc.), so set permits up to push agencies for long-term broad GI implementation -- focusing on achieving pollutant reduction forces agencies to implement GI in areas that don't support other community benefits and makes it a very tough road to implement. Allow reduction in funding certain compliance activities if agencies commit that funding toward a long-term GI implementation approach (unless we get new funding, need to free up existing funding streams to build projects but can't because it's all tied up in compliance efforts). Develop permits that directly support integrated, multi-benefit planning and implementation.
- Need better info on the cost-effectiveness of different control measures (e.g., how many pounds of pollutants are removed per dollar spent on public education? Industrial inspections? Street sweeping? Catch basin cleaning? Green infrastructure retrofits?) Such info would allow permits to be structured toward implementation of the most useful controls.
- Programs need to be allowed to adjust to known pollutants and should not be a one size fits all but should be based on regional weather patterns.
- Reduce investment in less productive program elements and focus more on more productive investments. Make requirements clearer, measurable, and accountable. Recognize financial limitations in setting compliance timeframes and help cities more to develop financing strategies.
- Clear, measureable requirements spelled out in permits.
- Public education and information -- the public does not know or appreciate what they are paying for and what they will get. Eliminate much reporting and focus on receiving water impairments. Use source control as a primary BMP
- The MCMs of IDDE, post construction, and good housekeeping provide the greatest opportunity for gaining environmental improvements. Permits should include clear and specific requirements for these measures to ensure they are effective.
- Permit writers need increased understanding of how municipal programs are funded.

- Permit coverage area: MS4s are increasingly asserting no discharge to WOTUS in parts of their jurisdiction. Permits should resolve this issue with clear statement on applicability. While requirements for Phase Is and IIs should start to merge, some Phase IIs are so small they won't possess the capacity to meet the requirements. An alternative that aligns with their threat to water quality should be available for the smaller MS4s. Low capacity Permittees present a significant dilemma: Alternative Compliance pathways only work when Permittees have capacity to develop and implement adaptive management, but at the same time, they will fail with prescriptive permits.
- I will refer to the 4th question in number 3 above. Clearer more understandable language would be of great assistance. However, this does not mean we need more measurable requirements. I think we need clearly written permits--some currently seem to be written as a legal compromise where there is no common understanding.
- MCM implementation, in general, does not equal water quality protection. We should be moving towards numerical water quality based limits with better modeling and monitoring. The strength of the NPDES program is when EPA and states establish numeric performance-based targets that encourage and require local innovation.
- Enforcement; water quality based effluent limits; new and redevelopment standards.
- improve calculations methodologies and load reduction estimates, technology transfer for new research results, support stormwater research, fund SW education at levels similar to recycling and anti-smoking campaigns.

15. Do you have any additional comments or suggestions for the workshop? (Actual responses; not edited)

- I'm looking forward to it! Because my background is more academic (no hands-on, practitioner experience), I expect to learn a great deal from the workshop. Hopefully I can make some useful contributions as well.
- How to develop effective strategies that maximize water quality benefit given the range of permittees (progressive actors who are leading the way, straightforward permit compliers, and those going more slowly/cautiously).
- Prioritized water quality goals based on risk will help effectiveness. Indicator bacteria criteria will never be met during storms, but controlling human sources can limit the risk. Meeting Title 22 drinking water standards for MUN beneficial uses during short term and infrequent storm events will not be accomplished but can for the rest of the year.
- The workshop (or subsequent workshop) should focus on how has a widespread lack of enforcement lead to continuing non-compliance across the state. And how is California, and other states, analyzing the voluminous monitoring data collected under MS4 and industrial stormwater permits? How can that data assist with or help motivate compliance/improvements?

- Seems like it will be challenging to have a focused discussion that doesn't get into the weeds of each participant's local experience. Perhaps need to propose a new approach and have people react to it or really facilitate discussion to get useful input out of each session that can feed into future efforts.
- It's helpful to set forth clear water quality objectives for the program -- modelling can then let the MS4 know how many BMPs are enough. I suspect in some parts of the country, trading between MS4s and agricultural sources could be useful -- I've lost track of where trading programs are.
- MS4s are unique as permittees--they are not business or industry. They are regulators who, for the most part, are heavily invested in sustainability. Guidance and clear communication of expected actions are far more valuable than new permit language. Most states have laws that prohibit permit language that allows for authority to be taken beyond what is written into the CFR. If permit language continues to become more broad without appropriate authority or justified by impaired waters, significant argumentation and even legal challenges can be expected.
- Reserve time for each group/team/table to create a consensus of action items.
- It would be great if the group to come up with one or two specific recommendations for permit improvement that could be implemented everywhere.
- Need to discuss permit in the context of acquiring/requesting funding.
- Can we discuss a rough time frame for addressing the key issues around which there is consensus?
- I think developing common understandings of the words we use will take considerable efforts but be critical to success. There are a lot of variables and differences between communities, states, and regions.
- Please discuss using audits and reporting to the full extent; please discuss state and local permit responsibility duplication (const., industrial) and fee allocations; please discuss representative monitoring instead of having every permittee monitor; and please discuss better approaches to street sweeping and urban trees.