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National Municipal Separate Storm Sewer System (MS4) Needs Assessment Survey Results

May 2019

Water Environment Federation
the water quality people

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PARTICIPANTS

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NATIONAL MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4) NEEDS ASSESSMENT SURVEY RESULTS

ABSTRACT

In 2018, the Water Environment Federation's (WEF) Stormwater Institute (SWI) conducted a national survey of municipal separate storm sewer system (MS4) permittees. The primary objectives of this survey were to identify the needs of these permittees and to better understand the MS4 stormwater program challenges. In total, the survey received 622 responses from 48 states, including the District of Columbia.

Approximately 25% and 65% of respondents represented Phase I and Phase II MS4 permittees, respectively. Non-traditional Phase II permittees and state transportation departments (DOT) accounted for 7% and 3% of the survey sample, respectively. Respondents were generally representative of the geographic distribution of MS4s across the United States.

MS4 PROGRAM CHALLENGES

Phase I and II MS4 respondents ranked lack of funding or availability of capital, aging infrastructure, and increasing or expanding regulations as their most important stormwater program challenges (Figure 1). Aging workforce, lack of technical expertise, and lack of information/training on best practices are the least important challenges for this group.

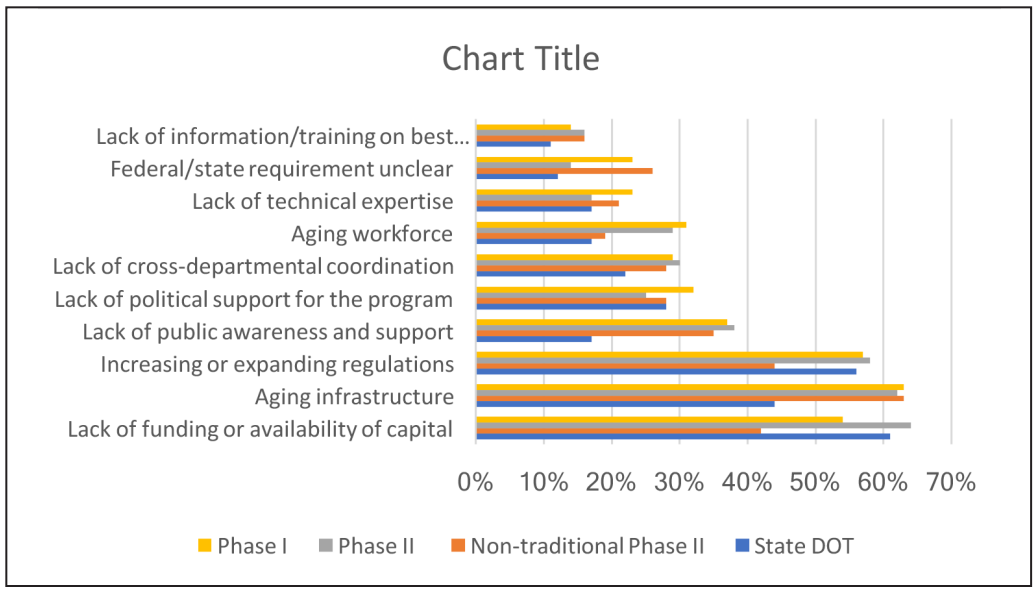

Figure 1. Stormwater program challenges – fairly or extremely significant challenge

MS4 BUDGETARY AND FUNDING NEEDS

Based on the data collected in this survey, the annual funding gap in the MS4 sector has been estimated to be $7.5 billion.

INTRODUCTION

Stormwater is the only growing source of water pollution in many waterways across the country. With urban populations expected to grow to nearly 70% by 2050, and more frequent and intense storms occurring across the country, there is ever-increasing pressure on stormwater systems and water infrastructure. Urban runoff is a leading environmental challenge now and will be in the years to come.

Based on input from leading stormwater professionals, the Water Environment Federation's (WEF) Stormwater Institute (SWI) developed *Rainfall to Results: The Future of Stormwater,* which details the challenges, opportunities, and pathways to improving the nation's stormwater systems to make them more efficient, effective, and sustainable.

The report developed a vision for the future of stormwater:

In the future, all stormwater will be considered a resource and managed through an optimized mix of affordable and sustainable green, gray, and natural infrastructure. Pollutant source control and management of runoff volume will be pursued aggressively as a complement to traditional stormwater controls. Stormwater infrastructure will be funded fully and managed by a true utility with a comprehensive asset management plan that benchmarks for future success. Management techniques will improve continually through new science, experiences, technical innovations, and responsive regulations. Stormwater management will be part of doing business and part of community resiliency and quality of life. The community will value and understand the many benefits of stormwater infrastructure.

It also identified six objectives that are central to supporting the future of stormwater vision:

- **Work at the Watershed Scale** – all communities will have integrated, watershed-scale assessments of water resources needs and challenges.
- **Transform Stormwater Governance** – communities will catalyze further formation of stormwater utilities and stormwater regulations will stimulate stormwater control innovation and performance improvement by focusing on program outcomes.
- **Support Innovation and Best Practices** – a broad suite of verified stormwater controls and best practices will support confident planning and maintenance.
- **Manage Assets and Resources** – stormwater systems will be maintained through robust asset management programs and supported by innovative information technology.
- **Close the Funding Gap** – communities will align stormwater management efforts with broader community goals to garner funding options and have access to innovative financing opportunities.
- **Engage the Community** – communities will understand and value the contribution stormwater management makes to flood risk reduction, clean and safe water, climate resiliency, and other benefits.

In an attempt to begin working towards meeting those objectives, WEF's SWI conducted a national assessment survey of municipal separate storm sewer system (MS4) permittees. The primary objectives of this survey were to identify the information and technical resource needs of MS4 permittees and to better understand MS4 stormwater program challenges.

RESPONDENTS

In total, the survey received 622 responses from 48 states and the District of Columbia. As shown in Figure 2, approximately 25% and 65% of respondents represented Phase I and II MS4 permittees, respectively. Non-traditional Phase II permittees and state transportation departments (DOT) accounted for 7% and 3% of the survey sample, respectively[1]. This statistically-significant sample[2] is also generally representative of the distribution of MS4s across the United States, as illustrated in Table 1.

Figure 2 - Percent of Total Responses by MS4 Permit Type

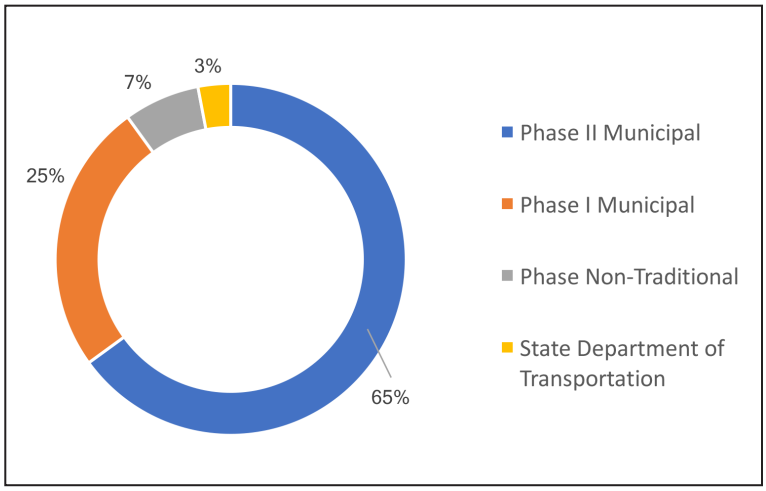

Table 1 - Percent of Respondents by EPA Region Contrasted with National MS4 Distribution

EPA Region	States in region	Percent of survey respondents	Percent of all MS4 permittees
1	CT, ME, MA, NH, RI, VT	7%	6%
2	NY, NJ, PR, VI	4%	7%
3	DE, MD, PA, VA, WV, DC	12%	12%
4	AL, GA, KY, MS, NC, TN, FL, SC	12%	13%
5	IL, IN, MI, MN, OH, WI	32%	31%
6	AR, LA, OK, NM, TX	7%	12%
7	IA, MO, KS, NE	5%	4%
8	CO, MT, ND, SD, UT, WY	7%	3%
9	AZ, CA, HI, NV Guam, Samoa	7%	5%
10	AK, ID, OR, WA	7%	7%

SURVEY CONSTRUCT

The nature of the questions included in the survey paralleled the six identified SWI objectives to ensure that information received can best enable efforts to meet the WEF SWI future of stormwater vision. Specifically, the survey included the following topic areas:

1. Drivers for MS4 Planning and Investment Decisions
2. Challenges for MS4 Programs
3. Information and Resource Needs for MS4 Programs
4. Preferred Information Sources
5. Annual Program Budgets and Budget Needs

[1] Non-traditional MS4s cover county, state, or federally owned separate sewer systems operated by such entities as universities, airports, hospitals, or prisons. State DOT responses are reported separately from other non-traditional MS4s because of their unique nature.

[2] Sample of municipal respondents is statistically significant at the 95% confidence interval, with a 5% margin of error.

FINDINGS FOR SURVEY TOPIC AREAS

DRIVERS FOR MS4 PLANNING AND INVESTMENT DECISIONS

Common areas of motivation for MS4 program managers when deciding on investments in stormwater programs is a fundamental area of interest. Reponses from Phase I and II (municipal and non-traditional) permittees were relatively consistent and ranked regulatory compliance, local/pluvial flooding, and water quality and habitat restoration issues as important program drivers. Drivers of lowest significance for MS4s were associated with water supply issues, climate change, large-scale/riverine flooding, and wet weather dynamics associated with urban runoff (e.g., combined sewer overflows, sanitary sewer overflows). State DOT MS4 permit holders also see regulatory compliance and water quality/habitat restoration as significant drivers, but place flood control as a lower priority for their program investments.

MS4 PROGRAM CHALLENGES

MS4 programs are faced with many challenges. Knowing which of these challenges are most critical to the success of programs informs on topic areas to target research, focus product development, and enhance information dissemination. The areas of more significant challenge as identified by Phase I and II MS4 respondents is lack of funding, aging infrastructure, and evolving regulations. To contrast, the lowest priority challenges includes aging workforce, information and training on stormwater control measures, and overall technical expertise. See Figure 3 for additional details.

Non-traditional and state DOT respondents provided very similar ratings for program challenges with the exception of aging infrastructure, which appears to be less of a challenge for state DOTs, and funding capacity and evolving regulations, which are lesser challenges for non-traditional MS4 permittees.

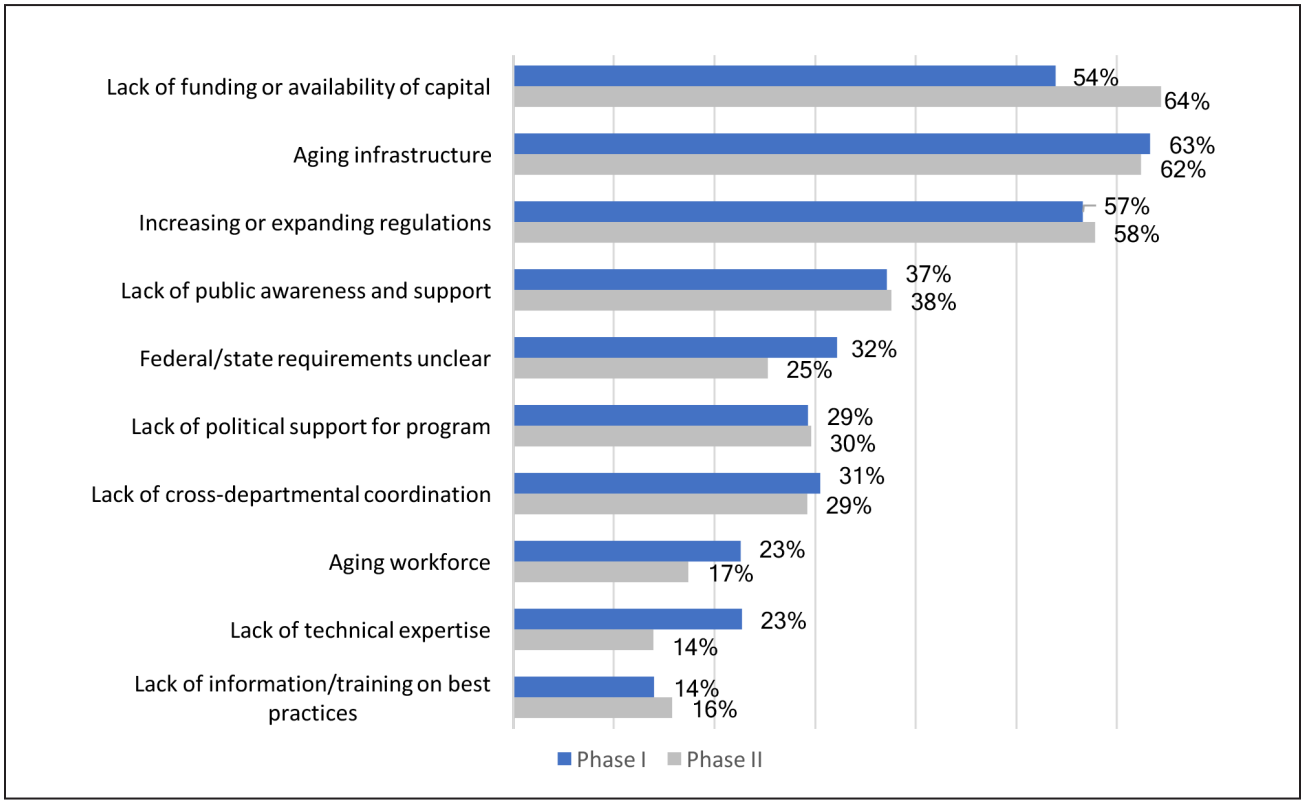

Figure 3 - Phase I and Phase II Program Challenges

INFORMATION AND RESOURCE NEEDS

Survey respondents indicated their need for additional information and technical resources related to six broad stormwater topic areas, which generally reflected the priorities outlined in Rainfall to Results. Respondents were also asked about information and technical resource needs related to the six minimum control measures (MCMs) and other aspects of permit compliance.

Of the six broad stormwater topic areas, both Phase I and II MS4 respondents indicated the greatest need for information and technical resources related to funding and financing by a wide margin. Figure 4 illustrates the relatively high need for information related to funding and financing compared to all other topics included. Secondary areas of need include information on green infrastructure (GI) practices and other innovative approaches as well as asset management. Non-traditional and state DOT responses also indicated the greatest need for information and resources related to asset management, total maximum daily load (TMDL) compliance, and GI and other innovative BMPs. When considering MCM areas of interest, Figure 5 shows the need for information is spread relatively evenly across all six areas, with slightly greater interest in post-construction runoff control and somewhat less of a need for information on industrial sites as well as pollution prevention/non-structural controls.

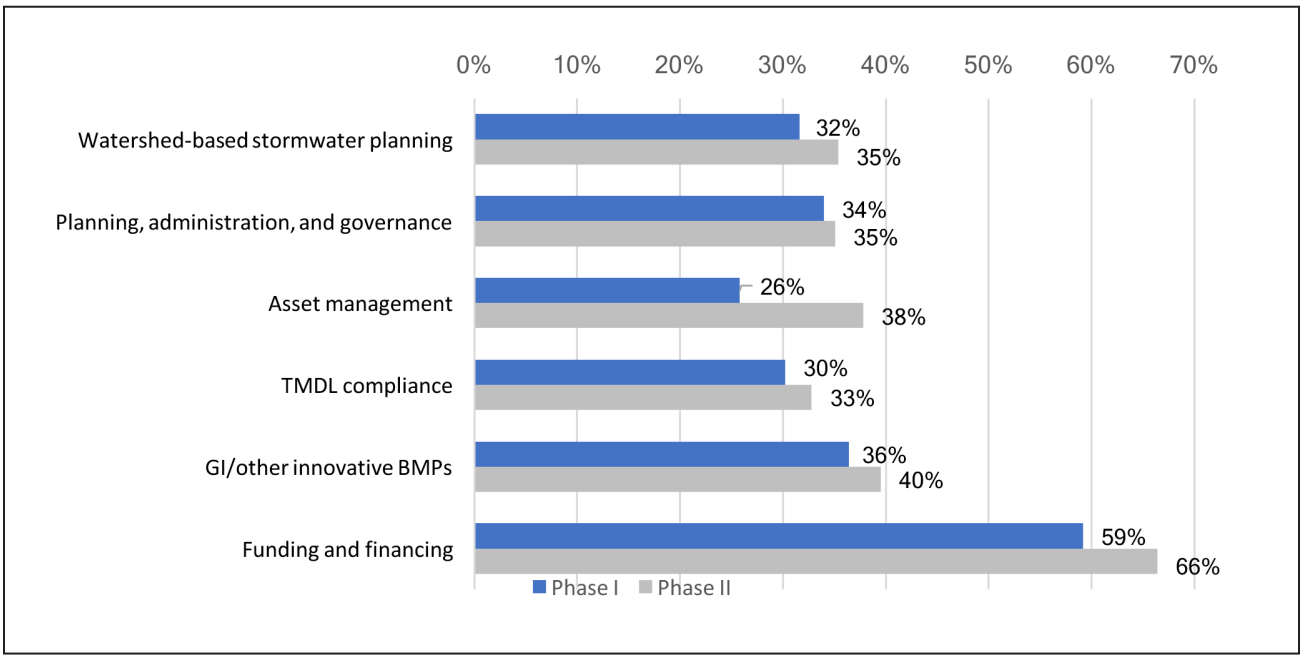

Figure 4 - Phase I and Phase II Permittee Areas of Information and Resources Needs

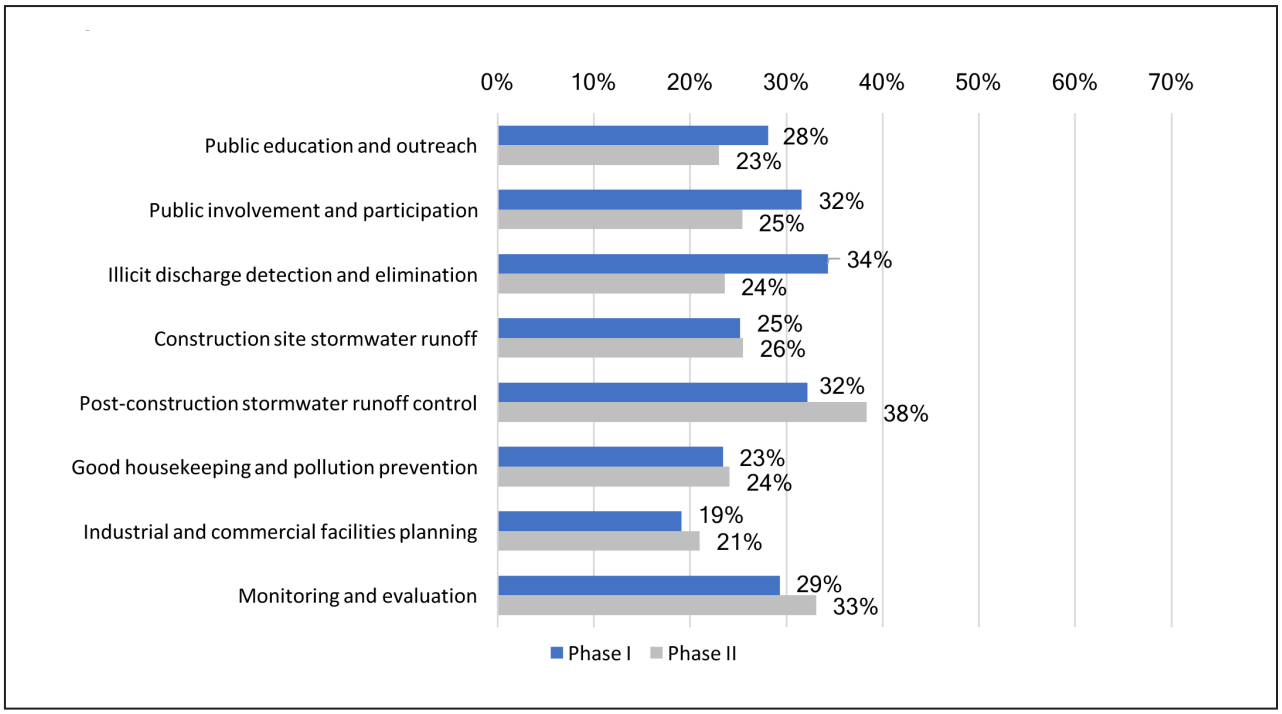

Figure 5 Phase I and Phase II MS4 respondents indicating a high or very high need for information and resources related to permit compliance

Respondents who indicated a moderate, high, or very high need for information and resources related to either the broader stormwater topics or compliance-related categories were asked to provide additional details by indicating their level of need for a series of sub-topics. Table 2 shows the sub-topics identified as most important for the highest-ranked category.

Finally, survey responses clearly show a preference towards web-based platforms, peer-to-peer exchanges, and local/state/regional events over national conferences when selecting sources to gain needed information on MS4-related topics. It is likely that these responses reflect the limited budgets of MS4 programs, as well as the rising quality of web-based options available for consumption.

ANNUAL PROGRAM BUDGET AND ADDITIONAL NEEDS

As is evident from survey responses in previous areas, the topic of funding and financing is the area of greatest challenge and highest need in terms of both information and resources. The section of the survey that addressed this topic in greater depth was based upon two questions as listed below:

1. "What is your estimated stormwater program budget for 2018, including approximate expenditures for programmatic, capital, operations, and maintenance activities?"
2. "Is your estimated 2018 annual stormwater budget adequate to meet all of your current stormwater goals, including regulatory compliance?
(Yes or No)"

   If respondents indicated that their 2018 stormwater budget was not adequate, the follow up question clarified the estimated amount required to meet goals, as listed below:

   a) "To be fully compliant and meet all of our current stormwater goals our agency needs approximately _____ MORE this year in addition to our current 2018 budget."

Table 2. Highest ranked sub-topics under information and resource need priority categories

Stormwater topic	Phase I (PI) and II (PII) communities	Non-traditional Phase II (NT)/state DOT
Funding and financing	• Leveraging additional sources of funding based on co-benefits	• Leveraging additional sources of funding based on co-benefits
	• Inventory of available funding sources (PI)	• Analysis of stormwater funding needs (DOT)
	• Analysis of stormwater funding needs (PII)	• Inventory of available funding sources (NT)
GI and other innovative BMPs	• Policies and incentives that encourage GI on private property	• Monitoring/quantifying BMP effectiveness (NT)
	• Development standards and incentives that encourage GI/innovative BMPs	• BMP maintenance requirements (NT)
	• Monitoring/quantifying BMP effectiveness (PII)	• BMP life-cycle cost analysis (DOT)
		• Screening/evaluation of new technologies (DOT)
Post-construction stormwater runoff control	• Post-construction inspection and enforcement	• Financial incentives/disincentives to encourage contractor compliance
	• Stormwater manuals and design templates for developers, especially for innovative BMPs	• Erosion and sediment control compliance
Asset management	• Cost estimating/cash flow analysis for capital expenditures	• Evaluating BMP life-cycle costs
	• Evaluating life-cycle costs of stormwater control measures (PII)	• Developing condition assessments (NT)
	• Prioritizing stormwater asset maintenance and replacement (PI)	• Prioritizing asset maintenance and replacement (NT)
		• Creating inventory/database of stormwater assets (DOT)

Approximately 20% of the 622 respondents did not answer these questions. This reduced rate of response is likely due to a lack of available data/information to answer the questions, as well as concerns regarding the potential to have respondent information revealed publicly.

Of those who did respond, 48% indicated that they did not have the resources needed to meet stormwater program goals. Phase I MS4 communities and state DOTs have the largest stormwater program budgets. These respondents indicated less need for additional budget (by percentage) compared to Phase II MS4s and non-traditional permittees. Of the Phase I and II MS4 permittees that indicated a need for additional funding, the total need increases with size of population served. For example, the average additional annual need for permittees serving 50,000 people or less is approximately $1.2 million compared to $9.6 million for communities serving 500,000 people or more. Table 3 summarizes responses on budgetary status and funding needs.

Table 3 - Summary of Information Related to Budget Status and Funding Needs of MS4 Permittees

MS4 permittee type (sample size)	Average estimated 2018 program budget	% of respondents requiring additional funds to meet program goals	Additional annual budget needed to meet all program goals	Annual budget increase needed (%)
Phase I community (n = 128)[a]	$ 10,968,000	47%	$ 5,719,000	52%
Phase II community (n = 324)	$ 1,367,000	49%	$ 1,862,000	136%
Phase II non-traditional permittee (n = 36)	$ 429,500	41%	$ 1,005,000	234%
State DOT (n = 11)	$ 22,165,000	57%	$ 2,563,000	12%

ANALYSIS OF MS4 BUDGETARY AND FUNDING NEEDS DATA

Based on the data collected in the survey, the annual funding gap in the MS4 sector has been estimated to be $7.5 billion. The section above references a lower than expected response rate addressing the inadequacy of MS4 budgets; therefore, refinements will be made in future surveys to further increase response rates through wider sector engagement and clarity in survey format and language.

An initial estimate for the funding gap was determined by multiplying the percentages of MS4 permittee types that identified a need for additional funding by the total MS4 universe across the country to determine an estimate of the total number of MS4s requiring additional funds. This value was then multiplied by the estimated additional funding need identified for each MS4 permittee category and summed up across all MS4 permittee categories. For example, 47% of Phase I permittees identified the need for additional funding, which is estimated to be $5.7 million annually. Using this data, along with an estimate of 855 total Phase I permittees across the country (U.S. EPA, 2018), an estimated annual funding gap for Phase I permittees is $2.3 billion. A complete listing with a total annual funding gap estimate using this methodology is listed below.

- Phase I = $2,298,180,150
- Phase II = $5,510,775,200
- Phase II Non-Traditional = $249,290,250
- State DOT = $73,045,500
- Total = $8,131,291,100

A secondary analysis was performed using information collected during the survey that associated budget shortfall information with population covered by MS4 program. This methodology is similar to the initial estimate with data grouped by population. This data is listed in Table 4.

Table 4 - Budgetary and Additional Funds Required by Population from Survey Data

Population	Distribution of Communities by Population	Percent Identifying Need for Additional Funds	Estimated Amount Needed to Meet Goals
Less than 10,000	18.3%	42%	$367,850
10,000 to 50,000	38.2%	57%	$1,490,639
50,000 to 100,000	17.0%	48%	$3,031,548
100,000 to 500,000	15.4%	36%	$9,292,000
Over 500,000	11.1%	54%	$9,605,870

Using this approach and distribution, an estimated annual funding gap of $12 billion is determined. A likely cause for this elevated number, compared to the initial estimate, is due to an oversampling of larger communities in the survey compared to the actual distribution of population represented by MS4s across the country. This oversampling is not surprising considering the challenge in obtaining survey response rates for smaller communities at the same rate as large communities.

In an effort to adjust this potential oversampling, the response rate and identified need by population was applied to the distribution of municipal governments using National League of Cities (NLC) (2007) information as listed below:

Table 5 - Distribution of Municipal Governments in the U.S. by Population (NLC, 2007)

Population	Distribution of Cities by Population
Less than 10,000	56.7%
10,000 to 50,000	33.0%
50,000 to 100,000	6.4%
100,000 to 500,000	3.3%
Over 500,000	0.6%

Using the response rates and funding needs from Table 4 and the distribution from Table 5, an estimate annual funding gap drops to $4.5 billion. The reason for this significantly lower estimate is due to a shift from a potential oversampling of large communities; the NLC data suggests a distribution of community sizes that are weighted too heavily compared to the universe of MS4 communities. In other words, a significant number of the small communities (< 10,000) in the NLC distribution should not be included in the analysis, as many of these smaller communities do not meet the threshold of urban size or density that would require them to obtain an MS4 permit.

Since the survey data may overstate the needs of large communities, the NLC data may overstate the needs of small communities, and considering that it is common for MS4 permits to be held at the county level, the distribution of population by county was used to develop a county-based estimate for an annual funding gap using the U.S. Census data listed below.

Table 6 - Distribution of Counties in the U.S. by Population (U.S. Census, 2013)

Population	Distribution of Counties by Population
Less than 10,000	44.1%
10,000 to 50,000	38.2%
50,000 to 100,000	8.5%
100,000 to 500,000	7.5%
Over 500,000	1.7%

Using the distribution from Table 6 and the response rates and funding needs from Table 4, an annual funding gap estimate was determined to be $6.2 billion. To address the fact that some MS4 permits are held by cities and some are held by counties, a final adjustment was made to the distribution in Table 5 by reducing the number of small cities considered (<10,000) by half, which resulted in an estimated distribution of communities in the MS4 program by population as listed in Table 7.

Table 7 - Estimated Distribution of MS4s by Population

Population	Estimated Distribution of MS4s by Population
Less than 10,000	28.4%
10,000 to 50,000	52.4%
50,000 to 100,000	10.7%
100,000 to 500,000	7.1%
Over 500,000	1.4%

Using the distribution from Table 6 and the response rates and funding needs from Table 4, an annual funding gap estimate is determined to be $6.9 billion. This number is between the two extremes produced from this analysis ($12 billion and $4.5 billion), and it is similar to the original estimate of $8.1 billion. Considering these figures, it is reasonable to estimate an annual funding gap of $7.5 billion for the MS4 sector, which is the midpoint between the two most reasonable estimates generated ($6.9 billion and $8.1 billion) and were determined through different analytical methods.

CONCLUSION

An important first step in a maturing infrastructure sector is to better understand the fundamental challenges and needs. This survey and analysis represent this first major step in the stormwater sector, which is a field that is notoriously data-poor. By collecting data on the MS4 sector, this effort identifies the priorities that need to be addressed in the near term while allowing for planning for coverage of other areas in a long-term strategic fashion.

Results in many areas confirm expectations, such as the strong motivation for investments in stormwater infrastructure associated with regulatory compliance, localized flooding impacts, and the restoration of water quality and habitat, as these are fundamental aspects of many stormwater programs. It is also not surprising that most MS4s are not highly motivated by wastewater-oriented runoff-driven impacts. These results suggest a continued focus on regulations impacting the MS4 sector, as well as addressing both water quality and quantity issues associated with separate storm sewer systems.

An unexpected finding is the lack of priority noted by respondents regarding climate change, which points to the need to highlight how changing precipitation patterns will impact MS4s in the future. These education opportunities may focus on extreme events and highlight the impacts of recent episodic flood events, such as Hurricane Harvey in Houston and the occurrence of two 1000-year-plus storm events in a three-year period in Ellicott City, Maryland. Future water quality impacts are also evident, as recent studies show that the current approach to stormwater management infrastructure, which has been designed based upon an assumption of climatological consistency, will become increasingly inadequate to address urban runoff volumes, rates, and associated pollutant loads in the face of climate change (Moglen and Rios, 2014).

The challenges for MS4s align more closely with expectations, as the survey respondents identified the need for funding, an evolving regulatory landscape, and aging infrastructure as high-priority concerns in stormwater programs. It is not surprising that these topics were at the top of the list for most respondents. As evolving regulations drive the need to replace aging and failing infrastructure and to implement additional measures to address continued degradation, permittees are struggling with the need for funding. This is a particular challenge in an infrastructure sector where an estimated third or less of all regulated entities have a dedicated source of revenue to manage their stormwater programs. Recently, Congress directed EPA to establish a Stormwater Funding Task Force to conduct a study on and develop recommendations to improve the availability of funds to construct and maintain stormwater infrastructure (P.L. 115-270). This task force is a positive step toward helping permittees develop sustainable funding for their programs; however, this is a first step and continued efforts to address these top challenges are needed.

Regarding needs for information and products, the largest area of interest unsurprisingly coincides with the greatest challenge, namely, funding and financing. In addition, there is a need for technical information and products focusing on green infrastructure practices and innovative techniques/technologies, as well as information related to asset management. SWI has been active in many of these areas, as evident by updated manuals of practices (MOPs) on topics such as stormwater user-fee funded programs, and green infrastructure implementation and maintenance. Ongoing efforts should be made to continue to focus in these areas, as well as expand into related topics through additional product lines and vehicles of communication and learning.

Survey results on preferred information sources illustrates the significance of local/state MS4 organizations and conferences, which highlights the need to engage at the ground level, as well as provide national leadership on stormwater issues. The interest in web-based information platforms, such as websites and webcasts/webinars, stresses the need to continue to invest in online systems for technical education. Also, the need to provide peer-to-peer and workshop/training opportunities to stormwater professionals is clearly identified in the survey. Regarding periodicals/ magazines, the high number of unidentified (i.e., "other") resources used by MS4 program managers motivates the need to better understand the landscape of periodicals overall.

This effort has identified funding and financing as the single most important issue and area of need in the MS4 sector. To effectively address this topic at the national level, it is necessary to develop robust information articulating the scale of funding needs. A major milestone of this inaugural needs survey is the development of the first funding gap estimate for the MS4 sector. This analysis estimates an annual need of an additional $7.5 billion in funds to fully implement stormwater programs and meet community goals. There is reason to believe this estimate is conservative, as less than half of MS4s surveyed identified any needs for additional funds, which is unexpectedly low. As has been discussed above, it is likely that local sensitives and information resource limitations played a role in these findings. These results are especially surprising when considering that the most significant information need identified for all groups in the survey is funding and financing by a wide margin. Ongoing survey efforts will seek to address this issue, as well as refine and expand upon current budgetary needs and needed funding levels.

This report summarizes the results of the inaugural MS4 Needs Assessment Survey led by the SWI, which reflects an effort to learn more about the nature and needs of the MS4 sector at a scale that has never before been attempted. In addition, this survey has brought to light some surprising and significant findings that will help to inform the SWI as it moves ahead in efforts to meet the needs of the MS4 sector.

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CDM Smith
Contech Engineered Solutions, LLC
Convergent Water Technologies
EA Engineering, Science, and Technology, Inc., PBC
Greyline Instruments
Haskell
Herrera Environmental Consultants
Jacobs Engineering Group
Larry Walker Associates
LimnoTech
Oldcastle Precast – Stormwater
OptiRTC, Inc.
Stantec Consulting
StormTrap
Tetra Tech, Inc.

NON-GOVERNMENTAL

Sacramento State, Office of Water Programs
University of Louisville Center for Infrastructure Research
University of New Hampshire Stormwater Center
Villanova Urban Stormwater Partnership

Under the direction of the WEF Stormwater Institute, May 2019

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Water Environment Federation
the water quality people

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