Investigation into the Feasibility of a National Testing and Evaluation Program for Stormwater Products and Practices

A White Paper by the National Stormwater Testing and Evaluation of Products and Practices (STEPP) Workgroup Steering Committee

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STEPP Workgroup – Steering Committee

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Terminology

"Product" – A manufactured, proprietary system that captures, retains, treats or otherwise manages stormwater runoff and associated pollutants.

"Practice" – A non-proprietary system that captures, retains, treats or otherwise manages stormwater runoff and the pollutants commonly associated with runoff.

"Stormwater Control Measure" – A device, whether product or practice, that is used to capture, retain, treat, or otherwise manage stormwater runoff and the pollutants commonly associated with runoff. This term is referred to as an "SCM" in this document. This term is also synonymous with the term "best management practice" (BMP).

"Testing" – The action of applying standard protocols on an SCM in order to estimate the efficacy of the SCM to meet a specified treatment goal based upon pre-established metrics for targeted pollutant(s). Testing can be performed either in a laboratory or in the field.

"Evaluation" – The analysis of results based on testing, as defined above, to determine efficacy of the tested SCM to meet specified goals or metrics established by standardized protocols.

"Verification" – The use of testing and evaluation through employment of specific procedures provided by an entity representing the SCM to confirm its performance as compared to results provided by the SCM entity. This is assumed to be performed by an independent third-party to provide objectivity and credibility.

"Certification" – The approval of an SCM based upon testing and evaluation efforts. This approval provides assurance that the SCM will perform to a level that is deemed sufficient by the certifying agency or group. These programs also may stipulate conditions of approval, such as sizing, land use or structural elements.

"Program" – In this document, a program refers to any program that tests, evaluates, verifies or certifies the performance of SCMs.

EXECUTIVE SUMMARY

Since industrial, agricultural and urbanization activities started to shape the modern landscape, stormwater runoff has affected U.S. receiving waterbodies. However, only in recent decades have those in the water sector started to better understand the significant and growing nature and scale of stormwater pollution.

As stormwater-related pollution has grown, regulatory programs have been established (and also have grown) at the state and Federal level to address the impacts of stormwater runoff. Various stormwater control measures (SCMs) — products and practices used to manage and treat runoff — have been developed and have evolved to address stormwater runoff in various contexts (ultra-urban, suburban, linear construction, etc.). These SCMs have been applied by communities and land developers across the country. As the universe and complexity of SCMs has grown, the need to develop a process to test, categorize, review, certify, evaluate, verify, and/or approve stormwater runoff controls became evident. This process ensures the performance efficacy of products and practices meets expectations, which are often tied to permit requirements. Programs to test and evaluate SCMs arose to provide this service at the state, regional and national level. These programs have had a range of effectiveness, with some programs growing and flourishing and others stagnating or even dissolving completely. Regardless of program success, a consistent challenge for programs is a lack of sustainable funding.

From the viewpoint of SCM product and practice representatives, testing and evaluation programs have evolved in a manner that has limited innovation. In some instances, the investment of time and money required to obtain approval of products and practices, creates barriers to market entry for small and up-start technology producer. This dynamic limits the ability of potentially effective products and practices from readily reaching the market. Hampering innovation reinforces status quo approaches and technologies and creates barriers to developing new and inventive ways to treat stormwater runoff that are both high-performing and cost-effective.

Further, since the characteristics of stormwater runoff quality and quantity vary with respect to elements such as, climate, dominant soil types, and land cover distributions, it is not surprising that the protocols and procedures associated with these programs vary as well. However, the differences between programs go beyond what is needed to capture local differences. The unnecessary scale of variability between programs further limits the ability of SCM product and practice representatives to reach new markets — even within regions of similar characteristics — impacting stormwater quality and quantity.

While it is recognized that these program bear a cost for the public as well as for industry, there also is a cost associated with the absence of these programs. This cost is manifest as uninformed SCM consumers either incur liability employing SCMs with unverified performance efficacy, or as they limit the use of new and innovative SCMs to minimize risks.

This document was developed to investigate the feasibility of a national testing program. The result of this investigation is that agreement exists on the feasibility and the need for a national testing and evaluation program. Critical elements of a national program to be considered and addressed include consistent protocol development, sustainable funding source integration, transparent and streamlined programmatic architecture development, widespread stakeholder engagement, and strong national leadership. Future actions by those who led this investigative effort include broader engagement in the sector, further refining the structure and critical issues of a proposed national program as well as technical and process protocol development and information dissemination efforts. These actions will be taken by the STEPP Workgroup while recognizing and respecting that the overall goal is to protect, enhance and restore the quality of U.S. waters.

SECTION 1: INTRODUCTION

Background

In the past, communities with regulated stormwater discharges, including stormwater programs associated with Municipal Separate Storm Sewer Systems (MS4), were tied solely to technology-based approaches to meet regulatory requirements (MS4 permits, etc.). During this phase, to help shape stormwater programs the sector relied on laboratory and field-testing results provided by the manufacturers/distributors of proprietary stormwater products, academic-driven studies, and the efforts of environmentally focused technical nonprofits. This work has been performed on public-domain stormwater practices as well as private proprietary stormwater systems, with the performance results commonly used to select treatment measures in stormwater programs. Often, municipalities or regulators developed "approved product" lists for proprietary devices. The "product approval processes" was developed to formalize the method by which a proprietary device becomes listed on an approved product list for a municipality or other regulated stormwater entity. For public-domain practices, certain design standards were deemed acceptable for use in designs and construction to meet stormwater requirements. Often the basis for approval has been producer-provided information and academic research. As the field matured and some state and local regulations became more stringent, this process grew more complex. Similarly, the population and diversity of stormwater products has continued to increase, adding another level of complexity to the approved product process development.

The Need for Testing and Evaluation Programs

Another development in this sector is the rise of statewide, regional, and federally funded testing and verification programs that seek to standardize protocols and raise the level of product examination beyond the local level. The increase in the number of technology testing and evaluation/verification programs illustrates a need that has arisen on an ad-hoc basis. This ad-hoc approach has been driven by both commercial and regulatory interests. For product manufacturers and those who construct practices, the motivation is due to the significant investment of time and money required to gain approval for each separate MS4 and/or community where they want to sell their product. Considering that there are approximately 7500 MS4s across the country, the effort to sell products at a national level is significantly hampered by this piecemeal approach to approval at the local level. The end result is a barrier to the growth of innovative and high-performing technology in the stormwater sector, and some would argue that this system may even constitute restraint of trade. On the public side, there are concerns of product and practice efficacy and performance, especially where this performance (or lack thereof) affects permit conditions and regulatory requirements.

While the goal for these programs has been clear — to raise the overall performance of stormwater products and practices, provide assurance on the performance of SCMs, and to reduce unnecessary financial and administrative burden on manufacturers — the results have been mixed. Available information and industry experience illustrates that the amount of time required for a product to become approved is significant. Many in the sector also highlight the substantial costs required to gain approvals. Still, others see the ability to fund and sustain programs, as well as providing consistent and technically-focused leadership, as weak points for many programs. Overall, these factors act as barriers to innovation in the sector, which dampens its ability to adequately and cost-effectively address the water pollution challenges of today.

Overall, 13 states have either developed, are engaged in, are currently developing, or recognize other state- or regional-level testing and evaluation programs for stormwater products. The only such

program at the national level, the U.S. Environmental Protection Agency's (EPA) Environmental Testing and Verification (ETV) program, was recently discontinued. With a major rulemaking underway that will most certainly establish the first national performance standard for stormwater, there is a strong likelihood that the extents of regulated areas will increase. Considering that a handful of states — primarily located in the West Coast, Mid-Atlantic, Northeast, and Upper Midwest — have programs consistent with the expected national performance standard, it is anticipated that a majority of states will be required to increase performance standards in their state permits to meet this new national baseline. Beyond regulatory drivers, stormwater runoff is one of the most significant growing sources of water quality impairments across the country. There is very likely to be continued pressure driving demand for products and practices in the stormwater sector considering the growing regulatory presence in stormwater; increasing urban populations leading to close to 405,000 hectares (one million acres) of developed land per year by 2030; the aging status of existing water and drainage infrastructure; and the predicted climate change effects on this infrastructure. If efforts are not made to ensure that these practices are both technically effective and cost-efficient, the sector will likely continue to see a plethora of under-performing and costly technologies that will not address stormwater sector needs. In contrast, a national testing and verification program could help the sector achieve inexpensive and consistently high-performing products and practices that can be used in a variety of regions and settings to improve the physical, biological and chemical conditions of waters impacted by urban stormwater runoff.

Development of the STEPP Workgroup and Steering Committee

The recent announcement ETV program discontinuation coupled with a perception that other programs may not have produced expected results has launched a fresh investigation into testing and verification programs. To help reduce or remove barriers to innovation in the stormwater sector, the Water Environment Federation (WEF) first hosted a meeting in October at WEFTEC® 2012 to discuss the topic of testing and evaluation programs for stormwater devices. Meeting participants included approximately 25 officials from EPA, consultants, nongovernmental organizations, and representatives from stormwater manufacturers. This meeting resulted in the genesis of the Stormwater Testing and Evaluation of Products and Practices (STEPP) Workgroup. It became clear among the meeting participants that the development of a national, standardized testing and evaluation program for proprietary stormwater products and practices needed consideration. Specific issues associated with the need to evaluate a national program that were highlighted during the meeting included:

- A history of poorly-performing stormwater management devices currently in operation,
- The costs of existing state and regional testing/verification protocols on SCM representatives as well as the public,
- The lengthy timeframe and significant effort required to receive approval from existing programs,
- The challenging nature of many state and regional programs that leads to barriers in the implementation of effective stormwater products at a national level,
- The costs and long timeframes associated with getting new and potentially effective stormwater treatment devices to market, and
- The need to raise the bar on performance expectations for stormwater management products and practices in a cost-efficient manner to address the growing problem of water quality and quantity impacts from urban runoff.

In response to information obtained at the WEFTEC 2012 meeting, WEF committed to investigate the feasibility of a national program to test and evaluate stormwater products and practices.

SECTION 2: HISTORY / BACKGROUND / STATUS

Overview of Past and Existing Programs

Over the past 12 years, several U.S. stormwater technology evaluation programs have developed to address the need for creating standardized testing to evaluate the performance of stormwater products and practices (see Figure 1). Some instances provide approval for usage that goes beyond the local level. Examples of state and regional programs include:

- Technology Acceptance Reciprocity Partnership (TARP)
- New Jersey Corporation for Advanced Technology (NJCAT)
- Washington State's Technology Assessment Protocol-Ecology (TAPE)
- Georgia Technology Assessment Program (GTAP)
- North Carolina Preliminary Evaluation Program (NCPEP)
- Virginia Technology Assessment Protocol (VTAP) program
- Massachusetts Stormwater Technology Evaluation Project (MASTEP)

These programs have similarities such as the focus on testing and evaluating stormwater products and practices to provide performance information as well as the reliance on standardized methods to perform these tests. There are, however, vast differences in these programs. Some have very complex and robust testing requirements while others have a more generalized and simplified approach. Some require either field or laboratory testing, while others require both field and laboratory testing. Some test efficacy of treatment for several pollutants, while others test fewer pollutants in their performance evaluation. Some recognize other programs in a reciprocating spirit, while others do not. The status of these programs is addressed later in this document. Figure 1 provides a geographic distribution of these programs. Note that Virginia and New Jersey were originally part of TARP but have since developed or are developing their own programs.

At the national level, only the EPA's ETV program was set up to evaluate and verify products and practices across the country. This program was established in 1995 and was administered by the EPA's Office of Research and Development as well as National Sanitation Foundation (NSF) International. The goal was to "provide credible performance data for commercial-ready environmental technologies to speed their implementation for the benefit of purchasers, permitters, vendors and the public" (EPA, 2013(a)). The ETV program addresses technologies in a variety of sectors — air quality, drinking water, materials, greenhouse gas, monitoring systems, and of course, water quality protection. However, the program officially stopped taking applications for technology verifications in 2013 (EPA, 2013(a)) and has been discontinued.

In 2010, the Washington Stormwater Center and the Washington State Department of Ecology convened a group of stormwater regulators and researchers throughout the United States to determine the status of various stormwater technology evaluation programs and explore the potential of developing a national technology evaluation program (Herrera, 2010). The resulting memorandum (Herrera, 2010) is attached as Appendix A. With the exception of a few brief updates, the following table provides a summary of the national, regional, and state verification programs listed in that memo.

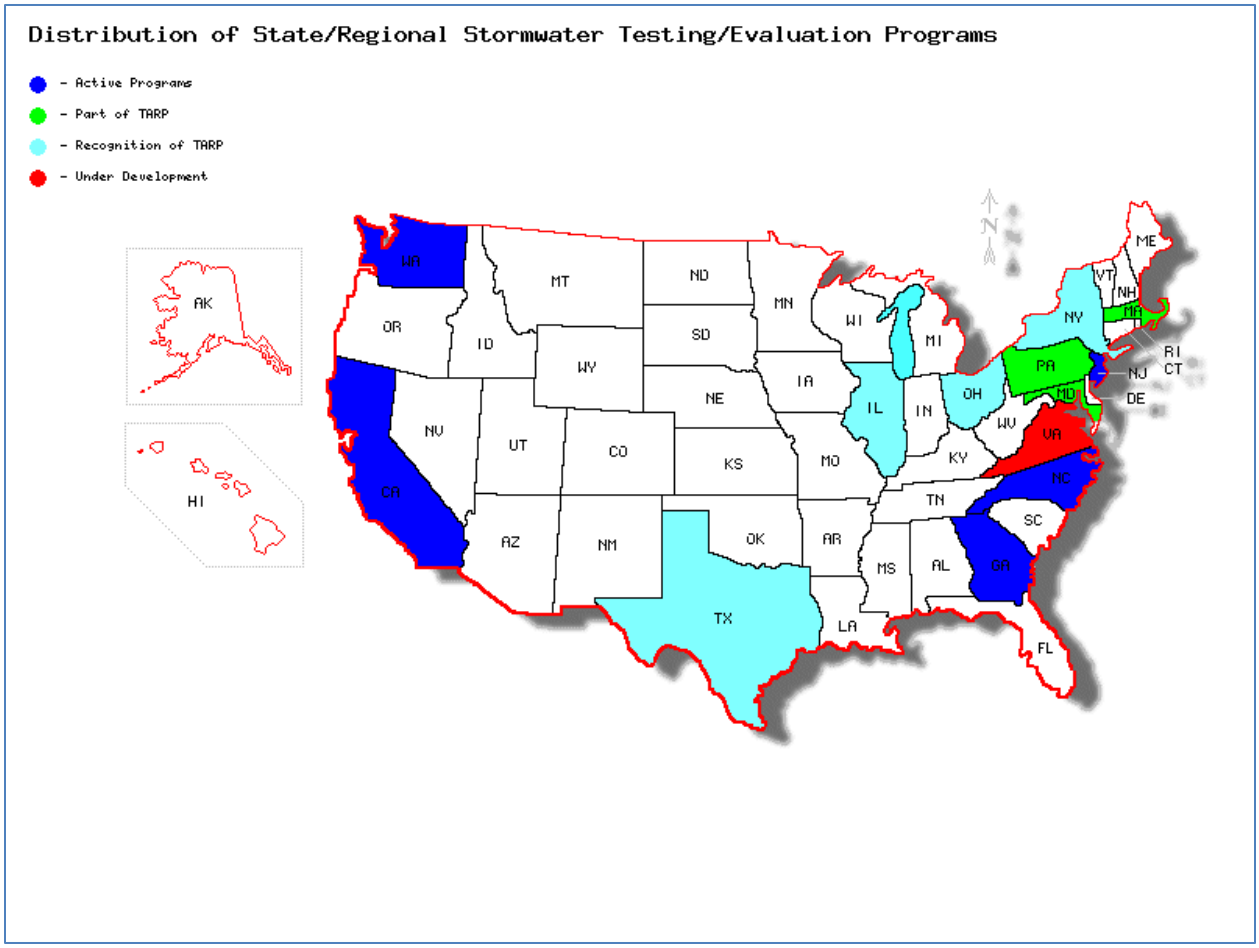

Figure 1 - Distribution of state and regional stormwater testing/evaluation programs in the U.S.

While this white paper focuses on U.S. domestic programs, note that evaluation and testing programs for stormwater products and practices exist outside the U.S. For instance, the Sustainable Technologies Evaluation Program (STEP) led by the Toronto Regional Conservation Authority focuses on evaluating and testing sustainable technologies in the air and water sector to inform both policies and technical applications (TRCA, 2013). STEP also assesses barriers to the implementation of sustainable practices and tools across Canada. Beyond the STEP program is the Canadian Environmental Testing Verification Program (CA ETV), which was established in 1997 to "support the implementation of innovative environmental technologies in Canada." This program uses third-party verification to ensure performance claims as well as build vendor credibility and buyer confidence for environmental technologies, such as street sweepers and oil-grit separators (CA ETV, 2013). Across the Atlantic, the EU has launched the Environmental Technology Verification (EU ETV) program as a "new tool to help innovative environmental technologies reach the market," (EU ETV, 2013, EU Joint Commission, 2007). EU ETV provides third-party testing by "verification bodies" to authenticate claims made by manufacturers that "are both credible and scientifically sound" (EU ETV, 2013). It should be noted that other similar testing and verification programs exist in a number of other countries beyond those listed in this document, which provides further support for the U.S. to develop a similar program.

Table 1 - Summary matrix of state and regional testing/evaluation programs in the U.S.

Program Name	Coverage	Jurisdiction or Entity of Origin	Reciprocity Granted by Other States	Program Status
EPA Environmental Technology Verification (ETV) Program	U.S./National	EPA, NSF International	Yes	Discontinued
Technology Acceptance Reciprocity Partnership (TARP) Program	Multi-state	Endorsed or recognized by CA, MA, MD, NJ, PA, VA, and NY	Yes	Partnership has dissolved, but protocol still used by many states
Technology Assessment Protocol – Ecology (TAPE) Program	State	Washington State	Yes	Active
New Jersey Corporation for Advanced Technology (NJCAT)	State	New Jersey	Yes	Active
CALTRANS	State	California	No	Active
Georgia Technology Acceptance Protocol (GTAP)	State	Georgia	No	Active
NC Preliminary Evaluation Program (NCPEP)	State	North Carolina	No	Active
Virginia Technology Acceptance Protocol (VTAP)	State	Virginia	No	Under development
Massachusetts Stormwater Technology Evaluation Project (MASTEP)	State	Massachusetts	No	Active

Active Research Efforts in Stormwater Sector

A number of organizations and academic institutions are engaged in both basic and applied research to better understand and predict performance of stormwater treatment products and practices. For instance, the University of New Hampshire Stormwater Center houses a field testing facility, which examines the treatment capacity for a number of manufactured products as well as non-proprietary stormwater practices. Other academic institutions, such as North Carolina State University; Villanova University; the University of Maryland, College Park; the University of Minnesota; the University of Texas at Austin; Washington State University, Puyallup; and several others have programs that research stormwater management products and practices.

Another important program is the Leaders in Innovation Forum for Technology (LIFT). This program, jointly led by WEF and the Water Environment Research Foundation (WERF), is an initiative designed to help move innovation into practice in the water quality industry. The program includes four main components:

- Technology Evaluation Program
- People and Policy
- Communication
- Informal Forum for Research and Development (R&D) Managers

The genesis of LIFT came out of an organic need for evaluation of innovative technologies in the water quality sector. While this program covers drinking, waste and stormwater sectors, the focus at this time has been primarily on wastewater technologies and any effort forward should include coordination with WERF.

Another example of an effort to categorize and promote research of stormwater practices is the International Best Management Practice (BMP) Database (www.bmpdatabase.org). This platform was established in 1996 through a cooperative agreement between the American Society of Civil Engineers (ASCE) and EPA. The program then transitioned into a multi-organization effort between the Water Environment Research Foundation (WERF), the Federal Highway Administration (FHWA), the American Public Works Association (APWA), and the Environmental and Water Resources Institute (EWRI), which is a specialty organization within the American Society of Civil Engineers (ASCE). The purpose of this effort is to, "provide scientifically sound information to improve the design, selection and performance of BMPs" (bmpdatabase.org, 2013). This project has provided, and continues to provide, invaluable information to the sector on the performance of practices (primarily non-proprietary in nature). However, the stated goal of this program is not consistent with a program to test, evaluate, verify or certify stormwater technologies, but rather, to gather, host and share basic research data on performance.

Regulatory Permit Monitoring Requirements: Although permit monitoring requirements are not new, specific monitoring of SCMs under an MS4 permit has been a relatively recent development and requires further exploration. To date, Washington State may be the only jurisdiction that has required MS4 Phase I communities to monitor a limited number of SCMs utilizing the methods of a state stormwater technology verification and certification protocol. This effort gives regulated localities flexibility on what kind of SCMs they monitor. As a result, there are a variety of both public domain and proprietary SCMs that have been monitored by localities using the TAPE protocol (WSC, 2012). This monitoring effort has resulted in the generation of preliminary bioretention performance data that previously did not exist within Washington State (Ecology, 2012). The use of a common stormwater protocol allows for greater comparison of performance data collected from a variety of stormwater SCMs. In this example, Washington State model demonstrates that both proprietary and public domain SCMs can be successfully monitored using the same rigorous scientific testing protocol.

Status of Existing Programs

As to be expected from programs that differ in structure, scale and local driving issues, the viability, sustainability and level of activity associated with these efforts vary and have led to mixed results. For instance, the ETV program, which to date is the only attempt at a national program, has been discontinued and no longer is providing services.

On the state and regional level, the singular attempt at developing a multi-state stormwater testing protocol program, TARP, has fallen short of its goals. Shortly after the development of the TARP Tier 2 Protocol (2003), the state of California backed out of the program in favor of their own. Eventually, the California program ended due to state budget constraints (CETCP, 2013). New Jersey subsequently developed an enhanced testing protocol that exceeded the TARP criteria (NJDEP, 2009) and has replaced the enhanced TARP protocols. Most recently, the proposed VTAP program has been under development in the Commonwealth of Virginia. It represents another partner state that has migrated away from the use of TARP and the concept of multi-jurisdictional reciprocity. Unlike some of the aforementioned programs that have stopped granting reciprocity, it also should be noted that several states continue to utilize and recognize TARP. These states include Massachusetts, Maryland and Pennsylvania. Other

states like Illinois and Ohio defer to the use of TARP; with Ohio EPA specifically listing TARP in both past (OH EPA, 2008) and the recently updated statewide general stormwater permit (OH EPA, 2013).

A handful of programs such as Washington State's TAPE and New Jersey's NJCAT, have been active and robust in testing and evaluating various stormwater products and practices. It is no surprise that other states have adopted elements of these programs or similar programmatic structures. For instance, the VTAP program will, similar to TAPE, rely on manufacturer-collected field testing data submitted to a technical reviewer for verification and certification. The VTAP program currently is undergoing regulatory review. Similarly, the District Department of Environment (Washington, D.C.) recognizes stormwater technology verified and certified by NJDEP (which is associated with the NJCAT program) via their recently released Stormwater Management Guidebook.

Other programs are less active or have simplified protocols and architectures, which may limit their overall impact. Others have attempted to develop a program and have not met success. Wisconsin, whose state legislature directed the Department of Natural Resource (DNR) to develop a performance standard for nonpoint-source pollution is one such example. The sector requested a tool to meet the performance standard, which lead to the development of testing protocols for proprietary SMCs with the goal of third-party testing (Stormwater, 2006). Ultimately, the momentum gained through initial interest in this program was lost, and the effort did not result in a formalized testing and verification program. This effort, and others like it, could provide valuable lessons learned for developing a nationwide program.

The remaining states have chosen not to develop their own testing/verification programs. As a result, some local jurisdictions, such as Sacramento County, CA, recognize certifications and/or accept testing data from state and regional programs or have developed their own testing protocols. Examples of these protocols include the City of Indianapolis' protocols for testing hydrodynamic separators and the City of Charlotte's pilot SWC program (City of Charlotte, 2013). With national regulatory changes on the horizon that will affect every state and thousands of local communities, more coverage of standardized testing for stormwater products and practices is needed. Further, many programs operate with limited, or no consideration of collaboration with other jurisdictions, so larger coverage should be done in a coordinated manner. One example of coordination exists between the Washington State TAPE program and Oregon Department of Transportation (ODOT) where TAPE focuses on the removal efficiencies of proprietary products and ODOT investigates the maintenance aspects of performance. Further, ODOT is currently constructing a site that is intended to become a TAPE-recognized field testing facility. Lack of coordination between other programs will continue to result in duplicative, expensive or conflicting testing protocols and evaluation programs throughout the country.

Scope, Scale and Nature of Problem for the Manufacturing Sector

As previously stated, a significant challenge in the manufacturing sector is the time and money required to receive product approval from various jurisdictions. And the compounding problem of going through this effort for multiple jurisdictions within the same state and within the United States further complicates the ability for a product manufacturer or representative to overcome geographic or regional barriers. This leads to a fragmented market where products in one region may flourish due to reasons beyond product performance.

Additionally, even for states or regions with established testing/evaluation/certification programs for stormwater products and practices, the investment required to gain regulatory approval may further stifle the establishment and growth of an effective technology or practice. For instance, TAPE and TARP studies typically take two years or longer to complete from start to finish. To reduce this time, optimal

climatic conditions are needed along with minimal problems deploying automated samplers, which are probabilistically unfavorable conditions.

Field studies are estimated to cost between $250,000 and $700,000 depending on the number of storm events needed to meet the testing protocol requirements. For example, based on surveys with stormwater equipment manufacturers regarding their actual costs for TAPE and TARP field studies, the proposed VTAP field study is anticipated to have an estimated cost of approximately $13,000 per qualified storm event. When considering the need for a minimum of 24 events to gain approval, the cost for VTAP field testing alone would be $312,000. This value is consistent with the cost range of $250,000 to $350,000 for field testing in the TAPE program (Howie, 2013). Additional costs, including staff overhead, capital cost of the SCM, application fees, and installation costs drive up the total investment to a range exceeding TAPE and TARP field studies (Terraphase, 2013). Other anecdotal information from the manufacturing sector suggests a total estimated investment of $500,000 or more over two to three years to gain approval through the VTAP program. This equates to an estimated five to seven years to recover the costs for the approval of one product in this program (WEF, 2012).

Beyond field testing costs, anecdotal evidence suggests that state and local technology verification programs are often implemented inequitably. Examples include:

- Iterative improvements that have no bearing on the performance of a previously approved SCM (for instance, a change in the product container that makes it easier to use or more applicable to a broader range of applications) requires a whole new round of field testing for approval.
- SCMs have been certified by certain programs when the submitted testing does not meet program requirements.
- Other programs have certified SCMs with no testing at all, despite a written requirement that all SCMs must be tested according to specific protocols.
- An SCM product successfully navigates the testing and evaluation process and is approved after expending time, money and resources, and subsequently, an SCM product using very similar technology “piggy-backs” on the process and is approved more quickly and easily with less, or no, resources or money spent.

Existing Challenges

A number of hurdles exist in the arena of stormwater product and practice testing and evaluation, which helps to inform challenges that may lie ahead when considering a national program. These challenges include inconsistent protocols, variability in approach, equitability between proprietary products and non-proprietary practices, lack of collaboration, lack of leadership, moving benchmarks and targets for performance standards, and challenges in defining program scope and scale. In order to move forward in investigating a national program, these critical topics must be considered.

Lack of Consistent Protocols: While some commonalities can be found between various stormwater monitoring protocols in existing programs, substantial variability exists. Appendix B includes a table that compares the various testing protocol requirements and notes both the commonalities and differences of these programs. This table highlights differences in hydrologic parameters. For example, several testing protocols require the use of a specific Natural Resources Conservation Service (NRCS) Rainfall Distribution Type (WA TAPE, VTAP, GTAP) while others do not (TARP, ETV, NJCAT, and CALTRANS). While there is some debate regarding the usefulness of specifying specific rainfall distribution types, it is worth noting that the two programs designed to have historical national application — TARP and ETV — do not have specific rainfall distribution requirements. Additionally, the Washington Department of Ecology has recently indicated it will potentially allow the future use of study sites located in Type II rainfall

distribution areas as part of the TAPE program (Doug Howie, 2013). The CALTRANS program also allows the use of multiple rainfall distributions within the jurisdiction's testing protocol (California has three different rainfall distribution patterns throughout the state — Types I, IA, and II). Since the majority of monitoring protocols with reciprocity in the U.S. will allow flexibility in the use of NRCS rainfall distributions, it stands to reason that a national testing protocol will also provide the same flexibility without compromising the integrity of the water quality studies and their subsequent results. This example of inconsistency in protocols highlights the challenge that stormwater product manufacturers and practice champions have when attempting to gain market entry and apply innovative SCM technologies across multiple states and regions. A national program could help to eliminate this unnecessary inconsistency in testing protocols. However, care should be taken in accounting for climatic and other variations that would impact how products and practices should be evaluated. There is recognition that this variability exists. However, the variability need not be as extreme as seen in the programs existing today.

Variability in Programmatic Approach: A range of options exist for a program that seeks to promote innovative practices, open markets up, and encourage competition. A program could simply test products and practices to evaluate and verify performance by an independent third-party, which is similar to the approach proposed by the ETV program. This format would utilize testing and protocols provided by the representative of the product or practice. Or, a program could go beyond testing and verification to develop standard protocols that would be used to test and evaluate the performance of products and practices. This is the structure used by programs such as TAPE, NJCAT and VTAP. Although, it should be noted that VTAP and NJCAT do not currently address public domain practices, and a small minority of approvals in the TAPE program have been provided for public domain practices. An enhanced version of this would be to group products and practices together based upon treatment process, such as infiltration, or another similar metric and test using consistent protocols to get "apples-to-apples" comparisons on performance. These results could be shared with program subscribers to help make informed decisions and drive higher performance in the marketplace. To go beyond this approach, the testing and evaluating entity could then also certify the performance of a product or practice. This level of investment comes with enhanced liability and costs, but would provide enhanced market entry for products and practices as well as increased assurance for municipalities and other consumers of stormwater management services.

Moving forward, a national program could govern just the technical or scientific testing process (testing/evaluating/verifying) of treatment technology performance. Or a national program could give approval of specific technologies (certifying). Keeping these two processes separate — a national verification program with state or local jurisdiction certification — requires a different structure and programmatic approach than a program that combines them. The challenge of a national certification and verification program is that there may be additional conditions that are regional or local, such as design criteria on a flow basis or runoff volume. Verification statements or reports can be generic, while certification done separately can be highly specific and take into account those local requirements. Some believe that having the certification process separate from verification process puts the time and cost burden on the manufacturer or technology proponent to gain certification from multiple jurisdictions. This route could make it difficult for manufacturers with limited funding or footprint to expand their markets, and it may limit access to important new technologies. Others believe that the varying nature of stormwater programs and local needs would translate to varying certification criteria. This would make the inclusion of a certification process more complex to manage. To those with this belief, the true advantage of a national program is providing consumer confidence. Regardless of

specific framework used, it is clear that any route chosen should ideally be as inclusive as possible to ensure that benefits are gained from the best ideas and technologies.

Program Depth and Scope: A national program with a well-defined scope of pollutants and methodology will require a strong, scientifically valid evaluation process that sets the technical factors for evaluation while maintaining a level playing field. The program has the challenge of determining what the goal is and what chemical constituents best represent evaluation of treatment performance. To date, most of the regional and state protocol programs have focused primarily on total suspended solids. There are other programs that either discuss or make other pollutants optional (WA TAPE, 2011; TARP 2003) and consider the use of phosphorus as a targeted pollutant (Ecology, 2005; Ecology, 2008; Ecology 2011; VTAP, 2012). There is a large suite of pollutants that need to be addressed. These include nitrogen, phosphorus, bacteria, metals, oil and grease, toxics, trash and debris, and others. There also are the short- and long-term hydraulics and maintenance aspects of SCMs that could be useful to a variety of stakeholders interested in SCM performance over time.

Once the most important constituents are identified, the methodology for testing will need to be developed. The two options available for developing a national stormwater testing protocol are laboratory- and field-based testing. Generally, laboratory-based research is easy to replicate, conducted within relatively short periods of time, is inexpensive and allows for direct comparison of one technology to another. Laboratory testing also provides the benefit of allowing a quick process for innovative technologies to be scientifically verified in a relatively short time period, ensuring that SCM consumers have the information needed to respond quickly to growing stormwater-related challenges. On the other hand, some argue field testing is needed for evaluating SCMs to analyze on-the-ground performance. There is also a belief by some that laboratory testing may not adequately represent field conditions. Similarly, field testing may not represent all regional conditions.

More than likely the answer lies in a combination of the two. For example, the NJCAT program recognized that lab testing could provide a good foundation for the technology and design. This provided enough confidence to allow a conditional use certification concurrent with more rigorous field testing. Though expensive and longer term, this process was historically executed successfully by NJCAT, using the Tier I (laboratory testing) and Tier II (field testing) process. The 2013 update to the NJCAT protocol now focuses solely on laboratory testing. The conditional use approach may benefit innovators and regulators by allowing new technologies to be sufficiently vetted, while also providing the manufacturer an opportunity to begin marketing and making sales needed to offset the cost of long-term monitoring that will provide additional data and validation. Another example is from the TAPE program, which provides a “Pilot Use Level Designation” to products based solely upon laboratory-based data results. This designation allows products to complete five installations within Washington to obtain field-based performance data. The product representative must monitor influent and effluent at all locations. Selecting sites with consistent drainage areas allows for aggregation of results that may help facilitate the development of a final report for submission. Generally, the conditional-use approach would allow products and practices to reach the field faster, thereby reducing the time to either reach markets or initiate data gathering for field-testing purposes. Lastly, conditional approvals would start the process of aggregating field testing data at locations representative of specific regions, states, or municipalities.

With the expansion of the scope of pollutants and technologies being evaluated, there also may be different levels of testing needed. For example, it may be appropriate to verify hydraulic capacity and strength of a permeable paver through laboratory testing (some of which may be tied to existing standards, such as the American Society for Testing and Materials). However, it may be appropriate for a technology that disinfects stormwater runoff to include additional field verification due to the variability

in pollutant load and concentration delivery based on site conditions. However, even in this scenario, laboratory testing and verification may provide sound basis for 'provisional' approval or certification that would stimulate broader field testing.

Equitability in Programs: Another challenge in the stormwater testing and evaluation sector is the focus of existing programs on stormwater products rather than practices. The vast majority of stormwater technology evaluation programs test and evaluate only SCMs produced by the manufacturing and private sector, excluding public domain SCMs, such as bioretention systems, bioswales, and constructed wetlands. TAPE is an exception, as they are involved with testing bioretenion facilities as well as permeable pavement in order to provide better guidance on where and how best to site the SCMs. Stormwater practices (public domain) are more frequently studied in academic settings and not through a certifying or approval process at the state or local level. The lack of a standard testing protocol for both stormwater products and practices creates an inequity where proprietary systems (products) are held to higher testing standards than public domain practices. It is important that stormwater practice performance studies are conducted and evaluated using a common testing design and analysis protocol. This allows for greater comparability of various stormwater products and practices and creates common standards for academia, government entities, and the private sector to implement SCM studies.

National Leadership: While EPA established the now discontinued ETV program to provide testing, evaluation and verification of stormwater products, the agency has not otherwise been directly involved in fostering of innovative stormwater products and practices either through guidance or funding.

The regulatory structure at the national level creates situations where jurisdictional stormwater program managers must determine how to address and potentially allow for the use of new stormwater technologies. Program managers are faced with various options ranging from allowing the use of new technologies without independent verification, allowing new technologies certified under a state or regional verification program, not allowing the use of any new technology, and everything in between. An important value provided by a national program is baseline evaluation criteria or protocols. This would give managers information that can be trusted and integrated into programs as they develop and mature. The growth of programs facilitated through additional confidence in product and practice performance provided by a national program would likely fuel further growth in the SCM marketplace.

It is clear from the organic development of stormwater technology testing and evaluation programs at the state and regional level over the last two decades that a need exists in the sector for programs to provide assurance to consumers on the performance of SCMs. Also, should EPA's proposed national stormwater rulemaking come to fruition, it is expected to include a national performance standard. Given this potential new regulatory change in addition to the existing demand for testing and evaluating stormwater products and practices, it is sensible that a national program be considered. The development of a national SCM performance and evaluation program could help provide more confidence to SCM consumers, enhance innovation dynamics in the sector, raise the bar on overall SCM performance, and drive down costs for SCMs through increased competition.

Funding Challenges: A lack of financial resources has significantly contributed to the instability of several programs. Currently, there are no planned financial resources available to the EPA to establish a consistent national evaluation program. States are economically strapped, and many do not have the staff or facilities available to dedicate to the evaluation of stormwater technologies. Many states also are faced with programmatic challenges and may not have the necessary resources to adequately implement their existing stormwater programs, let alone perform SCM evaluations and certifications.

The varying regulatory construct between states leads to equally varying levels of state regulatory requirements, goals, and motivations. Even if the forthcoming EPA stormwater rule provides a baseline

for increased performance of stormwater technologies, variability will likely remain between states. A national program can help fill this resource gap and allow states to better focus their limited resources towards other stormwater programmatic priorities. One important dialogue that needs to take place surrounds the issue of whether a national stormwater testing protocol and verification program could or should be considered within the stormwater rulemaking process – this concept will be further discussed amongst the sector stakeholders.

Transparency: Maintaining a clear, open structure that engages all of the participants, including manufacturers, SCM consumers, the research and engineering community, and regulatory agencies is one of the challenges of a national program. Currently, few states and local regulatory agencies have established a verification/certification program withmonitoring protocols, QA/QC protocols, and in-field testing. Engagement of those existing programs and education of states and localities lacking a program is a major challenge of a national program. Once engaged, continual engagement and discussion within the community is necessary as technology development, testing, and application is a dynamic process that requires a national program that grows and adjusts as necessary.

The 'Do-Nothing' Cost: Much of what has been presented up to this point has focused on the mixed success of existing programs and the challenges associated with testing, evaluation, verification and certification programs, especially as the development of a national program is considered. However, beyond these challenges is a more pronounced cost of having no program at all, whether at the national or local level. In the 2008 EPA Clean Watershed Needs Survey, which documents funding needs for Clean Water Act programs across the country, the total needs for municipal stormwater programs rose by 67 percent over the 2004 survey (EPA, 2010). Of this total amount, 85 percent of the total needs for municipal stormwater programs were associated with only seven (7) states, and perhaps more telling is that states who reported decreases in stormwater needs cited the lack of resources to document their needs (EPA, 2010). This fact reflects the limited resources available at the local level within many stormwater programs across the country, so it is not surprising that testing and evaluation programs have surfaced at the state, regional and national level to provide support for regulated entities.

The benefit of a testing, evaluating, verifying, and certifying program to a municipality is clear – to make informed decisions on what practices and products can and cannot be used within their jurisdiction. The lack of a program leaves a stormwater manager in the dark and dependent upon the producers or constructors of SCMs to provide treatment performance information. While many of these product and practice representatives may provide scientifically-sound performance data, there is no control on the veracity of the testing done. Since it is the regulated entity, not the SCM representative, who holds the permit, the liability related to performance efficacy resides with the jurisdiction. This puts stormwater managers in the position of either accepting the risk associated with using SCMs based upon unverified performance data or rejecting this risk and refusing to accept the product/practice based upon "best engineering judgment." Both alternatives have their costs: blind acceptance risks spending public dollars on under-performing SCMs, while rejection stifles the use of new, potentially innovative and highly effective practices. Further, rejection reinforces the status quo when deciding on the menu of SCMs used in a program. Both blind acceptance and risk aversion can lead to an outcome where pollution associated with stormwater runoff continues to increase over time, which is the case in many watersheds across the country. A program that provides independent information on performance can help stormwater professionals manage risk as and encourage the use of new and innovative products and practices. Knowing that managers have access to this information also would signal to the industry that the performance of SCMs must meet requirements deemed acceptable to jurisdictions, which are often tied to regulatory conditions. This should lead to enhanced SCM performance and higher levels of treatment with the outcome of improved receiving water quality. This is the ultimate goal motivating

the National Pollutant Discharge Elimination System stormwater program as well as the environmental ethic to preserve and protect the quality of the nation's waters.

SECTION 3: Overcoming Challenges

Structure

Product and Practice Categorization: One of the challenges to any SCM testing and evaluation program is the number and variety of products and practices available. Different practices have various goals ranging from volume control to sediment removal, and they use different processes to attain results, filtration versus centrifugal separation for instance. This makes it difficult to compare. However, due to emerging trends in urban planning, changes in rainfall patterns due to climate change, the shifting regulatory environment, and financial ability, end users demand a broad and varied set of products to choose from to customize their applications. Products not vetted through recognized evaluation programs risk being viewed as inferior or risky regardless of their suitability to the application. Although these challenges are formidable, they are not insurmountable and are worth overcoming. Moreover, given the variety of needs end users have, any narrowly defined set of practices would be of limited use. Therefore, any testing and evaluation program should be as broad as possible in its inclusion of products and practices.

This leads to the dual challenge of first, categorizing systems and determining which products and practices to include, and second, how to structure a testing and evaluation program. There are a variety of ways to categorize products, but ultimately the deciding factor for many end-users is the regulatory environment. The challenge is deciding in which regulatory context categories are developed. Pollutant-based regulatory requirements may not easily relate to SCM performance. For instance, performance standards are normally straightforward; however, product or practice efficacy is often based upon complex and sophisticated methods of analysis (Lenhart, 2007). Flow and volume-based regulations have their advantages because they are easy to monitor and may be seen as a proxy for pollutant removal (NRC, 2008). However, one disadvantage is that volume or flow is not yet a federal regulatory requirement and some products focus solely on pollutants without controlling for volume. To address these issues, an evaluation program should be developed in collaboration with federal regulatory agencies and perhaps environmental nonprofit groups and the larger regulated community. The group would reach consensus on what regulatory factors to consider, or what non-regulatory factors could be utilized as proxies. Ultimately, for example, multiple "end of pipe" categories might be considered and perhaps further sub-categorized for different climates, land use categories, or site requirements to ensure that products can be evaluated equally. However the categories are defined, they should be realistic and relate specifically to characteristics of stormwater and not simply adopted from other disciplines such as wastewater (Lenhart, 2007).

Program Architecture: There are a variety of frameworks to draw from, including government-sponsored certification programs and third-party and first-party-based programs. In any framework, the core elements include: preliminary meetings; Quality Assurance Project Plan (QAPP) development and approval; field and laboratory testing; internal, peer and stakeholder reviews; approval; issuance of the verification statement and terms; and public notification. It is important that clear and effective guidelines to QAPP development are provided with consideration to having the QAPP reviewed and certified by an outside and nationally/internationally recognized certifying entity, such as the International Organization of Standardization (ISO 9001 program). This may add costs to the testing and evaluation process. Also critical is the maintenance of a database of qualified reviewers to ensure a fair

and transparent review process. The perception and the reality that the reviewers are experts and unbiased is critical, as is their ability to dedicate the appropriate time to the review process. Other key elements to consider include ensuring the results and verification statement are easily available in the public realm with careful consideration of proprietary information disclosures, and that local jurisdictions understand how to interpret and use them. While these elements can be customized, any evaluation program should contain them in some form.

Discussion also is needed on the proper framework to house these core elements. As mentioned above, there are a variety of frameworks in the industry to draw from. For example, first-party studies use a framework managed by the owner of a particular product or method design, while third-party studies are managed by a separate entity in an attempt create an unbiased testing and evaluation process. Government certification programs like ENERGY STAR® and Sustainable Forestry Certification are examples of this type. Third-party studies often are more complex as they can involve several entities. For example, although a branding party may establish a set of principles and guidelines for certification, a separate auditing party will perform the studies, investigations and verification process. Once the verification process is complete, the branding party labels the particular product. Third-party groups can include the government, private consultants, qualified laboratories, academic institutions, or nonprofit entities. Further investigation is needed to understand how these certification programs work and to evaluate if any parallels can be drawn for stormwater product evaluation needs.

It is significant to note the lack of consensus on the use and validity of first- and third-party testing and evaluation frameworks. Many regard the third-party approach as the only credible manner to test, evaluate and verify SCMs, while others consider first-party testing as not only a valid approach, but a preferred methodology in this context. First-party supporters highlight that testing done by those most familiar with their respective products and practices provide more contextually-significant testing results.

Verification and certification programs in other sectors, for instance the ENERGY STAR program, often require third-party testing and evaluation. In the case of ENERGY STAR, there is an additional requirement that testing be done in laboratories that are EPA-recognized. While third-party verification and certification efforts are often preferred in favor of first-party efforts, some recognize the credibility of first-party frameworks. These supporters cite efforts such as following a rigorous QAPP, including accredited review by academics, public stakeholders and regulatory boards. Presenting the methodology at nationally-recognized conferences, in publications and on websites is also a way to potentially develop credible first-party frameworks. Either the first- or third-party approach may be corrupted if independence and objectivity in testing, evaluating and verification is not provided and is driven by a premeditated goal. This stresses the high-priority need to maintain objectivity in the process.

As previously mentioned, a range of programmatic structures can be considered. These options could include:

- **Testing and Evaluation Program:** This type of program would apply standardized testing protocols that have been developed through a consensus-based process by leading experts in the field. Protocols would be developed for various product and practice categories to facilitate like comparisons of SCMs within a category. There would be an understanding that the regulatory perspective is concerned primarily with the ability of a product or practice to meet performance standards. The results from testing would be integrated into a database available either to the public, if funding resources allowed, or to subscribers for a nominal fee. This type of program would not be intended to certify SCMs, but rather, increase consumer understanding of product and practice performance when making purchasing decisions or

developing lists of approved products for their community. This program would be similar to a "Consumer Reports" for SCMs minus the detailed written reviews and product recommendations.

This type of program assumes that purchasing decisions are homogeneous, which is not the case for stormwater. For instance, some street sweepers may perform more effectively in high-relief (hilly) areas at a higher cost. A stormwater manager in a low-relief community may not wish to pay the premium for high-relief performance and would opt for the less costly street sweeper that meets the regulated requirements or altruistic goals in their community. Similarly, some products or practices within a category may be more effective in removing certain types of pollutants. The information user should be able to match the needs of their program with products and practices that are best suited to address stormwater issues in their community.

- **Certification:** This program would be similar to the testing and evaluation program. It would, however, go further by including a certification step. Once a product or practice passes through the program, it would be certified to perform at a specific level. The product or practice would then be considered approved by public entities that participate in the program. The main advantage of a certification program over a testing and evaluation program is the enhanced marketability and increase in both consumer and regulator confidence of SCMs — think of ENERGY STAR appliances. One challenge of a certification program would be setting standards for categories that are meaningful for all regions and regulated communities across the country. A disadvantage is the program's increased administrative and financial liability, which administration costs. There would likely be a need for an independent arbitrating group that would field grievances or appeals from product or practice representatives and provide decisions or rulings on situations where certification results were disputed. This would further add to administrative costs.
- **Regional Standards:** A third solution could be regionalized standards and certifications — perhaps by EPA region — with significant opportunities for reciprocity. This option would perpetuate the geographic barriers that currently lead to market entry limitations for SCMs. It would, however, expand markets beyond the state level, while respecting regional variability. This recognition of variability may facilitate the development of standard protocols. A possible shortcoming of this structure may be the increased bureaucracy associated with a more fragmented architecture.

  One current example of a multi-state approach to environmental technology verification protocols is the Memorandum of Cooperation (MOC) between environmental regulating bodies from Indiana, Kentucky and Ohio. This agreement is currently investigatory and non-binding for these states and is being led by CONFLUENCE, a water technology innovation cluster located in Cincinnati, Ohio. The group recognizes the "sluggish timelines" and "prohibitive costs" for water technologies to reach markets, which limits the growth of innovative and effective technologies in the water sector (CONFLUENCE, 2013). This MOC seeks to reduce duplicative demonstrative testing efforts in individual states. It would harmonize testing protocols of water technologies between the three states, with the understanding that approval through this program would be recognized by all states. The organic rise of regionally-based agreements in this sector further illustrates the need to look beyond the local or even state level in order to spur innovation and growth of technology and performance in the water sector. It also should be noted that this agreement covers the whole

water sector, similar to the now-discontinued ETV program, and it is therefore not limited to stormwater products and practices.

- **Non-Programmatic Verifications:** This process involves the testing and evaluation of products where no pre-determined standard protocols exist. This verification effort would require that program administrators work in concert with SCM representatives and technical experts to develop testing protocols that could be used to establish standard testing protocols for similar SCMs. This verification effort may be seen simply as a way to address new technologies, and therefore could provide certification once standard protocols are developed.
- **Market-Based Verifications:** This verification would not be tied to a specific regulatory requirement or a developed standard protocol. Rather, it would be based on market factors requiring verification, often under specific conditions. For example, a manufacturer of a paver may want to have a verification statement relating to permeability under specific loading conditions. High-strength pavers may, for instance, be a selling point when attempting to market the use of pavers in areas with emergency vehicles or other heavy vehicles. Rather than having to continuously reprove the claim, a QAPP could be established to test and evaluate the results claimed by the SCM representative. These results could be documented in a report that the SCM representative could then use to market their product. The SCM representative would have confidence that the results have been verified through either stringent first-party or independent third-party testing and evaluation efforts.

Program Leadership: A number of challenges in developing, leading and administering a national program exist, including:

- The variety of stormwater products and practices in the market;
- Complexities in developing standard protocols that can be seen as meaningful across differing climates, dominant soil types, urban densities, landscapes, and local regulatory drivers
- Engagement with a set of wide-ranging stakeholders;
- Changing regulatory or industry requirements;
- Determining the role of field vs. lab testing; and
- Development of structure to provide sustainable and long-term funding.

Collaboration between various stakeholders is critical when developing a national program. Among such stakeholders are technical and professional associations and other NGOs, environmental groups, research groups, academic bodies, SCM consumers as well as local, state and federal regulatory agencies. Inclusive collaboration will be required to determine who should lead such a program. Choices between government and private sector sponsorship need to be made, while advisory bodies need to be comprised of representatives from the various SCM types included. Government agencies, EPA for example, could play a role that is objective yet supportive through funding or regulatory changes. However, current and future funding limitations as well as the slow pace of governmental bureaucracy are potential concerns for federal leadership. Alternatively, a private program could be more flexible and efficient. Yet safeguards against bias would have to be robust, and a leadership role would have to be established to help coordinate and moderate the various interested parties. A third option is for a nonprofit group, or a consortium of groups, to lead the administration of the program. A group(s) with a strong technical background and a mission to improve water quality across the nation could provide an objective leadership role in the development and administration of a program. Regardless of the scenario, significant and meaningful engagement by EPA would help lend credibility and the likelihood for success. Further, existing state and regional programs need assurance that a national program would be a long-term commitment.

Testing, Evaluation, Verification and Certification Bodies: As previously presented, a number of academic research centers specializing in the testing and evaluation of SCMs have arisen over the last few decades. These centers of research could be a resource of testing and evaluation for a national program. The development of standardized protocols presents an opportunity for any number of certified laboratories, research centers and academic institutions to provide the requisite testing and evaluation required to meet the goals of a national program. Ideally, an organization specializing in managing research projects in the stormwater arena would oversee contracts made with certified testing groups. This would help ensure consistency in the application of protocols and provide more efficient management of output data from testing and evaluation efforts. Additionally, it may be possible to delegate SCM testing and evaluation to professional or technical associations involved with different SCMs as long as clear and rigorous performance metrics are provided, analytical work is done by national or state certified laboratories, and review bodies are comprised of independent experts. More discussion and consideration must be made before engaging with trade associations, however.

As previously discussed, many universities and academic institutions have experts in the field with well-established laboratories and equipment. Involving select academic institutions, not limited to those with existing stormwater centers, should be considered, as faculty members associated with many of these institutions have sufficient experience and necessary equipment to evaluate various products and practices.

Data Management and Information Dissemination: With a technically sound testing process, incredibly valuable datasets will be generated. However, the national program will need to address how the data will be used and accessed. An important element of an evaluation and testing program is the collection, storage, maintenance, and dissemination of information. An online platform would house a database of results. Considerations include accessibility, in terms of audience, and whether the information is available for free or for a fee. As previously mentioned, care should be taken to protect proprietary information. While an online platform could provide near-universal access to participating groups, the information is not valuable without proper quality assurance and control as well as regular maintenance of web pages and databases.

Consistently generated data can be useful in characterizing pollutants from different land uses. The data can be utilized within water quality models, and it can provide baseline data for use in Total Maximum Daily Loads (TMDLs) and other useful applications. In fact, similar information for public domain SCMs have been used in TMDL implementation efforts, such as the Chesapeake Bay model. TMDLs require the quantification of SCMs and their effects on water quality. A natural extension of this effort would be to incorporate the results of SCM pollution removal effectiveness studies into broader water quality planning efforts throughout the nation. This has been done in promoting the use of alternative residential septic systems in bacterial TMDLs (VADEQ, 2005). Metadata should be integrated into data packages to provide the appropriate context for results presented. Ultimately, the program will be challenged with issues of data management and getting the public, regulators, and researchers' access to the data to provide value to the community.

Funding

One challenge common to all past and present SCM programs has been limited sustainable funding resources. Relying principally on volunteer efforts, the option requiring little to no funding, often results in reduced efforts and a degradation of the program integrity over time. This occurred early in the process of developing the TAPE program. Funding can come from a number of different sources, such as programmatic funding, grants and regulatory permit monitoring requirements.

Programmatic Funding: Programmatic funding represents funding provided by a government entity to support the successful implementation of a program. These programs have been historically subject to budget cuts in dire economic times and a general underestimation of the resources needed in order to successfully implement those programs.

For example, ETV was provided programmatic funding to pay for many of the program's operational costs. In 2012, over 95 percent of total funding came from outside organizations, such as EPA headquarters and regional offices (EPA, 2013(b)). The funding was used to support EPA staff, a consultant who managed the program, and a field testing organization that collected samples. This framework is described by EPA as a "public-private partnership through cooperative agreements between EPA and private nonprofit testing and evaluation programs." In this framework, manufacturers were responsible for the cost and installation of the device as well as their program costs. Further, a total of $5.7M in-kind contributions were made by vendors and others over the 18-year life of the program (EPA, 2013(b)). Some shortcomings associated with this approach became evident, however. For instance, program implementation costs were underestimated, and government funding was reduced due to financial and economic pressures. This decline continued until 2013, when the ETV program was officially discontinued after 18 years of service.

Another example of funding challenges is the NJCAT program. It originally received funding from the State of New Jersey in addition to receiving fees from program participants. Eventually, the State of New Jersey's funding to the NJCAT program was cut. Since that time, the NJCAT program has survived solely on a fee-for-service structure.

Programmatic funding provided by federal agencies that will gain from the establishment of a robust national SCM program should be considered. A partnership of Federal groups, likely led by EPA, that could benefit from this program include the Department of Transportation, Federal Highway Administration, Government Services Administration, Housing for Urban Development , as well as various military branches and coalitions, such as the Green Highways Partnership. Financial investment by these Federal groups could provide additional funding for the program. Aside from funding, this collaborative investment could ensure the engagement of Federal partners, which would signal to states and local governments that the Federal government is invested in this national program. As stakeholders in the process, Federal partners would have a strong voice at the table.

Grants Funding: Initially, limited funding was provided to support the Washington Department of Ecology's TAPE program, which created challenges in meeting the program's goals. Peer review was provided by volunteers. An all-volunteer committee of stakeholders fielded issues ranging from changes in protocols, user grievances, increasing work load, and growing documentation efforts. These challenges built up over time and eventually overwhelmed volunteer resources leading to a temporary decline in the program. Recognizing the continued need for the program, the Washington State Department of Ecology issued a grant of one million dollars to both manage the process and fund other activities associated with stormwater treatment issues. The funding was used to establish the Washington Stormwater Center, which has resulted in a nascent and promising program that provides technical and peer review oversight, training on stormwater related issues and academic-based research on SCMs. Originally, submitting a product for TAPE review was free, but that policy has changed.

Other sources of grant funding, depending on legislative and regulatory requirements or authorizations, could include those tied to federal grant programs similar to the funding structure of the ETV. Other grant-related funds could come from specific federal entities administered by nonprofit organizations, such as the National Fish and Wildlife Foundation and the Chesapeake Bay Trust. Groups like these could

be directed to incorporate water quality monitoring of SCMs installed through these programs. Some state-based stormwater and non-point source pollution programs have also been established in recent years throughout the country. Funding mechanisms associated with these programs can be used to direct grantees to monitor SCMs under a national testing protocol. This requirement would provide data that would allow comparisons between various technologies while refining existing efforts to quantify SCM pollution removal efficiencies throughout the country. A drawback to grant funding is potential for misaligned goals and agendas as well as grant management resources needed to administer grants.

Participant Funding: This structure follows a fee-for-services model and has proven to be a relatively stable source of program funding. A fee structure is established that provides funding or partial funding to manage the program. The fee structure varies and is paid over time as testing and evaluation review progresses. This allows a steady cash flow for verification and certification entities. There have been a few variants on fixed fees associated with a specific verification. Considering a robust national-level verification program, there could be a range of fees based on types of verification. Examples of participant funding tied to previously described program architectures include:

- **Testing, Evaluation and Certification Programs:** It is envisioned that primary funding for these types of programs would come through fixed fees, charged to representatives of the products and practices applying for testing and evaluation services. These charges would ideally cover testing efforts as well as administrative and operational costs associated with collecting test results, housing the resulting data, and supporting information dissemination efforts. The program could also charge users for this information. The variability associated with user-fee revenues may create uncertainties in administrative funding. Additional funding sources beyond user-fee revenues would help to provide long-term stability for the program.
- **Non-Programmatic and Market-Based Verification Programs:** The cost of verifying the performance of a specific SCM should fall on the shoulders of the SCM representative. This cost should include administrative as well as testing and evaluation costs. For non-programmatic efforts, costs possibly could be defrayed considering the larger benefit to the program from the development of standardized protocols, which would ostensibly benefit other SCM representatives. Similar to the testing, evaluation and certification program funding architecture, supplemental funding also could be provided by public agencies and other users of the information.

Miscellaneous Funding Alternatives: As previously mentioned, charging users for access to information provided by the program should be considered. Subscriber or membership fees have not been attempted by any past or existing programs, but this could be a source of additional revenue. Potential program subscribers or members could include:

- Certifying agencies wishing to be updated on the program and wanting some level of stakeholder input to the process. Perhaps these agencies need help with establishing protocol for new pollutants or dealing with issues specific to their jurisdiction. Since certification will be varied and agency specific, there will be a significant need for expertise in this area;
- Field and lab testing organizations can pay fees for qualifications or for providing them with market opportunities;
- Consultants wishing to be independent reviewers or provide QA/QC for manufacturers undergoing a verification;
- Public agencies or municipalities that may benefit from the information by short-cutting or eliminating the need for the development and maintenance of a robust product approval

process. For instance, if a regulated community previously spent $50,000 annually to maintain a product approval process and funded SCM research, an annual fee of $5,000-$10,000 to access the information available through the program would be a cost-efficient option.

- Another option is to work with academic institutions, which can help to lower costs and inject innovation into the sector. For example, an SCM product developer could cover the fees for a graduate student over a two-year period, including materials and supplies, if the academic institution qualifies as a certified testing entity. Engagement of academics and graduate students would encourage industry-academia collaboration and provide opportunities to train students for high-skilled jobs. Research performed in an academic setting often leads to publications in peer-reviewed journals, which would aid in information dissemination of emerging technologies in the stormwater sector. Additionally, students can provide lower-cost labor related to field sampling of systems already in the ground, which is crucial for understanding long-term performance of SCMs and maintenance practices as well. Finally, engagement of graduate students in technical areas would foster innovation. Students are keen to work on real life projects, and some may have new ideas and insights on how products and practices can be improved.
- Fostering the growth of innovative technologies by providing subsidies for a select group of smaller and less well-funded developers of new technologies should be considered. This subsidy would lower the barrier to market entry for technology companies that may not have the capacity larger and more well-funded companies.
- Workshops and training programs also can be organized concurrent with regional and national conferences to raise funds and to inform agencies and consultants about the program, methods of certification, sampling, protocols, and similar information.
- Lastly, trade organizations and other NGOs could include access to this information as a benefit to their organization and might then provide financial support for this access.

Conclusion

The depth and breadth of issues and topics covered in this document illustrates the complexity of stormwater testing and evaluation. From program architecture to protocol development to sustainable funding needs, the process of testing, evaluating and verifying products and practices in the stormwater sector is neither clear nor straightforward. The mixed success of existing state and regional programs illustrates the challenge in this sector, as does the recent discontinuation of the only national program that has been established. However, a program is clearly needed to provide SCM consumers with reliable performance information on products and practices. Such a program would also help product and practice developers and representatives gain wide market entry through reasonable investments in time and money.

More importantly, the growth of impairments associated with stormwater runoff in the nation's waters highlights the need for widespread application of high-performing stormwater technologies. These needs can be addressed through the development of a national testing and evaluation program in the stormwater sector. By reducing barriers to market entry and opening the gates to more technologies, competition should spur cost efficiencies not currently seen in the sector. Further, a transparent and consistently applied set of standard protocols on the efficacy of products and practices should provide the information needed by land developers and stormwater program managers. Data generated by the program will help stormwater professionals make informed decisions on the products and practices they choose to integrate into their projects and programs. This injection of performance information into the

sector should shed light on product and practice efficacy, thereby driving competition to create and establish SCMs with ever greater applicability and higher rates of efficacy.

Findings, Recommendations and Next Steps: A meeting of the STEPP Steering Committee occurred on October 1, 2013 in conjunction with the WEF Stormwater Congress at WEFTEC 2013 in Chicago, Illinois. The group reviewed previous sections of this document and developed a series of conclusions, recommendations, and future actions. The central question behind the development of this document was, "Is a national stormwater testing and evaluation program for products and practices needed and is it feasible?" **The Steering Committee agrees that there is a need for a national program, and that the development of such a program is feasible**. Beyond addressing these questions, the steering committee developed a series of recommendations that are listed below:

1. Meaningful engagement and support is needed from EPA.
2. The STEPP workgroup should engage with state regulatory agencies to gather input and support.
3. Both proprietary products and public-domain practices should be included in a comprehensive stormwater national testing and evaluation program.
4. Buy-in on a national program is needed from other professional organizations, NGOs, and state and regional stormwater organizations.
5. A common protocol for testing and evaluation and programmatic/process needs to be developed.
6. The development of an implementation plan and associated business plan is needed to determine logistical and financial sustainability.
7. Additional issues, such as long-term maintenance and international ETV programs, need to be further investigated in future efforts.
8. Collaboration with non-domestic ETV programs, such as the European ETV and Toronto Regional Conservation Authority's STEPP, is needed in future efforts.
9. To maximize the impact of the development of this document, widespread distribution is needed. STEPP workgroup members should engage in information dissemination efforts supported by activities, such as presentations and papers.

The development of this investigatory white paper is only the first step toward the development of a national program. More effort is required to address many of the issues and questions raised in this document. The STEPP Workgroup and Steering Committee will move forward to implement recommended items, and it is anticipated that these groups will continue meet regularly culminating in a meeting at the WEF Stormwater Congress at WEFTEC 2014 in New Orleans, Louisiana.

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APPENDIX A:

August 20, 2010 Conference Call Memorandum Titled, "National Stormwater Technology Evaluation Teleconference," Source: Herrera Environmental Consultants

Herrera Environmental Consultants, Inc.

Memorandum

To	Tanyalee Erwin, Washington State University
cc	Washington Stormwater Technical and Education Center Executive Management Team (EMT)
From	John Lenth, Rebecca Dugopolski, and Dylan Ahearn, Herrera Environmental Consultants
Date	September 17, 2010
Subject	National Stormwater Technology Evaluation Teleconference

Introduction

Herrera facilitated a discussion during an August 20, 2010 conference call to evaluate the merits of coordinating stormwater technology evaluations and protocols at a national level. Attendees participating in the teleconference included the following:

- John Lenth, Herrera Environmental Consultants
- Dylan Ahearn, Herrera Environmental Consultants
- Rebecca Dugopolski, Herrera Environmental Consultants
- Dr. Omid Mohseni, University of Minnesota/Barr Engineering
- Tom Maguire, Massachusetts Department of Environmental Protection (DEP)
- Doug Howie, Washington State Department of Ecology
- Joel Baker, University of Washington
- Tanyalee Erwin, Washington State University
- Sandy Blick, New Jersey DEP
- Dr. Robert Roseen, University of New Hampshire
- Tom Stevens, NSF International
- Rich Field, U.S. Environmental Protection Agency (U.S. EPA)
- Dr. George Guo, Rutgers University
- Jim Lenhart, Stormwater Northwest

This memorandum summarizes the discussion that occurred during the August 20, 2010 conference call and is organized into the following sections based on the meeting agenda:

- Status update on existing testing protocols
- Merits of developing a coordinated testing protocol
- Next steps

Status Update on Existing Testing Protocols

U.S. EPA Environmental Technology Verification (ETV) Program

Tom Stevens provided an overview of the ETV program which was developed in 2001. Not many changes have been made to the protocol since it was first developed (the latest edition is Draft 4.1, published in March 2002). Results from approximately a dozen different technologies have been submitted to the ETV program and Verification Reports and Verification Statements are posted on U.S. EPA's ETV website. Testing has not been completed in recent years according to Tom Stevens and there have been some issues with sampling solids.

Reference Links

ETV Protocol: http://www.epa.gov/nrmrl/std/etv/pubs/04_vp_stormwater.pdf

Verified Stormwater Technologies: http://www.epa.gov/nrmrl/std/etv/vt-wqp.html#SWSATD

Technology Assessment Protocol – Ecology (TAPE) Program

Doug Howie provided an overview of the TAPE program which was developed in 2002 for evaluating emerging stormwater technologies in the state of Washington. The current protocol in use is the January 2008 version. There are 8 to 10 applicants currently in the process and Ecology is not accepting any additional applications until the administrative structure is revised. The four treatment categories include basic, enhanced, phosphorus, and oil treatment. There is also an approval process for pre-treatment facilities and chemical treatment (as part of the Chemical Technology Assessment Protocol - Ecology [CTAPE] process). Ecology is working with the University of Washington, Washington State University, and Herrera Environmental Consultants to revise the protocol and to open the application process again soon. Treatment requirements are triggered by new development or re-development projects that are typically 1-acre or larger (Phase II jurisdictions); however, this threshold level may be lower based on previous requirements before the Phase II permit was issued in 2007. Enhanced treatment requirements are typically triggered due to high traffic loads.

Reference Links

TAPE Protocol: http://www.ecy.wa.gov/pubs/0210037.pdf

Use Level Designations:
http://www.ecy.wa.gov/programs/wq/stormwater/newtech/technologies.html

Technology Acceptance Reciprocity Partnership (TARP) Program

Jim Lenhart provided an overview of the TARP program which was developed in 2001. The current protocol in use is the July 2003 version. The protocol was endorsed by California, Massachusetts, Maryland, New Jersey, Pennsylvania, and Virginia; however, Jim Lenhart stated

that California is no longer recognizing technologies that pass through this process. Dr. Guo is still doing some research on technologies using the testing protocol. Rhea Brekke (the former executive director) has moved on and Dick Magee has taken over the New Jersey Corporation for Advanced Technology (NJCAT), the entity that reviews and verifies stormwater technologies monitored using the TARP protocol.

Reference Links

TARP Protocol: http://www.state.nj.us/dep/dsr/bscit/Stormwater%20Protocol.pdf

Verified Stormwater Technologies: http://www.njstormwater.org/treatment.html

New Jersey

Sandy Blick provided a summary of New Jersey's existing process for evaluating new stormwater technologies based on new criteria established in 2004 that stated a stormwater technology "must be verified and certified by the state." New Jersey's modifications to the TARP protocol are summarized in separate documents detailing laboratory and field protocols (see links below). The revised protocols were based on input from the state of Wisconsin and others. The certifications granted by the New Jersey DEP will expire on May 15, 2011, since they are tied to a specific regulation. Sandy Blick stated that New Jersey is still struggling with how to define maintenance requirements and mentioned that it would be helpful to have a verification entity (i.e., 3rd party evaluator like NJCAT or another entity such as a laboratory).

New Jersey Field Protocol: http://www.njstormwater.org/pdf/field_protocol_12_15_09.pdf

New Jersey Lab Protocol for Manufactured Filtration Devices:
http://www.njstormwater.org/pdf/filter_protocol_12-15-09.pdf

New Jersey Lab Protocol for Hydrodynamic Sedimentation Devices:
http://www.njstormwater.org/pdf/hydrodynamic_protocol_12_15.pdf

American Society of Civil Engineers (ASCE)

Dr. Guo provided a draft of the *Certification Guidelines for Manufactured Stormwater BMPs* developed by a joint committee between ASCE and the Environmental and Water Resources Institute (EWRI), a specialty institute of ASCE. Dr. Guo noted that this document is a currently considered a guidance document and not yet a protocol.

American Society of Testing and Materials (ASTM)

Dr. Mohseni mentioned that ASTM formed a subcommittee a couple of years ago for technology evaluations. They have developed a laboratory protocol for hydrodynamic separators, but have not started the protocol for filtration systems yet. They are also working on a removal efficiency (hydraulic testing) method and a scour (washout testing) method. All three standards will be going to ballot this fall.

ASTM WK17663 - New Test Method for Hydraulic Capacity Evaluation of Hydrodynamic Separators and Underground Settling Devices: http://myastm.astm.org/DATABASE.CART/WORKITEMS/WK17663.htm

Other Stormwater Testing Protocols

Other stormwater testing protocols that were mentioned during the conference call include:

- California – contact the California Stormwater Quality Association (CASQA) for more information
- California, Sacramento: Appendix M of the City of Sacramento Guidance Manual for On-Site Stormwater Quality Control Measures (2000), may consider reciprocity with TAPE: http://www.sacramentostormwater.org/SSQP/development/proprietary.asp
- Colorado, Denver – will accept TAPE or TARP approvals
- Florida – requirements for retrofits
- Georgia Technology Assessment Protocols (GTAP) for Evaluating Emerging Stormwater Treatment Technologies: http://www.northgeorgiawater.com/html/331.htm
- Maine – phosphorus and metals treatment
- Maryland – currently has two technologies approved for use; accepts TARP monitoring results: http://www.mde.state.md.us/assets/document/Proprietary%202005.pdf
- Massachusetts Stormwater Technology Evaluation Project (MASTEP): http://www.mastep.net
- Minnesota – talking about reciprocity with Wisconsin
- Missouri, St. Louis – The Metropolitan Sewer District (MSD) may consider reciprocity with TAPE or certification from the New Jersey DEP: http://www.stlmsd.com/portal/page/portal/engineering/planreview/PlanReviewInformation/List/ASCE%20Proprietary%20BMPs.pdf
- New Hampshire – TAPE and TARP listed in regulations
- North Carolina – the Department of Environment and Natural Resources (NCDENR) allows new stormwater treatment technologies to be evaluated under a Preliminary Evaluation Period (PEP): http://h2o.enr.state.nc.us/su/documents/Ch20-23merged08Aug2009.pdf

- Oregon, Portland (Bureau of Environmental Services) – currently has own protocol; may accept TAPE approvals in the future: http://www.portlandonline.com/bes/index.cfm?c=47956

- Rhode Island – bacteria, nitrogen, and phosphorus treatment; will accept TAPE or TARP approvals as well as testing done using their own protocol

- Tennessee, Nashville – Davidson County (Metro) – uses similar laboratory guidelines to those established by the New Jersey DEP and NJCAT for testing manufactured systems. For field testing, Metro encourages the use of the TARP Tier II Protocol with some modifications: http://www.nashville.gov/stormwater/regs/

- Texas – testing facility at the University of Texas in Austin: http://www.crwr.utexas.edu/scientists/barrett/projects/bmp.html

- Virginia Stormwater Best Management Practice (BMP) Clearinghouse and Virginia Technology Assessment Protocol (VTAP) – currently under development: http://www.vwrrc.vt.edu/SWC/index.html

- Wisconsin Department of Natural Resources Method for Predicting the Efficiency of Proprietary Storm Water Sedimentation Devices: http://dnr.wi.gov/runoff/pdf/stormwater/techstds/prop_devices_std_v2_040909.pdf

Merits of Developing a Coordinated Testing Protocol

Some of the merits of a coordinated testing protocol mentioned during the open discussion include:

- Testing is happening, but products are not getting out into the market and we are letting the stormwater management community down (Dr. Roseen)

- Testing is needed to validate and verify the manufacturer's claims

- Stormwater vendors want to be approved to sell their products

- Approvals help to guide cities and towns with their purchasing decisions

- An approval process provides an opportunity for regulatory agencies establish goals and criteria that are achievable

- An approval process provides an opportunity to review and revise regulations and standards

- There is a need to focus on manufactured or vendor devices and compare these facilities to generic BMPs

Additional discussion focused on the following topics:

- Total suspended solids (TSS) removal of 80 percent represents the best available technology at the time; 90 percent TSS removal is now required by Rhode Island

- The International Stormwater BMP (ISBMP) database currently only allows third party data

- John Lenth and Doug Howie mentioned that the Phase I permit-related monitoring is currently focused on monitoring several different generic BMPs

- Tom Maguire mentioned a recent United State Geological Survey (USGS) study on low impact development) LID BMPs

- Sandy Blick mentioned that maintenance is an issue and that the protocol needs to consider the end user and what is left after testing has been completed.

- EPA will not approve BMPs, but they can recognize other BMP review protocols. They were working on getting funding to make NJCAT and TARP nationwide at one time.

- There seemed to be interest in reenergizing TARP and adding more states – New Hampshire and Rhode Island are already on board.

Some of the BMP performance characteristics that may need to be considered for a national protocol include:

- How does the technology work under different flows?

- How does the technology work under different discharge conditions?

- How does the technology work in different climates?

- How does the technology work with different particle sizes?

Next Steps

Potential interested parties to include in ongoing discussions regarding developing a national protocol include:

- ISBMP database staff

- TARP staff
- Dr. Robert Pitt
- Stormwater Equipment Manufacturers Association (SWEMA)
- Other state representatives (possibly through the Environmental Council of States [ECOS])

Follow-up action items include:

- John Lenth will send out a side-by-side comparison of the TAPE and TARP criteria (Appendix F of the *Center for Watershed Protection Monitoring to Demonstrate Environmental Results: Guidance to Develop Local Stormwater Monitoring Studies Using Six Example Study Designs* [CWP 2008]).
- Dr. Roseen will send out another protocol comparison that he has prepared.
- Jim Lenhart will share his proposal to the U.S. EPA ($300,000 for hiring a full-time staff member for certification of BMPs, training, and education).
- Scheduling another conference call in two months (approximately mid to late October).

APPENDIX B:

Comparison of Stormwater BMP Testing Protocols Throughout the U.S. Source: Chris French, Mindy Hills, Filterra Bioretention Systems, A Division of Americast

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Comparison of Stormwater BMP Testing Protocols Throughout the U.S.								
	TAPE	**TARP (2003)**	**VTAP**	**NJCAT**	**CALTRANS**	**ETV∞**	**GTAP**	**NC PEP²**
Minimum # of aliquots:	10	10	10**	10**	6-12*	5	10	NA
Mean precipitation intensity (inches/hr):	>0.03	NA	NA	5 in /hr max	NA	NA	NA	NA
Minimum storm coverage:	≥75%	≥70%	≥70%	≥70%	75 - 85%*	NA	≥70%	NA
Sampling duration:	≤36 hr	NA	NA	NA	NA	NA	NA	NA
Total precipitation: (inches)	≥0.15	>0.10	>0.10^	>0.10 , < 3.0	>0.10	>0.2	>0.15	NA
Precipitation duration:	1 hr	NA	NA	NA	1 hr	NA	1 hr	NA
Antecedent dry period:	≥6hr	≥6hr	≥6hr	≥6hr	≥6hr	≥6hr	≥6hr	NA
Minimum # storm events	12	15	18-24***	20****	8	15	15****	10
Minimum precipitation to be monitored (inches)	recommend 4 seasons (1 yr)	15	15	15	2 yrs	NA	NA	Min. 1 year required
Lab Certification Criteria	NELAC/WADOE	NELAC/ELAP	VELAP[a]	NA	DHS[#]	NA	NA	NA
Sediment	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Nutrients	Yes - nr	Yes - nr	Yes	No	Yes	Yes - nr	Yes - nr	Yes - nr
Metals	Yes - nr	Yes - nr	Yes - nr[o]	No	Yes	Yes - nr	Yes - nr	No
Oil & Grease	Yes - nr	Yes - nr	Yes - nr[o]	No	Yes - nr	Yes - nr	Yes - nr	No
Bacteria	No	Yes - nr	Yes - nr[o]	No	Yes - nr	Yes - nr	Yes - nr	No
Toxicity	No	No	No	No	Yes	No	No	No
Specific Gravity	No	No	Yes	No	No	No	No	No
Protocol/Evaluation Program Jurisdiction of Origin	WA	CA, MA, MD, NJ, PA, VA	VA	NJ	CALTRANS	EPA	GA	NC
Reciprocity in other jurisdictions/localities	Yes	Yes	No	Yes	No	No	No	No
Jurisdictions with Reciprocity	Limited CA Localities, NY, OR DOT, St. Louis,	IL, MA, MD, OH, NJ (interim certification), NY, PA, TXCEQ, VA,	NA	DC, NY, Limited localities outside of NJ	NA	Historically NY and some limited localities throughout the US	NA	NA
NRCS Rainfall Distribution Type Specific	Yes, Type IA. Type II may be allowed in near future per discussions with WA Ecology	No, All Distribution Types Allowed	Yes, Type II & III	No, All Distribution Types Allowed	No, CA contains Type I, IA, & II.	No, All Distribution Types Allowed	Type II	NA
Protocol Applicable to Public Domain BMPs	Yes	Yes[1]	No	No	Yes	No	No	No
Allow for Simulated Rainfall Events	No	Silent	Yes	Yes	Silent	Silent	Silent	Silent
Allow for Synthetic Stormwater	No for field; Yes for lab	Silent	No	Yes	Silent	Silent	Silent	Silent

*Dependent upon total precipitation

**6 aliquots if less than 1 hour duration

***At a minimum, five sets of two qualifying storm events in sequence shall be sampled, for a total of 10 storms. In addition, monitor a minimum of two events that exceed 75% of the design capacity. For 18 samples to be used, need 50% confidence level.

****peak runoff rate from at least two/three of these storms shall exceed 75% of the device's Maximum Treatment Flow Rate (MTFR)

[a]VELAP certified laboratory unique to VTAP. Does not recognize the reciprocity associated with NELAC certified labs outside of VA. VELAP is traditionally used for permit compliance, not research based WQ studies.

Yes-nr - not required

Yes - nr[o] - "At the option of the applicant, performance data for additional constituents (such as bacteria, metals, and other pollutants) may be reported. Whereas no PR credit can be awarded for these constituents at this time, the data may be made available if the VTAP is extended to other pollutants. This optional data will NOT be reviewed by the evaluator, the committee, or the department at this time."

#DHS = Department of Health Services - alternative arrangements may be made provided that the exception is documented and approved by the Caltrans task order manager.

^ = At least one qualified storm event with greater than 1 inch of rainfall, and at least three qualified storm events with greater than 0.5 inches of rainfall shall be sampled during the testing period

∞ETV Program No Longer in Existence

[1]The Massachusetts Stormwater Technology Evaluation Project (MASTEP) evaluates both public domain and proprietary SW BMPs using the TARP program from studies across the country

[2]NC Preliminary Evaluation Program (PEP) requires up to 5 individual test sites for any given proprietary technology

Investigation into the Feasibility of a National Testing and Evaluation Program for Stormwater Products and Practices

A White Paper by the National Stormwater Testing and Evaluation of Products and Practices (STEPP) Workgroup Steering Committee

WATER ENVIRONMENT FEDERATION

February 6, 2014

Authored by: STEPP Workgroup – Steering Committee