Evolution of Stormwater Permitting and Program Implementation Approaches

Workshop Report and Recommendations for Program Improvement

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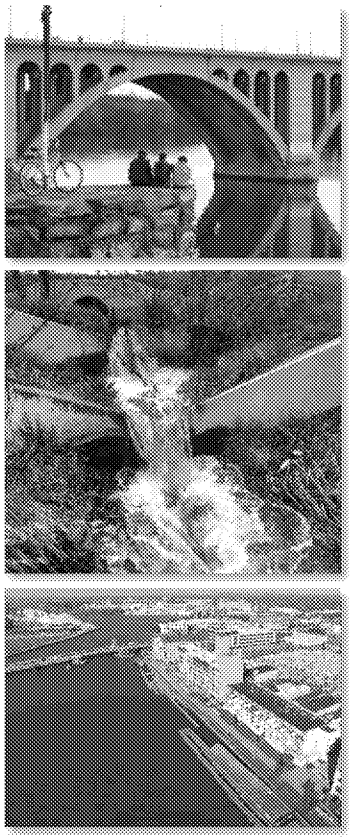
EXECUTIVE SUMMARY

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.

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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 3.1.4)
- **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)

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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)

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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

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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.

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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.

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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.

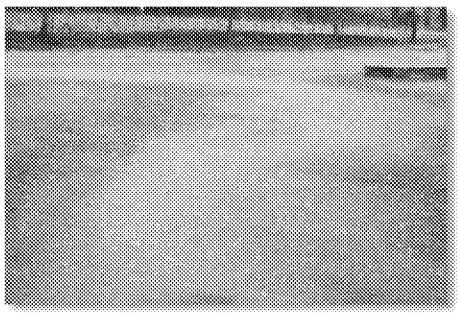

Photo: PG Environmental

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

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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).

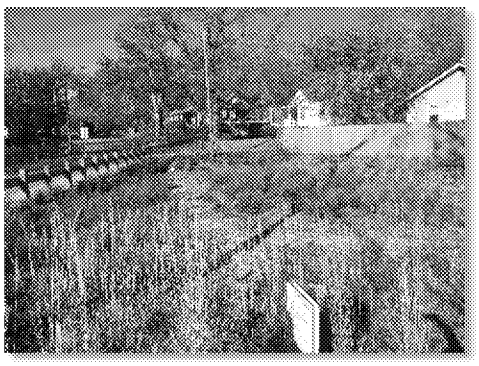

Photo: PG Environmental

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.

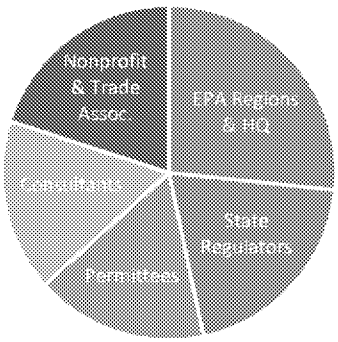

Figure 1. Relative distribution of workshop participants across the sector.

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.

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.

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"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.

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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.

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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.

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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.

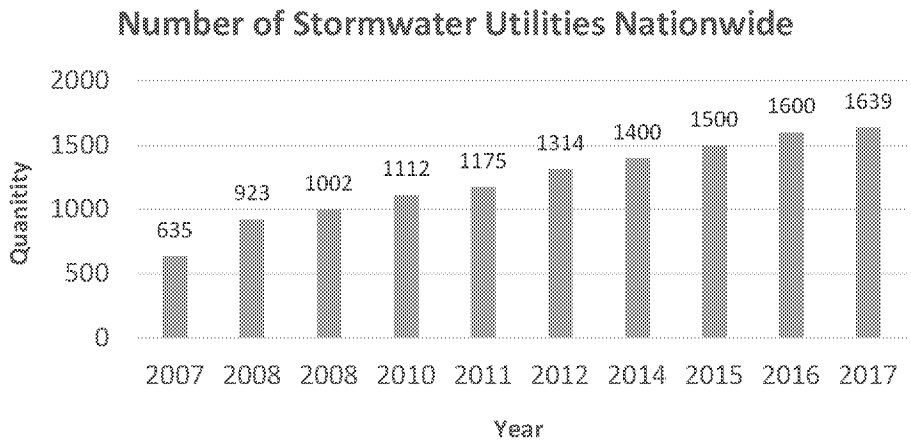

Figure 3. Graph depicting the growth of stormwater utilities across the country since 2007.

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

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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.

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3.1.6 Foster Coordination Across Water Programs

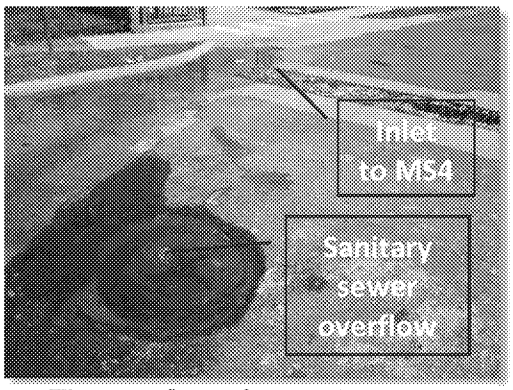
An integrated municipal water plan (stormwater, wastewater, and drinking water) that holistically considers all sources and uses for water within a watershed could be a more cost-effective approach to urban water management than the siloed management practices many communities now use.

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

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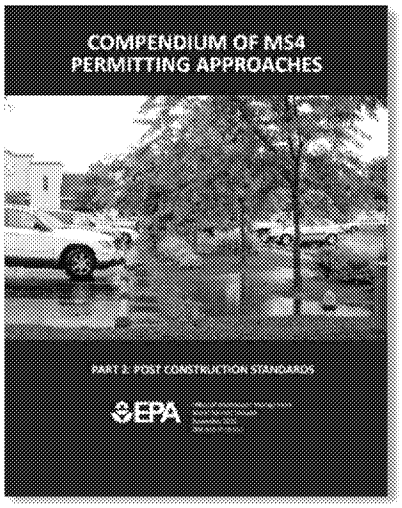

Figure 4. Post-construction standards compendium.

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.

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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

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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:

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- 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.

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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.

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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.

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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.

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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.

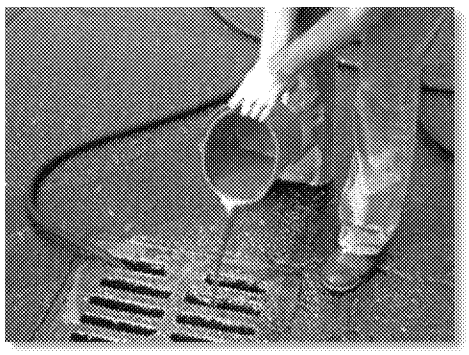

Photo: EPA

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.

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