Virginia Stormwater BMP Clearinghouse Committee Meeting

Virginia Department of Conservation and Recreation
Virginia Water Resources Research Center
September 11, 2007
Piedmont DEQ Regional Office
Glen Allen, Virginia

Virginia Stormwater BMP Clearinghouse Committee Members Present

Scott Crafton (substitute Committee Chairperson for Lee Hill), Virginia Department of Conservation and Recreation
A. Osman Akan, Frank Batten College of Engineering and Tech., Old Dominion University
Rishi Baral, County of Stafford, Planning Department, E & S Plan Review
Joseph G. Battiata, CONTECH Stormwater Solutions Inc.
Linda K. Blum, Department of Environmental Sciences, University of Virginia
Dean R. Bork, Department of Landscape Architecture, Virginia Tech
Gregory Johnson, Patton Harris Rust & Associates
Mary E. Johnson, Thomas Jefferson Soil and Water Conservation District
Joseph Lerch (for Michael Gerel), Chesapeake Bay Foundation
Roy Mills, Virginia Department of Transportation (VDOT), Location & Design Division
Douglas H. Moseley III, GKY & Associates, Inc.
David B. Powers, Michael Baker Jr., Inc.
Kelly Ramsey, Natural Resources Conservation Service
David W. Rundgren, New River Valley Planning District Commission
James S. Talian, City of Lynchburg
Scott J. Thomas, James City County Environmental Division
Burt Tuxford, Virginia Department of Environmental Quality

Virginia Stormwater BMP Clearinghouse Committee Members Not Present

W. Douglas Beisch, Jr., Williamsburg Environmental Group, Inc.
Gary Boring, New River Highlands RC&D Council
Larry Coffman, Filterra
Kristina Hill, Department of Landscape Architecture, University of Virginia
David J. Hirschman, Center for Watershed Protection
Cynthia S. Linkenhoker, City of Portsmouth, Dept. of Public Utilities/Public Works
Randy Sewell, Vanasse Hangen Brustlin, Inc. (VHB)
Kevin D. Young, Dept. Of Civil and Environmental Engineering, Virginia Tech

Virginia Department of Conservation and Recreation (DCR) Staff Present

Chuck Dietz
John McCutcheon

Virginia Water Resources Research Center (VWRRC) Staff Present

Stephen Schoenholtz
Jane Walker

Scott Crafton (DCR) called the meeting to order and asked everyone to introduce herself or himself. The minutes from the June 21, 2007 meeting were distributed and reviewed. No corrections or additions were made to the minutes.

Update: New Stormwater Regulations

Scott Crafton (DCR) provided an overview of the draft proposed stormwater regulations. A copy of the draft regulations will be provided to Committee members before the Soil and Water Conservation Board meetings on September 20 – 21. Highlights of the proposed regulations include:

-- The principle standards are included in **4VAC50-60-63. Water Quality Criteria Requirements:**

1. New development projects and projects occurring on prior developed lands that result in the total percent impervious cover of a site being less than or equal to 40% shall implement BMPs selected and designed to achieve a post-development pollutant load from the site that does not exceed 0.28 pounds of total phosphorus per acre per year.

2. New development projects that result in the total percent impervious cover of a site being greater than 40% shall implement BMPs selected and designed to achieve a post development pollutant load from the site that does not exceed 2.68 pounds of total nitrogen per acre per year.

3. Projects occurring on prior developed lands that result in the impervious cover of a site being greater than 40% shall implement BMPs selected and designed to achieve a reduction of total nitrogen of at least 28% below the post-development total nitrogen load. However, under no circumstance shall the total nitrogen load be required to be reduced to below 2.68 pounds of total nitrogen per acre per year.

-- Localities are given more flexibility in the proposed regulations. For example:

- Localities are allowed to develop more stringent criteria.
- Localities are given the discretion to apply criteria to each drainage area of a developed site.
- Localities have the final say in what area is considered to be the "planning area" of the site.
- Localities can allow off-site controls to achieve desired post-development loads under some situations.

4VAC50-60-56. Applicability of other laws and regulations:

"…Nothing in this chapter shall be construed as limiting the applicability of other laws and regulations or the rights of other federal agencies, state agencies, or local governments to impose more stringent technical criteria or other requirements as allowed by law."

4VAC50-60-63. Water Quality Criteria Requirements
A. "…. The local program shall have discretion to allow for application of the criteria to each drainage area of the site. However, where a site drains to more than one HUC, the pollutant load reduction requirements shall be applied independently within each HUC."
A.4. "Where the land disturbing activity only occurs on a portion of the development site, the local program has the discretion to consider the portion of the site subject to land disturbance as a planning area and to review the stormwater management plan on that basis…."

B. and C. Under certain circumstances, **"…**off-site controls may be used to meet the post-development pollutant load water quality technical criteria set out in subsection A…"

-- Low Impact Development techniques can be used to provide credits.

4VAC50-60-108.
D. "The percent of imperviousness may be adjusted through implementation of LID practices as set out in Table 2, allowing for an adjusted pollution removal rate requirement…."

Several members asked questions about the proposed regulations and provided comments. The control of water quantity and accountability were two concerns raised. Scott Crafton (DCR) offered that the public comment process is the proper forum in which to voice concerns and comments. He also suggested that members bring their concerns to Lee Hill and himself as they develop the clearinghouse and handbook.

Subcommittee Report:
The Web Site Subcommittee held its first meeting on August 1, 2007. Three documents developed as an outcome of that meeting were distributed and are attached in Appendix A:

- Comments and suggestions made at the meeting as recorded by Jane Walker (VWRRC);
- A possible means to develop the web site so that the database is searchable as envisioned by Doug Beisch; and
- An outline of the information that could be included on the web site as envisioned by Scott Crafton (DCR).

A member voiced support for the proposed plan to have independent researchers (coordinated through the VWRRC and DCR) test products instead of having the many different localities run tests. The goal is to test products on a small number of sites, not hundreds, before realizing whether or not the product is effective.

Some states use unapproved products at retrofit and redevelopment sites. The member making this statement recommended that, instead, Virginia should be sure that retrofit and redevelopment sites use approved products. Some states, such as Maryland, have a more receptive attitude compared to Virginia when it comes to using new products. If they later find that a product does not work, it is placed on a blackball list. Unfortunately, the product may be used by 100s of localities before the ineffectiveness of the product is known. Some states,

Washington and New Jersey for example, will require retrofits if they learn that a product does not work. Scott Crafton (DCR) offered that the Center for Watershed Protection (CWP) recently completed the document: "Urban Stormwater Retrofit Practices Manual" (available at http://www.cwp.org/PublicationStore/USRM.htm#usrm3). In the manual, CWP uses the design median value and assumes it works for back-to-back BMPs in retrofit areas. Because research has shown that the use of different BMPs in treatment trains is more effective than using multiples of the same BMP, Virginia should require different BMPs be used in treatment trains.

The committee discussed stormwater quantity issues and the use of LID credits. Because there is a meaningful link between stormwater quantity and quality, future regulations will likely consider water quantity as well as quality. DCR staff offered that most Virginians think of LID as bioretention and infiltration, but LID also includes reducing the amount of impervious surface (and therefore stormwater quantity) through such means as water harvesting (e.g., rain barrels). One member commented that people on the west coast have a different understanding of LID than those on the east coast. The group agreed to continue the dialogue and clarification of terminology as a part of future meeting discussions.

Presentation of BMP Selection Program

Scott Crafton (DCR) distributed an article published by *Science Daily* entitled: "Water Pollution Can Be Reduced With New Storm Water Analysis System" (See Appendix B). This article focuses on the project at Virginia Tech to develop a program that can help stormwater managers select BMPs based on site-specific criteria. Kevin Young, a member of the Clearinghouse Committee and one of the principal researchers on the project, has offered to give a presentation at the December meeting to summarize the goals and potential uses of the program.

Web Site Development and Maintenance

Stephen Schoenholtz (VWRRC) asked when a web developer should be hired. He does not want to hire someone for a six-month position, only to have the person with nothing to do for three or four months while the committee makes key decisions. Scott Crafton (DCR) recommended that the subcommittee meet at least one more time before hiring a web developer.

It was suggested that the VWRRC see if Virginia Tech offers any kind of consulting for developing the structure of the site. The person to help with the structural component would not necessarily be a web developer. A member of the committee who has worked with NASA and Virginia Coast Reserve Long Term Ecological Research (LTER) on similar web-based projects noted that these groups used a designer to develop an "information management model." This person does not need to be the web designer. She stressed that it is better to have the modeler involved early in the process. It was also suggested that Kevin Young and/or David Kibler be involved.

The VWRRC and DCR staff agreed to meet to discuss the ongoing support of the site. It may be necessary to hire a part-time person to perform regular updates to the web site. Without regular and frequent updates, the web site could become obsolete in 18 months. A member suggested that sponsorship of the site by manufacturers with products under review could help provide the funding needed to support web maintenance.

Next Meetings

The next meeting was set for December 12, 2007 in Charlottesville. The subcommittees will try to meet in October, and the members of these subcommittees were questioned for availability of best meeting dates.

With no further business, the meeting was adjourned.

Appendix A.

Virginia Stormwater BMP Clearinghouse
Web Site Subcommittee Meeting

Virginia Department of Conservation and Recreation
Virginia Water Resources Research Center
August 1, 2007
Piedmont DEQ Regional Office
Glen Allen, Virginia

-- Notes by Jane Walker (updated: few modifications made at 9/11/07 Clearinghouse Committee Meeting)

Attendance:
W. Douglas Beisch, Jr., Williamsburg Environmental Group, Inc. (conference call)
Mary E. Johnson, Thomas Jefferson Soil and Water Conservation District
Douglas H. Moseley III, GKY & Associates, Inc.

DCR and VWRRC Staff:
Mark Chambers, Virginia Department of Conservation and Recreation (DCR), Staunton Soil & Water Office
Scott Crafton, Virginia Department of Conservation and Recreation (DCR)
Jane Walker, Virginia Water Resources Research Center (VWRRC)

The committee decided that it needs to have the web site content and design ideas solidified as much as possible before hiring a web designer to create the pages.

Web Site Content
Possible Pages include:

- Home – purpose and contact information
- Background Information
- BMP Standards and Specs
- BMP Testing Protocols
- Associated Tools
- References or Links
- FAQs (frequently asked questions)

A member asked if the site would contain information solely about post-construction BMPs (best management practices) or if it would also have MS4 (municipal separate storm sewer system) BMPs and industrial BMPs. Scott Crafton, DCR, stated that the agency intends to cover all three areas, but will prioritize the work to cover post-construction BMPs first, then MS4 BMPs, and lastly industrial BMPs.

A member proposed the following idea as a way to consider organizing the web site.

SWM Regulation Compliance	SWM BMP Operation Maintenance	BMP Research	Menu of BMPs
Permitting Programs • Post-construction • MS4 • Industrial	Function/Design • Water Quality Components • Water Quantity Components	New	
Virginia SWM Regulations	Maintenance Guidance • Life Cycle • Maintenance Schedule/Doc. Techniques • Facility Costs • Maintenance Costs	In process	
Virginia Erosion and Sediment Control Regulations		Exists, but not tested	

SWM = stormwater management

The committee decided it prefers the use of a database so that users can search by individual BMPs or by maintenance costs, etc. By using a database, updates should only be needed in one place.

DCR staff suggested that the site could link to DEQ's TMDL (Department of Environmental Quality's total maximum daily load) web site so that users could easily find the wasteload allocations and reductions needed for watersheds with impaired waters for nitrogen and phosphorus. If this information is not currently easily accessible, DCR could work with DEQ in ensuring that such information is easily obtainable.

Another suggestion was to include a section on common mistakes to avoid.

It was suggested that several different types of maps could be included. Maps showing karst areas, hydraulic unit codes (HUCs), soils data, DEQ impaired waters, and FEMA floodplains were suggested.

It was suggested that the component of the site entitled "Menu of BMPs" should list BMPs and include a brief overview (e.g., associated costs, footprint area, vertical grade, etc.). It was suggested that this section should provide at least two main types of information: (1) a way to decide which BMPs are most useful for meeting the user's criteria and (2) a way to reproduce the information for distribution.

<u>BMP Selection</u>

It was suggested the site contain a Technology Table where users can narrow down a selection of many possible BMPs (e.g., 50 BMPs) to a few (e.g., 5 BMPs) that meet the most pressing needs of the user. A modified version of the screening selection process developed by David Kibler and Kevin Young at Virginia Tech for VDOT (Virginia Department of Transportation) would be

ideal. Users could select the primary criteria (N, P, or TSS to be removed, amount of removal needed, percent watershed impervious, etc.) and then the program would select several BMPs based on these criteria.

Reproduce Information

It was suggested that a print friendly option be made available and a "print to PDF" be possible. A member suggested that CADD (Computer-Aided Design & Drafting) drawings or TIF graphics be used instead of PDFs for the drawings.

Considering the web site from the perspective of local governments, it was suggested that maintenance issues are of significant concern. Because maintenance often falls to local governments, they are frequently interested in knowing the maintenance costs. Having information on the maintenance cycle would help local governments. It was also suggested that the local government planners who review the BMP designs would need different information than the local government maintenance crew.

Considering the web site from the perspective of the BMP manufacturer, it was determined that easily finding the process for how to get certified would be of most importance. Manufacturers would also be interested in learning the results of the testing of their products as well as those of their competitors. It was stressed that all results would need to be stated with a neutral tone (objectively stated). For pilot projects, a DCR staff member was more comfortable saying, "This pilot product has not been tested" instead of saying, "The manufacturer says X, Y, and Z."

Web Site Design

It was suggested that once a short list of possible BMPs is developed, the site needs to be able to provide the specifics on each BMP without having to go back to the home page and search the BMP menu for the listed BMPs.

In looking over information from Virginia Tech about its web site templates, Scott Crafton, DCR, stated that he prefers pages with vertical navigation so that the site can continue to expand. He also prefers a double column layout and fixed pages.

The group expressed the need to have a search engine for the site that is internal to the site.

When users of the site follow links to other sites, a disclaimer should appear (e.g., "You are now leaving the Virginia Stormwater BMP Clearinghouse Web Site and entering an external link. DCR and VWRRC cannot attest to the accuracy of information provided by this link or any other linked site. Providing links does not constitute an endorsement by DCR or VWRRC of the site or the information or products presented on the site.").

DCR and VWRRC need to discuss a plan for on-going maintenance of the web site once it is developed. These two entities will need to ensure that the copyright information is the property of the Commonwealth of Virginia and not simply belonging to Virginia Tech.

Next Steps
Additional ideas are to be sent to Scott Crafton within the next week. Scott will chart the ideas to develop a possible site map. Before the next meeting, the group will need to get more specific on its content and design ideas.

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-- Notes by Doug Beisch

The database could be searchable by certain technical parameters. Those parameters could be stored in a flat file or database and screened or sorted based on user-input selection criteria:

SEARCH FOR A BMP

Potential Selection Criteria

Minimum Efficiency Required
Drainage Area (ac)
Surface Area available (small, medium, large)
On-line or off-line
Flood control required
Channel Protection required
Technology Type Preferred (infiltration practices, filtering practices, hydrodynamic, etc..)

All of these would be *optional* user inputs and the specific search criteria that the user has to design to could be input, returning a list of available BMPs.

It would be fairly simple to construct a script to pull the BMPs that match the search criteria.

Search for a BMP

Efficiency Required (min.) TP or Efficiency Required (min.) TN or Impervious Cover (%)	▼ ▼ ▼	20, 40, 50, 60, 65, 70 45%, 55%, 60%, 70% 0-10; 11-15; 16-20; etc.
Drainage Area (ac)	Enter Data Here	
Surface Area Available	▼	Small (e.g., manufactured) Medium (e.g., infiltration) Large (e.g., bioretention)
On-line or Off-line	▼	
Water Quantity: Flood Control Required Channel Protection Required	 ▼ ▼	
BMP Technology Type	▼	Filtering Infiltration etc.

-- Notes by Scott Crafton (updated: additions from 9/11/07 Clearinghouse Committee Meeting in red)

MAIN POTENTIAL AUDIENCES (best to have different entry gateways for each type of audience/user to quickly and intuitively drill down to the kinds of information that the specific audience wants/needs)

- BMP Manufacturers want:
  - BMP certification criteria and process
  - Relevant information about competitor products NOTE: be careful NOT to editorialize about products; just provide the facts. How we say what we say is very important!)
    - General descriptive/education information (people don't know much about how these "black boxes" function and what they accomplish)
    - Could link to the Handbook web site for general information about the different types/categories and sub-categories of BMPs
    - Provide descriptions and useful graphics (could come from manufacturers)
    - Provide relevant research data
    - Provide information about how the various BMPs measure against the applicable research protocol (level of certification, etc.)
  - Other?

- Design Consultants and Developers want:
  - A simple, straightforward BMP selection process
  - BMP performance information
  - BMP design criteria and requirements
  - Perhaps information about common mistakes made (what NOT to do!)
  - Other?

- Local Government
  - Plan Reviewers want:
    - Performance and design information
    - Other?
  - Public Works Staff want:
    - Long-term inspection/maintenance requirements (checklists)
    - Annualized maintenance costs for each specific BMP
    - The costs of repairing a BMP to its specified design and function
    - Other?

- Homeowner's Associations want:
  - Relevant information about long-term BMP maintenance
  - Other?

HOME PAGE CONTENTS

- Project Purpose and Description
- Roles of DCR and the VWRRC in managing the project
- Overview of the website content by category and topic (how to use the site
  - Link to the website "map"
- "Contact Us" link (for both DCR and the VWRRC staffs)
- What's New

POTENTIAL WEB SITE GATEWAY CATEGORIES

1. **Stormwater Regulatory Programs**
   - Cross-reference
   - Stormwater Regulatory Structure (descriptions and links to laws and regulations)
   - Individual programs and how they inter-relate/coordinate
     - Construction (E&S Control plus chemical/waste control)
     - Post-construction
     - MS4
     - CBPA (Chesapeake Bay Preservation Act)
     - Industrial (is this considered stormwater/NPS, or point source?)
     - TMDL/Waste Load Allocations?

2. **Stormwater Runoff Pollution Control**
   - Stormwater Runoff Pollution
   - Runoff Volume Reduction through LID/Better Site Design
   - Treatment Processes
   - Selecting an appropriate treatment practice (see III below for more detail)
   - Operation and Maintenance
   - Costs and Economics of Stormwater Management
   - Proper Installation

3. **BMP Screening and Selection** (this could be a variation of the BMP Selection algorithm created for VDOT by Dr. David Kibler and Kevin Young – Doug Beisch noted that it will be important to be able to use this or another method internally to the Clearinghouse web site; that is, to be able to interact with the site's database)

   - Primary Screening (aim: to reduce the entire list of BMPs down to the 4-5 most appropriate selections for the site) – for example:
     - Target Pollutant(s): **TN/TP/(TSS?)**
     - Treatment Efficiency: **Select Technology Tier or Removal Efficiency Needed** (relate to Tech. Table in SWM Regs)
     - Site/Watershed Imperviousness: **%**
     - Drainage Area: **Acres**

- This would generate a list of available BMP technologies which could then be sorted by other categories or facets:
  - Individual Cost
  - Life-cycle cost
  - Soils constraints
  - % site area required
  - etc.

A member noted that designers want a simple search/selection process, and they want to be able to easily depict/represent the process for the plan reviewer, so he/she can follow the designer's decision process.

4. BMP Standards and Specifications

- Post-Construction Runoff Control
  - Structural BMPs listed in draft revised Va. SWM regulation
    - Extended Detention
    - Infiltration #1
    - Infiltration #2
    - Bioretention #1
    - Bioretention #2
    - Stormwater Wetland #1
    - Stormwater Wetland #2
    - Wet Pond #1
    - Wet Pond #2
    - Filtering Practice #1
    - Filtering Practice #2

  - Non-Structural BMPs (Better Site Design Practices and LID Practices for which volume/imperviousness reduction credits are proposed in Va. SWM program)
    - Reforesting a riparian area (includes an existing CBPA buffer that has herbaceous cover)
    - Expanding and protecting a riparian area beyond the extent required by law/regulation
    - Open space conservation
      - Protect sensitive/valuable resources
      - Cluster and concentrate imperviousness
      - Reduce impervious cover
    - Open space conservation with added hydraulic function (includes converting piped flow through a buffer to sheet flow through the buffer)
    - On-lot rain gardens/dry wells, etc., that effectively disconnect rooftop and driveway from other site impervious areas
    - Rainwater harvesting (rain barrels, cisterns, etc.)
    - On-lot soil amendments
    - Pervious parking area (porous asphalt, porous concrete, paver blocks – reducing impervious cover)

- Green roof (reducing impervious cover)
- Grass channel
- Other impervious disconnection not addressed through another credit (disconnect/distribute/decentralize)
- Other BSD non-structural practices
  - Minimize land disturbance and long-term maintenance needs
  - "Green" street/cul-de-sac designs)
  - Pollution Source Control

- Manufactured BMPs (listed by type, or by manufacturer/product name?)
  - Types
    - Vaults
      - Baysaver™
      - Bio-Storm™
      - Contactor™
      - Crystal Stream™
      - EcoStorm™
      - Isolator™
      - Multi-Chamber Treatment Train
      - Rainstorm3™
      - Recharger™
      - StormBloc™
      - Stormceptor™
      - StormChamber™
      - StormTank™
      - StormTrap™
      - StormTrooper™
      - Stormvault™
      - Terra Clean™
      - Other
    - Oil/Water Separators
      - EcoSep™
      - Highland™
      - StormSep™
      - Other
    - Swirl Concentrators
      - AquaSwirl™
      - Downstream Defender™
      - DualVortex™
      - First Defense™
      - HydroGuard (NJ?)
      - V2B1™
      - Vort Sentry™
      - Vortechs™

- Other

- Wetland
  - StormTreat™
  - Other
- Infiltrators
  - Cultec Subsurface Stormwater System™
  - Filterra™
  - Other
- Filters
  - AquaFilter™
  - Bay Filter™
  - CDS Filter™
  - DrainPac™
  - Ecostorm Plus™
  - Envirodrain™
  - Enviro-Pod™
  - Flo-Gard™
  - StormFilter™
  - UltraUrban™
  - Up-Flo Filter™
  - VortFilter™
  - Other
- Screens
  - Baramy GPT™
  - CDS™
  - Cleansall™
  - Curb Inlet Protector™
  - EnviroSafe™
  - EquiFlow™
  - GPI™
  - Hydroscreen™
  - NetTech™
  - Ocean-Pro™
  - Plastic Solutions™
  - Ski-Jump Trap®\
  - StormFlo™
  - StormScreen™
  - Surf Gate™
  - TrashTrap™
  - TrashTrooper™
  - Other
- Other?

        - Product Names
            - Baysaver
            - Crystal Stream
            - Stormceptor
            - Stormsep
            - Other

    - Categories of Information for Each BMP
        - Description
        - Purpose
        - Stormwater Functions (volume reduction, peak flow control, etc.)
        - Water Quality Functions and Treatment Processes Used (pollutant removal efficiencies/effectiveness)
        - *Manufactured BMP certification status*
        - Applications (conditions where practice applies)
        - Planning Considerations
            - Include what not to do (examples of design mistakes, lessons learned, etc.)
        - Variations
        - Design Checklist
        - Design Considerations and Criteria
            - Standards
            - Graphics
            - Details
        - Construction Specifications and Sequencing
        - Inspection Issues and Procedures
        - Construction Cost Data
        - Maintenance Cost Data
            - Routine Maintenance
            - Restoration/Repair to Proper Functioning Condition
        - References and Resources

- Construction Site Runoff (place-holder for the future)
- Four other MS4 Minimum control measure categories (place-holders for the future)
- Public Education and Outreach Programs
    - Public Involvement and Participation
    - Illicit Discharge Detection and Elimination
    - Pollution Prevention/Good Housekeeping for Municipal Operations
- Industrial (? – place-holder for the future?)

5. BMP Evaluation and Certification process

- Cooperative Agreements (TARP, NJCAT, etc.)
- Evaluation/Certification Criteria
    - Explanation of TARP protocol
    - Additional criteria/requirements imposed by Virginia to address regulatory requirements

- Categories/levels of certification
  - Level 1 ("pilot"?): new, not yet tested – very limited application for initial testing)
  - Level 2 ("conditional"?): broader application – more rigorous testing underway
  - Level 3 ("certified"?): certification of claims made for specific pollutant reduction efficiency (specific to stated conditions? – for example, 80% TSS removal, based on a stated particle size distribution characteristic of the tested site/runoff, etc.)
- Committee Evaluation Process
  - Ultimate certification status of each manufactured BMP would be included in the BMP's standards and specifications but could be accessed independently through a web link to that part of each BMPstandard

6. **Costs** (this information could be integrated into the BMP std/spec or Operation/Maintenance categories, rather than treated as a separate Gateway topic)
   - Design and Planning Costs
   - Installation/Construction Costs
   - Operation and Maintenance Costs

7. **Operation, Inspection and Maintenance**
   - Guidelines
   - Checklists
   - Contacts
   - Process guidance
   - Costs

8. **References and Tools**
   - BMP Performance Bond Calculator (from the Center for Watershed Protection)
   - Relevant journal articles, scientific papers, etc.
   - FAQs
   - Useful web links
   - Other?

POTENTIAL MAPPING RESOURCES (external links – Could be placed under references and tools)

- Karst topographic mapping (not available digitally, but can be obtained from the Dept. of Mines, Minerals and Energy – publication numbers 44, 83 and 167)
- NRCS soils mapper
- HUC code map (link to DCR website or other source, such as USGS, etc.)
- TDML impaired waters (303-d list – link to the DEQ website)
- TMDL Implementation plan affective stormwater planning (link to the DEQ website)
- Demonstration sites or great examples of various installed BMPs (this would be a map created for this web site – ideally, one that can be updated easily and digitially)
- FEMA flood plain maps (link to DCR website or FEMA website?)

- Other generally available info

POTENTIAL MISCELLANEOUS SITE ELEMENTS

- All content should be provided through a database
  - Should be able to sort info by subcategory or BMP type; for example:
    - Some users may prefer to sort information by maintenance requirements for all BMPs
    - Some may want to see all of the performance and operation categories for an individual BMP
  - Sections of content within the database could be linked to from various places within the web site
  - The Committee needs to decide whether we should do some research and specify what database software/format is used and specify in the subcontract that the web designer must be qualified and experienced to work with that database software; OR, alternatively, we could trust the judgment of the web designer to accomplish what we need using software familiar to the designer

- It should be easy to print and download content and images from the website
  - Should be able to perform "Print Preview" from every page
  - Should include a "Print Screen" (PRNT SCRN) function
  - If feasible, should include the ability to print to a .pdf file
  - The website should have tabs that format the pages or selected content to a "printer-friendly" format
  - Technical drawings and graphical details should, ideally, be in CADD format or, at least, in high-resolution .tif format so they can be downloaded and imported into site plans being created by design consultants

GENERAL WEBSITE DESIGN GUIDELINES (based on information from Virginia Tech's website design guidelines)

- Be sure the DCR logo is prominently displayed on the Home Page
- Use the vertical organizational style for web pages
- Use the fixed page style for web pages

(NOTE: Both of the above provide greater flexibility and allow for easier site expansion in the future)

- Use the Arial (sans serif) font for content text
- Use the Times New Roman (serif) font for headers
- For font sizing use relative units, such as percentages (%) or "ems", so that users can resize text, rather than pixels (px) or points (pt). For maximum compatibility with Internet Explorer, set the font size of the body element to 80% or 90%, and then adjust the size of the other elements using % or "ems."
- Use color coordination (text color and background colors) similar to that used for the DCR website
- Be sure content portals can be linked both vertically and horizontally (through the databse)

- Include functions for both a “site search” and an “external web search”
- Include a notice, when someone links to an external website that clearly states:
  - The user is leaving the Clearinghouse web site
  - The Clearinghouse Committee/Program does not warrant information on any other website
- Image compression:
  - All images for the web should be compressed to a resolution of 72 dots per inch (dpi) to speed download times (what about CADD files?)
  - JPEG compression should be used for photographs and continuous tone images. A compression rate of 40% - 60% (or 4 to 6) usually produces the best balance between file size and image quality
  - GIF compression should be used for diagrams and line art. Reducing the number of colors may help reduce file size
- Page dimensions:
  - A fixed width of no more than 760 pixels (px) is required to avoid horizontal scrolling with a screen resolution of 800x600. For maximum compatibility with Internet Explorer, create a print stylesheet with a fixed width of no more than 670px so content is not cut off during printing. Images wider than 670px should also be avoided.
- The website should support the following web browsers:
  - Windows
    - Internet Explorer 7.x
    - Internet Explorer 6.x
    - Netscape 7.x
    - Mozilla 1.x
    - Firefox 2.x ? (a Mozilla derivative)
    - Firefox 1.x ?
  - Mac OS
    - Mozilla 1.x
    - Netscape 7.x
    - Safari 1.x
  - Linux
    - Mozilla 1.x
- Markup and Validation:
  - Mark up web pages using valid, structural HTML or XHTML to the extent possible. Control presentation with Cascading Style Sheets (CSS) whenever possible. Layout tables should be avoided.
- Handicap Accessibility:
  - Web pages should be accessible to people with disabilities, making technology and design choices that are compatible with the way people with disabilities access information on the web.
  - Refer to Virginia Tech’s “Web Accessibility Policy,” the *Guidelines and Techniques* of the “Web Accessibility Initiative” (WAI), and Section 508 of the Rehabilitation Act of 1973. Also refer to the “Virginia Information Technology Accessibility Standard” (ITRM Standard GOV103-00)

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Appendix B:

From *Science Daily*: **http://www.sciencedaily.com/releases/2007/08/070828110703.htm**

Water Pollution Can Be Reduced With New Storm Water Analysis System

Science Daily — Streams, lakes, and bays may soon be cleaner thanks to an innovative approach to managing stormwater runoff being developed at Virginia Tech and funded by the U.S. Environmental Protection Agency (EPA).

A novel software application will help engineers and planners select the most efficient and site specific methods -- called "Best Management Practices" (BMPs) -- of controlling the amount of pollutants that enter the receiving waters through stormwater runoff.

Pollutants are washed off the roads, parking lots, or other surfaces by stormwater, and include toxic motor oil, pesticides, metals, bacteria, and trash. The Congressional Research Service reported in 2007 that up to 50 percent of water pollution problems in the United States are attributed to stormwater runoff.

The application is the product of collaboration between faculty and researchers from Virginia Tech's Virginia Water Resources Research Center, the Center for Geospatial Information Technology in the College of Natural Resources, and the Via Department of Civil and Environmental Engineering in the College of Engineering.

The new BMPs selection approach, called Analytical Hierarchy Process (AHP), will factor in dozens of site-specific criteria such as soil types, land slopes, or maintenance accessibility before choosing the optimal BMPs for a particular location.

"This technique is expected to drastically reduce the BMP selection time and will also eliminate the human error from such a complex process," says project coordinator Tamim Younos, water center associate director and research professor of water resources in the Department of Geography in the College of Natural Resources. Other project leaders include Randy Dymond, CGIT co-director, and David Kibler, professor of civil and environmental engineering.

Traditionally, the selection of BMPs has been done only by proficient stormwater experts guided by little more than vaguely written regulations, experience, and intuition. "They rely heavily on past knowledge, tradition, or even personal preference for particular methods of controlling stormwater runoff," explains Kevin Young, research associate at CGIT.

Young adds that all too often personal bias has led to "cookie-cutter" solutions to very complex stormwater management needs, resulting in poor control of the pollutants.

A widely used, conventional BMP is to build detention ponds near commercial or residential areas, regardless of the actual construction site needs and conditions. "The stormwater is directed to a detention pond where gravity takes over, depositing sediment and some pollutants onto the bottom," says Younos. "Pond overflow that still may contain dissolved pollutants reaches streams, rivers, and lakes, and possibly groundwater."

Other types of BMPs are trenches and porous pavement that allow the stormwater to infiltrate the ground, vegetated wetlands, and sand filters that help sift the pollutants, or proprietary stormwater technologies such as hydrodynamic separators.

The new tool will be pilot-tested on Town of Blacksburg's storm water system and the local Stroubles Creek watershed. The AHP software will be used by the research team to select BMPs within the watershed contributing runoff to Stroubles Creek, the town's main receiving water body. Two existing computer models will then be used to simulate how efficient the selected BMPs are at removing the stormwater runoff pollutants.

"The best part about conducting a pilot test on Blacksburg is that the town will be able to implement our recommendations," says Younos. "We are very pleased by the town's enthusiasm and support for this project." Other stakeholders include the New River Planning District Commission, Virginia Department of Environmental Quality, and Virginia Department of Conservation and Recreation.

Young discussed the principles of this novel approach to managing stormwater runoff in his Master's thesis, under the guidance of the late professor G. V. Loganathan.

The software, expected to be available next year, will be free for use by all interested engineers and planners, localities, and BMP review authorities, and will be applicable in other states with geographic and climatic environments similar to Virginia.
Note: This story has been adapted from a news release issued by Virginia Tech.