Virginia Stormwater BMP Clearinghouse Committee Meeting

Virginia Department of Conservation and Recreation
Virginia Water Resources Research Center
May 30, 2007
Piedmont DEQ Regional Office
Glen Allen, Virginia

Virginia Stormwater BMP Clearinghouse Committee Members Present

Lee Hill (Committee Chair), Virginia Department of Conservation and Recreation
Rishi Baral, County of Stafford, Planning Department, E & S Plan Review
Joseph G. Battiata, CONTECH Stormwater Solutions Inc.
W. Douglas Beisch, Jr., Williamsburg Environmental Group, Inc.
Dean R. Bork, Department of Landscape Architecture, Virginia Tech
Gary Boring, New River Highlands RC&D Council
Larry Coffman, Filterra
Kristina Hill, Department of Landscape Architecture, University of Virginia
Gregory Johnson, Patton Harris Rust & Associates
Mary E. Johnson, Thomas Jefferson Soil and Water Conservation District
Cynthia S. Linkenhoker, City of Portsmouth, Dept. of Public Utilities/Public Works
Roy Mills, Virginia Department of Transportation (VDOT), Location and Design Division
Douglas H. Moseley III, GKY & Associates, Inc.
David B. Powers, Michael Baker Jr., Inc.
James S. Talian, City of Lynchburg
Scott J. Thomas, James City County Environmental Division
Burt Tuxford, Virginia Department of Environmental Quality

Virginia Stormwater BMP Clearinghouse Committee Members Not Present

A. Osman Akan, Frank Batten College of Engineering and Tech., Old Dominion University
David J. Hirschman, Center for Watershed Protection
Kelly Ramsey, Natural Resources Conservation Service
David W. Rundgren, New River Valley Planning District Commission
Randy Sewell, Vanasse Hangen Brustlin, Inc. (VHB)
Kevin D. Young, Dept. Of Civil and Environmental Engineering, Virginia Tech

Virginia Department of Conservation and Recreation (DCR) Staff Present

Scott Crafton
John McCutcheon

Virginia Water Resources Research Center (VWRRC) Staff Present

Stephen Schoenholtz
Jane Walker

Observers Present

Glen Payton, Filterra

The Chairperson called the meeting to order and asked everyone to introduce herself or himself by describing her/his interest and expertise in stormwater management and best management practices (BMPs).

A one-page list of the members of the Virginia Stormwater BMP Clearinghouse Committee was distributed (Appendix A). It was explained that initial terms of the committee would need to be staggered to prevent complete turnover of the committee within any given year. It was recommended that the terms be staggered in such a way to keep diversity among the different groups represented. R. Baral, L. Coffman, K. Hill, and B. Tuxford offered to serve an initial term of one-year. L. Coffman and J. Talien offered to serve a two-year term initially. It was noted that initial terms would be announced by the next meeting.

Goals of Project

S. Crafton described the public process of revising stormwater regulations and ways the stormwater BMP handbook and clearinghouse website are expected to be incorporated into the new stormwater regulations. BMPs are evolving rapidly, and DCR needs to be able to make changes to the regulations rapidly as new information becomes available. The handbook is currently referenced in the stormwater regulations (4VAC 50-60) and is expected to be referenced in the new regulations. In addition, the clearinghouse also is expected to be referenced in the new regulations.

Research by the Center for Watershed Protection (CWP) evaluated the tools available to meet load limits (Are the load limit values accurate and achievable?). The findings, just announced last week, suggested that, DCR can have a high level of confidence in the tools. A member asked if nitrogen (N) and phosphorus (P) are the parameters measured to meet reduction goals. S. Crafton said the CWP found strong support for N and P. They considered total suspended solids (TSS) but were not as confident in these numbers. It was noted that TSS is used in other states. S. Crafton responded that by reducing N and P, TSS will also be reduced.

A member asked if researchers can tell how parking lots, roof tops, etc. relate to N and P loads. L. Hill said that when equal to or less than 40% impervious level, P is the driving nutrient. When impervious levels are greater than 40%, N shows up in higher relative concentrations [higher N:P ratio]. S. Crafton noted that people will be able to see how to achieve a particular goal for a specific impervious level by looking in a table and matching the BMP efficiency rating with the needed goal. He also explained that CWP has developed a credit system. If a developer uses low impact development (LID) and DCR's envisioned spreadsheet, they may be able to provide "credit" for the location. For example, if an area is less than 40% impervious and LID is incorporated, the spreadsheet should be able to show if credit is to be granted for using LID. The goal is to have an "on-site" achievable goal that can be met at all times.

A member requested the link to the CWP results:
Report: http://www.dcr.virginia.gov/documents/stmwtrcwprpt.pdf
Appendix A: http://www.dcr.virginia.gov/documents/stmwtrcwprptappa.pdf
Appendix B: http://www.dcr.virginia.gov/documents/stmwtrcwprptappb.pdf
Appendix C: http://www.dcr.virginia.gov/documents/stmwtrcwprptappc.pdf

DCR staff explained that the department is moving towards having a single completion date for the stormwater handbook, clearinghouse, and regulations so that when the regulations go into effect, there will be an updated handbook and clearinghouse ready for use. A member inquired if the regulations would apply statewide, to which L. Hill replied "yes." S. Crafton explained that the handbook would contain the policies, calculations, sample site-plans, and case studies. The

clearinghouse is expected to have other information, including tools used to select BMPs. The goal is to provide information so that decision makers can find tangible benefits to preserving floodplains, etc. (from both an environmental and economic perspective). For example, software potentially being developed by David Kibler and Kevin Young at Virginia Tech could be posted on the clearinghouse. These researchers have been working with VDOT to prioritize BMP choices given the value judgments of decision makers (who prioritize 15 different criteria, including cost, maintenance, etc.). These researchers expect to be able to modify the software for use with other BMPs. If so, this type of information could be posted on the clearinghouse.

A member suggested that some designs for new BMPs should be included in the clearinghouse.

Other Stormwater BMP Websites

S. Crafton provided web addresses to two Stormwater Clearinghouses

- Massachusetts: http://www.mastep.net/
- Missouri: http://www.dnr.mo.gov/env/wpp/stormwater/index.html

He requested that committee members review these sites before the next meeting to facilitate discussions of what Virginia could present on its clearinghouse and how.

S. Crafton distributed five handouts (See Appendix B-F):

- Potential BMP Clearinghouse Tasks
- List of Illustrations/Bacteria Removal
- Stormwater BMP List
- Best BMP design References
- The Technology Acceptance Reciprocity Partnership (TARP): Protocol for Stormwater Best Management Practice Demonstrations.

S. Crafton described DCR's request that the committee help evaluate the research that is presented by BMP manufacturers. He noted that three possible categories could be used:

- Research can't be verified ("Buyer Beware")
- Research follows standard protocol (but not TARP protocol)
- Research follows TARP protocol.

A member described a similar rating system being used in the state of Washington. It has a data sheet that the manufacturer's complete. The BMPs are given a rating of either "pilot," "conditional," or "generally approved." It was suggested that Washington's process could be used as a starting point for Virginia.

A member inquired if the committee is expected to put research information on the clearinghouse website or if the manufacturers would do so, particularly given the way the names of products change and are revised. S. Crafton suggested we might want to include links from the clearinghouse to the manufacturers' web sites.

S. Crafton mentioned that neither DCR nor VWRRC would conduct research; however the VWRRC may facilitate research by third-parties. The manufacturers would cover the expenses of the research. The Committee is invited to provide ideas on what types of research are needed. I was suggested that EPA may be a source of funding to help pay for such research.

Similarly, DCR and VWRRC may work together to provide BMP training.

Committee Charter

J. Walker reviewed the committee charter. See Appendix G for a copy of the charter.

Article II – Definitions
A member questioned the definition of BMP as being only for "non-point" sources. Industrial, MS4, and construction discharges are considered "point sources." L. Hill suggested using the definitions in the handbook because of the need to include both structural and non-structural BMPs.

A member suggested that the use of the term "land disturbance projects" in the definition for Stormwater BMP sounds more like "construction" than "post construction."

Article V – Membership
Section 2 – Representation of stakeholder groups – Two additional members for the committee were suggested:

1.) Web designer – S. Crafton offered that one would be hired for the project and that DCR has a web designer who could help address questions.
2.) Ecosystem ecologist to help screen monitoring data and procedures. A member was willing to suggest names of ecosystem ecologists.

Section 6 – Resignation, Termination, and Absences – A member proposed that the attendance policy should only apply to regular quarterly meetings (and not special meetings that can be called with only 5-days notice). Furthermore, if a substitute attends, it should not be counted as an absence.

Article VI – Meetings
It was suggested that video conferencing be listed as a possibility if these capabilities are available.

A member asked who could make motions. S. Crafton replied that any member of the committee could make a motion.

Article XI – Administration
In response to a question, J. Walker offered that the VWRRC would set up a listserv so the committee members can easily communicate with one another.

A member asked if the contact list for committee members could be made confidential so that the committee members would not receive phone calls directly from manufacturers, etc. L. Hill said that the names of the committee members could not be held confidential but that the contact information would not need to be listed anywhere.

Questions and Other Items of Business

It was suggested that a master work plan be developed with target dates. Members of the committee may be more effective if they knew what to expect and when.

A member commented that receiving information in duplicate and reminders about upcoming tasks to be completed would be appreciated.

It was requested that any information to be discussed at meetings be distributed before the meeting. Also to be most effective, it was noted that the committee should come to a consensus and not simply discuss the issues.

Next Meeting

The next meeting was set for June 21. The location of the meeting is to be announced.

With no further business, the meeting was adjourned at 12:45 p.m.

Appendix A—

PROPOSED BMP CLEARINGHOUSE COMMITTEE

LOCAL GOVERNMENT (5)

RA	Baral, Rishi (Stafford Co.)
J	Linkenhoker, Cindy (Portsmouth)
N	Rundgren, David (New River Valley PDC)
J	Talien, Jim (Lynchburg)
Y	Thomas, Scott (James City Co.)

DEVELOPMENT/CONSULTING (5)

J	Beisch, Doug (WEG)
J	Johnson, Greg (Patton, Harris & Rust)
P	Mosely, Doug (GKY)
P	Powers, David (Baker Eng.)
J	Sewell, Randy, or other (VHB)

ENVIRONMENTAL/CONSERVATION (4)

N	Boring, Gary (New River Highlands RC&D)
J	Johnson, Mary (T.J. SWCD) -- R. Rash des.
J	Lerch, Joe or Gerel, Mike(CBF)
J	Hirschman, David (CWP)

STATE/FED AGENCIES (4)

NA	DCR (Hill, Lee: Committee Chair)
NA	VDOT (Roy Mills)
NA	USDA-NRCS, State Office (Kelly Ramsey)
NA	DEQ (Burt Tuxford)

ACADEMIA (4)

C	Akan, Osman, PhD (Old Dominion U.)
N	Bork, Dean (L. A. Prof., Virginia Tech)
J	Hill, Kristina (L.A. Prof., U. Va.)
N	Young, Kevin, P.E. (Virginia Tech C.E. Dept.)

BMP MANUFACTURERS (2)

J	Battiata, Joe (Contech)
P	Coffman, Larry (Filterra-Americast)

OTHER DCR STAFF

NA	Capps, Eric
NA	Crafton, Scott
NA	Deitz, Chuck
NA	Frye, Jack
NA	McCutcheon, John

VIRGINIA TECH WRRC (Committee Staff)

NA	Schoenholtz, Steve
NA	Walker, Jane

Watershed Legend:

C -- Coastal
J -- James
N -- New
P -- Potomac
RA -- Rappahannock
RO -- Roanoke
S -- Shenandoah
T -- Upper Tennessee

Appendix B—

POTENTIAL BMP CLEARINGHOUSE TASKS

May 30, 2007
Scott Crafton

1. **LIST OF BMPs:** Determine the list of BMPs that will be included on the web site and the order in which they will be addressed and included

2. **CONTENT OF BMP STANDARDS AND SPECIFICATIONS:** Determine what categories of descriptive information should be included for each BMP and assure the sources of information used are the best available and applicable to Virginia conditions

   Potential Content Categories:
   - Definition/Description
   - Purpose
   - Stormwater Functions (Volume Reduction, Peak Flow Reduction, etc.)
   - Water Quality Functions (Pollutant Removal Efficiencies/Effectiveness)
   - Applications (Conditions Where Practice Applies)
   - Planning Considerations
   - Variations
   - Design Considerations and Criteria
     - Details
     - Graphics
   - Construction Specifications and Sequencing
   - Inspection Issues and Procedures
   - Maintenance Issues and Procedures
   - Cost Data and Issues
   - References/Resources

3. **RATING/CERTIFICATION OF PROPRIETARY/MANUFACTURED BMPs:** Evaluate available research pertaining to proprietary BMPs on the market and determine what pollutant removal efficiencies will be associated with each for their implementation in Virginia

   TARP Protocol

4. **BMP RESEARCH:** The VWRRC may provide manufacturers with assistance in establishing research projects and identifying potential investigators and funding sources for such projects

5. **BMP TRAINING:** The DCR may ultimately contract with or through the VWRRC to provide periodic SWM and BMP Training aimed at various audiences throughout the Commonwealth

6. **CLOSE CONNECTION WITH VIRGINIA SWM REGULATIONS & HANDBOOK**

7. **OTHER ASSOCIATED AND PERIPHERAL RESPONSIBILITIES**

Appendix C — (See PDF file)

The Technology Acceptance Reciprocity Partnership

Protocol for

Stormwater Best Management Practice Demonstrations

Endorsed by

California, Massachusetts, Maryland,

New Jersey, Pennsylvania, and Virginia

Final Protocol 8/01
Updated: 7/03

The TARP Protocol for Stormwater Best Management Practice Demonstrations

Endorsed by the Technology Acceptance Reciprocity Partnership (TARP) states of:

California, Massachusetts, Maryland,

New Jersey, Pennsylvania, and Virginia

Final—8/01, Updated: 7/03

Endorsement

For technology evaluations following the elements of this Protocol, the state partners in California, Massachusetts, Maryland, New Jersey, Pennsylvania, and Virginia have agreed to:

1. *Address technology review and approval barriers in policy and regulations that do not advance knowledge of a technology's performance or recognize innovative approaches to meet environmental protection goals;*

2. *Accept the performance tests and data, and acknowledge the approval results of a partner's review of a technology demonstration, as appropriate, in order to reduce subsequent review and approval time;*

3. *Increase expertise in the applications and advantages of technologies that may have superior environmental and economic benefits for controlling stormwater pollution;*

4. *Use the Protocol, as appropriate, for state-led initiatives, grants, and verification or certification programs where the objective is to document performance efficiency and cost of best management practices;*

5. *Share technology information with potential users in the public and private sectors using existing state supported programs; and*

6. *Monitor and evaluate the results of using this Protocol, and periodically review and revise the Protocol to maintain its viability.*

This Protocol describes a set of uniform criteria acceptable to the endorsing states.

However, specific state requirements must be considered when applying for certification or verification of a stormwater BMP in a particular state. Each partner reserves the right to evaluate any application and request specific information as outlined in Appendix D in order to satisfy an individual state's requirements.

Any state, regional, or private entity interested in using the Protocol should contact the stormwater leads listed in Appendix D. States wishing to join the partnership and endorse this Protocol should contact Calvin Kirby, Pennsylvania Department of Environmental Protection; contact information is provided in Appendix D.

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1 Introduction

1.1 Overview

Stormwater pollution, especially in developed urban areas is a leading cause of water quality degradation in U.S. rivers, lakes, streams, and other surface waters. Water quality problems associated with nonpoint sources of pollution, particularly stormwater, are being addressed by federal mandates that affect all states. Expansion of the National Pollutant Discharge Elimination System (NPDES) Phase II, Storm Water Regulations, requires stormwater plans from thousands of municipalities nationwide, and a renewed focus on the total maximum daily load provisions (TMDL) in the Clean Water Act brings unprecedented attention and increased resources to stormwater control issues. These programs also are predicted to have a significant influence on the rate at which new technologies enter the marketplace.

To support responsible use of stormwater technologies, the Demonstration Protocol is designed to be flexible and inclusive of both structural and nonstructural best management practices (BMPs). The Protocol primarily deals with the demonstration of BMPs that are designed for one or more of the following: 1) directing and distributing flows; 2) reducing erosive velocities; and 3) removing contaminants such as suspended or dissolved pollutants from collected stormwater through physical and chemical processes such as settling, media-filtering, ion-exchange, carbon adsorption, and precipitation. Current BMPs used in industrial, municipal, and construction stormwater pollution control applications, include vegetated swales, detention basins, infiltration basins, wet ponds, constructed wetlands, media filtration, bioretention, and sedimentation units (e.g., hydrodynamic structures, oil/sediment separators, and screen separators).

1.2 Purpose

The purpose of the Protocol is to provide a uniform method for demonstrating stormwater technologies and developing test quality assurance (QA) plans for certification or verification of performance claims. The advantages of using the Demonstration Protocol are numerous. Technology proponents will reduce duplicative or overlapping demonstration and performance testing of technologies; maximize research and development dollars; certify or verify the technology in accordance with performance claims and state regulatory standards; demonstrate effectiveness, cost, and marketability; and achieve maximum market penetration.

Since current NPDES Phase I and II regulations require industrial and municipal permittees to provide stormwater discharge control through use of BMPs, specific BMP usage is not subject to regulation. Stormwater BMPs with demonstrated capability, i.e., BMPs with reliable removal rates based on field testing, are more likely to be used in NPDES required Stormwater Pollution Prevention Plans (SWPPP) to control stormwater discharges. Obtaining certification or verification of a stormwater BMP technology from participating states can assist the technology in gaining regulatory acceptance in this application.

The requirements for a stormwater BMP demonstration are minimized in the Protocol to a common set of uniform criteria, acceptable to all participating states. However, specific state requirements must be considered when a technology proponent is pursuing certification or verification of a stormwater BMP in that state; specific requirements for the endorsing states are described in, but are not limited by, Appendix D. In addition, the Protocol does not completely eliminate all state review or approval of projects proposing to use the stormwater technology, nor does it require any state to “rubber stamp” the approval or permit of another state or regulator.

2 Preparing a Test QA Plan Scope for Validation Screening

States endorsing this Protocol recognize that new information and approaches to stormwater control may warrant future adjustments to the Protocol. As acknowledged on page 1, states are committed to reviewing and revising the Protocol, as necessary, to maintain its viability.

2.1 Preparation

Prior to undertaking a Stormwater BMP Technology Demonstration, a proponent should research current developments in stormwater BMPs to compare a technology's capabilities with applicable field-tested BMPs or state-of-the-art standards. A major effort to develop a nationwide stormwater BMP database on the performance capabilities of structural and non-structural BMPs has been undertaken by the American Society of Civil Engineers (ASCE) and the U.S. Environmental Protection Agency (EPA). The database includes BMP removal efficiency data for specific contaminants, as well as site-specific data, area hydrologic data, and BMP specifications for locations throughout the U.S. This database can be accessed at the following Web site: http://www.bmpdatabase.org/.

If a proponent requires financial assistance for evaluating a technology, funding may be available through federal, state, or local government agencies. Financial assistance for evaluation testing of innovative environmental technology can be pursued through the EPA Office of Research and Development (ORD) program, National Center for Environmental Research Web site: http://www.epa.gov/ncer/.

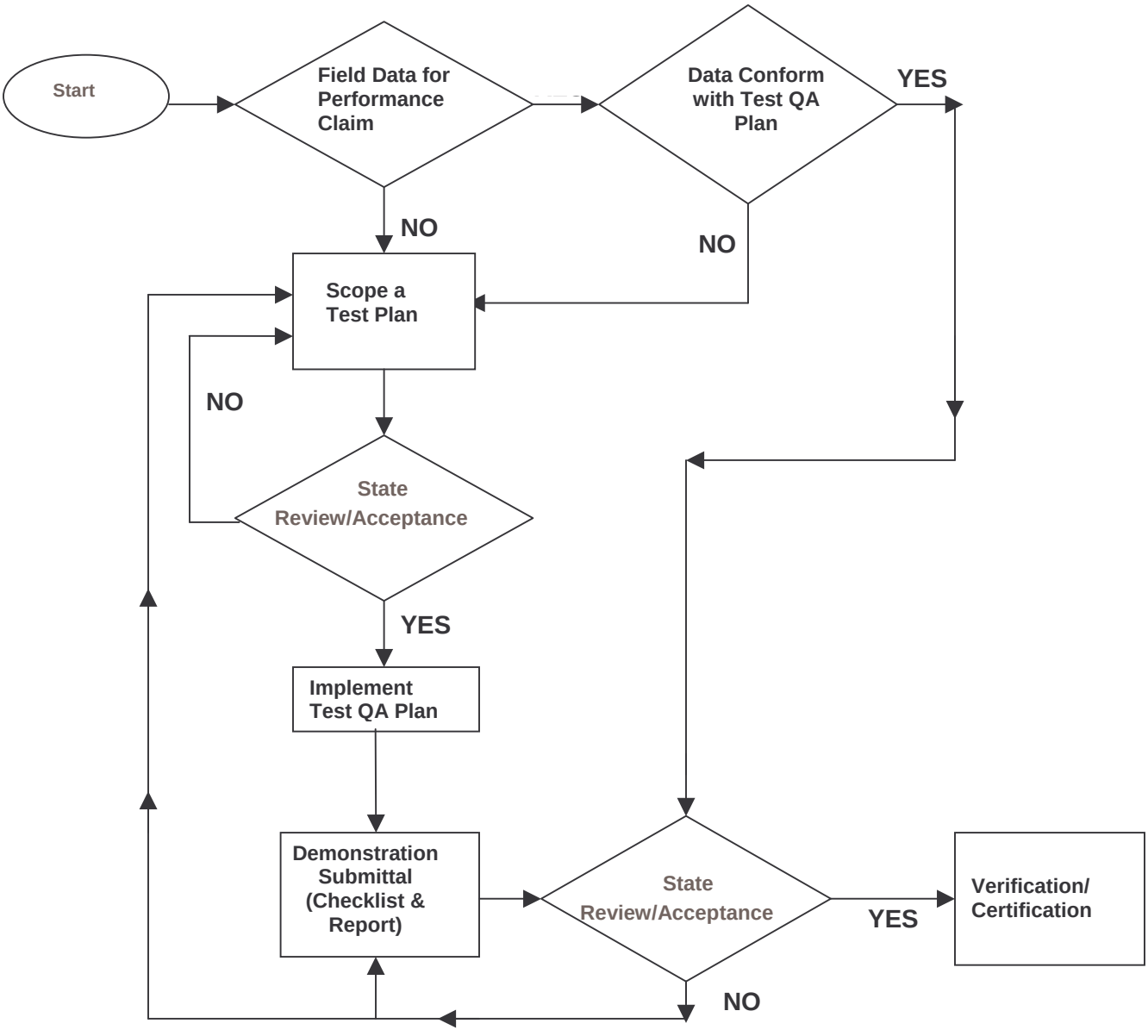
A technology proponent may use existing lab and field studies or other appropriate data to support claims about a technology's performance capabilities. Replication of field-testing under a variety of conditions (i.e., flow rates, contaminant loadings, antecedent moisture conditions, rainfall distribution, maintenance intervals, primary treatment device or treatment train approach, land use, percent imperviousness, and type of drainage system) is desirable for a Stormwater BMP Technology Demonstration. Therefore, field-testing in accordance with the Test QA Plan is required in addition to performance claim data, which may be available in lab and field studies.

The main focus of the states' technology verification and certification programs is the independent validation of data supporting specific technology performance claims. Although the emphasis of the Protocol is to provide guidance on the requirements for obtaining performance data through use of Test QA Plans, proponents with existing data can check their data to determine if the requirements of a Test QA Plan can be fulfilled. A flowchart of the test QA plan and field demonstration review process is shown in Figure 1.

2.2 Stormwater BMP Screening for Validation

Before undertaking a Stormwater BMP Demonstration, technology specifications, performance claims, the Test QA Plan scope, and performance claim data (if available) must be submitted for review and validation by verification/certification organizations. Technology specifications and existing data will be reviewed first to ensure that the technology meets program criteria, e.g., environmentally beneficial, commercially available, field-tested, and the product has been quality controlled.

Figure 1. Overview of the Test QA Plan and Field Demonstration Review Processes



The performance claim and Test QA Plan scope will be reviewed and validated based on elements in the Test QA Plan scope, including: test objectives, use of standardized test methods and procedures, a data quality assurance and control plan, data collection, and statistical tests of the data. Each test plan must have a quality assurance project plan (QAPP), meeting the requirements specified in Appendix F.

2.3 Technology Specifications

The technology, components, and all process units should be described completely. Generally, the technology specifications must include physical, chemical, and biological processes, operation and maintenance (O&M) requirements, process flow diagrams and algorithms, equipment drawings and specifications, existing test plans, performance data, certifications, and a description of process inputs and outputs. More specifically, the following information should be provided in the specifications.

1. A summary of the underlying scientific and engineering principles for the technology.
2. Technology specifications, alternative technology configurations, and any associated disadvantages, such as physical constraints and limitations, weight and buoyancy, transportability, durability, energy requirements, and consumable materials.
3. Minimum siting and design specifications to achieve stated performance, including but not limited to: pollutants that should and could be addressed; minimum and maximum influent concentrations; pollutants that will not be addressed or that may be increased; and siting, location, land use, and land activity limitations or restrictions.
4. A discussion of the advantages of the technology when compared to conventional stormwater systems providing comparable stormwater control.
5. Standard drawings, including a schematic of the technology and a process flow diagram.
6. A discussion of technology hydraulics and system sizing to meet performance standards and goals (e.g., to handle the water quality volume, rate of runoff, type of storm, or recharge requirements).
7. Full range of operating conditions for the technology, including minimal, maximal, and optimal conditions to achieve the performance goals and standards, and for reliability of the technology.
8. Minimum maintenance requirements to sustain performance.
9. Significant modifications and technical advancements in the technology design.
10. Technology limitations, such as performance limits for control of certain water quality parameters, and predicted impacts from construction, operation, and maintenance of the technology.
11. Identified secondary impacts.
12. Discussion of the generation, handling, removal, and disposal of discharges, emissions, and waste byproducts in terms of mass balance, maintenance requirements, and cost.
13. Discussion of pretreatment and preconditioning of stormwater, if appropriate to achieve stated performance of the BMP.
14. Identification of any special licensing or hauling requirements, safety issues, and access requirements associated with operation or maintenance of the technology.

2.4 Performance Claim

In preparation for a technology demonstration, a proponent must make a performance claim that identifies the technology's intended use and predict the technology's capabilities to remove contaminants and/or control the quantity of stormwater runoff. Performance claims should be objective, quantifiable, replicable, and defensible. Claims that are overstated should be avoided, as they may not be achievable.

Stormwater BMP technologies are typically evaluated for contaminant removal efficiency, although pollution prevention claims also are possible. An example of a stormwater treatment BMP performance claim could be:

> *"The Model X system can capture and treat the first half-inch, 24-hour storm for a 10-acre runoff area. Under these conditions, a total suspended solid (TSS) removal rate of 85%± 5% (at a 95% confidence level) can be achieved with inflow TSS concentrations greater than 100 mg/l."*

2.5 Test QA Plan Scope

The procedures for a stormwater BMP field test must be described in the Test QA Plan scope, which will be reviewed and validated to ensure that the procedures for collecting, handling, and analyzing samples and data will be accurate, precise, representative, complete, and comparable. Elements in a Test QA Plan include test objectives, use of standardized test methods and procedures, a data quality assurance and control plan, data collection, and statistical tests of the data. Test objectives for performance claims should be clear, concise, quantitative, and unambiguous, such that standardized test methods and procedures can be applied. The entire range of technology performance capabilities should be tested in order to demonstrate the full potential of the technology.

3 Test QA Plan Contents

3.1 Standardized Test Methods and Procedures

Standardized test methods and procedures should be used to collect stormwater BMP data. For determining stormwater contaminant removal efficiencies or removal rates, BMP inlet and outlet flows and contaminant concentrations will need to be measured. Typical standardized test methods may include ASTM flow measurement methods, ASCE hydraulic flow estimation methods, and EPA test methods for water constituent analysis. Other nationally recognized organizations have produced standards, which may be used, such as American Water Works Association (AWWA), NSF International, and American Public Health Association (APHA) Standard Methods. The standards typically used for the specific field where a technology is applied should be specified, e.g., NSF International for water and wastewater treatment technologies. Use of standardized test methods and procedures have the advantages of being prepared by technology specific, expert subcommittees, and these standards typically incorporate peer-reviewed data QA/QC. Where standard methods are not appropriate and alternative methods are proposed, sufficient evidence to assure data quality must be developed and submitted for review. Under most test conditions, a unique sampling plan will be required and a standard operating procedure (SOP) must be developed.

Several sources of test plans, test methods, procedures, and standards are available for testing stormwater technologies. Test methods for measuring flow and water constituent analysis are provided in Appendices B and C. Some examples are:

- EPA Test Methods (Appendix C) for contaminant analysis, http://www.epa.gov/epahome/index/nameindx.htm
- ASME Standards and Practices (pressure flow measurements),
- ASCE Standards (hydraulic flow estimation methodologies),
- ASTM Standards (precision open-channel flow measurements/practices for water constituent analysis),
- Wilde et al, 1998. National Field Manual for Collection of Water Quality Data, Techniques of Water Resources Investigations Book 9, USGS (ISBN:0-607-90623-5),
- Caltrans "Guidance Manual: Stormwater Monitoring Protocols," http://www.dot.ca.gov/hq/env/stormwater/special/index.htm and
- Test QA Plans and Protocols for wet weather flow technologies are available on the Environmental Technology Verification (ETV) Web site sponsored by EPA and NSF International: http://www.epa.gov/etv.

3.2 Data Quality Assurance Project Plan

The test QA plan must show that the following practices and procedures will be followed in obtaining performance claim data to ensure data quality assurance and control:

- Prepare a Quality Assurance Project Plan (QAPP) and/or a sampling and analysis plan to ensure that performance claim data sets meet data quality objectives (DQOs) and are "defensible." The QAPP and/or SAP should be prepared using either *Guidance for Quality Assurance Project Plans (QAPP), EPA QA/G-5, 1998* or *Standard Guide for Quality Planning and Field Implementation of a Water Quality Measurement Program, ASTM D5612-94.* Both EPA QA/G-5 and ASTM 5612-94 provide directions for developing a sampling and analysis plan, which includes all necessary requirements to obtain valid data for water monitoring. The guides cover development of sampling and analysis plans, sampling procedures, analytical requirements, data quality assurance/control requirements, and documentation. For a copy of EPA QA/G-5, see the EPA Web site: http://www.epa.gov/quality/qa_docs.html.
- The current national QAPP requirements are available in *Requirements for Quality Assurance Project Plans (EPA QA/R-5, 2001).* The minimum elements of a QAPP in Appendix F are cited from EPA QA/R-5. This document can be downloaded from the EPA Quality System Documents Web page, http://www.epa.gov/quality/qapps.html.

    - Use standardized test methods and procedures where applicable (Appendix B).
    - Use qualified personnel in testing and data acquisition.
    - Prepare and coordinate a Stormwater Sampling and Analysis Plan (see Appendix C). Ensure Sampling and Analysis Plans include:
        - Data quality objectives (DQOs);
        - Sampling equipment and procedures (location and frequency) (ASTM D3694-96/D3370-95A);
        - Chain-of-custody procedures (ASTM D4840-99);
        - Sample preservation/holding times (ASTM D4841- 88/D4515-85/D3694-96);
        - QC sample protocol (splits and composites; field, trip, equipment blanks; spikes; duplicates) (ASTM D5612-94/D5810-96/D5788-95); and
        - Sample equipment decontamination.
    - Use certified or accredited laboratories for sample analysis.

See the National Environmental Laboratory Accreditation Conference (NELAC) Program Web site: http://www.epa.gov/ttn/nelac/.

- Use certified or accredited laboratories for testing (ASTM, ASCE). See the following ASTM laboratory listing Web site: http://www.astm.org/labs.
- Test equipment and instrument calibration/certification.

3.3 Stormwater Data Collection Guidance

This section guides the selection of criteria for data collection; it is based in part on criteria currently used for NPDES permit compliance. The *NPDES Storm Water Sampling Guidance Document* (EPA 833-B-92-001) provides additional guidance for sampling and analyzing stormwater for compliance with industrial, municipal, and construction NPDES permits.

A copy can be downloaded from the EPA Web site: http://www.epa.gov/npdes/pubs/owm0093.p[illegible]ecific stormwater technologies should tailor data collection and analysis to their specific performance claim Test QA Plan. Although there are different approaches for collecting performance data, the following criteria are considered by the participating states to be necessary for obtaining scientifically valid data, particularly for field demonstrations.

3.3.1.1 Storm Event Criteria to Sample

The following criteria will need to be considered, in order to obtain representative contaminant loading data (flows and contaminant concentrations).

- Historic data: obtain monthly mean rainfall and snowfall data, for all 12 months over the period of record, from the nearest National Weather Service (NWS) station (airport). Rainfall data for a site may be obtained from local weather station records and almanacs. The National Climatic Data Center Web site can be accessed for rainfall data for locations throughout the U.S.: http://www.ncdc.noaa.gov/oa/ncdc.html. .

  Note: Precipitation data from a single, distant station may not accurately estimate local weather patterns. In this situation, use of data from several stations with appropriate averaging methodologies (e.g., isohyetal or Theissen) may be necessary.

- Current weather forecast available on: http://weather.gov/. *(Substitute any state's abbreviation for "MA" in the Web site address above.)*

- Use continuous recording rain gauges to measure the intensity of the storm for its duration. Measurements in 15-minute increments are recommended for consistency with NWS reporting of precipitation intensity.

3.3.1.2 Identifying Storms to Sample

- More than 0.1 inch of total rainfall.
- A minimum inter-event period of 6 hours, where cessation of flow from the system begins the inter-event period.

- Obtain flow-weighted composite samples covering a minimum of 70 % of the total storm flow, including as much of the first 20 % of the storm as possible.

Note: Composite samples are not appropriate for all parameters.

- A minimum of 10 water quality samples (i.e., 10 influent and 10 effluent samples) should be collected per storm event. For composite samples, a minimum of 5 subsamples is acceptable (i.e., 2 composites with 5 subsamples = 10 water quality sample minimum or 1 composite sample with 10 subsamples = water quality sample minimum).

Note: If a storm is too small for 10 samples, an average of 10 samples per storm may be substituted. However, more than 10 samples per storm event should be collected wherever possible.

3.3.1.3 Determining a Representative Data Set

- Flow measurements should be taken to predict or calculate pollutant loads. The mass of pollutants in the discharge should be based on flow rates and pollutant concentrations or another reasonable approach.
- Data are needed to characterize the flow rate and flow volume for each storm event.
- The number of water quality sampling events should be representative of the storm events in the climatic region. At least 50 % of the total annual rainfall must be sampled, for a minimum of 15 inches of precipitation and at least 15, but preferably 20, storms. (Also see Appendix D for California's requirements.) Storm events should be consecutive, where practicable. One-year of water quality sampling is optimal to observe performance changes as a function of season. Collection of a representative number of water quality samples may take more than a year in some regions.
- Some sampling must be done during adverse weather conditions; for example, during spring snowmelt and heavy rainfall, when runoff and contaminant transport is expected to be greater. Data quantifying process inputs and outputs should be collected for use in mass balances and cost analysis.

3.3.2 Selecting Stormwater Sampling Locations

Sampling locations for stormwater BMPs should be taken in as close proximity as possible to the BMP inlet and outlet to avoid potential sources of contamination that would alter the BMP efficiency data. Typically, the inlet and outlet for a BMP should be sampled to obtain performance claim data.

Describe and provide a scaled plan view of the demonstration site, indicating all buildings, land uses, storm drain inlets, and other control devices. Include a description of the site drainage area, percent impervious area, percent area directly connected to the BMP, description of the path of storm water flow to the BMP, type of activities conducted, pollutant sources, soil type, geological and

hydrological conditions, existing control structures, and a site drainage plan. Estimate the impervious area within the drainage area and show sample inflow and outflow points.

Specify the location of flow devices and samplers in relationship to the inlets and outlets of the stormwater technology. Demonstrate that flow devices and samplers are installed and positioned properly to ensure that samples are representative of influent runoff and effluent runoff, (i.e., sample the influent as close as possible to the inlet of the system and sample the total treated effluent). For systems that bypass runoff, the influent location will be directly upstream of the system and before the flow is split between the treatment system and the bypass. The second, effluent sampling location will be directly downstream of the treated flow (i.e., the technology or treatment system outlet) and after the effluent joins the bypass. If the treated effluent flow does not join the bypass, the second location will allow sampling of the total flow after the treatment unit outlet.

Note: Sampling points used for NPDES permit compliance monitoring may not be appropriate for testing BMP technologies, e.g., if there is a contaminant source between the BMP and the outfall of a facility.

3.3.3 Stormwater Sampling Methods

Programmable automatic flow samplers with continuous flow measurements should be used unless it is demonstrated that alternate methods are superior or that automatic sampling is infeasible. Grab samples should only be used for certain constituents, in accordance with accepted standard sampling protocols, unless it is demonstrated that alternate methods are superior. Constituents that typically require grab sampling include: pH, temperature, cyanide, total phenols, residual chlorine, oil and grease, total petroleum hydrocarbons (TPH), *Escherichia coli*, total coliform, fecal coliform, fecal streptococci, and enterococci. Collection and flow-weighted composite sampling also should follow the NPDES guidance.

Note: Time-weighted composite samples are not acceptable, unless flow is monitored and the event mean concentration can be calculated from the data.

3.3.4 Stormwater Flow Measurement Methods

Primary and secondary flow measurement devices are required.

3.3.5 Sample Data Quality Assurance and Control

The following elements should be described in the Test QA Plans and Sampling and Analysis Plan (see III. B. Data QA Project Plan):

- Equipment decontamination,
- Preservation,
- Holding time,
- Volume,
- QC samples (spikes, blanks, splits, and field and lab duplicates),

- QA on sampling equipment (e.g., calibration of automatic samplers and flow measurement devices)
- Packaging and shipping,
- Identification and labeling, and
- Chain-of-custody.

3.3.6 Selection of Parameters

Parameter testing applies to stormwater quality control BMPs. Municipal and construction site parameters are generally the contaminants in runoff studies, such as total dissolved solids (TDS), total suspended solids (TSS), suspended sediment concentration (SSC), or total petroleum hydrocarbons (TPH), total Kjeldahl nitrogen (TKN), total nitrogen, total phosphorus, chemical oxygen demand (COD), biochemical oxygen demand (BOD), *Escherichia coli*, total coliform, enterococci, pH, conductivity, temperature, and the following metals: lead, copper, zinc, and nickel. Runoff contaminant data from BMP evaluation studies can be found in the ASCE-EPA Nationwide Database. Also, data from parking lots and roadways can be found on the following Web site: http://www.bmpdatabase.org/.

In selecting test parameters, include total suspended solids (TSS) and suspended sediment concentration (SSC), at a minimum, and consider other parameters that support performance claims, including those listed in Appendix C. (If a parameter is not listed, obtain approval for testing during validation screening of the Test QA Plan scope (see Section II.B.).

For some technologies, TSS and SSC removal efficiency testing will be adequate. However, confirmation of testing requirements with the state reviewing the technology, or by consulting the BMP database, is recommended, as requirements may change over time. Before selecting parameters, also consider the advantages of a comprehensive demonstration. With comprehensive parameter testing, a technology is likely to gain broader acceptance and some relief from specific technology approval requirements of the individual states. A demonstration of removal effectiveness for bacteria, nutrients, or toxics will be available to all in an Internet database.

The results of parameter testing must be compared with influent concentrations to demonstrate removal efficiencies.

3.3.7. Analytical Laboratory Requirements

Laboratories used to perform stormwater sample analysis should be certified by a national or state agency regulating laboratory certification or accreditation programs. The National Environmental Laboratory Analysis Certification (NELAC) program or, the Environmental Laboratory Accreditation Program (ELAP) (in California) should be used to perform standardized test methods and procedures.

3.3.8. Calculating BMP Efficiencies (ASCE BMP Efficiencies Task 3.1)

Process efficiencies or removal rates should be determined from influent and effluent contaminant concentration and flow data to quantify the performance of the BMP technology.

ASCE and EPA have published a Technical Memorandum on determining removal efficiencies for stormwater BMPs. This document should be used in determining BMP efficiencies (Development of Performance Measures, Task 3.1 – Technical Memorandum, Determining Urban Stormwater Best Management (BMP) Removal Efficiencies). The paper can be downloaded from the following Web site: http://www.bmpdatabase.org/docs.html.

In summary,

- Efficiencies can be calculated for four BMP categories: 1) BMPs with well defined inlets and outlets that depend on extended detention storage, 2) BMPs with well-defined inlets and outlets that do not depend on significant storage of water, 3) BMPs that do have well-defined inlets and outlets, and 4) widely distributed BMPs that use reference watersheds to determine effectiveness.

- Five methods are typically used to evaluate BMP efficiency: 1) Efficiency Ratio, 2) Summation of Loads, 3) Regression of Loads, 4) Mean Concentration, and 5) Efficiency of Individual Storm Loads.

Note: The Efficiency Ratio method is preferred. However, BMP efficiency also should be estimated, using the Summation of Loads method, where feasible.

- Data used to calculate efficiencies from the ASCE-EPA database are influent/effluent data of two principal types: 1) event mean concentration data (flow-weighted composite, weighted composite, and no flow or time weighting), and 2) discrete water samples (grab samples).

- Process efficiencies or removal rates should be determined from influent and effluent contaminant concentration and flow data to quantify the performance of the technology. Where applicable, the effect of bypass flow on process efficiency and system performance should be quantified.

3.4 Statistical Testing of Data (and Data Reduction)

Statistical testing should be performed on performance claim data to ensure that data are reliable, significant, and within confidence limits. When testing at specified ranges of flow and contaminant concentrations and when normal parametric statistical analysis is performed, coefficient of variation (CV) should be within ±10% for efficiency data, wherever possible. A larger range of CV may be allowed where justified. The vendor must demonstrate that the data set is normally distributed prior to using normal parametric statistical analysis. Data sets that are not normally distributed will need to be evaluated using nonparametric statistical analysis and may require further analysis and review.

The *Data Quality Assessment Guidance Manual*, EPA QA/G-9 includes an array of statistical methods, e.g., parametric analysis (mean, standard deviation, confidence intervals, and Z-statistic), comparison of populations (analysis of variance, box-whisker plots, and Tukey-tests), which can be used to compare and validate data sets. EPA QA-G9 can be downloaded from the following Web site: http://www.epa.gov/quality/qa_docs.html.

4 Health and Safety Plan

A health and safety plan should be developed and included with the Test QA Plan for a Stormwater BMP technology, covering installation, operation, and maintenance of the technology. Specifically, the plan should address hazard identification and mitigation, engineered controls and procedures, personal protective equipment, and training. Also, where related to the stormwater BMP technology, include: collecting stormwater samples in confined spaces (manholes, storm sewer lines, and utility vaults); collecting high flow stormwater samples from culverts, drainage channels, and sedimentation basins during storms; and chemical, biological or physical hazards associated with the technology.

5 Cost Information

Reliable cost information is an essential component of a stormwater technology demonstration. Consider capital expenses; annual operation and maintenance costs; one time and recurring costs of the design, construction, and operation associated with monitoring/measurement; and cost associated with conducting certification or verification tests. Also, include a discussion of the cost effectiveness of the technology, in terms of pollutant removal to achieve goals and applicable stormwater management standards. Although not required to evaluate the technology's performance claim, a vendor may consider performing a cost-benefit analysis for comparison to similar technology categories to determine the economic viability of the technology. Such an analysis may include capital costs, operations and maintenance costs, and aggregate costs (cost per gallon treated or BMP efficiency may be represented as a cost per pound of each pollutant removed).

6 Report Contents for Verification/Certification

The suggested format for a Stormwater BMP Demonstration Report is:

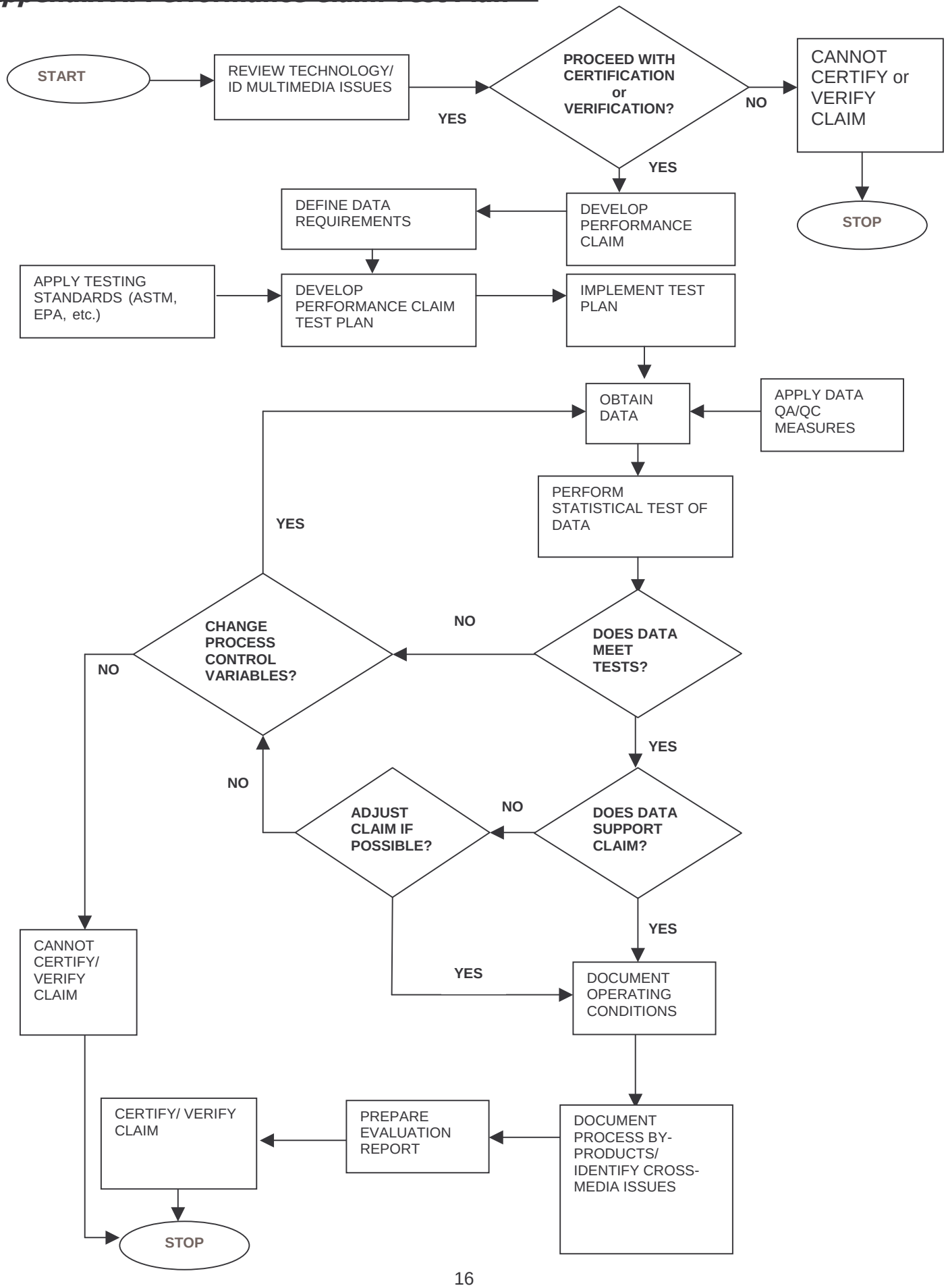
- Title/Purpose,
- Theory/Technology Description,
- Performance Claim,
- Test Methods and Procedures,
- Data Quality Assurance Project Plan (EPA QA-G5),
- Test Equipment and Apparatus,
- Verification/Certification Data and Analysis,
- Data Quality Assessment (EPA QA-G9),
- Conclusions/Recommendations/Limitations, and
- Cost Information.

In addition, the report should include a completed Stormwater BMP Demonstration Application Form (Appendix E), an executive summary, and a signed statement on the first page certifying that all information is accurate and true to the best of the proponent's knowledge.

7 Protocol Limitations, Release of Liability, and Disclosure

This protocol has been published for the purpose of evaluating or generating performance claim data for stormwater BMP technologies for environmental certification and verification programs. The Technology Acceptance and Reciprocity Partnership (TARP) accepts no responsibility or liability for performance of stormwater technologies being evaluated using this Protocol.

Appendix A: Performance Claim Test Plan



Appendix B: List of Applicable Test Methods and Procedures

ASTM Methods

D3370, Practices for Sampling Water.

D4840, Guide for Sampling Chain of Custody Procedures.

D4841, Practice for Estimation of Holding Time for Water Samples Containing Organic and Inorganic Constituents.

D5612-94 (1998), Standard Guide for Quality Planning and Field Implementation of a Water Quality Measurement Program.

D5847-99a , Standard Practice for Writing Quality Control Specifications for Standard Test Methods for Water Analysis.

D5851-95, Standard Guide for Planning and Implementing a Water Monitoring Program.

D6145097, Standard Guide for Monitoring Sediments in Watersheds.

D3977-97, Standard Test Method for Determining Sediment Concentration in Water Samples.

D5907-96a, Standard Test Method for Filterable and Non-filterable Matter in Water.

D4841-88 (1998), Standard Practice for Estimation of Holding Time for Water Samples containing Organic and Inorganic Constituents.

PS74-98, Provisional Standard Test Method for Oil and Grease (Solvent Extractable Substances in Water by Gravimetric Determination.

D5790-95, Standard Test Method for Measurement of Purgeable Organic Compounds in Water by Capillary Column Gas Chromatography/Mass Spectroscopy.

D6362-98, Standard Practice for Certificates of Reference Materials for Water Analysis.

D6104-97, Standard Practice for Determining the Performance of Oil/Water Separators Subjected to Surface Water Run-off.

F625-94, Standard Practice for Classifying Water Bodies for Spill Control Systems.

D5906-96, Standard Guide for Measuring Horizontal Positioning During Measurements of Surface Water Depths.

D5073-90 (1996), Standard Practice for Depth Measurement of Surface Water.

D5413-93 (1997), Standard Test Methods for Measurement of Water Levels in Open-Water Bodies.

D5243-92 (1996), Standard Test Method for Open-Channel Flow Measurement of Water Indirectly at Culverts.

D5130-95, Standard Test Method for Open-Channel Flow Measurement of Water Indirectly by Slope-Area Method.

D5129-95, Standard Test Method for Open Channel flow Measurement of Water Indirectly by Using Width Constrictions.

D3858-95, Standard Test Method for Open-Channel flow Measurement of Water by Velocity-Area Method.

D5614-94 (1998), Standard Test Method for Open Channel Flow Measurement of Water with Broad-Crested Weirs.

D5242-92 (1996), Standard Test Method for Open-Channel Flow Measurement of Water with Thin-Plate Weirs.

D5640-955, Standard Guide for Selection of Weirs and Flumes for Open-Channel Flow Measurement of Water.

D5089-95, Standard Test Method for Velocity Measurements of Water in Open Channels with Electromagnetic Current Meters.

D4409-95, Standard Test Method for Velocity Measurements of Water in Open Channels with Rotating Element Current Meters.

D5390-93 (1997), Standard Test Method for Open Channel Flow Measurement of Water with Palmer-Bowlus Flumes.

D1941-91 (1996), Standard Test Method for Open Channel Flow Measurement of Water with the Parshall Flume.

D4375-96, Standard Practice for Basic Statistics in Committee D-19 on Water.

E178, Practice for Dealing with Outlying Observations.

F1779-97, Standard Practice for Reporting Visual Observations of Oil on Water.

F1084-90 (1995), Standard Guide for Sampling Oil/Water Mixtures for Oil Spill Recovery Equipment.

Appendix C: List of Parameters for Sampling

Pollutant	Target Pollutant	Incidental Pollutant	Not Addressed
SOLIDS			
• Floating solids and debris			
• 0.062 mm – 0.0250 mm			
• 0.250 mm –1.0 mm			
• Larger than 1.0 mm			
• Total Suspended Solids[a]			
• BOD, COD, TOC, TDS			
• Hydrocarbons			
• Oil & Grease			
• TPH by IR			
• Total PAH			
• Floating oil			
METALS			
• Copper (total/dissolved)			
• Lead (total/dissolved)			
• Zinc (total/dissolved)			
• Chromium (total/dissolved)			
• Cadmium (total/dissolved)			
• Other (e.g., cyanide, nickel)_____			
NUTRIENTS			
• Total Phosphorus			
• Total Dissolved Phosphorus			
• Nitrate/nitrite			
• Ammonium			
• Total Kjeldahl nitrogen			
• Total nitrogen			
BACTERIA (*E. coli*, total coliform), Enterocci			
TEMPERATURE EFFECTS			

NOTES

Target Pollutant -- Pollutant directly addressed by the design of the device; Incidental Pollutant – Pollutant incidentally addressed by device; Not Addressed -- Pollutant not addressed by device

All pollutants with performance claims must be tested. If no test result is provided, EVALUATOR will assume the pollutant is not addressed by the device.

a – assumes that sufficient data has been provided to demonstrate that TSS and SSC of untreated/inflow samples is consistent with the total load and particle size distribution of typical urban runoff (i.e., consistent with the NURP study data distribution.)

Instructions

1. Indicate L if demonstrated in laboratory and F if demonstrated in field evaluation.
2. Provide supporting data for all target and incidental pollutants tested in field or laboratory as outlined below.
3. For metals indicate whether total and/or dissolved forms were evaluated.

DOCUMENTATION OF TESTING RESULTS SHOULD, AT A MINIMUM, INCLUDE:

For laboratory testing:

Testing should demonstrate performance under a range of operating conditions, including high stress conditions. Specify hydraulic loading rates and concentrations of pollutants tested. Also, provide documentation of device performance under flows exceeding design capacity (i.e., we are interested in learning whether captured pollutants are flushed out by extreme events).

For field testing:

Description of site use (e.g., commercial parking lot, roadway, construction site, and pertinent characteristics of area being treated (e.g., total area and percent impervious). List number storms tested peak rates, and total volumes treated by device; for each storm tested provide information on total storm size, duration, intensity, and antecedent dry period. Results should be presented for each storm individually and summarized statistically for all storms.

Appendix D: States' Standards and Contacts

Pennsylvania

Pennsylvania's erosion and sediment control requirements stipulate that temporary best management practices (BMPs) should be designed for a 2-year frequency storm, 5-year frequency storm for special protection watersheds, and a 10-year frequency storm for permanent BMPs. The permanent BMP criteria relate to the structural integrity of the BMP rather than the pollutant removal requirements. Pollutant (sediment) removal requires design of erosion and sediment control BMPs according to the established standards in the Pennsylvania Erosion and Sediment Control Program Manual or other criteria equal or greater than these standards.

The regulation of post-construction stormwater runoff from new development activities and associated groundwater recharge/infiltration and water quality are specified in NPDES Permits for Stormwater Discharges Associated with Construction Activities Municipal Separate Storm Sewer System (MS4) Permits, and watershed stormwater plans prepared and adopted by counties in accordance with the PA Stormwater Management Act, (Act 167 of 1978).

Fundamentally, the goal of Pennsylvania's Comprehensive Stormwater Policy is to improve and sustain ground and surface water quality and quantity through the use of planning practices and BMPs that minimize the generation of stormwater runoff, provide ground water recharge, and minimize the adverse effects of stormwater discharges on ground and surface water resources. Pennsylvania's highest quality surface waters are designated as either Exceptional Value (EV) and High Quality (HQ) or special protection waters. These water uses are protected on a waterbody segment when the Department issues a permit or approval for an activity which may impact the use.

The BMPs for post-construction stormwater management must include design features that will manage and control runoff volume and velocity, infiltrate stormwater, and filter sediments, nutrients and other pollutants from a 2-year/24-hour storm event for any location in Pennsylvania.

PADEP supports reciprocity by accepting data, analyses, and findings: 1) from other TARP states that verify (or certify) stormwater technologies' performance in accordance with the TARP Stormwater BMP Demonstration Protocol; and 2) from organizations with qualifying protocols and technology evaluation programs that generate technology verifications (or certifications), in conformance with accepted protocols. PADEP generally supports the efforts of EPA's Environmental Technology Verification (ETV) and the state of Washington's program protocols. PADEP does not completely eliminate state review of data or approval of projects proposing to use the stormwater technology for reciprocity in Pennsylvania.

For more information on Pennsylvania's Comprehensive Stormwater Management Policy (Technical Guidance # 392-0300-002), or other technical guidance or program information please refer to the Department's website at: http://www.dep.state.pa.us or the stormwater homepage at: http://www.dep.state.pa.us/dep/deputate/watermgt/wc/subjects/stormwatermanagement.htm

For further information, contact: Kenneth Murin, Bureau of Watershed Management, Rachel Carson State Office Building, P.O. Box 8775, Harrisburg, PA 17105-8775, Phone: 717-772-5975, Fax: 717-772-5986, E-mail: **kmurin@state.pa.us**; **or**

Dennis Stum, Bureau of Watershed Mar 21 ent, Rachel Carson State Office Building, P.O. Box 8775, Harrisburg, PA 17105-8775, Phone: 717-772-5963, Fax: 717-772-5986, E-mail: **dstum@state.pa.us** ; **or**

Calvin Kirby, PA DEP, Office of Pollution Prevention and Compliance Assistance, 15th Floor-RCSBO, 400 Market Street, Harrisburg, PA 17105-8772, Phone: 717/772-5834, Fax: 717/783-2703, E-mail: *ckirby@state.pa.us.*

Massachusetts

Massachusetts seeks stormwater BMP demonstrations that show effectiveness in terms of the Commonwealth's Stormwater Management Standards in the Stormwater Management Policy. The Stormwater Management Policy and supporting handbooks are available on the Massachusetts Department of Environmental Protection Web site: http://www.state.ma.us/dep/stomwtr/stormpub.htm. The handbooks can be downloaded from the DEP Stormwater publication list.

For water quality control: The volume of runoff to be treated for discharges to critical areas is calculated as 1.0 inch of runoff times the total impervious area of the post-development project site. For all other discharges, the volume to be treated is calculated as 0.5 inches of runoff times the total impervious area of the post-development project site.

(Critical areas are Outstanding Resource Waters (ORWs), shellfish beds, swimming beaches, cold water fisheries, and recharge areas for public water supplies.)

For stormwater management systems, the Massachusetts Stormwater Management Standard 4 is 80 percent removal of the annual load of total suspended solids (TSS). This standard applies to new development and is presumed to met when:

a) Suitable nonstructural practices for source control and pollution prevention are implemented;
b) Stormwater management best management practices (BMPs) are sized to capture the previously prescribed runoff volume; and
c) Stormwater management BMPs are maintained as designed.

Stormwater technology vendors interested in field testing technologies in MA to evaluate performance claims should contact Linda Benevides, (Director of the Strategic Envirotechnology Partnership, Suite 900, 251 Causeway Street, Boston, MA 02114, Phone: 617-626-1197, Fax: 617-626-1180, email: linda.benevides@state.ma.us,) and the STEP Web site: http://www.state.ma.us/envir/pollution/step.htm.

The Strategic Envirotechnology Partnership prepares technology verifications for performance demonstrations that adhere to the TARP Tier II Protocol. STEP verification reports and summary fact sheets will be provided to participating TARP states and organizations recognized in this Protocol so that they can initiate the reciprocity process. The MA publications also will be available for end-users and public officials on the STEP Website: http://www.stepsite.org/.

Massachusetts supports reciprocity by accepting data, analyses, and findings 1) from other TARP states that verify (or certify) stormwater technologies' performance in accordance with the

TARP Stormwater BMP Demonstration Protocol; and 2) from organizations with qualifying protocols and technology evaluation programs that generate technology verifications (or certifications), in conformance with accepted protocols. At this time, the Environmental Technology Verification (ETV) program and the state of Washington have qualifying protocols and programs, which are eligible for reciprocity in Massachusetts.

Reciprocity will be granted to conforming performance evaluations by the STrategic Envirotechnology Partnership (STEP) in collaboration with the Department (Division) of Environmental Protection (DEP). Re-issuance or conditional re-issuance of a performance verification, in formats conducive for public outreach, will be necessary to confer reciprocity for evaluated stormwater technologies. It is anticipated that, in most cases, a fact sheet will be issued, based on the verification report from another participating state or eligible organization. Reciprocity summary fact sheets will be provided to TARP states upon completion of the process, and these publications also will be available on the STEP and TARP Websites.

For further information, contact: Nancy Baker, Massachusetts Department of Environmental Protection, 1 Winter Street, Boston MA 02108, Phone: 617/654-6524, Fax: 617/ 292-5850, E-mail: ***nancy.baker@state.ma.us****.*

Claire Barker, Massachusetts Department of Environmental Protection, Bureau of Resource Protection, Phone: 617/556-1128, Fax: 617/292/5696, E-mail: **claire.barker@state.ma.us.**

New Jersey

Regulation of stormwater runoff by the New Jersey Department of Environmental Protection (NJDEP) presently occurs in three different programs: Stormwater Management, Stormwater Permitting, and Land Use Regulation. The accepted water quality design storm utilized for evaluation is 1.25 inches of rainfall falling in two hours. This testing criterion is applicable to all post construction residential and commercial BMP applications. In addition, stormwater management systems are expected to reduce total suspended solids (TSS), to the maximum extent possible, from stormwater runoff generated from the water quality design storm.

The Division of Watershed Management's (DWM) Nonpoint Source and Stormwater Management Program establishes rules for stormwater discharges from new construction of residential and commercial development. This program is largely implemented through the development of municipal and county stormwater management plans, and municipal stormwater ordinances. The program is also linked to the Department of Community Affairs Residential Site Improvement Regulations. Information on BMPs acceptable for use in this program are contained in the Department's Stormwater Best Management Practices Manual (currently being amended) and available on the NJDEP, DWM Website (Appendix F).

The Bureau of Nonpoint Pollution Control issues permits for discharges of stormwater to surface water from industrial and construction activities under the New Jersey Pollutant Discharge Elimination System (NJPDES). Water quality criteria for industrial applications will vary depending on site activity and adopted federal or state effluent limitation guidelines for targeted pollutants. Generally, the testing criteria established for commercial BMP applications will be sufficient. However, this office should be consulted to determine if specific-testing criteria are applicable to evaluate BMP performance intended for industrial applications. NJPDES permits from the NJDEP for construction activities are coordinated with the local Soil Conservation

Districts. Proposed measures for erosion and sediment control associated with construction or agricultural activities are referred to the New Jersey State Soil Conservation Committee for inclusion into the Standards for Soil Erosion and Sediment Control in New Jersey.

The Land Use Regulation Program reviews certain stormwater discharges from new development and generally approves manufactured devices on a case by case basis utilizing the following criteria:

a. 80% TSS removal
b. Removal of Oil and Grease and Floatables
c. Removal of Heavy Metals
d. Device must operate automatically with no need for someone to activate it during a rain event.
e. Device must have relatively low maintenance with agreements on who will maintain it.

The NJDEP is presently developing amendments to its NJPDES Regulations and its Stormwater Management Regulations that will establish a consistent basis for applying stormwater BMPs in all of its regulatory programs. In addition, the New Jersey Stormwater BMP Manual is being developed to provide guidance to address the requirements in the proposed Stormwater Management Rules, N.J.A.C. 7:8. One chapter in the proposed manual provides criteria for certifying manufactured devices and their pollutant removal rates. The final certification of a pollutant removal rate would be based upon one of the following:

1. Verification of the device's pollutant removal rates by the N.J. Corporation for Advanced Technology (NJCAT) in accordance with the New Jersey Energy and Environmental Technology Verification Program (NJSA 13:D-134 et seq). This verification must be conducted in accordance with the protocol "Stormwater Best Management Practices Demonstration Tier II Protocol for Interstate Reciprocity" as developed under the Environmental Council of States (ECOS) and Technology Acceptance and Reciprocity Partnership (TARP).
2. Verification of the device's pollutant removal rates by another TARP State, or another state or government agency that is recognized by New Jersey through a formal reciprocity agreement, provided that such verification is conducted in accordance with the protocol "Stormwater Best Management Practices Demonstration Tier II Protocol for Interstate Reciprocity."
3. Verification of the device's pollutant removal rates by other third party testing organizations (i.e., NSF), provided that such verification is conducted in accordance with the protocol "Stormwater Best Management Practices Demonstration Tier II Protocol for Interstate Reciprocity." Other testing protocols may be considered if it is determined by the NJDEP to be equivalent to the Tier II Protocol.

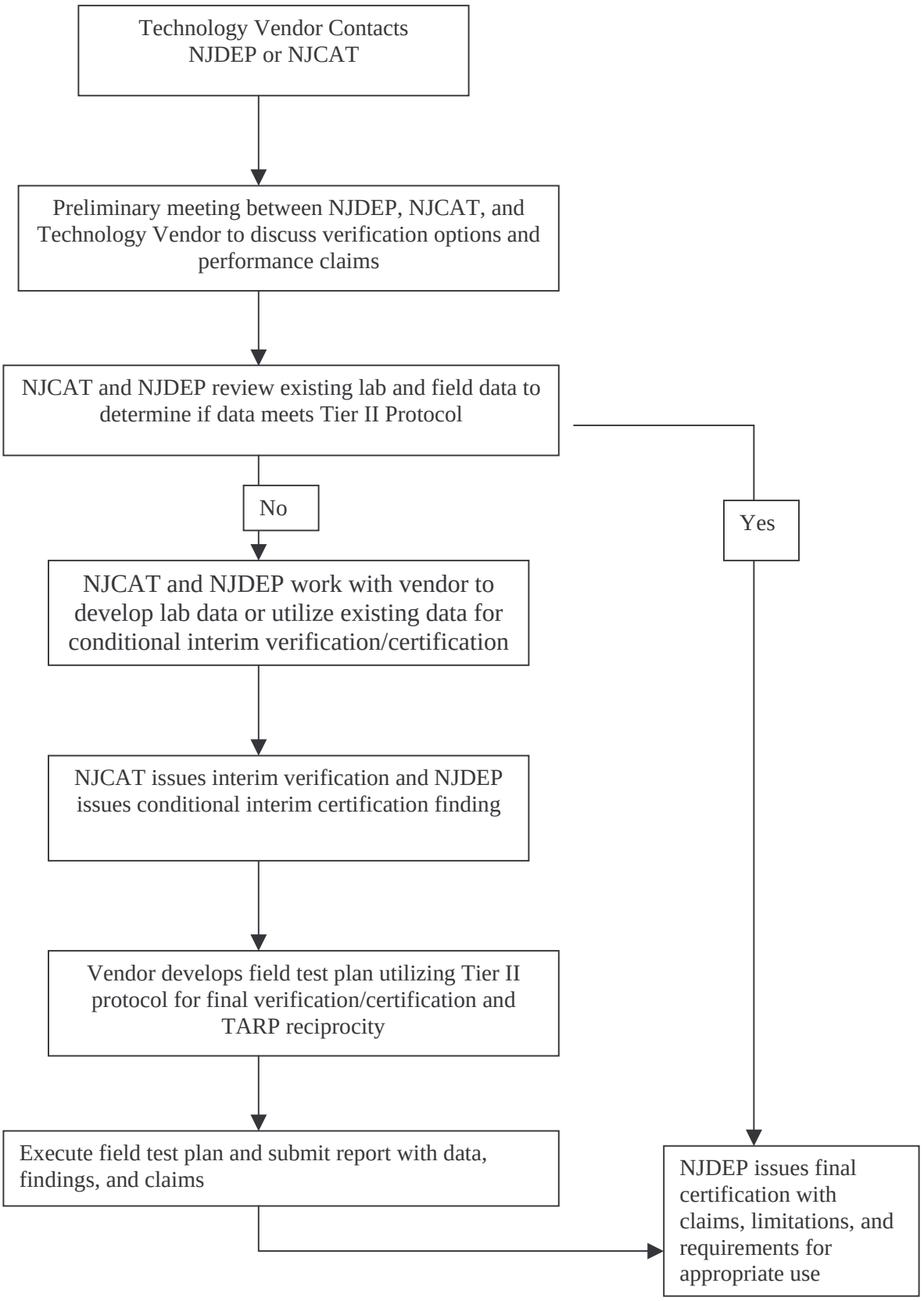
It should be noted that the pollutant removal rates for a manufactured treatment device may be granted interim conditional certification by the NJDEP provided that the manufacturer submits an interim verification report through NJCAT and further agrees to apply for and complete the final certification process described above. All interim certifications are effective for only a limited time period, as determined on a case-by-case basis by the NJDEP.

For further information, contact: Manny Patel, New Jersey Department of Environmental Protection, Division of Science, Research & Technology, Office of Innovative Technology andMarket Development, P.O. Box 409, Trenton, New Jersey 08625, phone: 609/292-0231, Fax: 609/292-7340, E-mail: ***mpatel@dep.state.nj.us***.

Brian McLendon, New Jersey Department of Environmental Protection, Division of Water Quality, Bureau of Nonpoint Pollution Control, P.O. Box 029, Trenton, New Jersey 08625-0029, phone: 609/633-7021, Fax: 609/984-2147, E-mail: **bmclendo@dep.state.nj.us**.

Sandy Blick, New Jersey Department of Environmental Protection, Division of Watershed Management, NPS Program, P.O. Box 418, Trenton, New Jersey 08625, phone 609/633-1441, E-mail: **sblick@dep.state.nj.us**.

New Jersey Stormwater Verification/Certification Process in Conjunction with NJCAT



California

The State Water Resources Control Board (SWRCB) and Regional Water Quality Control Boards (RWQCBs) are seeking technologies for use in California's Storm Water Pollution Prevention Plans (SWPPPs) and Storm Water Management Plans (SWMPs). The SWRCB and RWQCBs reserve the right to request additional data from a technology proponent in order to satisfy state requirements and environmental conditions, and to refuse a technology for evaluation based on state needs and available resources. California specific conditions/regulations include, but are not limited to, the following:

1) A minimum inter-event period of 72 hours from the previously measurable storm event should be used. Additional testing/data could be required for technologies that are verified using 6 hours as the minimum inter-event period. This inter-event period is required by Federal Regulation, 40 CFR 122.21 (g)(7), for industrial sites.

2) Water quality samples should be collected from a representative number of storm events to ensure that 80 to 90% of the average yearly rainfall amount, up to a maximum of 15 inches, is captured over a period of one calendar year. A one-year demonstration is optimal to observe performance changes as a function of season. This sampling condition is more reflective of wet weather patterns in California than the conditions specified in section C.1 of this protocol.

The SWRCB has been delegated the NPDES permitting authority in California. The NPDES permitting program is administered by the SWRCB through the nine RWQCBs. For industrial facilities and construction activities, the SWRCB has issued statewide general permits that apply to all stormwater discharges requiring a NPDES permit. In addition to the stormwater general permits, the RWQCBs may, at their discretion, issue industry or regional specific permits, as well as individual permits. Municipal stormwater permits are issued by the individual RWQCBs, with the exception of the municipal permit issued to the State of California's Department of Transportation (Caltrans). Caltrans has been issued a statewide municipal permit by the SWRCB.

The types of permits issued to industrial, construction and municipal operators are different, but the requirements of the permit are similar in that they require the permittees to develop and implement plans to reduce pollutants in stormwater runoff and protect water quality. The plans describe the BMPs that will be implemented to comply with the applicable stormwater permit. Like the permit, the type of plan to be developed also varies by the type of operator.

Construction and industrial operators that are required to obtain an NPDES permit need to file a Notice of Intent (NOI) with SWRCB before commencement of construction or industrial activity. The NOI requirements are intended to establish a mechanism that can be used to clearly identify the responsible parties, locations, scope of discharges, and to document the operator's knowledge of the requirements for SWPPP. The construction and industrial operators that are required to obtain an NPDES permit need to develop and implement the SWPPP that describes the BMPs and other measures to be implemented to reduce pollutants in runoff and protect water quality.

Operators of municipal separate storm sewer systems are required to submit comprehensive SWMPs as part of the permit application. SWMPs describe the BMPs to be implemented throughout the permitted area to reduce pollutants and protect water quality. The federal stormwater regulations require SWMPs, in part, to include BMPs to address industrial, commercial and construction activities, new development and major redevelopment and municipal activities.

For further information on stormwater permits and/or application of a permit, contact: Storm Water Section, State Water Resources Control Board, Division of Water Quality, P.O. Box 100, Sacramento, CA 95812, phone: 916/341-5455, email: **stormwater@dwq.swrcb.ca.gov**.

Questions on the California Certification process for stormwater technologies should be addressed to: Greg Williams, P.E., California Environmental Protection Agency, Department of Toxic Substances Control, Office of Pollution Prevention and Technology Development, P.O. Box 806, Sacramento, CA 95812-0806, Phone: 916/322-0453, Fax: 916/327-4494, E-mail: **g.williams@dtsc.ca.gov.**

Bruce Fujimoto, Senior Water Resources Control Engineer, Division of Water Quality, State Water Resources Control Board, 1001 I Street, P.O. Box 100, Sacramento, CA 95812-0806, Phone: 916/341-5523, E-mail: **FUJIB@dwq.swrcb.ca.gov**.

Xavier Swamikannu, Storm Water Program, CalEPA - RWQCB LA Region, 320 W. 4th Street, Suite 200, Los Angeles, CA 90013, Phone: (213) 6202094, Fax: (213) 576-5777 E-mail: **xswami@rb4.swrcb.ca.gov**.

Maryland

Title 4, Subtitle 2 of the Environment Article, Annotated Code of Maryland states that "…the management of stormwater runoff is necessary to reduce stream channel erosion, pollution, siltation and sedimentation, and local flooding, all of which have adverse impacts on the water and land resources of Maryland." The program designed in the early 1980's to address this finding of the General Assembly concentrated primarily on controlling runoff increases associated with new development. On October 2, 2000, the Maryland Department of the Environment (MDE) adopted new stormwater regulations [Code of Maryland Regulations (COMAR) 26.17.02] including the 2000 Maryland Stormwater Design Manual, Vol. I and II (the Design Manual). These regulations represent a more comprehensive approach to stormwater design.

The Design Manual recognizes the importance and encourages the principles of environmentally sustainable design. Accordingly, Maryland has developed fourteen performance standards that must be met at development sites. These standards, as set forth in Section 1.2 of the Design Manual, apply to any construction activity disturbing 5,000 or more square feet of earth unless specifically exempted by COMAR. While providing incentives for total site design and nonstructural practices, these performance standards also address the design of structural best management practices (BMPs) to mitigate water quality and channel stability impacts.

Currently, the different structural BMP designs used in Maryland are assigned into five general categories (see Figure 1) for stormwater quality control. Chapter 3 of the Design Manual outlines performance criteria based on general feasibility, conveyance, pretreatment, geometry, environmental and landscaping requirements, and maintenance concerns for these five groups. BMPs that may be classified into one of these five groups may be used as stand-alone water quality devices if designed and constructed in accordance with the methods and specifications detailed in the Design Manual. BMPs that cannot be classified into one of the five categories cannot be used for stand-alone water quality treatment until independent pollutant removal performance data are submitted. MDE uses these data to determine conformance with State criteria for treatment, maintenance, and environmental impact.

Stormwater Ponds

- **Micropool Extended-Detention (ED) Ponds**
- **Wet Ponds**
- **Wet ED Ponds**
- **Multiple Pond Systems**
- **"Pocket" Ponds**

Stormwater Wetlands

- **Shallow Wetland**
- **ED Shallow Wetland**
- **Pond/Wetland System**
- **"Pocket" Wetland**

Stormwater Filtering Systems

- **Surface Sand Filters**
- **Underground Sand Filters**
- **Perimeter Sand Filters**
- **Organic Filters**
- **Pocket Sand Filters**
- **Bioretention**

Open Channel Systems

Figure 1. Structural BMPs that may be used for "stand-alone" water quality treatment in Maryland

Maryland supports reciprocity by accepting data and analyses that have been collected and prepared in conformance with the TARP Stormwater BMP Demonstration Protocol. However, Maryland reserves the right to request specific information as necessary to evaluate stormwater management BMPs for conformance with the Design Manual and COMAR.

The **2000 Maryland Stormwater Design Manual, Vol. I and II** and related information are available on MDE's website – http://www.mde.state.md.us./ For more information, please contact Stewart Comstock of MDE's Nonpoint Source Program at 410-537-3543 or email (**scomstock@mde.state.md.us**).

Virginia

The Virginia Stormwater Management Regulation Water Quality Criteria (4 VAC 3-20-71) requires compliance by applying p*erformance-based* criteria or t*echnology-based* criteria. Both criteria require the control or management of the water quality volume (or multiple water quality volumes (WQV), depending on the BMP, i.e., 2 x WQV), defined as the first one-half (½) inch of runoff from impervious surfaces.

Specific test performance claims may be insufficient to support the general acceptance of the technology. Rather, an attempt should be made to transfer the specific test results to an average annual removal efficiency (for phosphorus and/or associated NPS pollutants) based on Virginia's annual rainfall characteristics and typical runoff pollutant concentrations associated with conventional land development practices.

To simplify the calculation procedures for water quality compliance, a "keystone pollutant" is selected. In Virginia, phosphorus has been selected as the keystone pollutant because: 1) phosphorus has a well defined adverse impact on the Chesapeake Bay and its tributaries; 2) phosphorus exists in a "composite" form, i.e., roughly an equal split between particulate and soluble phases; and 3) adequate research exists to provide a reasonable basis for estimating how phosphorus loads change in response to development and to current stormwater control practices. Performance claims should be based on test results for phosphorus, as well as the "overall" performance at removing typical urban pollutants such as sediment, nitrogen, bacteria, BOD/COD, oil/grease, zinc, lead, and toxics.

Additional information on the Virginia Law and Regulations, Handbooks, etc., can be found at the Department of Conservation and Recreation, Division of Soil and Water Conservation Web site: http://www.dcr.state.va.us/sw.

(PLEASE NOTE: WE ANTICIPATE CHANGES TO THE WEB SITE TO ACCOMMODATE DOWNLOADABLE VERSIONS OF THE STORMWATER LAW, REGUILATIONS, HANDBOOKS, AND OTHER POLICY GUIDANCE.)

For further information contact:

Burt Tuxford, Virginia Department of Environmental Quality, P.O. Box 10009 Richmond, VA 23240-0009, Phone: 804/698-4086, Fax: 804/698-4032, E-mail: ***brtuxford@deq.state.va.us****.*

Larry Gavan, Urban Programs Manager, Virginia Department of Conservation and Recreation, 203 Governor Street, Suite 206, Richmond, Virginia 23219, Phone: 804/786-4508, Fax: 804/371-2630, E-mail: **lgavan@dcr.state.va.us.**

Catherine Harold, Environmental Engineer, Chesapeake Bay Local Assistance Department, James Monroe Building, 101 14th Street, 17th Floor, Richmond, VA 23219, Phone: 804/371-7501, Fax: 804/225-3447, E-mail: **CHarold@cblad.state.va.us.**

Washington

Although the state of Washington is not currently a participating TARP state, the Department of Ecology will consider data, analyses, and performance evaluations undertaken with test plans that follow the TARP Protocol. Ecology also plans to inform TARP of all applications received for review and approval of a technology, Ecology decisions on use level designations for each technology and related supporting data. The status of Ecology designation decisions and ongoing reviews are located at Ecology's web site at: http://www.ecy.wa.gov/programs/wq/stormwater/newtech/.

For further information contact: Stanley J. Ciuba, P.E., Dept. of Ecology, Water Quality Program, PO Box 47696, Olympia, WA 98504-7696, (360)407-6435, E-mail: **sciu461@ecy.wa.gov**.

Stormwater BMP Demonstration Summary

Fill out the following form and submit it in print and electronically with the Stormwater BMP Demonstration Report.
The information in this application will be used in the etarp BMP database.

Technology Name _____ Technology Category (e.g.,structural, non-structural; detention pond, sand filter) _____ Date _____

1. Contact Information

Vendor Name _____
Contact Name _____
Address (street, city, state, zip) _____
Address (street, city, state, zip) _____
Phone, Fax, e-mail address _____

2. Test Site Information

Site Name _____
Address (street, city, state, zip) _____
Land Use:

☐ Commercial/Office ☐ Residential ☐ Industrial ☐ Open ☐ Other (specify)

Total Contributing Drainage Area _____

3. Watershed Information

Watershed Name _____
Total Watershed Area _____
Percent of Impervious Area in Watershed _____

4. Precipitation Information

Regional Climate Station _____
Average Number of Storms Year _____
Average Annual Rainfall (cm) _____
Monthly Average Rainfall at Test Site (cm) (During Testing) _____
Storm Events Start and End Times (During Testing) _____
Storm Precipitation (For Each Storm Event During Testing) _____

Stormwater BMP Demonstration Summary

Technology Name _____ Technology Category _____ Date _____
(e.g.,structural, non-structural; detention pond, sand filter)

5. BMP Information

Date System Installed _____
Dates Tested/Sampled _____
Test Events Start and End Times (For Each Event) _____
Total Storm Flow Volume Into BMP (For Each Event) _____
Total Storm Flow Volume Bypassed (For Each Event) _____
Type of Samples Collected (e.g., flow-weighted, composite) _____
Parameters and Units Measured _____
Analysis Method _____

6. Report Submittal Checklist (*Use the checklist to affirm that the Stormwater BMP Demonstration Report conforms with the protocol.)*

_____ Executive Summary
_____ Title/Purpose
_____ Theory/Technology Description
_____ Performance Claim
_____ Test Methods and Procedures
_____ Data Quality Assurance Project Plan
_____ Test Equipment and Apparatus
_____ Verification/Certification Data and Analysis
_____ Data Quality Assessment
_____ Conclusions/Recommendations/Limitations
_____ Cost Information

7. Certification

I certify that all information submitted is true and correct and was accumulated using approved methods specified in the Stormwater BMP Demonstration Protocol. I understand that any misrepresentation or misuse of information will result in immediate denial of the technology being demonstrated and may prohibit me or, the company I represent from seeking future approvals.

_____
Signature / Date

Appendix F: QAPP Groups and Elements

The elements of a QAPP are categorized into "groups" according to their function. Specifications for each element are found in *EPA Guidance forQuality Assurance Project Plans,* EPA QA/G-5 (EPA/600/R-98/018). Details of each requirement of the elements from that document available at http://www.epa.gov/quality/qa_docs.html.

The elements of a QAPP are:

Group A: Project Management
This group of QAPP elements covers the general areas of project management, project history and objectives, and roles and responsibilities of the participants. The following 9 elements ensure that the project's goals are clearly stated, that all participants understand the goals and the approach to be used, and that project planning is documented:

A1 Title and Approval Sheet
A2 Table of Contents and Document Control Format
A3 Distribution List
A4 Project/Task Organization and Schedule
A5 Problem Definition/Background
A6 Project/Task Description
A7 Quality Objectives and Criteria for Measurement Data
A8 Special Training Requirements/Certification
A9 Documentation and Records

- date of event,
- time and duration of the storm event,
- size of the storm event,
- inches of rain and intensity,
- number of days since preceding storm event,
- total volume of runoff treated and volume bypassed,
- time into event and conditions when BMP was bypassed,
- condition of the drainage area prior to and during the event,
- activities being conducted,
- chemicals, materials, equipment, or vehicles stored or handled in drainage area,
- good housekeeping measures implemented prior to event,
- upset, spills, or leaks in drainage area, including the material or chemical,
- construction or maintenance activities in the drainage area, and
- any other information needed to adequately characterize the contributing areas to the BMP.)

Group B: Measurement/Data Acquisition
This group of QAPP elements covers all of the aspects of measurement system design and implementation, ensuring that appropriate methods for sampling, analysis, data handling, and QC are employed and will be thoroughly documented:

B1 Sampling Process Design (Experimental Design)
B2 Sampling Methods Requirements
B3 Sample Handling and Custody Requirements
B4 Analytical Methods Requirements
B5 Quality Control Requirements
B6 Instrument/Equipment Testing, Inspection, and Maintenance Requirements
B7 Instrument Calibration and Frequency
B8 Inspection/Acceptance Requirements for Supplies and Consumables
B9 Data Acquisition Requirements (Non-Direct Measurements)
B10 Data Management

Group C: Assessment/Oversight

The purpose of assessment is to ensure that the QAPP is implemented as prescribed. This group of QAPP elements addresses the activities for assessing the effectiveness of the implementation of the project and the associated QA/QC activities:

C1 Assessments and Response Actions
C2 Reports to Management

Group D: Data Validation and Usability

Implementation of Group D elements ensures that the individual data elements conform to the specified criteria, thus enabling reconciliation with the project's objectives. This group of elements covers the QA activities that occur after the data collection phase of the project has been completed:

D1 Data Review, Validation, and Verification Requirements
D2 Validation and Verification Methods
D3 Reconciliation with Data Quality Objectives

40 CFR SUBCHAPTER D (1995--1999) - WATER PROGRAMS
http://www.epa.gov/epacfr40/chapt-I.info/
40 CFR Part 122: National Pollutant Discharge Elimination System
Select Subchapter D, Part 122 at the referenced Web site.

American Society of Civil Engineers (ASCE) Web site, "ASCE/EPA Stormwater Best Management Practices Nationwide Database," http://bmpdatabase.org/
ASTM Store, Search for Standards Web site (List, Title & Description for ASTM Methods) (see ASTM appendix for specific methods applicable to Stormwater Technologies)
http://www.astm.org/.
CALTRANS - CSU Sacramento - UC Davis Storm Water Project Web site
http://www.stormwater.water-programs.com/

CALTRANS Stormwater Management Program
http://www.dot.ca.gov/hq/env/stormwater/index.htm

EPA Web site: Water Quality Standards (Total Maximum Daily Limits)
http://www.epa.gov/OWOW/tmdl/index.html

EPA's Stormwater Program Web site
http://cfpub.epa.gov/npdes/home.cfm?program_id=6
EPA Test Method Index (List of EPA Test Methods)
http://www.epa.gov/epahome/index/nameindx.htm

NJDEP Bureau of Nonpoint Pollution Control – Industrial Stormwater Permitting Program
http://www.state.nj.us/dep/dwq/stormw.htm

NJDEP Nonpoint Source and Stormwater Management Program – Best Management Practices for Control of Nonpoint Source Pollution from Stormwater is available in the publications list.
http://www.state.nj.us/dep/watershedmgt/.

Appendix H: Bibliography

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United States Environmental Protection Agency. 1998b. *Guidance for Quality Assurance Project Plans.* (QA/G-5) EPA/600/R-98/018. Washington, D.C.

United States Environmental Protection Agency. 2001. *EPA Requirements for Quality Assurance Project Plans.* (QA/R-5) EPA/240/B-01/003 Washington, D.C.

Urbonas, Ben R. 1996. *EPA-ASCE Cooperative Agreement, Determining Urban Stormwater Best Management Practices (BMP) Removal Efficiencies. Task 2.2 – Recommend the Needed Information/Data Tables and Suggested Data Base Structure.*

URS Greiner Woodward Clyde, Urban Water Resources Research Council of the American Society of Civil Engineer, Environmental Protection Agency. 1999. *Development of Performance Measures, Task 3.1 – Technical Memorandum, Determining Urban Stormwater Best Management (BMP) Removal Efficiencies.*

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Appendix D—

LIST OF ILLUSTRATIONS

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BACTERRA™ ADVANCED BIORETENTION SYSTEM
BACTERIA REMOVAL PERFORMANCE SUMMARY

Application: Stand Alone Stormwater Treatment Best Management Practice
Type of Treatment: High Flow Rate Media Filtration and Bioretention

Manufactured by: Americast, Inc
11352 Virginia Precast Road, Ashland VA 23005
Toll Free (East Coast) (866) 349-3458
Toll Free (West Coast) (877) 345-1450
www.filterra.com

May 2007

filterra
A Growing Idea in Stormwater Filtration.

BACTERIA REMOVAL

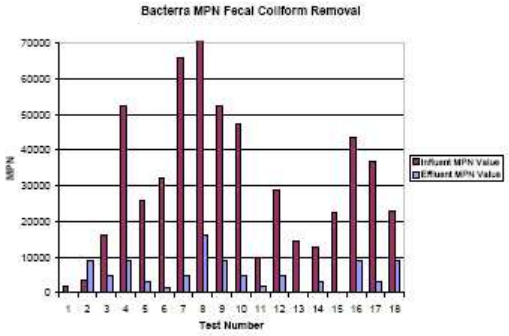
Numerous water bodies nationwide are impaired due to excessive levels of fecal bacteria from stormwater runoff. Fecal coliform exist in the digestive track of warm blooded animals. The major sources of fecal coliform in urban runoff are contributed by pet and wild animal, especially bird, feces. Previous studies by other researchers have shown that urban runoff can result in fecal coliform levels on average between 15,000 and 22,000 MPN/100mL. For safe water contact usages fecal coliform levels should be at or below 400 to 200 MPN / 100ml.[1]

With the growing concern about bacterial impairment of recreational waters associated with stormwater runoff, extensive laboratory studies were conducted by Filterra®, division of Americast, Inc., to determine an optimum blend for bacteria removal. The Filterra® bioretention BMP blend is currently designed to remove typical stormwater pollutants such as TSS, phosphorus, nitrogen and heavy metals. Filterra® has developed a specialized treatment media to remove fecal coliform and other pathogens from urban stormwater runoff. This new product has been trademarked Bacterra™.

Laboratory tests have shown removal rates as high as 99% removal for non-bypass flows, which represent the majority of storm events, and 96% removal for bypass flows, with concentration reductions as high as ten fold. It is believed that the media goes through a maturation process where it develops a complex microbiological ecosystem that enhances predation, capture and destruction of fecal coliform. Physical, chemical and biological processes are all believed to contribute to the removal process, but sorption is believed to be the primary removal mechanism. Clark and Pitt (1999) note that media filters develop a biofilm on and within the media that promotes the ability of the media to remove bacteria.[2]

The samples were analyzed for fecal coliform MPN (Most Probable Number) according to the EPA approved HACH method 8368 using A-1 Medium Broth Data were reported in MPN per 100 mL.

Tests were performed under bypass and non-bypass flows over a five month period between October 2006 and March 2007 to study if increasing the amount of organic materials would increase the ability of the media to remove bacteria. The average removal over the test period under bypass and non-bypass flows was 87%. The lowest MPN level achieved was 110 MPN which is near the commonly used threshold number of 200 MPN for water contact activities. The table below shows the influent and effluent MPN counts.



It is assumed that the Bacterra™ blends will not only remove fecal coliform, but also other types of fecal bacteria such as E. coli and Entercocci since the mechanisms for removal are the same. More research is needed to determine the exact method of bacteria removal by the media, but sorption is believed to be the primary mechanism in removal.

This does not support conventional thinking that it has been assumed that long contact times are needed to effectively remove bacteria from stormwater runoff using bioretention media. According to the United States Environmental Protection Agency Stormwater Best Management Practice Design Guide, a 72 hour flow through time is recommended for bioretention filters.[3] Our study again shows that the high flow rate can achieve high bacteria removal efficiencies.

FIELD TESTING

Preliminary field testing is currently underway in California, and test sites are now being evaluated locally. Field testing will continue through 2007 with periodic updates on research findings.

CONCLUSION

The best available information on Bacterra demonstrates this technology is capable of removal of fecal bacteria. Current data has shown removal rates of up to 99% and effluent quality at or near to that suitable for receiving waters designated for human contact uses.

Manufactured by:
AMERICAST

For ordering and technical information call:
866 349 3458

Appendix E: STORMWATER BMP LIST (POTENTIAL–190):
(USEPA NPDES REC'M'DS 127)

The World of SWM BMPs

Major Categories: 8 (EPA: 6)
Sub-Categories: 30
Individual SWM BMPs: 197
EPA Listed SWM BMPs: 127
Va. SWM BMPs: 17

A. PUBLIC EDUCATION AND OUTREACH (NPDES-MS4)

1. Developing Municipal Outreach Programs

a. Developing an Outreach Strategy

2. Promoting the Stormwater Message

a. Classroom Education on Stormwater
b. Stormwater Outreach for Commercial Businesses
c. Tailoring Outreach Prgms to Minority and Disadv. Comm's and Children
d. Using the Media

3. Stormwater Outreach Materials

a. Educational Displays, Pamphlets, Booklets, and Bill Inserts
b. Promotional Giveaways
c. Stormwater outreach Materials

4. Education for Homeowners

a. Alternatives to Toxic Substances Chlor. Water Discharge Options
b. Landscaping and Lawn Care
c. Pest Control
d. Using the Media
e. Proper Disposal of Household Hazardous Wastes
f. Residential Car Washing
g. Water conservation Practices for Homeowners

5. Education for Businesses

a. Automobile Maintenance
b. Pollution Prevention for Businesses
c. Promoting Low Impact Development (LID)

B. PUBLIC INVOLVEMENT/PARTICIPATION (NPDES-MS4)

1. Stormwater-Related Activities

a. Adopt-a-Stream Programs
b. Pollution Prevention for Businesses
c. Storm Drain Marking
d. Stream Cleanup and Monitoring
e. Volunteer Monitoring
f. Wetland Plantings

2. Soliciting Public Opinion

a. Attitude Surveys
b. Stakeholder Meetings
c. Watershed Organizations
d. (Focus Groups?)

C. ILLICIT DISCHARGE DETECTION AND ELIMINATION (NPDES-MS4)

1. Developing an IDDE Program _ _

a. Illicit Discharge Detection and Elimination Program Development

b. Reducing the Occurrence of SSOs

2. Trash and Illegal Dumping _ _

a. Developing a Used Oil Recycling Program

b. Illegal Dumping Control

c. Trash Management

3. Decentralized Wastewater _ _

a. Preventing Septic System Failure

b. Sewage from Recreational Activities (includes boating and camping?)

4. Public Reporting _ _

a. Community Hotlines

D. CONSTR. SITE STORMWATER RUNOFF CONTROL (NPDES-MS4) _ _

1. Municipal Program Oversight _ _

a. Construction Phase Plan Review

b. Contractor Training and Certification

c. Local Ordinances for Construction Site Runoff Control

d. Municipal Construction Inspection Program

2. Construction Site Planning and Management _ _

a. Construction Sequencing

b. Construction Site Operator BMP Inspection and Maintenance

c. Land Grading

d. Preserving Natural Vegetation

e. (Protect Sensitive and Special Value Features?)

f. (Protect/Conserve/Enhance Riparian Areas?)

g. (Protect/Utilize Natural Flow Pathways in Overall SWM Planning & Design?)

h. (Cluster Uses at Each Site; Build on the Smallest Area Possible?)

i. (Concentrate Uses Areawide through Smart Growth Principles?)

j. (Minimize Total Disturbed Area – Grading?)

k. (Minimize Soil Compaction in Disturbed Areas?)

l. (Landscape Restoration?)

m. (Soil Amendment and Restoration?)

n. (Floodplain Restoration?)

3. Erosion Control _ _

a. Chemical Stabilization

b. Compost Blankets

c. Dust Control

d. Geotextiles

e. Volunteer Monitoring

f. Mulching
g. Riprap
h. Seeding
I. Sodding
j. Soil Retention
k. Soil Roughening
l. Temporary Slope Drain
m.Temporary Stream Crossings
n. Wind Fences and Sand Fences
o. (Outlet Protection and Energy Dissipators?)
p. (Contaminated Soil Management?)
q. (Construction Road Stabilization?)
r. (Trees, Shrubs and Vines?)
s. (Bank Stabilization?)
t. (Soil Bioengineering?)

4. Runoff Control - -

a. Check Dams
b. Compost Blankets
c. Permanent Slope Diversions
d. Temporary Diversion Dikes
e. (Gabions?)

5. Sediment Control - -

a. Brush Barrier
b. Compost Filter Berms
c. Compost Filter Socks
d. Construction Entrances
e. Fiber Rolls
f. Filter Berms
g. Sediment Basins and Rock Dams
h. Sediment Filters and Sediment Chambers
i. Sediment Traps
j. Silt Fences
k. Storm Drain Inlet Protection
l. Straw or Hay Bale Barriers
m.Vegetated Buffers
o. (Dewatering Operations?)
p. (Sandbag Barrier?)
q. (Floating Sediment Curtain?)

6. Good Housekeeping/Materials Management - -

a. Concrete Washout
b. Compost Filter Berms
c. Spill Prevention and Control Plan
d. Vehicle Maintenance and Washing Areas at Construction Sites
e. (Structure Construction and Painting?)

E. POST-CONSTR. SWM IN NEW DEVELOPMENT/REDEVELOPMENT (NPDES-MS4)

1. Municipal Program Elements

a. BMP Inspection and Maintenance
b. Ordinances for Post-Construction Runoff
c. Post-Construction Plan Review
d. Zoning

2. Innovative BMPs for Site Plans

a. Alternative Pavers
b. Alternative Turnarounds
c. Conservation Easements
d. Development Districts
e. Eliminating Curbs and Gutters
f. Green Parking
g. Green Roofs
h. Infrastructure Planning
i. Low Impact Development (LID) and Other Green Design Strategies
j. Narrower Residential Streets
k. Open Space Design and Conservation
l. Protection of Natural Features
m.Redevelopment
n. Riparian/Forested Buffer
o. Street Design and Patterns
p. Urban Forestry
q. (Rooftop Disconnection?)
r. (Disconnection from Storm Drains?)

3. Infiltration

a. Grassed Swales
b. Infiltration Basin
c. Infiltration Trench
d. Porous Pavement
e. (Level Spreader?)
f. (Subsurface Infiltration Bed?)
g. (Dry Well/Seepage Pit?)
h. (Infiltration Berm and Retentive Grading?)

4. Filtration

a. Bioretention (Rain Gardens, etc.)
b. Catch Basin Inserts
c. Sand and Organic Filters
d. Vegetated Filter Strips
e. (Swales?)
f. (Constructed Filter?)
g. (Water Quality Filter and Hydrodynamic Device?)

5. Retention/Detention

a. Dry Detention Basins

b. Dry Extended Detention Basins 

b. In-Line Storage

c. On-Lot Treatment

d. Stormwater Wetland 

e. Wet Ponds 

f. Earthen Embankment 

g. Principal Spillway 

h. Vegetated Emergency Spillway 

i. Sediment Forebay 

j. Landscaping 

k. (Underground Detention?)

l. (Runoff Capture and Reuse?)

m. (Special Detention Areas – Parking Lot, Rooftop?)

n. Rain Barrels (disconnect roof runoff from storm drains & recycle water)

6. Other

a. Alum Injection

b. Manufactured Products for Stormwater Inlets 

c. (Channel Linings?)

d. (Oil/Water Separator?)

e. (Multiple Systems?)

F. POLLUTION PREV./GOOD HOUSEKEEPING FOR MUNICIPAL OP'S (NPDES-MS4)

1. Education

a. Municipal Employee Training and Education

2. Municipal Activities

a. Municipal Landscaping

b. Municipal Vehicle Fueling

c. Municipal Vehicle and Equipment Maintenance

d. Municipal Vehicle and Equipment Washing

e. Parking Lot and Street Cleaning

f. Road Salt Application and Storage

g. Roadway and Bridge Maintenance

h. Storm Drain System Cleaning

3. Municipal Facilities

a. Hazardous Materials Storage

b. Materials Management

c. Municipal Facilities Management

d. Spill Response and Prevention

G. BMPs FOR INDUSTRIAL AND COMMERCIAL ACTIVITIES/FACILITIES

1. Industrial/Commercial Activities

a. Non-Stormwater Discharges to Storm Drains

b. Outdoor Loading and Unloading of Materials

c. Outdoor Container Storage of Liquid Materials

d. Outdoor Process Equipment Operations
e. Grounds Construction and Maintenance
f. Over-Water Operations
g. Food Service and Handling
h. Power or Pressure Washing
i. Kitchen Exhaust Cleaning
j. Resonse to Sanitary Sewer Overflows

2. Industrial/Commercial Facilities

a. Swimming Pools and Spas
b. Dumpsters
b. Air Conditioners and Refrigeration
c. Farms and Agricultural Land
d. (Boating and Marinas?)

H. BMPs FOR RESIDENTIAL AND HOMEOWNERS

1. Residential Properties

a. Non-Stormwater Discharges to Storm Drains
b. Vehicle Washing
c. Vehicle Maintenance and Repairs
d. Landscape Irrigation and Lawn Watering
e. Pesticides and Fertilizers
f. Household Hazardous Waste
g. Sanitary Sewer Laterals and Septic Tanks
h. Pet and Animal Wastes
i. Slope and Streambank Stabilization
j. Swimming Pools and Spas
k. Boating and Marinas
l. Tips for Wet Basements and Crawl Spaces

Appendix F: BEST BMP DESIGN REFERENCES

Stormwater Practice Selection and Basic Stormwater Practice Design/Performance Specifications			
Stormwater Practice Selection Guidance	Northern Mariana Islands and Guam	CNMI and Guam Stormwater Management Manual	http://www.guamepa.govguam.net/programs/water/index.html
	New York	New York State Stormwater Management Design Manual	http://www.dec.state.ny.us/website/dow/toolbox/swmanual/index.html
	Connecticut	2004 Stormwater Management Manual	http://dep.state.ct.us/wtr/stormwater/strmwtrman.htm#download
	Minnesota	The Minnesota Stormwater Manual	http://www.pca.state.mn.us/water/stormwater/stormwater-manual.html
Basic Stormwater Practice Design/ Performance Specifications	Maryland	Maryland Stormwater Design Manual	http://www.mde.state.md.us/Programs/WaterPrograms/SedimentandSt
	New Jersey	New Jersey Stormwater Best Management Practices Manual	http://www.nj.gov/dep/watershedmgt/bmpmanualfeb2004.htm
	Vermont	Vermont Stormwater Management Manual	http://www.anr.state.vt.us/dec/waterq/cfm/ref/Ref_Stormwater.cfm
	Northern Mariana Islands and Guam	CNMI and Guam Stormwater Management Manual	http://www.guamepa.govguam.net/programs/water/index.html
Detailed Stormwater Practice Design/Performance Specifications			
Bioretention	Prince George's Co, MD	Bioretention Manual	http://www.goprincegeorgescounty.com/Government/AgencyIndex/DEF
	Lake Co, OH	Bioretention Guidance	http://www2.lakecountyohio.org/smd/Forms.htm
	Washington	Low Impact Development Technical Guidance Manual for Puget Sound	http://www.psat.wa.gov/Publications/LID_tech_manual05/lid_index.htm
	Wisconsin	Stormwater Management Technical Standards	http://www.dnr.state.wi.us/org/water/wm/nps/stormwater/techstds.htm#
Filtration	District of Columbia	Stormwater Management Guidebook (not available online)	http://dchealth.dc.gov/DOH/site/default.asp?dohNav=|33110|
	Minnesota	The Minnesota Stormwater Manual	http://www.pca.state.mn.us/water/stormwater/stormwater-manual.html
	Maryland	Maryland Stormwater Design Manual	http://www.mde.state.md.us/Programs/WaterPrograms/SedimentandSt

	Center for Watershed Protection	Design of Stormwater Filtering Systems	http://www.cwp.org/PublicationStore/special.htm
Infiltration	Pennsylvania	Draft Stormwater Best Management Practices Manual	http://www.dep.state.pa.us/dep/subject/advcoun/Stormwater/stormwate
	Delaware	Green Technology: The Delaware Urban Runoff Management Approach	http://www.dnrec.state.de.us/DNREC2000/Divisions/Soil/Stormwater/N
	New York	New York State Stormwater Management Design Manual	http://www.dec.state.ny.us/website/dow/toolbox/swmanual/index.html
	Maryland	Maryland Stormwater Design Manual	http://www.mde.state.md.us/Programs/WaterPrograms/SedimentandSt
Open Channels	New York	New York State Stormwater Management Design Manual	http://www.dec.state.ny.us/website/dow/toolbox/swmanual/index.html
	Vermont	Vermont Stormwater Management Manual	http://www.anr.state.vt.us/dec/waterq/cfm/ref/Ref_Stormwater.cfm
	Western Washington	Stormwater Management Manual for Western Washington	http://www.ecy.wa.gov/programs/wq/stormwater/manual.html#How_to_
	Northern Mariana Islands and Guam	CNMI and Guam Stormwater Management Manual	http://www.guamepa.govguam.net/programs/water/index.html
Stormwater Ponds	Vermont	Vermont Stormwater Management Manual	http://www.anr.state.vt.us/dec/waterq/cfm/ref/Ref_Stormwater.cfm
	Austin, TX	Drainage Criteria Manual	http://www.cityofaustin.org/watershed/publications.htm
	Maryland	Maryland Stormwater Design Manual	http://www.mde.state.md.us/Programs/WaterPrograms/SedimentandSt
	New York	New York State Stormwater Management Design Manual	http://www.dec.state.ny.us/website/dow/toolbox/swmanual/index.html
Stormwater Wetlands	Vermont	Vermont Stormwater Management Manual	http://www.anr.state.vt.us/dec/waterq/cfm/ref/Ref_Stormwater.cfm
	Connecticut	2004 Stormwater Management Manual	http://dep.state.ct.us/wtr/stormwater/strmwtrman.htm#download
	Washington	Stormwater Management Manual for Western Washington	http://www.ecy.wa.gov/programs/wq/stormwater/manual.html
	Minnesota	The Minnesota Stormwater Manual	http://www.pca.state.mn.us/water/stormwater/stormwater-manual.html

Innovative/Proprietary Stormwater Practices	New Hampshire	Innovative Stormwater Treatment Technologies Best Management Practices Manual	http://www.des.state.nh.us/wmb/was/manual/
	Virginia	Virginia Stormwater Management Handbook	http://www.dcr.state.va.us/sw/stormwat.htm#pubs
	Massachusetts	Massachusetts Stormwater Technology Evaluation Project	http://www.mastep.net/
	New Jersey	New Jersey Stormwater Best Management Practices Manual	http://www.nj.gov/dep/watershedmgt/bmpmanualfeb2004.htm
Green Rooftops	Portland, OR	Stormwater Management Manual	http://www.portlandonline.com/bes/index.cfm?c=35122
	Rhode Island	Urban Environmental Design Manual	http://www.dem.ri.gov/pubs/index.htm
	Minnesota	Urban Small Sites Best Management Practice Manual	http://www.metrocouncil.org/environment/watershed/bmp/manual.htm
	Philadelphia, PA	Stormwater Management Guidance Manual	http://www.phillyriverinfo.org/
Porous Pavement	Pennsylvania	Draft Stormwater Best Management Practices Manual	http://www.dep.state.pa.us/dep/subject/advcoun/Stormwater/stormwate
	Urban Drainage and Flood Control District (Denver, CO)	Urban Storm Drainage Criteria Manual	http://www.udfcd.org/downloads/down_critmanual.htm
	New Jersey	New Jersey Stormwater Best Management Practices Manual	http://www.nj.gov/dep/watershedmgt/bmpmanualfeb2004.htm
	Virginia	Virginia Stormwater Management Handbook	http://www.dcr.state.va.us/sw/stormwat.htm#pubs
Rain Barrels	Texas	The Texas Manual on Rainwater Harvesting	http://www.twdb.state.tx.us/publications/reports/RainwaterHarvestingM
	Montana	Rainwater Harvesting Systems for Montana	http://www.montana.edu/wwwpb/pubs/mt9707.pdf
	Rhode Island	Urban Environmental Design Manual	http://www.dem.ri.gov/pubs/index.htm
	Eugene, OR	Stormwater Management Manual	http://www.eugene-or.gov/portal/server.pt?space=CommunityPage&cached=true&parentn

Rain Gardens	Maine	Stormwater Management for Maine	http://www.maine.gov/dep/blwq/docstand/stormwater/stormwaterbmps/
	Wisconsin	Rain Gardens: A How-To Manual for Homeowners	http://clean-water.uwex.edu/pubs/home.htm#rain
	North Carolina	Designing Rain Gardens	http://www.bae.ncsu.edu/cont_ed/bioretention/lecture/design_rain.pdf
	Maplewood, MN	Maplewood Rainwater Gardens	http://www.ci.maplewood.mn.us/vertical/Sites/{EBA07AA7-C8D5-43B1-
Design Examples			
Design Examples	Northern Mariana Islands and Guam	CNMI and Guam Stormwater Management Manual	http://www.guamepa.govguam.net/programs/water/index.html
	Virginia	Virginia Stormwater Management Handbook	http://www.dcr.state.va.us/sw/stormwat.htm#pubs
	Vermont	Vermont Stormwater Management Manual	http://www.anr.state.vt.us/dec/waterq/cfm/ref/Ref_Stormwater.cfm
	Georgia	Georgia Stormwater Management Manual	http://www.georgiastormwater.com/
Landscaping			
Landscaping Criteria	North Carolina	Draft Manual of Stormwater Best Management Practices	http://h2o.enr.state.nc.us/su/bmp_updates.htm
	Northern Mariana Islands and Guam	CNMI and Guam Stormwater Management Manual	http://www.guamepa.govguam.net/programs/water/index.html
	New Jersey	New Jersey Stormwater Best Management Practices Manual	http://www.nj.gov/dep/watershedmgt/bmpmanualfeb2004.htm
	Shaw and Schmidt	Plants for Stormwater Design: Species Selection for the Upper Midwest	http://www.pca.state.mn.us/publications/manuals/stormwaterplants.htm
Operation and Maintenance			
Operation and Maintenance Requirements	Ontario	Stormwater Management Planning and Design Manual	http://www.ene.gov.on.ca/envision/gp/4329eindex.htm
	North Carolina	Draft Manual of Stormwater Best Management Practices	http://h2o.enr.state.nc.us/su/bmp_updates.htm

	Eugene, OR	Stormwater Management Manual	http://www.eugene-or.gov/portal/server.pt?space=CommunityPage&cached=true&parentna
	Center for Watershed Protection	Stormwater Pond and Wetland Maintenance Guidebook	http://www.stormwatercenter.net/Manual_Builder/Maintenance_Manual
Urban Stormwater Management			
Hotspot Management/ Pollution Prevention	Los Angeles, CA	Development BMP Handbook	http://www.lastormwater.org/WPD/download/techman.htm
	Western Washington	Stormwater Management Manual for Western Washington	http://www.ecy.wa.gov/programs/wq/stormwater/manual.html#How_to
	Connecticut	2004 Stormwater Management Manual	http://dep.state.ct.us/wtr/stormwater/strmwtrman.htm#download
	Center for Watershed Protection	Urban Subwatershed Restoration Manual 8: Pollution Prevention Practices	http://www.cwp.org/PublicationStore/USRM.htm#usrm8
Ultra-Urban/Small Site Practices	Minnesota	Urban Small Sites Best Management Practice Manual	http://www.metrocouncil.org/environment/watershed/bmp/manual.htm
	District of Columbia	Stormwater Management Guidebook (not available online)	http://dchealth.dc.gov/DOH/site/default.asp?dohNav=|33110|
	Portland, OR	Stormwater Management Manual	http://www.portlandonline.com/bes/index.cfm?c=35122
	Philadelphia, PA	Stormwater Management Guidance Manual	http://www.phillyriverinfo.org/

Appendix G —

CHARTER

ARTICLE I – NAME

This organization shall be known as the Virginia Stormwater Best Management Practices (BMP) Clearinghouse Committee, hereinafter referred to as the "Committee."

ARTICLE II – DEFINITIONS

For the purposes of this charter, the following words shall have the meanings respectively ascribed to them:

"Best Management Practice" or "BMP" means a practice, or combination of practices, that is determined and recognized to be the most effective, practicable means of preventing or reducing the amount of physical, chemical and biological degradation of state waters generated by nonpoint source runoff pollution to a level compatible with state water management goals and requirements.

"Meeting" means a gathering of the Committee, either together in a designated physical location or through electronic/telecommunication means or both, for the purpose of discussing Committee business.

"Stormwater Best Management Practice" or "Stormwater BMP" means a BMP that is intended to control the physical, chemical and biological characteristics of stormwater runoff from land disturbance projects.

ARTICLE III – PURPOSE

The purpose of this Committee shall be to provide direction for the Virginia Stormwater BMP Clearinghouse, a state-of-the-art, statewide-accessible information clearinghouse for application of stormwater BMPs available through a website managed and maintained by the Virginia Water Resources Research Center (VWRRC).

The Committee shall:

- Provide direction for the clearinghouse website design;
- Provide direction for development and management of the website and support database;
- Evaluate research and monitoring (and associated recommendations) pertaining to manufactured BMPs;
- Establish BMP pollutant removal efficiencies and effectiveness ratings for Virginia; and
- Provide assistance to BMP manufacturers in arranging for third-party research pertaining to their products, and identify other stormwater issues that need research.

ARTICLE IV – LEADERSHIP

The Virginia Department of Conservation and Recreation (DCR) will chair the Committee. The VWRRC will provide staff support for the Committee.

ARTICLE V – MEMBERSHIP

Section 1 – Membership selection
The Committee shall be comprised of up to twenty-five key stakeholders. Invitations to serve on the Committee will be issued by the VWRRC on behalf of the DCR.

Section 2 – Representation of stakeholder groups
The DCR and VWRRC will strive to ensure a balanced representation and participation from the following stakeholder groups:

- Federal agencies;
- State agencies;
- Local governments of various sizes and complexities;
- Soil and water conservation districts;
- BMP manufacturers;
- Consulting engineers and industry representatives;
- University and other researchers; and
- Environmental and conservation organizations.

Section 3 – Geographic representation
The DCR and VWRRC will strive to ensure representation and participation from all major Virginia watersheds.

Section 4 – Rights of membership
Decisions will be based on collective professional judgment of the Committee. All Committee members will have voting privileges.

Section 5 – Terms
The initial Committee will include members with a reasonably equal distribution of one, two, or three-year terms, effective as of April 1, 2007. This will establish staggered terms, assuring an appropriate level of collective experience and continuity among the members. Appointments thereafter shall be made for three-year terms. Upon invitation, members are eligible to serve up to three consecutive three-year terms. The DCR will have a permanent representative on the Committee who will serve as the chairperson.

Section 6 – Resignation, Termination, and Absences
A Committee member may resign by providing written notice to the Committee Chair and sending a copy of the notice to the VWRRC staff. A Committee member may be dismissed if he or she has three absences from Committee meetings within a 12-month period. A member who must be absent may send a substitute to the meeting, but the substitute will function as an observer, rather than a participant, and will not exercise the absent member's voting privileges.

Section 7 – Vacancies
Vacancies on the Committee, either as a result of term limits or by a member's inability to fulfill a term, will be filled in the same manner as the initial membership selection. Members chosen to complete another's term may represent the same stakeholder category (e.g., an environmental organization) or a different stakeholder category.

ARTICLE VI – MEETINGS

Section 1 – Regular and Special Meetings
Regular meetings of the Committee will be held quarterly. The Chairperson may call special meetings upon providing a notice of at least five (5) working days. Business may be conducted through electronic mail and conference calls as well.

Quarterly meetings shall be scheduled no later than the final regular quarterly meeting of the calendar year for the following year. The VWRRC staff will communicate meeting reminders and reference materials to the committee members at least two (2) weeks prior to each quarterly meeting, and as quickly as is feasible for special called meetings.

Section 2 – Quorum
A quorum of at least sixty percent of the Committee members, not including any vacancies, must be present before motions can be introduced or passed.

ARTICLE VII – SUB-COMMITTEES

The Committee may create sub-committees of at least three members as needed. Each sub-committee will have a sub-committee chairperson appointed by the Committee Chairperson. Subcommittees must have a simple majority of their members present before decisions may be made and shall operate by consensus to arrive at reports or recommendations to be brought to the full Committee.

ARTICLE VIII – RECOMMENDATIONS AND FINAL DECISIONS

Decisions of the Committee shall be based on a majority vote of a quorum of committee members.

ARTICLE IX – THIRD-PARTY SCIENTIFIC EVALUATIONS

The Committee and the VWRRC have no direct responsibility to conduct scientific studies and evaluations of BMPs. However, the VWRRC may provide a service by helping to arrange for such research to be done. Costs to carry out research of BMP effectiveness and efficiency are to be paid by the manufacturer or by special grants or other methods and will not be a direct expense of the DCR or the VWRRC.

ARTICLE X – FINANCES

Section 1 – Committee Finances
The Committee members will receive no monetary compensation. The Committee members or the organizations they represent will cover the costs associated with travel and meals to attend all Committee meetings and related functions.

ARTICLE XI – ADMINISTRATION

Section 1 -- Role of the Virginia Department of Conservation and Recreation

- The DCR will provide guidance and collaborate with the VWRRC staff regarding Committee membership and development of the BMP Clearinghouse project.
- The DCR will chair the Committee.

Section 2 -- Role of the Virginia Water Resources Research Center

- The VWRRC will facilitate meetings of the Committee and provide support staff to the Committee, including recording meeting minutes. The VWRRC will facilitate a listserv for Committee activities.
- When requested, the VWRRC will consider facilitating third-party research and evaluation services by coordinating with stormwater BMP designers, regulators, researchers, and manufacturers regarding the scientific review of existing BMP test data or new monitoring and testing. Through the BMP clearinghouse, the VWRRC will make available third-party research recommendations concerning practice effectiveness and efficiency.
- The VWRRC will develop and maintain the clearinghouse website based on the directions of the Committee in corroboration with the DCR.
- The VWRRC will provide the DCR with quarterly progress reports.