Virginia Stormwater BMP Clearinghouse Committee Meeting

Virginia Department of Forestry Building, Training Room
Charlottesville, VA
January 25, 2010

Meeting minutes by Jane Walker

Committee Members Present
Joe Battiata, Center for Watershed Protection
Doug Beisch, Williamsburg Environmental Group
Gary Boring, New River-Highlands Resource Conservation and Development (RC&D) Council
Joanna Curran, University of Virginia (UVA)
Lee Hill, Virginia Department of Conservation and Recreation (DCR)
Julia Hillegass, Hampton Roads Planning District Commission (HRPDC)
Greg Johnson, PHR&A
Roy Mills, Virginia Department of Transportation (VDOT)
Doug Moseley, GKY & Associates, Inc.
David Powers, Michael Baker, Jr. Inc.
David Sample, Biological Systems Engineering and Occoquan Watershed Monitoring Laboratory, Virginia Tech
James Talian, City of Lynchburg

Department of Conservation and Recreation (DCR) Staff Present
Chuck Dietz
Lloyd Edwards
Ved P. Malhotra
John McCutcheon

Virginia Water Resources Research Center (VWRRC) Staff Present
Jane Walker

Others Present
Derek Berg, Contech
Tim Edwards, ADS
Tom Fitzpatrick, Hydro International
Steve Kindy, VDOT
Gene LaManna, Terre Hill Stormwater Systems
Shawn Luton, KriStar
John Olenik, VDOT
Glen Payton, Filterra
Terry Siviter, Filterra

Call to Order and Introductions

Lee Hill of DCR called the meeting to order and thanked everyone for coming. Each person introduced herself or himself. Jane Walker suggested that anyone who was not already on the list of individuals interested in the Virginia Stormwater BMP Clearinghouse should provide her with his or her contact information.

Comments on DRAFT Minutes from Meeting on September 10, 2009

Jane Walker reviewed the draft minutes from the September 10, 2009 meeting of the Clearinghouse Committee. She explained that the minutes would remain in draft form until they were reviewed and approved by DCR staff. Thus, the official minutes could differ slightly from those currently being reviewed. No changes to the minutes were proposed by the Clearinghouse Committee members. The official minutes will be posted on the Virginia Regulatory Town Hall Website: http://townhall.virginia.gov/.

Committee Terms Ending in 2009

With the postponement of the December 2009 Clearinghouse Committee meeting to January 25, 2010, the following members were completing their 2007-2009 terms on the Clearinghouse Committee:

-- Joe Battiata, Center for Watershed Protection
-- Dean Bork, Virginia Tech Department of Landscape Architecture
-- Mike Gerel, Chesapeake Bay Foundation
-- Roy Mills, Virginia Department of Transportation
-- Doug Moseley, GKY & Associates, Inc.
-- Randy Sewell, Vanasse Hangen Brustlin, Inc. (VHB)
-- Scott Thomas, James City County Environmental Division

Lee Hill thanked these members for their contributions to the development of the Clearinghouse and service on the Clearinghouse Committee.

Lee Hill requested that the names of those who might be interested in serving on the Clearinghouse Committee for the term 2010-2012 be submitted as soon as possible. DCR staff will review the submitted names and invite new members to fill the slots of those rotating off the committee.

Update to Stormwater Regulations and General Assembly Actions Related to Stormwater Management

Lee Hill provided an update concerning the proposed new stormwater regulations. He explained that on December 9, 2009, the Virginia Soil and Water Conservation Board adopted revisions to the Virginia Stormwater Management Program (VSMP) Permit Regulations Parts I, II, and III (4 VAC 50-60). The final regulations were published in the *Virginia Register of Regulations*, and a 30-day adoption period began on January 4, 2010. Because the Board received 25 petitions during the 30-day final adoption period requesting an additional public comment period, it suspended the effective date of these regulatory actions at its January 14, 2010 meeting. The suspension allows time for a 30-day public review and comment period on changes made since the original proposed regulations were approved on September 24, 2008. The Board is receiving comments only on the changes that were made between the proposed regulations and the final regulations adopted by the Board on December 9, 2009 (published on January 4, 2010 in Volume

26, Issue 9 of the *Virginia Register of Regulations*). Lee encouraged those present to submit written comments pertaining to the final regulations. Comments must be received between February 15, 2010 and March 17, 2010 (5:00 p.m.). Copies of the final regulations and the Town Hall final regulation discussion forms may be obtained on the Virginia Regulatory Town Hall Website (http://www.townhall.virginia.gov/L/ViewStage.cfm?stageid=5397).

Lee Hill added that several bills have been submitted for consideration by the General Assembly and encouraged the members of the Clearinghouse Committee to review the proposed bills on the Legislative Information System Website: http://leg1.state.va.us/. Most of the proposed bills delay the start date when the stormwater regulations will go into effect. One proposed bill (1) delays the effective date until EPA's approval of the Total Maximum Daily Load (TMDL) Implementation Plan for the Chesapeake Bay; and (2) requires the Soil and Water Conservation Board to adopt new regulations consistent with the source allocations made in the approved TMDL plan.

Mention of the Bay TMDL prompted one committee member to ask about the status of the TMDL. Under the Virginia TMDL Consent Decree, EPA is obligated to establish a TMDL for impairments caused by the nutrient and sediment pollutants in the Virginia sections of the Chesapeake Bay and tidal tributaries by no later than May 1, 2011. Lee Hill explained that EPA intends to propose a draft Chesapeake Bay TMDL for public review and comment in June 2010 and has set a goal of completing the Bay TMDL by December 31, 2010. During TMDL development, EPA will work with the Bay states and Washington D.C. to develop individual Watershed Implementation Plans and an overall TMDL implementation framework to help provide reasonable assurance that the necessary nutrient and sediment reductions from point and nonpoint sources identified in the TMDL will be achieved.

Lee Hill offered that the stormwater regulations adopted by the Soil and Water Conservation Board in December 2009 were changed from 0.28 pounds per acre, per year (lbs./acre/year) phosphorus, as proposed in earlier versions, to 0.45 lbs./acre/year phosphorus based on the results of a preliminary TMDL model. This TMDL model indicates the amount of phosphorus flowing from Virginia into the Chesapeake Bay is smaller than previously estimated. Lee explained that the developed TMDL implementation plans will identify specific nutrient and sediment reduction targets by geographic location and sector to achieve allowable loadings. Ved Malhotra added that EPA is prepared to initiate specific consequences to any Bay state that does not meet its targeted phosphorus load (See "December 29, 2009 letter to the states in the watershed and the District of Columbia PDF" on the Webpage: http://www.epa.gov/chesapeakebaytmdl/).

Other stormwater-related bills for consideration by the Virginia General Assembly concern the Nonpoint Nutrient Offset Program, a program to assist developers in achieving required nutrient reductions through the acquisition of nonpoint nutrient offsets in the same tributary. As currently established, the program states that localities may allow the offset program. Draft legislation has been circulated that would require localities to allow the offset program [Note: This legislation was not introduced.]. Another bill authorizes the State Water Control Board to provide loans from the Virginia Water Facilities Revolving Fund to projects that allow retrofits for stormwater management.

Lee Hill reminded the group that Part XIII of the Virginia Stormwater Management Program (VSMP) Permit Regulations (4VAC50-60) as described in the January 4, 2010 edition of the *Virginia Register of Regulations* (Volume 26, Issue 9) goes into effect February 3, 2010. Thus, new fees for the Municipal Separate Storm Sewer System (MS4) Program and new fees for the Construction General Permit will go into effect February 3, 2010.

Brief Comments on Virginia Technology Assessment Protocol (VTAP) Sections 1-5

Lee Hill opened the floor for brief comments concerning VTAP Sections 1-5. He stated that DCR is well aware of the concerns expressed during earlier meetings relating to the ability of manufacturers to meet the requirements currently proposed in the VTAP. He added that the purpose of today's meeting is not to review those views but instead to focus on brief comments.

Jane Walker stated that the VTAP document was updated following the September 10, 2009 Clearinghouse Committee meeting and distributed prior to this meeting (Appendix 1). She added that changes since the August 2009 version are highlighted in yellow.

Jane Walker also offered that the column entitled "Minimum Number of Field Test Sites" in Table 3 could be removed because the information is provided in Table 2. The committee members did not express a preference for including the information in Table 3 or removing it.

One member questioned allowing "total phosphorus or total suspended solids or suspended sediment concentration" (TP or TSS or SSC) as the test parameters for receiving the pilot use and conditional use designations (PUD and CUD) as expressed in Table 2. This question prompted some discussion, which concluded with leaving the table as it is currently: "TP or TSS or SSC."

Update on VTAP Section 6+

Committee member David Sample with Virginia Tech's Department of Biological Systems Engineering and its Occoquan Watershed Monitoring Laboratory presented a summary of the comments provided by a review panel working on a project for DCR that concerns the assessment of water quality performance of BMPs. The review panel consists of David Sample (panel leader) and Tom Grizzard of Virginia Tech, Allen Davis from the University of Maryland, Rob Roseen at the University of New Hampshire, and John Sansalone with the University of Florida. David stressed that the opinions expressed in the presentation were those of the panel members and not those of DCR. He further explained that a final report to DCR is in the process of being written.

Background Information:

David Sample began his presentation by describing the role of proprietary technologies in the protection of water quality. He then provided a brief explanation of the workings of different stormwater treatment processes. Since the stormwater management regulations in Virginia focus on phosphorus loads, David focused his presentation on phosphorus removal. He mentioned that some stormwater controls lead to runoff volume reduction and/or peak attenuation. He covered physical, chemical, and biological processes that can be used to remove phosphorus from

stormwater runoff, including sedimentation, coagulation, filtration, sorption (as well as the coupling of filtration and adsorption), and phytoremediation.

David Sample stressed the importance of maintenance for ensuring proper performance of BMPs. He mentioned research that estimates the reliability of a device. If researchers can better predict when a device is likely to fail and how it will likely fail, they can better predict how often and what kind of maintenance is needed.

Recommendations of the Panel:

David Sample summarized the comments of the review panel about the proposed protocols developed from the meetings of the Research Protocol Subcommittee. He cautioned that the protocols should avoid over prescribing steps, stating that unintended consequences could result, e.g., result in "designing to the test" instead of "testing the design." All comments from other manuals should be removed from the protocol document, and the information in the manuals should be incorporated by simply referring the readers to these documents.

David Sample offered that everyone associated with the assessment process needs to recognize the limitations of testing, e.g., the number of samples needed to show statistical significance may be cost prohibitive. In part, because fewer samples are needed for statistical analyses if continuous monitoring is used, the panel recommends the use of continuous monitoring. Assuming that continuous monitoring is used, panel members recommend that a minimum of 24 storms be required for testing. One Clearinghouse Committee member expressed that in his opinion 24 storms is "overkill." Testing that many storms would take lots of time and money. This committee member proposed that the protocol should set a maximum time limit so that we do not need to wait five years for results. Another member asked if Monte Carlo methods were used to see if the 24 storms is the correct number to use. David Sample replied that Allen Davis used his best professional judgment in combination with traditional statistics. Davis did not use Monte Carlo methods. David offered to include Davis' analyses in the appendix of the final report to DCR.

David Sample further stressed that continuous monitoring should be employed because BMP responses to storm events are not independent. The intensity and amount of the previous storm as well as the length of time from the previous storm to the current storm are examples of how storm events used in the assessment of BMP performance are not independent. Because the performance of the device changes over time, continuous monitoring is recommended. Additionally, testing should cover at least one maintenance cycle of the device.

David Sample stated that the review panel recommends that total phosphorus (TP) measurements be partitioned into the three forms of phosphorus: soluble reactive (SRP), soluble unreactive (SUP or organic), and particulate. Furthermore, because the kinetics of partitioning phosphorus among these species are rapid and depend upon water chemistry, the panel encourages keeping sample holding times to a minimum (within 8-12 hours).

The experience of the panel members indicates that the range of P concentrations in stormwater runoff is low (median 0.27 mg/L). Therefore, they recommend requiring that inflow P levels be greater than 0.05 mg/L and less than 1.00 mg/L for inclusion in the assessment analysis.

David Sample reported that the panel requests more instructions regarding field sampling. For example, the consensus of the panel is that two compositing methods would be acceptable:

- equal volume/variable time composites, which are amenable to field compositing; and
- variable volume/variable time composites, which are constructed after the fact.

The panel members do not find constant time composites to be acceptable.

David Sample suggested that if SSC is a required parameter for testing, the DCR and the Clearinghouse Committee will need to consider the impacts to the sampling requirements. David added that having TSS/SSC and particle size distribution (PSD) information is essential. The panel recommends against sieving at 250 microns, as currently suggested in both the protocol developed by the Research Protocol Subcommittee and the one developed by the vendors.

The hydraulics associated with sampling play an important role in the outcome of the results. David Sample explained that flow splitters can bias results and that uniform flow is almost always violated. He added that hydraulic control must be provided. David noted that the panel prefers the use flumes over weirs as the primary flow measurement device and stressed that flow monitoring devices must be calibrated to field conditions.

Other comments by the panel mentioned by David Sample include the following:

- While lab studies are useful for understanding the behavior of the system, they are not equal to field studies and should not be used in substitution of field studies.
- The sampling protocols should be updated; use the 2009 edition of "Urban Stormwater BMP Performance Monitoring" (October 2009) by the American Society of Civil Engineers (ASCE). (See "What's New" on the International Stormwater BMP Database Website: http://bmpdatabase.org/.)
- De-emphasize the Effluent Probability Method (because it assumes that storm events are independent) in favor of mass flux during and across all events.

Comments from the panel members concerning the technology evaluation report (TER) indicate the following:

- Allow at least 12 months for writing and submitting the TER, as opposed to the 6 months currently allowed.
- Provide more flexibility in the role of the technical advisor in writing the TER.
- Include costs associated with the device in the TER section that covers factors other than treatment performance; capital costs as well as operation and maintenance (O&M) costs are essential.

One panel member stressed that the goal of the TER is to document the behavior and mechanics of a device, i.e., understand the mass flux, and then evaluate overall performance.

The review panel also provided comments on the consensus protocol developed by several vendors. The reviewers noted that this version is more streamlined than the protocol developed by the Research Protocol Subcommittee. As mentioned previously, the panel supports the

vendor's recommendation to measure SRP, SUP, and particulate P. The review panel does not recommend using time weighted sampling or limiting the maximum number of samples to 35, as proposed in this version of the protocol. The panel also does not recommend sieving samples to include only particles less than 250 microns. The panel noted that if continuous monitoring is performed as the panel recommends, summation of loads (SOL) and event mean concentration (EMC) are interchangeable. The panel does not support the use of percent removal.

Proposed Testing Center

David Sample concluded his presentation by proposing the establishment of a testing center for proprietary and nonproprietary stormwater BMPs. He envisions that such a center could help balance the risk of the three parties: DCR, manufacturers, and university researchers. David proposed streamlining the process by taking the responsibility of the TER from the manufacturers and moving it to a consortium of universities. Each manufacturer would need to pay a fixed fee for having its product tested by university researchers, and the researchers would then report the results to the manufacturers, BMP Clearinghouse Committee, and DCR. Advantages envisioned for this system is that it would pool the risks, likely reduce costs, and eliminate duplication. Also, some requirements, as currently proposed in the protocol, may not need to be as explicit since university researchers would be performing the testing. Because startup funds will be necessary to initiate the testing center, David Sample requested that DCR begin discussions with Virginia Tech, UVA, and other universities, as it sees fit, to begin putting together the outline of a potential grant application for this purpose.

Discussion

Lee Hill offered that DCR and VWRRC would take the comments from the review panel and develop an updated version of the VTAP for review by the Clearinghouse Committee. Lee added that if Virginia establishes a testing center as described by David Sample, much of Sections 1-5 of the VTAP may also need to be re-written.

Lee is unsure about getting funding for startup from the state. David Sample mentioned that there are federal and private sources of funds to consider as well. Two Clearinghouse Committee members, Joanna Curran of UVA and David Powers of Michael Baker Jr., Inc., offered to help with initiation of a proposal.

One member questioned whether or not vendors would be willing to write a check for $150,000-$300,000 and then hand over their product to universities for testing instead of doing the testing in house. Another member suggested letting the economic market make the decision. Vendors would be OK with the approach if it is less expensive for the universities to do the testing.

Ved Malhotra of DCR questioned testing at only one site. He offered to send a paper by Allen Davis to the Clearinghouse Committee members that reported on testing biorention at two sites. The BMP worked well for removing phosphorus at one site and but did not work well at the other site. (Article: "Water Quality Improvement through Reductions of Pollutant Loads Using Bioretention" by Houng Li and Allen Davis in the *Journal of Environmental Engineering* (c) ASCE; August 2009; Volume 135, Issue 8; Pages 567-576 at: http://pubs.asce.org/journals/environmental/default.htm).

Another member added that when vendors test their products, they frequently realize that system modifications are needed after 2 or 3 storms. If universities test the product, they will not make modifications if the device is performing poorly after a couple storms. They will simply continue testing and report that the BMP does not perform well.

The first step in this process would be to set up the consortium. This would be a huge step. Would it be limited to just Virginia, states in the Chesapeake Bay Watershed, or a Mid-Atlantic Consortium?

How to Develop Registry of Manufactured Treatment Devices in Virginia

At the June meeting, it was suggested that a registry be added to the Clearinghouse for vendors to complete what their product is designed to do, how it is sized, and what parameters it targets. It was also suggested that vendors indicate where their devices are installed in Virginia. At the September meeting, the committee decided to move forward on the development of the registry.

One member offered that it would be helpful to have a map of Virginia that shows where the manufactured treatment devices are located using symbols and attach a fact sheet with a photo of the installed device.

Lee Hill offered that manufacturers wanting to be listed in the registry section of the Clearinghouse could provide the names of their products and links to their Websites. Some members cautioned that listing the manufacturers on the Clearinghouse could be seen as an endorsement. There was consensus that disclaimers would need to be prominently displayed on the Registry Web pages. Other members questioned the usefulness of a simple list of products with links to outside Websites. Another member added that Scott Crafton of DCR had already developed a fairly comprehensive list of stormwater treatment vendors. He recommended that the vendors, and not the Clearinghouse Committee, develop the information to be provided in the registry and further stated that submission to the registry could be used as a "letter of interest" in pursuing certification in Virginia. Thus, the Clearinghouse would host a registry of products intending to seek certification in Virginia.

Jane Walker offered to modify Appendix A of the VTAP as a template for the registry form and include a question about where the product is installed in Virginia. Jane Walker and Lee Hill agreed to work more on developing the form for use with the registry.

Next Meeting Dates:

The committee set the next four meetings dates for
-- April 19, 2010
-- July 19, 2010
-- October 18, 2010 and
-- January 24, 2011.

Adjourn:

Lee Hill requested that those whose terms on the Clearinghouse Committee are ending and are willing to continue serving for the 2010-2012 term should let him know their ability to continue serving on the committee. If any committee member knows of an individual who he or she

thinks would be a good addition to the committee, please send the name and contact information to Jane Walker (janewalk@vt.edu). Lee also stated that if anyone had comments on the VTAP Sections 1-5, they should send those comments to Jane Walker. Comments should not be sent concerning Sections 6+ of the VTAP because substantial changes are envisioned for this section. With no additional business, the meeting was adjourned.

Appendix 1

Handout

Guidance for Evaluating Stormwater Manufactured Treatment Devices
Virginia Technology Assessment Protocol
(VTAP)

October 2009 Version

Guidance for Evaluating Stormwater Manufactured Treatment Devices

Virginia Technology Assessment Protocol (VTAP)

Prepared by:

Virginia Department of Conservation and Recreation

Research Protocol Subcommittee of the
Virginia Stormwater BMP Clearinghouse Committee

You can print or download this document from DCR's Website at:
http://www.dcr.virginia.gov

or from the Virginia Stormwater BMP Clearinghouse at:
http://www.vwrrc.vt.edu/swc

For more information contact:
Department of Conservation and Recreation
203 Governor Street
Richmond, VA 23219-2094
(804) 786-1712

October 2009

Table of Contents (Page # to be included later)

Acronyms, Abbreviations, and Symbols Used in this Document

ASCE – American Society of Civil Engineers
BMP – best management practice
CD – compact disc
cfs – cubic feet per second
Clearinghouse Committee – Virginia Stormwater BMP Clearinghouse Committee
CUD – conditional use designation
D_{50} – mass median particle diameter (µm)
DCR – Virginia Department of Conservation and Recreation
e.g. – Latin *exempli gratia*, "for example"
EMC – event mean concentration
EPA – United States Environmental Protection Agency
ER – efficiency ratio
et al. – Latin *et alii*, "and others"
etc. – Latin *et cetera*, "and so forth"
gpm/ft^2 – gallons per minute per square foot
GUD – general use designation
GULD – general use level designation (from TAPE)
i.e. – Latin *id est*, "that is"
mg/L – milligrams (one thousandth of a gram) per liter
MTD – manufactured treatment device
µm – micron or micrometer (one millionth of a meter)
NJ – New Jersey
NOAA – National Oceanic and Atmospheric Administration
O&M – operation and maintenance
PLD – pilot level designation (from TAPE)
PP – particulate phosphorus
PSD – particle size distribution
PUD – pilot use designation
QAPP – quality assurance project plan
SOL – summation of loads
SP – soluble phosphorus
SRP – soluble reactive phosphorus
SSC – suspended sediment concentration
SUP – soluble unreactive phosphorus
SWM – stormwater management
TAPE – Technology Assessment Protocol -- Ecology
TARP – Technology Acceptance Reciprocity Partnership
TER – technology evaluation report
TMDL – Total Maximum Daily Load
TP – total phosphorus
TSS – total suspended solids
USEPA – United States Environmental Protection Agency
VSMP – Virginia Stormwater Management Program
VTAP – Virginia Technology Assessment Protocol
VWRRC – Virginia Water Resources Research Center
WQV – water quality volume

1 -- Introduction

The Virginia Department of Conservation and Recreation (DCR) evaluates and approves manufactured (proprietary) devices deemed to be reasonable methods of prevention, control, and/or treatment of stormwater runoff. Methods under consideration or approved by DCR are listed on the Virginia Stormwater Best Management Practices (BMP) Clearinghouse: http://www.vwrrc.vt.edu/swc. This document, the *Virginia Technology Assessment Protocol* (VTAP), describes the assessment process for listing manufactured treatment devices on the Clearinghouse.

Virginia DCR also publishes the *Virginia Stormwater Management Handbook* (DCR 1999). The handbook, currently being revised, provides information for stormwater management programs regarding basic hydrology and hydraulics, stormwater best management practice selection and pollution removal efficiencies, and administrative guidelines to support compliance with state stormwater regulations. A link to the handbook as well as additional information can be found on the Clearinghouse: http://www.vwrrc.vt.edu/swc.

1.1 – Authority

Virginia's stormwater management programs are implemented according to the Virginia Stormwater Management Law and Virginia Stormwater Management Regulations. The law is codified at Title 10.1, Chapter 6, Article 1.1 of the *Code of Virginia,* and the regulations are found at Section 4VAC50-60 of the *Virginia Administrative Code*. The Law provides authority for the Virginia Soil and Water Conservation Board to *". . . establish minimum design criteria for measures to control nonpoint source pollution and localized flooding . . . ."* (§10.1-603.4 2) and to *". . . [delegate to the Department (sic DCR) . . . any of the powers and duties vested in it by [the law] . . . ."* (§10.1-603.2:1.2). By extension, DCR thus maintains the authority to establish, approve and update standards and specifications of the best management practices (BMPs) that may be used within Virginia to control stormwater runoff.

Because treatment technologies are evolving rapidly, the DCR needs to be able to make changes to BMP standards and add new practices as new information becomes available. For this reason, DCR has partnered with the Virginia Water Resources Research Center (VWRRC) to establish the Virginia Stormwater BMP Clearinghouse Committee (Clearinghouse Committee). DCR staff and members of the Clearinghouse Committee have worked together to develop and design the Virginia Stormwater BMP Clearinghouse. The Clearinghouse (http://www.vwrrc.vt.edu/swc/) is where the approved list of BMPs – both public domain practices and manufactured treatment devices (MTDs) – and their associated standards and specifications are found. This guidance document shall be used to evaluate MTDs for certification in Virginia. These approved removal efficiencies will be the ones that state agencies and local stormwater management programs will recognize and approve when the devices are used in specific stormwater management plans.

This VTAP document was developed by the DCR and the Clearinghouse Committee in 2009 in anticipation of updated stormwater regulations in Virginia. The Clearinghouse is referenced within the VSMP Permit Regulations effective July 1, 2010.

1.2 -- Purpose of Virginia Technology Assessment Protocol (VTAP)

The purpose of VTAP is to:

1. Define the structure and procedures to follow for approving and listing manufactured treatment devices or treatment designs on the Virginia Stormwater BMP Clearinghouse for stormwater management.
2. Establish minimum monitoring guidelines and methods for evaluating and reporting on the appropriate uses of manufactured treatment devices or treatment designs for stormwater management.

DCR and the Clearinghouse Committee support the Technology Acceptance Reciprocity Partnership (TARP) and thus the *TARP Protocol for Stormwater Best Management Practice Demonstrations* (see the "TARP Protocol" section below). Use of the TARP Protocol, however, does not eliminate state review or approval of projects proposing to use TARP-certified stormwater management technologies, nor does it require Virginia to "rubber stamp" the approval or certification of another state. Those seeking reciprocal certification from Virginia of practices and methods previously certified by another state must still demonstrate consistency with the procedures articulated in this document.

The VTAP is an extension of the TARP Protocol and is specific to Virginia, which has established total phosphorus load limits. It provides a means to obtain a reasonable level of statistical confidence in the performance of a manufactured treatment device with respect to its operation and total phosphorus reductions. The VTAP defines a testing protocol and process for evaluating and reporting on the performance and appropriate uses of manufactured treatment devices that address post-construction stormwater runoff.

By obtaining accurate and relevant data, evaluators can assess performance claims and make informed decisions whether or not to approve manufactured treatment devices for use in Virginia. Information acquired during testing may also be useful for the development and implementation of Total Maximum Daily Loads (TMDLs). Local governments statewide can apply the use level designations listed on the Clearinghouse to evaluate the suitability of these devices for use in their communities.

TARP Protocol

For technology evaluations following the elements of the TARP 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 TARP 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 the TARP Protocol, and periodically review and revise the Protocol to maintain its viability.

The TARP 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 in order to satisfy an individual state's requirements.

1.3 -- Applicability

This testing protocol is intended for detention, flow-based (volume and peak rate) manufactured treatment devices (MTDs) and designs and may not be suitable for all stormwater treatment practices. The protocol is NOT for use in the evaluation of erosion and sediment control technologies or products. This protocol is also NOT intended for conducting research on conventional/traditional (i.e., public domain) BMPs.

The assessment protocol deals with MTDs that are designed for (1) reducing stormwater runoff volume, (2) reducing peak runoff rate, and/or (3) reducing total phosphorus (TP). Devices designed to remove pollutants other than phosphorus (e.g., nitrogen, oil/grease/hydrocarbons, metals, bacteria, etc.) will not be certified in Virginia at this time. However, links to information about MTDs approved in other states for the removal of pollutants other than phosphorus will be provided on the Clearinghouse.

This protocol is not intended for conducting research on experimental devices. Technologies with limited data will only be evaluated for the **Pilot Use Designation** (PUD). The DCR will not consider an application for a **Conditional Use Designation** (CUD) or a **General Use Designation** (GUD) unless the application includes sufficient performance data that clearly demonstrate acceptable feasibility and the likelihood that the device will achieve desired performance levels using the manufacturer's recommended sizing criteria, pretreatment requirements, and maintenance schedule.

1.4 -- Roles and Responsibilities

1.4.1 -- Virginia Department of Conservation and Recreation (DCR)

The Virginia Department of Conservation and Recreation is responsible for the Stormwater Management Programs in Virginia (see **Section 1.1 -- Authority**). For this reason, the DCR may obtain recommendations from outside evaluators and the Clearinghouse Committee, but is ultimately responsible for granting or denying use designations.

The Department of Conservation and Recreation:

- Assumes the duties of the contracted evaluators (see below) when necessary;
- Grants use level designations;
- Approves extensions and changes made to use level designations;
- Provides oversight and analysis of all submittals to ensure consistency with the DCR's stormwater management requirements; and
- Reviews new information and updates the VTAP as needed.

1.4.2 – DCR's Contracted Evaluators

The DCR may contract with a qualified and independent individual or entity to assist with the assessment process.

When contracted, DCR's evaluators:

- Review all applications for completeness;
- Review all quality assurance project plans (QAPPs);
- Provide recommendations to the DCR for approval or denial of QAPPs;
- Review technology evaluation reports (TERs) for completeness and conformance with Clearinghouse procedures and protocols; and
- Provide recommendations and assessments to the Clearinghouse Committee and DCR regarding pollution removal efficiencies to assign to devices and whether or not to certify/approve devices at requested use designation levels.

1.4.3 -- Clearinghouse Committee

Members of the Virginia Stormwater BMP Clearinghouse Committee will review TERs and provide recommendations to the DCR. The reviewers represent both academics and practitioners that have experience with stormwater BMPs but are not affiliated with the proponent of the technology or other stormwater BMP manufacturers/vendors.

The Clearinghouse Committee:

- Interacts with the DCR staff to assess how well the VTAP process satisfies the DCR's stormwater treatment BMP selection objectives;
- Meets quarterly to provide oversight review of use level designation applications and technology engineering reports; and
- Provides recommendations and assessments to the DCR regarding pollution removal efficiencies to assign to devices and whether or not to certify/approve devices at requested use designation levels.

1.4.4 -- Virginia Water Resources Research Center

The Virginia Water Resources Research Center facilitates the VTAP review process by coordinating with the DCR and the Clearinghouse Committee.

The Virginia Water Resources Research Center:

- Develops and maintains the Virginia Stormwater BMP Clearinghouse under the direction of the DCR and the Clearinghouse Committee; and
- May facilitate outside research and evaluations, when requested, by coordinating with stormwater BMP designers, regulators, researchers, and manufacturers regarding the scientific review of existing BMP test data or new monitoring and testing.

1.4.5 -- Proponent of Technology

The proponent of the technology (MTD) refers to the person/company that is promoting the project through the VTAP process. The proponent can be the manufacturer, the product vendor, consultant, etc.

The proponent:

- Submits the use level designation application;
- Submits QAPPs for all field monitored test sites;
- Informs the DCR of changes in the QAPP; production, manufacturer standing, key personnel, etc.;
- Submits interim status reports; and
- Submits the TER.

1.4.6 – Proponent's Technical Advisor

The proponent's technical advisor provides outside, objective oversight of performance testing. This qualified technical advisor is paid for by the proponent of the technology and is not provided by the DCR, the DCR's contracted evaluators, the Clearinghouse Committee, or the VWRRC.

The DCR *requires* the use of a technical advisor for all applications: **Pilot Use Designation** (PUD), **Conditional Use Designation** (CUD) and **General Use Designation** (GUD). Independent consultation must begin at the onset of the testing program.

At a minimum, the technical advisor:

- Reviews and approves the QAPPs for all field-monitored test sites;
- Provides oversight of QAPP implementation at field-test sites by periodically inspecting site conditions, sampling equipment, sample handling, etc.;

- Prepares a TER that includes a summary of test results and research conclusions and compares these with the proponent's performance claims;
- Provides information about the technology to DCR and the Clearinghouse Committee to be included on the Clearinghouse.

1.5 -- Protocol Limitations, Release of Liability, and Disclosure

This protocol has been published for the purpose of evaluating or generating performance claim data for manufactured treatment devices and treatment designs for certification in Virginia for stormwater management. Neither the DCR; its contracted partners, including the VWRRC; nor the Clearinghouse Committee accept responsibility or liability for performance of stormwater technologies being evaluated using the VTAP.

2 -- BMP Performance Goals

2.1 -- Stormwater Runoff Volume Reduction

Runoff volume reduction is defined as the total volume of rainfall and runoff reduced through canopy interception, soil infiltration, evaporation, rainfall harvesting, engineered infiltration, extended filtration or evapotranspiration at small sites. Stormwater management experts throughout the United States, participating in a panel of experts for the National Academies of Science during the past two years (2007-2008), have recently recommended that stormwater managers should change our strategies for reducing pollution. Instead of relying simply on the various treatment processes employed in stormwater BMPs, we should focus our compliance criteria on reducing the volume of runoff. In response, the Virginia DCR has incorporated the **Runoff Reduction Methodology** as part of the Virginia Stormwater Management Program (VSMP) Permit Regulations. The intent of Virginia's Runoff Reduction Methodology is to (1) reduce the total volume of runoff carrying pollutants, and (2) to maintain predevelopment hydrology.

Pollution treatment is defined as the change in pollution concentration in runoff due to the treatment processes the practice incorporates. The **total pollutant load** removed by a practice is the product of the runoff volume reduction and the reduction achieved by the practice's treatment process(es). Virginia's new approach to water quality protection will, in fact, provide for enhanced pollution reduction as runoff volume is reduced and, in the process, accomplish a significant amount of groundwater recharge using the same BMPs.

Manufactured treatment devices for which the proponents desire to receive certification for runoff volume reduction must demonstrate the percentage of the total runoff flowing into the device that is removed from the flow prior to runoff exiting the device. Proponents must also demonstrate whether that removed flow is (1) permanently removed from the surface discharge (e.g., through infiltration into a stone base or soil beneath the device), (2) shunted aside temporarily for slower discharge following the storm event, or (3) is subject to some other specified process. Limitations of the device must be disclosed. For example, if site constraints prevent the use of the device in the Tidewater or karst regions of Virginia, this limitation must be stated.

Underground storage devices that provide only void space for water storage do not need to undergo the assessment process. If a device is used to reduce water volume and/or improve water quality, it will need to undergo the assessment process.

2.2 -- Stormwater Runoff Peak Rate Control

Peak rate control is defined as the process of controlling or reducing the maximum discharge of stormwater runoff from a drainage area. Methods to achieve this goal generally assume that the stormwater runoff is channelized and/or concentrated into a conveyance system. In other words, the hydrologic model assumes a single point of discharge for the drainage area. Peak rate control is then achieved by providing an outlet structure designed to limit the flow, and a storage volume sized to detain the developed condition runoff volume.

Although the hydraulics of storing water and restricting the rate of release tend to be non-proprietary, the use of innovative materials, configurations, trash and debris control devices, or other components for achieving the goals of stormwater runoff peak rate control may be subject to testing for certification in Virginia. In order to evaluate such manufactured devices or designs, it is necessary for proponents to provide design information on the storage volume component -- such as underground vaults, chambers, or other vessels for storing runoff -- and the outlet control. Additional information must adequately cover long-term operation and maintenance, longevity of materials, and possible unforeseen negative consequences of installing such devices.

2.3 -- Stormwater Runoff Quality Control

The goal of the VTAP regarding runoff quality control is to determine how much a specific MTD can remove total phosphorus (TP). MTDs seeking certification for runoff quality control in Virginia will only be approved for TP removal at this time (see **Section 1.3 – Applicability**).

The removals cited below are desired targets. Each target lists the removal efficiency and describes the influent characteristics.

- Total Phosphorus (TP) Target:
  - 50% TP removal for influent with TP concentrations ranging from 0.15 mg/L to 0.5 mg/L and meeting the particle size distribution target described below.

- Total Suspended Solids (TSS) Target:
  - 80% removal of TSS for influent with TSS concentrations ranging from 100 mg/L to 200 mg/L and meeting the particle size distribution target described below;
  - > 80% removal of TSS for influent with concentrations greater than 200 mg/L and meeting the particle size distribution target described below; and
  - < 20 mg/L of effluent TSS for influent with concentrations less than 100 mg/L and meeting the particle size distribution target described below.

- Suspended Sediment Concentration (SSC) Target:
  - 80% removal of SSC for influent with SSC concentrations ranging from 100 mg/L to 200 mg/L and meeting the particle size distribution target described below;
  - > 80% removal of SSC for influent with concentrations greater than 200 mg/L and meeting the particle size distribution target described below; and
  - < 20 mg/L of effluent SSC for influent with concentrations less than 100 mg/L and meeting the particle size distribution target described below.

- Particle Size Distribution (PSD) Target:
  To test and approve BMPs, the particle size distributions of the influent and effluent need to be measured and reported for at least five runs in laboratory tests or five storms in field tests. For field test sites, at least one storm needs to have 10 or more consecutive dry days between storms, and at least one storm needs to have only 1-dry day between storms.

  The influent and effluent should have distributions of particle sizes in the ranges shown in Table 1. Because the particle size range of 10-60 μm has been associated with the majority of the total phosphorous in stormwater, it is important that the influent contain at least 50%

of its particles in this size range. Furthermore, the effluent should show a reduction such that no more than 10% of the particles are between 10-60 μm in size.

Table 1. The range of targeted percentages for given particle sizes from stormwater influent and effluent for laboratory tests and field test sites.		
Particle Size Range (μm)	Influent Percent by Mass (%)	Effluent Percent by Mass (%)
0-10	0-30	0-40
10-30	15-40	0-5
30-60	10-35	0-5
60-100	0-10	0-30
100+	0-10	0-100

The VTAP program is open to certifying devices with influent characteristics (e.g., concentration and PSD) and pollutant reduction efficiencies that differ from the cited target levels. Devices will be assigned pollutant removal efficiencies based upon the conditions under which the device was tested and the resulting verified data pursuant to the VTAP.

A future goal of the VTAP is to exhibit removal of other pollutants (e.g., sediment, nitrogen, oil/grease/hydrocarbons, metals, bacteria, etc.). Certifications for the removal of pollutants other than TP will not be granted in Virginia at this time. The Clearinghouse, however, will provide web links to information about MTDs approved in other states.

2.3.1 -- Total Phosphorus (TP) Treatment

The water quality regulatory criterion in VSMP Regulations (4VAC 50-60-63) is aimed at removal of Total Phosphorus (TP). These criteria may provide the basis for testing for Virginia certification.

2.3.2 -- Total Suspended Solids (TSS) and Suspended Sediment Concentration (SSC) Treatment

DCR has not established water quality regulatory criteria pertaining to the removal of total suspended solids (TSS) or suspended sediment concentration (SSC) from stormwater runoff. Although MTDs are not certified for TSS or SSC in Virginia, the Clearinghouse will provide web links to information about MTDs approved for TSS or SSC in other states. In addition, TP certification at the PUD or CUD level may be awarded in Virginia for devices that have been based on TSS or SSC data if the submitted data are considered valid.

3 -- BMP Certification Designations

Use designations are based on the quality and quantity of performance data and other information that the proponent supplies. There are three use designations for manufactured treatment devices in Virginia: **Pilot Use Designation** (PUD), **Conditional Use Designation** (CUD), and **General Use Designation** (GUD). The goal for the proponent is to obtain a GUD, whereby the technology may be marketed throughout Virginia, subject to conditions that the DCR may apply as a result of the testing and assessment of the practice. The device may not be installed in Virginia unless the DCR grants it the status of PUD, CUD, or GUD. Table 2 summarizes the testing requirements that must be met to receive each certification level. Table 3 provides information for testing the MTD at each certification level once awarded.

Table 2. Summary of the testing requirements for manufactured treatment devices to receive the pilot use designation (PUD), conditional use designation (CUD), and general use designation (GUD) in Virginia.

Certification Level	Testing Required to Receive Certification	Test Parameter Required to Receive TP Certification
PUD	Full-scale Lab or Field	TP or TSS or SSC
CUD	≥ 2 approved field sites	TP or TSS or SSC
GUD	≥ 5 approved field sites	TP

Table 3. The number of installations allowed in Virginia and the testing requirements for manufactured treatment devices certified in Virginia at the pilot use designation (PUD), conditional use designation (CUD), and general use designation (GUD).

Certification Level	Maximum Number of Installations Allowed in Virginia	Minimum Number of Field Test Sites	Assumed TP Performance Credit	Parameter to be Tested at Va. Sites
PUD	5	2 approved sites needed for CUD; 5 approved sites needed for GUD	Variable (≥ 20%)	TP
CUD	15 (total includes any PUD installations)	5 approved sites for GUD	Variable (≥ 20%)	TP
GUD	No Limit	None	Based on Field Test Results	None

The use of testing data collected in other states is allowed for assessment by the DCR. However, any field data to be included in the assessment process must be derived from testing

sites representative of the urban stormwater conditions expected in Virginia (Table 4). For the assessment of the MTD, the developed QAPP for each test site outside of Virginia is needed and thus must be submitted to DCR for review and approval as a test site for certification in Virginia. For example, any product verification in a rainfall distribution other than Type II, such as those approved in Washington's TAPE program must address the influence of the rainfall intensity, duration, peak flow, etc. Thus, a flow based system that is designed to treat the water quality flow rate would have to be sized for the Type II intensity – rather than the much lower Type IA of the Pacific Northwest.

Table 4. Urban stormwater test conditions for certification in Virginia.	
Condition Influencing Stormwater	Test Conditions
Precipitation	Type II Distribution (Distribution obtained at NOAA Atlas 14)
Temperature	26.0°F-86.1°F Long-term Monthly Average 44.6 °F-66.7°F Long-term Annual Average (From Virginia State Climatology Office: http://climate.virginia.edu/virginia_climate.htm)
Particle Size Distribution	Refer to PSD Target in Section 2.3 – Stormwater Runoff Quality Control

3.1 -- Pilot Use Designation (PUD)

The **Pilot Use Designation** (PUD) allows limited use of devices for the purpose of collecting field performance data according to the VTAP when the performance data do not meet the standards of applying for CUD or GUD. A PUD certification for phosphorus treatment may be granted for MTDs that were tested for TSS or SSC removal in the laboratory at full-scale size using Sil-Co-Sil 106. Because devices will be assigned pollutant removal efficiencies based upon the resulting verified data, there is no specified TP, TSS, or SSC removal level required by DCR for phosphorus treatment at the PUD certification level.

The DCR's evaluators (contracted and/or internal staff) and the Clearinghouse Committee will review all PUD applications and make recommendations to the DCR. The DCR will grant a PUD certification if it believes the practice has merit and should have field performance testing conducted.

Devices with PUD certification will be listed as such on the Clearinghouse. Before installing a PUD for testing in Virginia, the proponent must receive approval from the DCR for its product-specific QAPP and site-specific QAPP. The DCR may impose conditions for installations in Virginia. During the testing period, DCR will limit the number of installations of PUD devices in Virginia to a maximum of five. In addition, the proponent of the technology must notify DCR of all installation sites in Virginia. Testing is required at two approved field sites to move to the CUD level and 5 approved sites to move to the GUD level.

MTDs certified at the PUD level for stormwater runoff quality control will be granted an initial assumed TP performance credit ($\geq$ 20%) based on the evidence from prior testing. PUD certification applies for a specified testing period (typically two years), after which the practice may NOT be installed in Virginia until monitoring has been completed, and the test data are evaluated. Once the data have been evaluated, the proponent has three options: (1) submit a

technical evaluation report (TER); (2) request an extension from DCR for more time to conduct additional testing; or (3) cancel the certification request. The DCR will grant extensions on a case-by-case basis but will not allow additional installations during the extension period. No additional installations are allowed until the TER is approved by DCR and a CUD or GUD is granted. At the end of the test period, the test results from the approved field sites will be used to determine a TP removal credit.

The proponent of a poor performing PUD technology is not required to remove devices installed in Virginia but must implement its established remediation action plan at poor-performing sites in Virginia.

3.2 -- Conditional Use Designation (CUD)

The **Conditional Use Designation** (CUD) is for MTDs that have undergone rigorous testing. Proponents of MTDs with data from two or more approved field test sites may chose to submit a CUD application. Proponents seeking CUD certification for total phosphorus treatment should have field performance data showing TP, TSS, and/or SSC removal (After December 31, 2015, only TP data will be accepted for CUD certification). The CUD certification should be sought when data are insufficient to adequately evaluate performance claims under urban stormwater conditions in Virginia and/or the data were not collected in a manner consistent with the VTAP protocol.

The DCR's evaluators (contracted and/or internal staff) and the Clearinghouse Committee will review all CUD applications and make recommendations to the DCR. The DCR will grant a CUD certification if it believes the practice has merit and should have more field performance testing conducted. The DCR grants CUD certifications based on submission of sufficient performance data, the recommendations from its evaluators and the Clearinghouse Committee, and comments received from peer reviewers. Devices with CUD certification will be listed on the Clearinghouse. Proponents of technologies not granted a CUD must request to have their device immediately considered at the PUD level (PUD review fees waived) or resubmit the application at a later date at the CUD level (and pay all associated CUD review fees).

Technologies granted a CUD certification by the DCR are allowed to be installed in Virginia while more extensive field testing occurs. Proponents of CUD technologies must submit a product-specific QAPP and site-specific QAPP for each test site and cannot begin performance testing at sites in Virginia until both QAPPs are approved. The DCR may impose conditions for installations in Virginia.

DCR will limit the number of installations of CUD devices in Virginia to a maximum of 15, with MTDs installed in Virginia under the PUD certification counting towards this maximum. Testing is not required at all installations, but the proponent of the technology must notify DCR of all installation sites in Virginia. Testing is required at five distinct field sites for certification at the GUD level.

MTDs certified at the CUD level for stormwater runoff quality control will be granted an initial assumed TP performance credit ($\geq$ 20%) based on the evidence from prior testing. CUD certification applies for a specified testing period (typically two years), after which the practice may not be installed in Virginia until monitoring has been completed, and the test data are evaluated. Once the data have been evaluated, the proponent has three options: (1) submit a

technical evaluation report (TER); (2) request an extension from DCR for more time to conduct additional testing; or (3) cancel the certification request. The DCR will grant extensions on a case-by-case basis and reserves the right to allow or disallow for the continuation of marketing during the extension period. At the completion of the test period, the test results from the approved field sites will be used to determine a TP removal credit.

Until December 31, 2015, applications that show a reliable 80% removal or greater of TSS or SSC using field data (meeting the PSD target described above) or laboratory data (Benchmark Particle Size Distribution Sil-Co-Sil 106) will be granted a reciprocal TP credit of 25% removal at the CUD level until field testing is performed for TP removal and device-specific results are obtained. TP removal for the **General Use Designation** will be based on the results of performance field testing of TP, not TSS or SSC data.

The proponent of a poor performing CUD technology is not required to remove devices installed in Virginia but must implement its established remediation action plan at poor-performing sites in Virginia.

3.3 -- General Use Designation (GUD)

The **General Use Designation** (GUD) confers a general acceptance for the treatment device based on validated field performance claims. At a minimum, a product should have a substantial data set that verifies

- sizing for the land use type that was monitored -- specific treatment flow rate (gpm/ft^2 of filter media if a filtering device, or surface area of treatment chamber if a settling device) or volume capture;
- treatment performance (qualified by testing minimum and maximum influent loads, etc.);
- maintenance requirements and frequency of maintenance; and
- longevity for typical urban conditions in Virginia.

To obtain a GUD certification for stormwater runoff quality control, field testing for TP removal is required. The testing and evaluation must conform to the requirements in the VTAP and represent application conditions expected in Virginia.

Devices seeking a GUD certification must have been field tested in at least five field sites that are representative of urban stormwater conditions in Virginia. The easiest way to ensure that the testing occurs under the required conditions is to pick field test sites located in Virginia. When including test sites outside of Virginia, the proponent must show that the site will represent conditions commonly expected in Virginia (Table 4). Typical weather must be characterized by similar rainfall patterns, such as Type II rainfall. Providing storm intensity information and particle size distribution data from the proposed site will help assess how well the site represents conditions in Virginia. For the assessment of the MTD, the developed QAPP for each test site outside of Virginia is needed and thus must be submitted to DCR for review and approval as a test site for certification in Virginia.

To apply for the GUD certification, the proponent of the technology submits a GUD application, complete with QAPPs for the field test sites and TER, to the DCR. The DCR's evaluators (contracted and/or internal staff) and the Clearinghouse Committee will recommend to the DCR that a GUD certification be granted if they find the performance claims to be validated. The DCR grants GUD certifications for technologies based on submission of sufficient performance data,

the recommendations from its evaluators and the Clearinghouse Committee, and comments received from peer reviewers. Proponents of technologies not granted a GUD must specify to have their device immediately considered either at the PUD or CUD level (PUD or CUD review fees waived, respectively) or resubmit the application at a later date at the GUD level (and pay all associated GUD review fees).

Devices with GUD certification will be listed as such on the Clearinghouse. Technologies with a GUD certification from the DCR may be used anywhere in Virginia, subject to conditions the DCR may apply as a result of the testing and evaluation of the practice. Technologies that receive a GUD certification have no expiration date. If at a later date, it is discovered that a GUD certified technology is not performing at the level of the approved performance claim, the practice will be removed from the Clearinghouse until revisited so that either the design criteria are improved to achieve the listed performance or the performance claim is corrected.

4 -- Assessment Process

The Virginia Stormwater BMP Clearinghouse will maintain a vendor list on the Clearinghouse to assist local jurisdictions in identifying stormwater technologies and products. Technologies undergoing testing to meet GUD criteria may be listed on the Clearinghouse with either a pilot use designation (PUD) or a conditional use designation (CUD). Special restrictions apply to technologies with a PUD or CUD (refer to **Section 3 -- BMP Certification Designations).**

4.1 -- Overview of Virginia Technology Assessment Protocol

The assessment process in Virginia, illustrated in Figure 1, begins when the proponent submits a PUD, CUD, or GUD application package to DCR (application fee applies, see Table 5). Submitted applications are reviewed for completeness, and if complete, the DCR's evaluators (contracted or internal staff) will assess the application package and propose a use designation. If recommended by the DCR's evaluators, the technical evaluation report (TER), submitted as part of the application package, will be included on the Clearinghouse for peer review and comment. The DCR's evaluators will respond to the public comments and present their recommendations to the Clearinghouse Committee. The Clearinghouse Committee will review the application package, recommendations made by DCR's evaluators, and the public comments. The Clearinghouse Committee will develop a use designation recommendation and submit it to the proponent and to the DCR. The DCR will review all recommendations and determine an appropriate use designation. Certified technologies will be included on the Clearinghouse.

Table 5. Application and review fees for manufactured treatment devices seeking certification in Virginia.

Type of Review	Fee
Application Review	
PUD	$
CUD	$
GUD	$
Product-specific QAPP Review	$
Site-specific QAPP Review	$
TER Review	$
Re-review fee	Re-review fees are a percentage of the initial review fee.

Technologies that do not meet the GUD criteria may be listed on the Clearinghouse as either a PUD or a CUD. Once a PUD or CUD has been awarded, the proponent must provide quarterly status reports to the DCR. Proponents of technologies with certifications at the PUD or CUD level must contract with a technical advisor (an objective outside party) to develop and submit a product-specific QAPP to the DCR. Furthermore, for each field-testing site, a site-specific QAPP will need to be developed and approved by the DCR. Even if the testing site is located outside the state of Virginia, QAPPs are required for Virginia certification. Both product-specific and site-specific QAPPs will be reviewed by DCR's evaluators (QAPP review fees apply, see Table 5); the members of the Clearinghouse Committee will have the opportunity to review and comment

on the QAPPs. DCR will review all recommendations and approve or disapprove the QAPPs. Proponents may not begin performance testing at sites in Virginia until the DCR has approved both the product-specific QAPP and the site-specific QAPP. If the either QAPP is disapproved by DCR, the proponent must modify and resubmit the plan (re-review fees apply). Once the QAPPs are approved by DCR, field performance testing in Virginia may begin.

At the end of the testing period, the proponent of a MTD with either a PUD or a CUD submits a TER to DCR. The TER is reviewed in the same manner as the initial application package (described in the first paragraph of this section) (TER review fees apply). Approved technologies will be listed on the Clearinghouse. If the TER of the field-tested technology is disapproved for the CUD or GUD, the proponent will be notified of the DCR's decision and reason for it. The proponent may respond to DCR's disapproval by requesting to conduct additional testing and/or requesting to resubmit the TER (re-review fees apply). DCR may grant this permission at its discretion.

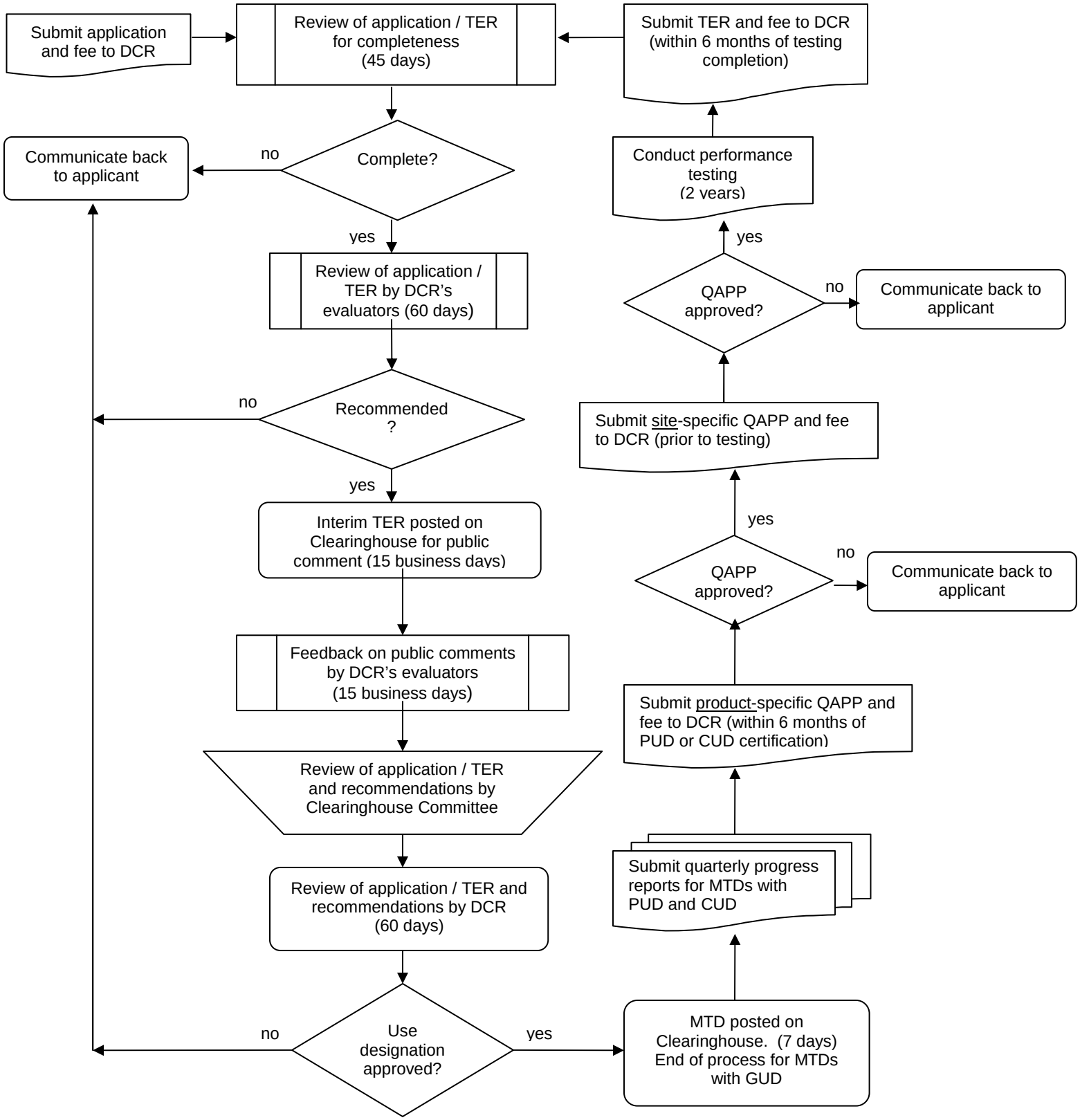

Figure 1. Flow chart illustrating the certification process in Virginia for stormwater manufactured treatment devices (MTDs).

4.2 -- Requesting/Revising Use Level Designations

The first step for a proponent wishing to market a manufactured treatment device in Virginia will be to amass the product information and data to determine the use designation level for which to apply. The proponent will need to ask a fundamental question:

Does the technology have field data that represent urban stormwater pollutant load and rainfall characteristics in Virginia, and do these data meet the VTAP requirements?

To determine the answer to this question, the proponent of the technology must be familiar with the VTAP as described in this document.

The following may be helpful guidance in selecting the most appropriate use designation level for which to apply:

- Proponents of MTDs with full-scale laboratory performance data and no, or limited, field testing data should submit a PUD application. TP, TSS, and/or SSC data can be used to receive TP certification at the PUD level. If TSS or SSC data from laboratory testing is reported, Sil-Co-Sil 106 should have been used.
- Proponents of MTDs with at least two field sites that represent urban stormwater conditions in Virginia should submit a CUD application. MTDs seeking CUD status for total phosphorus treatment should either have performance data showing TP removal and/or performance data showing TSS/SSC removal.
- Proponents of MTDs with field performance data that were
  (a) collected from at least five sites representing urban stormwater conditions in Virginia, and
  (b) conform to the VTAP
  should submit a GUD application. TP data are required to receive TP certification at the GUD level.

Proponents seeking a technology use level designation by the DCR will need to submit an application fee (Table 5). Proponents should mail their submission to the following address:

Virginia Department of Conservation and Recreation
Stormwater Management BMP Clearinghouse
203 Governor Street, Suite 206
Richmond, VA 23219-2094
E-mail: BMPClearinghouse@dcr.virginia.edu

The application will be initially reviewed for completeness. Submit two paper copies and an electronic version (E-mail attachment or CD) to the address above. Submit two paper copies and an electronic copy of quality assurance project plans, interim status reports, requests for extensions, and other correspondences to this address as well. Additional hard copies of submittals may by requested by DCR.

For assistance, please contact:

Ved P. Malhotra, P.E.
Stormwater Compliance Engineer
Virginia Department of Conservation and Recreation
Email address: Ved.Malhotra@dcr.virginia.gov
Phone: (804) 786-1863
Fax: (804) 786-1796

4.3 -- Assessment Timeline

The timelines below include required deadlines in bold-type font. Failure to meet these deadlines may result in a suspension or cancellation of a designation. The remaining items provide guidelines for the amount of time expected for a given step in the process. The evaluators will review submittals as quickly as possible and will communicate with the proponent of the MTD if delays or problems arise.

4.3.1 -- PUD Assessment Timeline

1. PUD application package, including the TER, is reviewed for completeness – Within 45 calendar days
2. If application is complete, PUD application is reviewed by DCR's evaluators (contracted and/or internal staff) – Within 60 calendar days
3. If recommended by DCR's evaluators, interim TER is listed on the Clearinghouse for peer review – 15 business days
4. DCR's evaluators review peer comments – 15 business days
5. Clearinghouse Committee reviews application and recommendations -- The Clearinghouse Committee meets quarterly and will review applications in the order they were received. Depending on the number of applications and TERs to be reviewed, the submitted application will be assessed at the earliest possible Clearinghouse Committee meeting.
6. DCR reviews application and recommendations – Within 60 calendar days
7. Proponents of technologies not granted a PUD may resubmit an updated application at a later date (and pay all associated PUD review fees). If approved by DCR, a MTD granted a PUD is listed on the Clearinghouse – Within 7 calendar days
8. Reporting time begins once granted the PUD. **Submit quarterly progress reports to DCR on April 15th, July 15th, October 15th, and January 15th for the preceding three-month period.** Continue submitting progress reports until TER is submitted.
9. **Submit product-specific QAPP that meets the VTAP's requirements within six months of receiving the PUD.**
10. Product-specific QAPP is reviewed by DCR's evaluators – Within 60 calendar days
11. If product-specific QAPP is approved, submit site-specific QAPP amendments prior to BMP installation in Virginia.
12. Site-specific QAPP is reviewed by DCR's evaluators – Within 30 calendar days
13. If site-specific QAPP is approved, monitor field installation – two years.
14. **Submit TER that meets the VTAP's requirements within six months of completing testing. PUD certification expires 30 months from the time when testing begins.** This timeframe allows for 24 months of monitoring and 6 months for writing the TER.
15. The TER is reviewed for completeness – Within 45 calendar days
16. If TER is complete, DCR's evaluators review the TER – Within 60 calendar days
17. If recommended by DCR's evaluators, interim TER is included on the Clearinghouse for peer review – 15 business days
18. DCR's evaluators review peer comments – 15 business days
19. Clearinghouse Committee reviews TER and recommendations -- The Clearinghouse Committee meets quarterly and will review applications in the order they were received. Depending on the number of applications and TERs to be reviewed, the submitted TER will be assessed at the earliest possible Clearinghouse Committee meeting.
20. DCR reviews TER and recommendations – Within 60 calendar days
21. The DCR issues a CUD or a GUD, revokes the PUD, or allows for an extension.

Failure to submit the product-specific QAPP within 6 months of receiving a PUD results in a cancellation of the PUD and removal from the Clearinghouse. The proponent must reapply for the PUD. Proponents with a PUD have a maximum of 12 months to begin implementation of the product-specific QAPP or communicate why. Failure to submit progress reports, failure to demonstrate satisfactory progress during the testing period, or failure to submit a TER within 6 months of completion of testing risks suspension or cancellation of the PUD and possible removal from the Clearinghouse. A suspension limits the additional installations to one in Virginia during the suspension period. The DCR will remove the suspension when the proponent demonstrates satisfactory progress in completing the required component. A cancellation requires the proponent to resubmit an application for the desired use level designation.

If proponents of PUD technologies require extensions on use level designation components (QAPPs, TER), they must submit a request to the DCR at least 2 weeks before the due date. The DCR will grant extensions only if the proponent shows that progress is being made.

4.3.2 -- CUD Assessment Timeline

1. CUD application package, including the TER, is reviewed for completeness – Within 45 calendar days
2. If application is complete, CUD application is reviewed by DCR's evaluators (contracted and/or internal staff) – Within 60 calendar days
3. If recommended by DCR's evaluators, interim TER is listed on the Clearinghouse for peer review – 15 business days
4. DCR's evaluators review peer comments – 15 business days
5. Clearinghouse Committee reviews application and recommendations -- The Clearinghouse Committee meets quarterly and will review applications in the order they were received. Depending on the number of applications and TERs to be reviewed, the submitted application will be assessed at the earliest possible Clearinghouse Committee meeting.
6. DCR reviews application and recommendations – Within 60 calendar days
7. Proponents of technologies not granted a CUD must request to have their device immediately considered at the PUD level (PUD review fees waived) or resubmit an updated application at a later date at the CUD level (and pay all associated CUD review fees). If approved by DCR, a MTD granted a CUD is listed on the Clearinghouse – Within 7 calendar days
8. Reporting time begins once granted the CUD. **Submit quarterly progress reports to DCR on April 15th, July 15th, October 15th, and January 15th for the preceding three-month period.** Continue submitting progress reports until TER is submitted.
9. **Submit product-specific QAPP that meets the VTAP's requirements within six months of receiving the CUD.**
10. Product-specific QAPP is reviewed by DCR's evaluators – Within 60 calendar days
11. If product-specific QAPP is approved, submit site-specific QAPP amendments prior to BMP installation in Virginia.
12. Site-specific QAPP is reviewed by DCR's evaluators – Within 30 calendar days
13. If site-specific QAPP is approved, monitor field installation – two years.
14. **Submit TER that meets the VTAP's requirements within six months of completing testing. CUD certification expires 30 months from the time when testing begins.** This timeframe allows for 24 months of monitoring and 6 months for writing the TER.

15. The TER is reviewed for completeness – Within 45 calendar days
16. If TER is complete, DCR's evaluators review the TER – Within 60 calendar days
17. If recommended by DCR's evaluators, interim TER is included on the Clearinghouse for peer review – 15 business days
18. DCR's evaluators review peer comments – 15 business days
19. Clearinghouse Committee reviews TER and recommendations -- The Clearinghouse Committee meets quarterly and will review applications in the order they were received. Depending on the number of applications and TERs to be reviewed, the submitted TER will be assessed at the earliest possible Clearinghouse Committee meeting.
20. DCR reviews TER and recommendations – Within 60 calendar days
21. The DCR issues a GUD, revokes the CUD, or allows for an extension.

Failure to submit the product-specific QAPP within 6 months of receiving a CUD results in a cancellation of the CUD and removal from the Clearinghouse. The proponent must reapply for the CUD. Proponents with a CUD have a maximum of 12 months to begin implementation of the product-specific QAPP or communicate why. Failure to submit progress reports, failure to demonstrate satisfactory progress during the testing period, or failure to submit a TER within 6 months of completion of testing risks suspension or cancellation of the CUD on the Clearinghouse. A suspension limits the additional installations to one in Virginia during the suspension period. The DCR will remove the suspension when the proponent demonstrates satisfactory progress in completing the required component. A cancellation requires the proponent to resubmit an application for the desired use level designation.

If proponents of CUD technologies require extensions on use level designation components (QAPPs, TER), they must submit a request to the DCR at least 2 weeks before the due date. The DCR will grant extensions only if the proponent shows that progress is being made. The DCR reserves the right to allow or disallow for the continuation of marketing during the extension period.

4.3.3 -- GUD Assessment Timeline

1. GUD application package, including the TER, is reviewed for completeness -- Within 45 calendar days
2. If application is complete, GUD application is reviewed by DCR's evaluators (contracted and/or internal staff) – Within 60 calendar days
3. If recommended by DCR's evaluators, interim TER is listed on the Clearinghouse for peer review – 15 business days
4. DCR's evaluators review peer comments – 15 business days
5. Clearinghouse Committee reviews application and recommendations -- The Clearinghouse Committee meets quarterly and will review applications in the order they were received. Depending on the number of applications and TERs to be reviewed, the submitted application will be assessed at the earliest possible Clearinghouse Committee meeting.
6. DCR evaluates application package and all recommendations and issues a GUD or CUD or denies the GUD. – Within 60 calendar days
7. Proponents of technologies not granted a GUD must request to have their device immediately considered at the PUD or CUD level (PUD or CUD review fees waived, respectively) or resubmit an updated application at a later date at the GUD level (and pay all associated GUD review fees). If approved by DCR, a MTD granted a GUD is listed on the Clearinghouse – Within 7 calendar days

4.4 -- Approving Quality Assurance Project Plan (QAPP)

A product-specific quality assurance project plan (QAPP) *must be submitted to DCR within six months of* obtaining a PUD or CUD and *before* initiating performance testing (review fees apply). In addition, a site-specific QAPP is needed for each field testing site (review fees apply). Development of the QAPPs should be a collaborative effort between the proponent of the device and the proponent's technical advisor. **Section 6 -- QAPP** outlines the requirements of the QAPP.

The DCR will identify evaluators to review and provide recommendations concerning approval of QAPPs, and the members of the Clearinghouse Committee will have the opportunity to review and comment on the QAPPs. DCR will make the final decision concerning QAPP approval. The proponent should not begin performance testing until both the product-specific and site-specific QAPPs are approved. Even if testing sites are located outside the state of Virginia, QAPPs are required for Virginia certification. If either the product-specific or site-specific QAPP is disapproved by DCR, the proponent must modify and resubmit the plan (re-review fees apply). Once the QAPPs are approved by DCR, field performance testing in Virginia may begin.

When a substantive change to the QAPP is warranted, the author of the plan must revise it to document the change and submit the revised plan to the DCR for approval.

4.5 -- Requirements of Performance Testing

A QAPP must be approved by the DCR before initiating any performance testing. Performance testing must follow the procedures outlined in the approved QAPP. Performance testing should be designed to meet all requirements of the VTAP, with the goal of obtaining the **General Use Designation**. Data used in the assessment must be derived from field test sites of typical urban stormwater conditions in Virginia.

4.6 -- Granting a Use Level Designation

The DCR grants a use level designation based on the information submitted and best professional judgment. Submitting the appropriate amount of data does not guarantee that the DCR will grant a use level designation. The DCR bases decisions on the system performance and factors that influence the performance (e.g., sizing, maintenance).

Certain restrictions apply to technologies granted a PUD or CUD (refer to **Section 3.1 – Pilot Use Designation** and **Section 3.2 – Conditional Use Designation**). The DCR may place restrictions on the use of the technologies granted a GUD.

Proponents of technologies not granted a CUD must request to have their device immediately considered at the PUD level (PUD review fees waived) or resubmit the application at a later date at the CUD level (and pay all associated CUD review fees). Likewise, proponents of technologies not granted a GUD must specify to have their device immediately considered

either at the PUD or CUD level (PUD or CUD review fees waived, respectively) or resubmit the application at a later date at the GUD level (and pay all associated GUD review fees).

For approved technologies, the manufacturer shall provide design standards and specifications and operation/maintenance specifications for the technology that are consistent with the accepted research findings. This information and other qualifying information shall be provided to DCR by the proponent's technical advisor for listing on the Clearinghouse.

5 -- Use Level Designation Application

For efficient review of the application for a pilot use designation (PUD), conditional use designation (CUD), or general use designation (GUD), complete all required components before submitting the application to DCR. In addition to providing the information requested in this document, DCR, the Clearinghouse Committee, and/or other evaluators contracted by DCR may request additional information on a case-by-case basis.

At a minimum, an application *must* include:

- Use Designation Application Form
- Performance Claim
- Theory/Technology Description
- Remediation Action Plan
- Technical Evaluation Report
- Certification Statement

5.1 -- Use Designation Application Form

Complete the use designation application form in Appendix A.

- Develop a title for the technology assessment project and use this title in all submittals associated with the project (e.g., QAPP, Status Reports, Technical Evaluation Report).
- Be sure to check the desired designation level for which the technology is to be evaluated: Pilot Use Designation, Conditional Use Designation, or General Use Designation (See **Section 3 -- BMP Certification Designations**).
- If either the Pilot Use Designation or the Conditional Use Designation has been certified previously by Virginia DCR or certification has been granted in another state, the applicant shall indicate that this designation has been achieved, and include the date of certification and the certification number.

5.2 -- Performance Claim

The performance claim will be used to evaluate the use designation. Performance claims should be objective, quantifiable, replicable, and defensible. Wherever possible, include information about anticipated performance in relation to climate, design storm and/or site conditions. Claims that are overstated should be avoided, as they may not be achievable.

Because the Virginia stormwater management (SWM) regulations focus water quality compliance criteria on reduction of total phosphorus (TP), water quality certification in Virginia is awarded only for TP removal at this time (refer to **Section 2.2 – Stormwater Runoff Quality Control**). Thus proponents of MTDs seeking certification for runoff quality control in Virginia must include total phosphorus reduction claims.

The performance claim should include the following descriptions:

- List of pollutant constituents that will be used to evaluate performance.
- Reduction of pollutants from stormwater runoff and what those reductions are based upon (i.e., reduction of the event mean concentration (EMC) through the device's

treatment processes, reduction of runoff volume, a combination of both, etc.). See Appendix B.

- The conditions under which those reductions were achieved; e.g., the specific influent and effluent concentrations of pollutants in tests (mean/median/range), the particle size distribution of sediments in tests (entire distribution, specify D_{50}), the flow volumes treated versus volumes that by-passed the device, etc.
- Application limitations of technology if known to exist.
- The basis for sizing of the technology (e.g., hydraulic loading at a specific head, concentration of influent, etc.).

An example of a stormwater treatment BMP performance claim could be:

The Model X system can be used in the treatment of stormwater runoff from commercial sites. It can capture and treat the first half-inch of a 24-hour storm from a 10-acre contributing drainage area. During testing, flow rates of 100 gpm to 400 gpm were observed, with no flow being bypassed. Inflow TP concentrations ranged between 0.15 mg/L and 0.50 mg/L (mean: 0.38 mg/L, median: 0.34 mg/L). Table 1 illustrates the range of particle size distributions for the test sites. Under these conditions, an event mean concentration removal rate for total phosphorus (TP) of 60%+ 5% (at a 95% confidence level) can be achieved.

Table 1. The mean percentages for given particle sizes from stormwater influent and effluent for test site.

Particle Size Range (μm)	Influent Percent by Mass (%)	Effluent Percent by Mass (%)
0-10	0-30	10-28
10-30	21-37	2-5
30-60	14-29	0-5
60-100	0-10	10-30
100+	0-8	38-58

5.3 -- Theory/Technology Description

Begin this section by listing the title of the practice and include a photograph of the BMP. Then provide a detailed description of the MTD. The description should ensure that the reader can understand completely how the technology works.

This section is to be organized in such a way that the information can be lifted from the application and included on the Clearinghouse. Thus, the application should contain as many of the elements from the list below as applicable. At a minimum, all topic headings should be addressed. The standard and specifications information for non-proprietary, post-construction BMPs listed on the Clearinghouse can be used as examples for the types of information to provide and the format to use in presenting the information (www.vwrrc.vt.edu/swc).

5.3.1 -- Description of Practice

Provide a detailed description of how the device works and include the purpose of the BMP:

- Summarize the underlying scientific and engineering principles for the technology. Describe the physical, chemical, or biological treatment processes.

- Describe significant modifications and technical advancements in the technology design.
- Include details on the relevant treatment mechanisms such as those in Table 6:

Table 6. Measurements to describe for various BMP mechanisms.	
Mechanism	**Measurement**
Exchange Capacity / Sorption Capacity (dissolved pollutants)	Each medium's anion or cation exchange capacity and target pollutant's overall removal capacity indicated by isotherms (mass/mass) and breakthrough (pollutant load per volume) analyses (capturing typical range of stormwater pollutant concentrations and hydraulic loading rates).
Hydrocarbon Sorption	Capacity -- Pollutant mass absorbed or adsorbed per mass (mass/mass). Absorbent type -- Each medium's percent organic matter or organic carbon.
Gravity Separation	Detention time, length to width ratio, hydraulic loading rate for design flow, removal efficiency versus flow rate, particle size distribution, and specific gravity for each system type or size.
Filtration	Filter media grain size distribution, clean media hydraulic conductivity, hydraulic conductivity versus sediment loading (provide sediment grain size distribution and dry density used in analysis), provide typical and maximum operational hydraulic gradient.
Biological	Describe target pollutant's specific degradation mechanisms and estimated half-life versus temperature, provide estimated stormwater contact time (or detention time) for design flow, and provide target pollutant's estimated treatment efficiency versus flow rate.

5.3.2 -- Performance Criteria

List the expected treatment performance capabilities. Describe the advantages of the technology compared to conventional stormwater systems providing comparable stormwater control.

5.3.3 -- Site Installation Requirements and Impacts

Address any and all site installation requirements and likely impacts resulting from the installation of the technology. As a guide, be sure to consider at least the following:

- Siting location -- Contributing drainage area, upstream controls (non-structural and structural), available space needed, soil characteristics, hydraulic grade requirements, hydraulic capacity, depth to water table.
- Land use – Report any utility requirements. List restrictions to installations within proximity of underground utilities, overhead wires, and hotspot land uses. Provide needed setbacks from buildings and vehicle loading allowances.
- Limitations – Consider the physical constraints to installing the BMP within karst terrain, steep terrain, flat terrain, cold climates, sites with shallow groundwater tables, linear highway sites, etc. Also include limitations associated with the BMP's weight and buoyancy, transportability, durability, energy requirements, consumable materials, etc.
- Environmental impacts – Describe likely impacts resulting from the construction,

operation, and maintenance of the technology. Address community and environmental concerns, including safety risks and liability issues, local codes, winter operation, mosquitoes, aesthetics, etc.

5.3.4 – Design and Sizing

Divide this section into specific subsections that adequately describe design and sizing. The use of tables can be helpful to convey information.

Show standard drawings, including a schematic of the technology and a process flow diagram. Photographs may also be useful. Describe any alternative technology configurations.

Describe the following information --

- Siting and design specifications to achieve stated performance, include:
  - Pollutants that should and could be addressed;
  - Pollutants that will not be addressed;
  - Pollutants that may be increased;
  - Range of operating conditions for the technology, including minimal, maximal, and optimal influent conditions to achieve the performance goals and standards, and for reliability of the technology;
  - Description of bypass process; and
  - Description of pretreatment and preconditioning of stormwater, if appropriate to achieve stated performance of the BMP.
- Physical description of each treatment system component:
  - Engineering plans/diagrams showing each of the functional components;
  - Equipment dimensions; and
  - Description of each component's capacity.

Provide a detailed description of the overall sizing methodology. Include 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). When applicable, include the structural design, hydraulic design, soil infiltration rate testing, etc.

5.3.5 -- Material Specifications

When applicable, include a table that lists each construction material. For non-proprietary and patented materials, include specifications. Include raw material specifications for all non-proprietary treatment media.

5.3.6 -- Construction Sequence and Inspection

List the steps to construction in chronological order. Begin with protection during site construction.

5.3.7 -- Operation and Maintenance

Describe special operation instructions and maintenance needed to sustain performance, include:

- Preventative maintenance procedures to be implemented during the course of the field test as well as long-term maintenance;
- Personnel, supplies, replacement materials and/or parts availability (e.g., filter media) and equipment needed to operate and maintain the facility;
- Recommended maintenance schedule;
- Maintenance checklist;
- Access ports and dimensions provided to facilitate maintenance;
- Generation, handling, removal, and disposal of discharges, emissions, and waste byproducts in terms of mass balance, maintenance requirements, and cost;
- Special licensing or hauling requirements, safety issues, and access requirements associated with operation or maintenance of the technology; and
- Projected operational and maintenance (O&M) costs.

5.3.8 – System Longevity

Assuming the device is designed, installed, and maintained correctly, what is the expected life of the BMP? In addition list factors that cause it to not perform as designed:

- Describe circumstances where the technology can add, transform, or release accumulated pollutants?
- If applicable, does the filter medium decompose or is it subject to slime/bacteria growth?
- How is underperformance diagnosed and treated?
- What is the warranty?
- What initial/ongoing user support is provided?
- Does the vendor charge for support?

5.3.9 -- References

List any sources of published information, including Websites, cited in the theory/technology description section. List sources alphabetically. Follow the formatting used for the following citation examples:

ASTM International. 2006. Standard Guide for Selection, Installation and Maintenance of Plants for Green Roof Systems. Standard E2400-06. ASTM International, West Conshohocken, PA. Available online: http://www.astm.org/Standards/E2400.htm (accessed August 7, 2009).

Gowland, D. and T. Younos. 2008. Feasibility of Rainwater Harvesting BMP for Stormwater Management. Special Report SR38-2008. Virginia Water Resources Research Center, Blacksburg, VA. Available online: http://www.vwrrc.vt.edu/special_reports.html (accessed August 7, 2009).

Schueler, T. 2008. Technical Support for the Baywide Runoff Reduction Method. Chesapeake Stormwater Network, Baltimore, MD. Available online: www.chesapeakestormwater.net (accessed August 7, 2009).

Schueler, T., D. Hirschman, M. Novotney and J. Zielinski. 2007. Urban Stormwater Retrofit Practices Manual 3: Urban Subwatershed Restoration Manual Series. Center for Watershed Protection, Ellicott City, MD. Available online: http://www.cwp.org/Store/usrm.htm (accessed August 7, 2009).

5.3.10 -- Appendices

Include any additional information requested by the evaluators in appendices.

5.4 -- Remediation Action Plan

Include a generic remediation action plan that specifies what actions will be taken by the proponent if the device is found to perform at a substandard level.

5.5 -- Technical Evaluation Report

A Technical Evaluation Report (TER) should be submitted as part of the application once laboratory and/or field testing have been completed. A TER is required for technologies seeking a PUD, CUD or GUD certification. Information about developing the TER is described in **Section 8 -- Technical Evaluation Report.**

5.6 -- Certification

Include both the signature of a company representative and date of certification. Use the following certification statement:

> "I certify that all information submitted is true and correct. The information was accumulated using approved methods specified in the Virginia Technology Assessment Protocol, unless otherwise noted. 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."

Appendix A

Use Designation Application Form
For Manufactured Treatment Devices

Complete the following form for each technology seeking a use designation certification in Virginia and submit an electronic version and two paper copies of the completed form as part of the application package. Insert additional columns and rows as needed.

Project Title:

MTD Name: Today's Date:

1 Basic Product Information

Proponent
Company name:
Address: Street City State Zip

Proponent Contact
Name (to whom questions should be addressed):
Address: Street City State Zip
Phone number:
Fax number:
E-mail address:

Technical Advisor
Name:
Address: Street City State Zip
Phone number:
Fax number:
E-mail address:

Manufactured Treatment Device
MTD model serial #:
MTD common (marketing) name:
Specific size/capacity of MTD model:

2 Use Designation Currently Sought (check only one)

☐ Pilot Use (PUD)
☐ Conditional Use (CUD)
☐ General Use (GUD)

3 Certification Request (check all that apply)

☐ Stormwater Runoff Volume Reduction
☐ Stormwater Runoff Peak Rate Control
☐ Stormwater Runoff Quality Control (Total Phosphorus)

4 Pollutants the Device is Designed to Treat (check all that apply)

☐ Total Phosphorous (TP)
*Check all pollutants for which MTD is designed to treat. Certification in Virginia is only granted for TP at this time.
☐ Floatables/trash
☐ Sediment
☐ Nitrogen
☐ Bacteria
☐ Oil & grease
☐ Heavy metals
☐ Organic toxicants
☐ Other (describe):

Project Title:

MTD Name: Today's Date:

5 Warranty Information (describe or attach details)

6 BMP History

How long has this specific model been on the market?

List other applications of this exact model/size and location (provide latitude and longitude) of this application:

7 Device Intended Application (check all that apply)

☐ Pre-treatment for downgradient BMP
☐ Water quality treatment
☐ Flood control
☐ Channel protection
☐ Other:

8 Basis for Treatment (check one and fill in blanks)

☐ **Volume-based** (captures & treats Water Quality Volume [WQV]) – Specify WQV: cubic feet
☐ **Flow rate-based** (provides treatment up to a set rate of flow) – Specify treatment flow rates and hydrologic methods used. Specify the flow rates that are treated and provide documentation:
- ☐ i. All flows up to the year, 24-hour storm event.
- ☐ ii. Peak flows associated with water quality storm event (inches of rainfall; cfs)
- ☐ iii. Other (specify):

If flow rate-based system, can MTD treat without flush-out/resuspension/scouring.
- ☐ Yes (Provide validating documentation); specify design features to prevent resuspension of captured particles/pollutants:
- ☐ No. If no, explain why:

☐ **Other** (describe):

9 Water Quality Treatment Mechanisms (check all that apply and provide brief description)

☐ Sedimentation/settling:
☐ Infiltration:
☐ Filtration (specify filter media):
☐ Adsorption/cation exchange:
☐ Chelation/precipitation:
☐ Chemical treatment:
☐ Biological uptake:
☐ Other (describe):

Project Title:

MTD Name: Today's Date:

10 Design Features of Interest (answer each of the following questions.)

Pre-treatment/removal of larger particles achieved via which of the following?
☐ No pre-treatment
☐ Internal settling/sedimentation chamber
☐ Upgradient (separate) settling/sedimentation device
☐ Other (describe):

By-pass/diversion of larger flows (not designed for treatment) via which of the following?
☐ Internal by-pass for larger flows
☐ Upgradient flow splitter used to divert water quality storm to device
☐ Other (describe):

11 Independent Performance Certification (check all that apply)

Has the device been "certified or performance verified" by any of the organizations below?
☐ **No** (skip to next question)
☐ **Yes**; Continue below and include date of certification and certification number.

- ☐ **Virginia DCR**
  - ☐ PUD (date awarded: , Certification #:)
  - ☐ CUD (date awarded: , Certification #:)
- ☐ **State Agency** (list):
  - ☐ Approved (date awarded: , Certification #:)
  - ☐ Performance certified (date certified: , Certification #:)
  - ☐ Status pending
  - ☐ Other (explain):
- ☐ **TARP** (NJ only)
  - ☐ Approved:
    - ☐ Tier I (date awarded: ; Certification #:)
    - ☐ Tier II (date awarded: ; Certification #:)
    - ☐ Tier III (date awarded: ; Certification #:)
  - ☐ Performance verified
  - ☐ Other (explain):
- ☐ **TAPE** (WA State only)
  - ☐ Approved:
    - ☐ PLD - Pilot Level Designation (date awarded: , Certification #:)
    - ☐ CUD - Conditional Use Designation (date awarded: , Certification #:)
    - ☐ GULD - General Use Level Designation (date awarded: , Certification #:)
  - ☐ Performance Certified (date certified:)
  - ☐ Status pending
  - ☐ Other (explain):
- ☐ **NJCAT** (NJ)
  - ☐ Interim Certification (date awarded: , Certification #:)
  - ☐ Final Certification (date awarded: , Certification #:)
- ☐ **Other** (provide documentation of testing protocol, status of device and results of testing):

Project Title:

MTD Name: Today's Date:

12 Vendor-initiated Performance Testing (check all that apply):

Has the device been tested and its performance reported?

☐ **Laboratory Tested**
- ☐ Manufacturer (directly tested)
- ☐ Contractor retained by manufacturer
- ☐ Tested by third party (e.g., not associated or tied financially to manufacturer)

☐ **Field Tested**
- ☐ Manufacturer (directly tested)
- ☐ Contractor retained by manufacturer
- ☐ Tested by third party (e.g., not associated or tied financially to manufacturer)

13 Results of Vendor-initiated Performance Testing

Has the MTD been tested for pollutants of concern? (Check all that apply)

☐ **Phosphorous**; please provide lab or field results in the TER. Removal rates for phosphorus based upon measured:
- ☐ Total Phosphorus (TP)
- ☐ Particulate Phosphorus (PP)
- ☐ Soluble Phosphorus (SP)
  - ☐ Soluble Reactive Phosphorus (SRP)
  - ☐ Soluble Unreactive Phosphorus (SUP)
    - ☐ Check here if reported % removal, load reduction, and/or effluent concentrations are provided over a range of influent concentrations, and list the range of influent concentrations

Although certification in Virginia is only granted for total phosphorus at this time, check all pollutants for which MTD has been tested.

☐ **Sediment**; please provide lab or field results in TER.

Removal rates for sediment based upon:
- ☐ Total Suspended Solids (TSS)
- ☐ Suspended Sediment Concentration (SSC)
  - ☐ Check here if reported % removal, load reduction, and/or effluent concentrations are provided over a range of influent concentrations, and list the range of influent concentrations

☐ **Nitrogen**; please briefly describe.
- ☐ Check here if reported % removal, load reduction, and/or effluent concentrations are provided over a range of influent concentrations, and list the range of influent concentrations

☐ **Oil/Grease**; please briefly describe.
- ☐ Check here if reported % removal, load reduction, and/or effluent concentrations are provided over a range of influent concentrations, and list the range of influent concentrations

☐ **Heavy metals**; please briefly describe.
- ☐ Check here if reported % removal, load reduction, and/or effluent concentrations are provided over a range of influent concentrations, and list the range of influent concentrations

☐ **Bacteria**; please briefly describe.
- ☐ Check here if reported % removal, load reduction, and/or effluent concentrations are provided over a range of influent concentrations, and list the range of influent concentrations

☐ **Organic toxicants**; please briefly describe.
- ☐ Check here if reported % removal, load reduction, and/or effluent concentrations are provided over a range of influent concentrations, and list the range of influent concentrations

☐ **Other**; please briefly describe.
- ☐ Check here if reported % removal, load reduction, and/or effluent concentrations are provided over a range of influent concentrations, and list the range of influent concentrations

Project Title:

MTD Name: Today's Date:

14 Particle Size Distribution (PSD)

If laboratory test results are included in the TER and TSS/SSC results are reported, was Sil-Co-Sil 106 used in the test runs?
☐ Yes
☐ No -- If no, explain what was used instead:

What method and equipment were used to determine PSD?
If the method or equipment used to determine PSD differed for any lab test/storm where PSD was measured, provide the date of the test/storm and describe the change.

If laboratory test results are included in the TER, were the influent and effluent analyzed for PSD and reported for at least 5 test runs?
☐ Yes
☐ No -- If no, explain why not:

If field test results are included in the TER, were the influent and effluent analyzed for PSD and reported for at least five storms?
☐ Yes
☐ No -- If no, explain why not:

If field test results are included in the TER, did the PSD measurements that were reported include at least one storm that had 10 or more consecutive dry days before the storm?
☐ Yes
☐ No -- If no, explain why not:

If field test results are included in the TER, did the PSD measurements that were reported include at least one storm that had only 1-dry day before the storm?
☐ Yes
☐ No -- If no, explain why not:

Describe/document how and why the PSD used for testing deviates from the PSD presented below:

Table 1. The range of targeted percentages for given particle sizes from stormwater influent and effluent for laboratory tests and field test sites.

Particle Size Range (μm)	Influent Percent by Mass (%)	Effluent Percent by Mass (%)
0-10	0-30	0-40
10-30	15-40	0-5
30-60	10-35	0-5
60-100	0-10	0-30
100+	0-10	0-100

Project Title:

MTD Name: Today's Date:

Did the influent contain at least 50% of its particles in the 10-60 µm size range for lab tests/storms where PSD was measured?
☐ Yes
☐ No -- Provide date(s) and characteristics of lab test/storms not meeting this target and list the percentage of particles in the 10-60 µm size range for the influent

Did the effluent contain less than 10% of its particles between 10-60 µm in size for any lab tests/storms where PSD was measured?
☐ Yes
☐ No -- Provide date(s) and characteristics of storms not meeting this target and list the percentage of particles in the 10-60 µm size range for the effluent

15 Maintenance Considerations (check all that apply and briefly explain maintenance procedures/standards)

What is the generic inspection and maintenance plan/procedure? (attach necessary documents):

Is there a maintenance track record/history that can be documented?
☐ No, no track record.
☐ Yes, track record exists; (provide list of local or regional devices currently in use and maintenance track record info)

What is the expected maintenance frequency, per year?
i. Total life expectancy of device and/or media (if relevant):
ii. For media or amendments functioning based on cation exchange or adsorption, how long will the media last before breakthrough (indicator capacity is nearly reached) occurs?:

Maintenance contract offered by:
☐ Vendor
☐ Other commercial entities (Provide names and contact info):

Is the maintenance procedure and/or are materials/components proprietary?
☐ Yes, proprietary;
- ☐ Device lends itself to competitive bidding for maintenance
- ☐ Recourse / options exist if the vendor goes out of business

☐ No, not proprietary;
- Are local certified contractors available?
  - ☐ Yes; provide a list with contact information.
  - ☐ No; local contactors are not available
- Does the device lend itself to competitive bidding for maintenance?
  - ☐ Yes; provide a list of local, certified, maintenance companies and their contact information.
  - ☐ No; local competitive bidding not possible because only one maintenance company certified locally.

Project Title:

MTD Name: Today's Date:

Maintenance complexity (Check all that apply):

☐ Confined space training required for maintenance
☐ Liquid pumping and transportation
    Specify method:
    Specify certified disposal locations:
☐ Solids removal and disposal
    Specify method:
    Specify certified disposal locations:
☐ Hazardous waste disposal
    Specify method:
    Specify certified disposal locations:

Other noteworthy maintenance parameter? (describe):

Appendix B

Treatment Efficiency Calculation Methods

Slightly modified from Center for Watershed Protection's

Tool 8: BMP Performance Verification Checklist Appendices

www.cwp.org/postconstruction (Accessed August 7, 2009)

Treatment Efficiency Calculation Methods

The pollutant removal efficiency of a BMP refers to the pollutant reduction that is achieved by comparing the influent and effluent of a BMP or treatment train. Pollutant reduction can be determined on either a concentration or load/mass basis and is typically expressed as a percentage.

Concentration-based methods use the ratio of pollutant concentrations or event mean concentrations (EMCs) at the outflow to pollutant concentrations or EMCs at the inflow as the basis for calculating BMP efficiency. As a general rule, concentration-based methods often result in slightly lower performance efficiencies than mass-based methods. This may be attributed to the fact that BMPs that reduce runoff volume are also reducing pollutant loads, but a concentration-in versus concentration-out study does not account for water losses that occur through infiltration and evapotranspiration, or storage within the BMP. For this reason, the pollutant removal efficiency of these types of BMPs may be under-reported using concentration-based methods.

Mass-based methods use pollutant loads as the basis for calculating BMP efficiency. Pollutant load is the total amount of a pollutant conveyed over a specified duration. The pollutant loading from a given storm can be estimated using pollutant EMCs and flow data. Mass-based methods are influenced by the volume of water entering the BMP and water losses within the BMP (e.g., evapotranspiration and infiltration), so they are more accurate for BMPs that reduce runoff volume (Winer 2000).

The Efficiency Ratio method and the Summation of Loads methods are recommended for use by ASCE and EPA (2002) and DCR. Use of either method should be supplemented with an appropriate statistical test indicating if the differences in mean EMCs between the outflow and inflow are statistically significant.

Methods to Estimate BMP Efficiency (from Center for Watershed Protection 2008; compiled from ASCE and USEPA 2002)			
Method	**Type of Method**	**Formula**	**Comments**
Efficiency Ratio (ER)	**Concentration**	$ER = 1 - \frac{Average\ outlet\ EMC}{Average\ inlet\ EMC}$ Where the EMC = $\frac{\sum_{j=1}^{n} CiVi}{\sum_{j=1}^{n} Vi}$ Where: *Ci* = event inflow concentration; *Vi* = event inflow volume	• Most useful when loads are directly proportional to the storm volume. • Weights EMCs from all storms equally. • The accuracy varies with BMP type. • Minimizes impacts of smaller/cleaner storms on performance calculations. • Can apply log normalization to avoid equal weighting of events.
Summation of Loads (SOL)	**Mass**	$SOL = \frac{sum\ of\ \ outlet\ loads}{sum\ of\ \ inlet\ loads}$ Where the Load = C*i*V*i* *Ci = average concentration within period i; Vi = volume of flow during period i*	• Loads are calculated using concentration and flow volume and are summed for the number of events measured. • A small number of large storms can significantly influence results. • Removal of material is most relevant over entire period of analysis • Uses a mass balance approach. • Effluent concentration may still be high despite high removal efficiency