



The Center for Transportation and the Environment
North Carolina State University

NATIONAL BROADCAST SERIES

Program No. TC-41:
The International Stormwater
BMP Database: A Resource
for BMP Selection and
Design Guidance

November 29, 2006
1:00 - 3:00 p.m., EST

Broadcast Live From
The NC Agency for Public Telecommunications
Raleigh, North Carolina

CTE is a USDOT university transportation center located at:

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International Stormwater BMP Database and Related Topics9

AGENDA

The International Stormwater BMP Database: A Resource for BMP Selection and Design Guidance

November 29, 2006 (1:00 - 3:00 p.m., EST)

| TIME | TOPICS | PRESENTERS | AUDIOVISUALS |
|-------------|--|--|--------------|
| 1:00 - 1:05 | CTE Welcome/Introduction of Moderator | Katie McDermott, CTE | |
| 1:05 - 1:10 | Program Overview & Introduction of Speakers | Jeff Moeller, P.E., WERF (moderator) | PowerPoint |
| 1:10 - 1:20 | BMP Database Background | Ben Urbonas, P.E., Urban Drainage and Flood Control District | PowerPoint |
| 1:20 - 1:30 | BMP Database Findings & Uses | Eric Strecker, P.E., GeoSyntec Consultants | PowerPoint |
| 1:30 - 1:40 | BMP Performance Monitoring & Available Guidance | Marcus Quigley, P.E. GeoSyntec Consultants | PowerPoint |
| 1:40 - 1:50 | DOT Case Study How is WashDOT involved in stormwater management and monitoring? How can other DOTs get involved with and benefit from the database? | Richard Tveten, Washington State DOT | PowerPoint |
| 1:50 - 2:00 | Panel Discussion: Potential Uses of Database By Public Agencies and Others | Entire Panel w/Audience | |
| 2:00 - 2:10 | Break! | | |
| 2:10 - 2:15 | Welcome Back, Recap of Hour One, Overview of Hour Two | Jeff Moeller, WERF (moderator) | |
| 2:15 - 2:25 | Public Agency Case Study How is UDFCD involved in stormwater management and monitoring? How can other municipal agencies get involved with and benefit from the database? | Ben Urbonas, P.E., Urban Drainage and Flood Control District | PowerPoint |
| 2:25 - 2:50 | Panel Discussion & Audience Q&A | Entire Panel w/Audience | |
| 2:50 - 2:55 | Program Summary, Closing Remarks | Jeff Moeller, WERF (moderator) | PowerPoint |
| 2:55 - 2:59 | CTE Wrap-Up & Closing Credits | Katie McDermott, CTE | |
| 3:00 | Program Adjourns | | |

You can continue the discussion from this program in CTE's "After The Program" discussion forum!
<http://cte.ncsu.edu/cte/techtransfer/teleconferences/forum.asp>

PANELIST PROFILES

Mr. Jeff Moeller, P.E. (Moderator)

Senior Program Director, Water Environment Research Foundation (Alexandria, VA)

Jeff Moeller is a senior program director at the Water Environment Research Foundation where he has worked since 1997. He directs the activities for two of WERF's research program areas: stormwater and decentralized systems. His responsibilities include managing research projects, formulating and implementing strategic research planning processes, and communicating research findings to the water quality community. Mr. Moeller has over 15 years of experience in environmental engineering, and previously worked as an engineer for Hazen and Sawyer designing water, stormwater, and wastewater systems. He has worked on water projects in the mid-Atlantic and southeastern U.S., as well as internationally for Inter-American Development Bank (IADB)-funded projects in Central America. He has extensive experience in hydraulics, hydrology, best management practices, and water quality modeling, and is a registered Professional Engineer in the states of Virginia and North Carolina. Mr. Moeller has a bachelor's degree in civil engineering from North Carolina State University, a master's degree in civil and environmental engineering from M.I.T., and a certificate of business administration from Georgetown University.

Mr. Ben Urbonas, P.E., D.WRE, M.ASCE

Urban Drainage and Flood Control District (Denver, CO)

Ben Urbonas is a civil engineer, licensed as a Professional Engineer in Colorado, with a career spanning 45 years. For the last 30 years he has worked at Urban Drainage and Flood Control District in Denver, Colorado, where he directed the development of over 130 major drainageway master plans, the District's technology activities, and the District's Master Planning Program. He also set up the original District's Maintenance Program and the South Platte River Program and directed the latter for 15 years. He served three terms as the chairman of the Urban Water Resources Research Council of the American Society of Civil Engineers and seven years as the vice-chair of the Colorado Water Quality Control Commission. Currently, Mr. Urbonas serves on the Water Environment Research Foundation's Research Council, as chair on two of its research Project Steering Committees, on the Board of Directors of the Cherry Creek Basin Water Quality Authority, and as president of the Urban Watersheds Research Institute. He is a Life Member of the American Society of Civil Engineers and Environment Water Resources Institute, and one of the inaugural diplomates of the American Academy of Water Resources Engineers. During his career, Mr. Urbonas co-authored two books, contributed to several others, including two ASCE/WEF Manuals of Practice, and published over 100 technical papers. In 2002, he was one of the three recipients of the ASCE State-of-the-Art Award for helping develop the International BMP Database. In 2004, he was awarded the Lifetime Achievement Award by the Urban Water Resources Research Council, and in 2006, he was one of three to be awarded the Lifetime Achievement Award by the Environment Water Resources Institute.

Mr. Eric Strecker, P.E.

GeoSyntec Consultants (Portland, OR)

Eric Strecker holds degrees in environmental engineering and fisheries science from Humboldt State University, and an M.S.E. in civil engineering from the University of Washington. Mr. Strecker is specialized in the area of stormwater management, especially in the design, monitoring, and evaluation of best management practices (BMPs) and in the development of integrated watershed management plans. For over 20 years, he has provided technical direction and assistance to public and private sector clients in surface water master planning, National Pollutant Discharge Elimination System (NPDES) permitting, and surface water pollution

assessment and control. On behalf of the U.S. Environmental Protection Agency (USEPA), Mr. Strecker conducted a comprehensive, nationwide study of BMP effectiveness, which included an assessment of the protocols used to evaluate BMPs. The results of the study noted that there exist wide discrepancies in methods for evaluating the effectiveness of BMPs and that BMP performance is best described via how much runoff is treated and what effluent quality is achieved. Mr. Strecker also managed the effort to develop a detailed BMP monitoring guidance document based upon the American Society of Civil Engineers (ASCE) BMP Database. Mr. Strecker was awarded the ASCE “2003 State-of-the-Art in Civil Engineering” Award for his contributions as a principal investigator to this project. He recently served as the principal investigator of a project for the Water Environment Research Foundation (WERF), titled Critical Assessment of Stormwater Treatment and Control Selection Issues, which resulted in guidance on the application of unit processes and scientifically based data in the selection and design of BMPs. Mr. Strecker completed a similar project for the National Cooperative Highway Research (NCHRP) program as a co-principal investigator, and has led related studies for the Federal Highway Administration. He has also completed projects with the Oregon, Washington, Idaho, and California state transportation departments and with New Zealand transportation agencies.

Mr. Marcus Quigley

GeoSyntec Consultants (Acton, MA)

Marcus Quigley is recognized as a national technical leader in stormwater design, modeling, data analysis, and field data acquisition and has extensive experience in the execution and management of major compliance auditing and litigation support projects. Mr. Quigley has co-authored a number of national guidance manuals for monitoring of stormwater runoff and evaluating and designing stormwater BMPs for clients such as the USEPA, the National Cooperative Highway Research Program, the Water Environment Research Foundation, and the Federal Highway Administration. In addition to his technical and managerial leadership of a wide range of public and private water resources projects, Mr. Quigley has given many invited talks, regularly speaks at technical conferences, and has authored numerous stormwater journal articles. He is currently a senior project engineer with Geosyntec Consultants out of the Boston, Massachusetts, office.

Mr. Richard Tveten

Water Quality Team Lead, Washington State Department of Transportation (Olympia, WA)

Richard Tveten is the water quality team lead for the Washington State Department of Transportation (WSDOT) and has ten years of experience in stormwater management. He currently manages his agency's stormwater activities relating to National Pollutant Discharge Elimination System (NPDES) monitoring, stormwater outfall retrofit, erosion control, and the National Environmental Policy Act. Prior to working at WSDOT, Richard worked as an environmental consultant developing polymer treatment methods for cleaning construction runoff and as a wetlands biologist. He earned a masters of science in ecology from Western Washington University in 1996.

ADDRESS INFORMATION

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QUESTION / COMMENT FAX SHEET

Phone: 1-888-228-6736 (Toll Free)

Fax: 1-919-715-3569

Or you can email your questions/comments to: cte_email@ncsu.edu (please type "TC-41" in subject header)

Please check whether this is a comment or a question for the panelist(s).

Comment

Question for: _____

Would you like to state your question or comment on the air? ___YES ___NO

(If "YES," please write your phone number below and CTE will attempt to include you in the broadcast.)

Provide the following information.

Name: _____ Title: _____

Agency: _____

Site (City/State): _____ Phone (Current Location): _____

Fax: _____ Email: _____

*Please write your question or comment in **bold, legible print** in the box below.*

Trouble Line for C-Band Sites:
(919) 850-4565 or (919) 850-4563
(Please reference "CTE Broadcast" for proper assistance.)

CTE BROADCAST EVALUATION

Please take a moment to complete this evaluation and return it to your downlink site coordinator. Your comments and suggestions are important to us. [NOTE: If you participated in this program *via the Internet*, please use the electronic evaluation form located on the CTE Web site at <http://www.itre.ncsu.edu/cte/TechTransfer/Teleconferences/evaluation.asp>] Thank you for your cooperation!

Downlink Site Location: (City) _____ (State) _____

Select the category which best describes your current place of work:

- a. Federal b. State c. Local/MPO d. University e. Private f. Other

Circle the letter(s) that apply and provide additional comments when possible.

1. Did the program content meet your expectations? (If you select C or D, please explain.)

- a. Excellent b. Good c. Fair d. Poor

2. Was the information presented well organized? (If you select C or D, please explain.)

- a. Excellent b. Good c. Fair d. Poor

3. The information I received from the teleconference will be:

- a. Extremely useful in my current job b. Somewhat useful c. Not useful at all

4. The best part(s) of this teleconference was:

- a. Panelist(s)' knowledge, experience, delivery
b. Printed materials and handouts
c. Visual aids
d. Interaction between panel and national audience
e. Use of real-world examples, case studies

5. The most needed improvement(s) to this teleconference are:

- a. Panelist(s)' knowledge, experience, delivery
b. Printed materials and handouts (Explain: _____)
c. Visual aids
d. Interaction between panel and national audience
e. Use of real-world examples, case studies

6. Was the downlink facility appropriate/comfortable for the teleconference?

- a. Excellent b. Good c. Fair d. Poor

7. What topics would you like to see developed for future teleconferences?

8. What overall suggestion(s) or comment(s) can you provide about this teleconference?

BIBLIOGRAPHY:
CTE National Broadcast (TC-41):
International Stormwater BMP Database:
A Resource for BMP Selection and Design Guidance

The following bibliography represents a sampling of the published literature and/or Web sites relating to the program topic. The bibliographic references and abstracts were identified through a keyword search of several online databases and through a survey of the panelists. We hope you find these resources helpful. Publication source and ordering information are provided where available.

International Stormwater BMP Database. Web site. An activity of the U.S. Environmental Protection Agency, American Society of Civil Engineers, Federal Highway Administration, and Water Environment Research Foundation, in cooperation with GeoSyntec Consultants and Wright Water Engineers, Inc. On this web site, you can obtain:

- Minimum protocols for submitting BMP monitoring studies for inclusion into the database
- Guidance for monitoring stormwater BMPs to meet these protocols
- Data entry software to store and report BMP monitoring study data
- Performance summaries for individual BMPs through the on-line searchable database containing roughly 200 BMPs
- Statistical summaries of the overall BMP database
- Statistical summaries of performance by BMP types (e.g., wet ponds)
- Technical reports describing the statistical techniques recommended for analyzing BMP performance and the results of performance evaluations
- Published papers from conference proceedings and journals on the BMP database

<http://www.bmpdatabase.org/>

International Stormwater BMP Database Document Library. Web site. This site provides downloadable documents produced by the International Stormwater BMP Database Project Team. Documents are divided into the following categories: database description, database background, and BMP performance measures. <http://www.bmpdatabase.org/docs.htm>

Documented Performance

Authors: Clary, Jane; Jones, Jonathan; Quigley, Marcus; Strecker, Eric

Journal Title: *CE News*

Publication Date: February 2006

Abstract: This article describes the International Stormwater Best Management Practices (BMP) Database, which has been created to help improve selection and design of stormwater best management practices. The project is supported by a coalition that includes the Federal Highway Administration, the Environmental Protection Agency, the American Public Works Association and the Environmental and Water Resources Institute of the American Society of Civil Engineers. As of January 2006, the project provided design, reporting and monitoring information on approximately 250 structural and non-structural BMP studies. The information is provided in an online, publicly-available database. In addition to developing the database, the project also seeks to determine appropriate methods for assessing BMP performance, and then to use the performance data to improve BMP selections and designs.

Alternative Practices for Highway Stormwater Management. Web broadcast series. Produced by the Izaak Walton League of America in cooperation with the Federal Highway Administration, U.S. Environmental Protection Agency, and Center for Transportation and the Environment. This four-part webcast series outlines the latest techniques available to help transportation agencies save money, comply with water quality and water supply regulations, and improve water quality with context-sensitive stormwater management practices, including low impact development techniques. These techniques also can help highway department personnel manage stormwater quantity and quality while using existing rights of way and providing easy access for maintenance crews.

<http://www.iwla.org/index.php?id=169>

BMP Retrofit Pilot Program: Final Report

Publication Date: 2003

Abstract: The objective of the Best Management Practice (BMP) retrofit pilot program was to acquire experience in designing, installing and operating a wide range of structural BMPs for treating stormwater runoff from existing California Dept. of Transportation (Caltrans) facilities. In addition, the project focused on evaluating the performance and costs of each of the tested technologies. The retrofit pilot program may possibly be the most comprehensive test of common stormwater management BMPs ever conducted, and the first significant evaluation in a climate similar to that of southern California. The program's findings provide a basis for developing a procedure for selecting the technically feasible BMP expected to provide the greatest and most consistent reduction of pollutants of interest in highway runoff.

Availability: Available from UC Berkeley Transportation Library through interlibrary loan or document delivery. Order Document: <http://www.lib.berkeley.edu/ITSL/services.html>

URL: <http://www.fmcsa.dot.gov/documents/hazmat/hazmat-es-finaldoc.pdf>

Cities Step Up Stormwater Control

Author: Stidger, R W

Journal Title: *Better Roads*

Publication Date: July 2005

Abstract: This article profiles stormwater management programs in Virginia, the District of Columbia, Texas, and Florida and the improvements made to the programs in response to federal and state environmental mandates. Specially adapted best management practices (BMPs) known as ultra-urban BMPs are non-conventional practices particularly suitable for urban areas. While standard BMP facilities use dry ponds, wet ponds, and infiltration devices, urban areas such as Alexandria, Virginia, where available land and alternatives are limited, make use of sand filter technology to treat urban runoff. The District of Columbia installed two underground vault sand filter systems, thus allowing full economic use of surface land areas. The City of Austin, Texas also uses a sand filtration BMP for stormwater quality management, but in addition, it requires new development and redevelopment to pay the costs caused by their impact. The article also discusses the extensive stormwater runoff program in Orlando, Florida, where a number of innovative treatment systems and retrofit methods have been implemented. These include the creation of stormwater wetlands for pretreatment of runoff, digressional landscaping to encourage runoff infiltration, exfiltration basin retrofits, storm drain retrofits, trash screens, and sediment control devices. In addition, the city established a stormwater utility to ensure a steady revenue source.

Availability: James Informational Media, Inc. Available from UC Berkeley Transportation Library through interlibrary loan or document delivery

Order Document: <http://www.lib.berkeley.edu/ITSL/services.html>

URL: <http://obr.gcnpublishing.com/articles/jul05d.htm>

Critical Assessment of Stormwater Control Selection Issues

Author: Eric Strecker, P.E., GeoSyntec Consultants

Abstract: Assists stormwater managers and their consultants in the selection and prioritization of stormwater controls (i.e., BMPs) to meet the goals of protecting local receiving waters and other objectives in the most cost effective manner possible. Published by the Water Environment Research Foundation.

WERF Stock No. 02SW1.

<http://www.werf.org>

Development of a Stormwater Best Management Practice Placement Strategy for the Virginia Department of Transportation

Authors: Yu, S L; Zhen, J X; Zhai, S Y

Publication Date: October 2003

Abstract: Since the implementation of the federal and state stormwater management regulations, the Virginia Department of Transportation (VDOT) has constructed hundreds of best management practices (BMPs) for controlling stormwater runoff from highways and its other facilities, such as maintenance headquarters, storage areas, etc. In recent years, the U.S. Environmental Protection Agency (USEPA) has promoted the watershed approach in controlling pollution from various sources in a watershed. One of the key elements of the watershed approach is to include the participation of all stakeholders in the planning and implementation of control measures. The USEPA expects stakeholders, such as regulators, pollutant dischargers, citizens, etc., to work together to develop the best strategy for pollution control with the entire

watershed as a planning unit. VDOT is such a stakeholder in many watersheds in Virginia. In the present study, a holistic methodology for determining the cost-effective placement and configuration of stormwater BMPs for VDOT was developed. The methodology involves the coupling of a comprehensive watershed simulation model with an optimization technique. Specifically, the methodology consists of three interacting functional components: a watershed simulation model, a BMP simulation module (the impoundment routine), and an optimization model. A highway application case study was conducted using the VDOT Rt. 288 Project in Chesterfield County, Virginia. The results showed that the current VDOT BMP placement approach, which consists of on-site treatment of stormwater runoff from highways, might not be cost-effective in terms of protecting the water quality at the watershed level. The results of the case study indicate that if VDOT were to work with other stakeholders in developing a BMP placement strategy for the entire watershed, greater cost-effectiveness would be achieved as a result of fewer BMPs being required for VDOT to construct than would otherwise be the case. The methodology developed in the present study can be modified and expanded into a decision support system, which can include more types of BMPs and which would allow more BMP placement scenarios.

Availability: National Technical Information Service

URL: http://www.virginiadot.org/vtrc/main/online_reports/pdf/04-cr9.pdf

Environmental Technology Verification Report of the Low-Cost Stormwater BMP Study

Author: Edwards, F

Publication Date: December 15, 2003

Abstract: This Technology Verification report describes the nature and scope of an environmental evaluation of catchbasin inserts manufactured by AbTech Industries, AquaShield, Inc., GeoMarine, Inc., and PacTec, Inc. The information contained in this report represents data that were collected in a laboratory study. The study was limited in scope and therefore the information contained within this report should be combined with other evaluations to understand the total capabilities of the inserts. The data as summarized within this Evaluation Report are being made available and distributed to federal, state, and local governmental regulators and to the stormwater treatment community. The goal of this report is to provide users and purchasers of the inserts with information they need to make more informed decisions about catchbasin inserts and their stormwater discharge.

Availability: National Technical Information Service

Enhancing Stormwater Management with Sediment Removal Boxes

Authors: Chavez, M F; Cunningham, J C

Journal Title: *Public Works*

Publication Date: January 2001

Abstract: This article describes Jacksonville, Florida's use of sediment removal boxes in their stormwater management approach. The device, which is also known as a baffle box, is used in situations where traditional best management practices (BMP) like sedimentation basins cannot be installed. Baffles boxes, which are also considered a BMP, are simple and cost-effective, reducing the amount of sediment passing through storm drains by 26 to 34 percent for fine sediment and 86 to 96 percent for coarse sediment.

Availability: Public Works Journal Corporation

Order Document: <http://www.lib.berkeley.edu/ITSL/services.html>

Erosion and Sediment Control Best Management Practices: Reference Manual

Authors: Stordahl, D M; Huffsmith, R L

Publication Date: February 2003

Abstract: The *Erosion and Sediment Control Construction Best Management Practices Manual* was developed to assist in the design, construction, and post-construction phases of Montana Department of Transportation projects. This manual provides background to State and Federal regulations associated with erosion and sediment control practices including a general overview of the erosion and sediment processes. Best management practices (BMPs) are listed within the manual based on application categories. Each BMP is described; its applications and limitations are listed, as well as its design criteria. The design phase includes development of construction plans, notice of intent (NOI), and Stormwater Pollution and Prevention Plan (SWPPP). Construction phase includes the finalization of the SWPPP, NOI, and implementation of BMPs. Post-construction phase includes monitoring, maintenance, and removal activities.

Availability: National Technical Information Service

URL: <http://www.mdt.state.mt.us/research/projects/env/erosion.shtml>

Guidance Manual for Monitoring Highway Runoff Water Quality (FHWA-EP-01-021)

Authors: Strecker, Eric; Mayo, Lynn; Quigley, Marcus; Howell, Jim

Publication Date: 2001

Abstract: This document provides guidance for selecting and using stormwater runoff monitoring equipment for monitoring of highway runoff. The guidance provided is intended to help achieve stormwater monitoring program goals through the collection of more useful and representative rainfall, flow, and water quality information. Ultimately, it is intended to improve monitoring information that will lead to better highway runoff management decision making.

Identification of Research Needs Related to Highway Runoff Management. Report No. 521 of the National Cooperative Highway Research Program. Transportation Research Board, National Academy of Sciences.

Authors: Venner, Marie; Leisenring, Mark; Pankani, Dan; Strecker, Eric

Publication Date: 2004

Abstract: This report presents an analysis of research needs in the area of highway water runoff management and control. Research directors and water-quality professionals from state departments of transportation (DOTs) participated in a survey to identify pressing needs related to the impacts and control of stormwater runoff. The survey results were supplemented with an extensive literature review and analysis by the research team.

http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_521.pdf

Impact of Alternative Storm Water Management Approaches on Highway Infrastructure: Guide for Selection of Best Management Practices - Volume 1

Authors: Arika, Caleb; Canelon, Dario J; Nieber, John L; Sykes, Robert D

Publication Date: February 2006

Abstract: Highway infrastructure represents a substantial portion of the total impervious areas that generate runoff water. Because of long winters in congested areas that require frequent applications of de-icing materials, much of the runoff has the potential for affecting downstream water quality. However, storm water management techniques themselves have the potential for compromising the integrity of adjacent highways when they result in significant increases of water content in the soil beneath the roadway. Because of impacts and the costs associated with construction and maintenance, any storm water management system needs to be assessed before any decisions are made regarding new highway development or redevelopment. The authors consider Best Management Practices (BMPs) as they relate to the most commonly used storm water management approaches including dry ponds, wet ponds, infiltration trenches, infiltration basins, constructed wetlands, grassed swales, bioretention cells, sand filters and porous pavements. They provide a framework for considering cost of practices, negative impact on infrastructure, results from a BMP-related survey of highway design and maintenance professionals and cost-estimation formulas for each of the most commonly used storm water management approaches in urban Minnesota.

Availability: National Technical Information Service

URL: <http://www.lrrb.org/PDF/200549A.pdf>

Impact of Alternative Storm Water Management Approaches on Highway Infrastructure: Project Task Reports - Volume 2

Authors: Arika, Caleb; Canelon, Dario; Nieber, John; Sykes, Robert

Publication Date: February 2006

Abstract: Highway infrastructure represents a substantial portion of the total impervious areas that generate runoff water. Because of long winters in congested areas that require frequent applications of de-icing materials, much of the runoff has the potential for affecting downstream water quality. However, storm water management techniques themselves have the potential for compromising the integrity of adjacent highways when they result in significant increases of water content in the soil beneath the roadway. Because of impacts and the costs associated with construction and maintenance, any storm water management system needs to be assessed before any decisions are made regarding new highway development or redevelopment. The authors consider Best Management Practices (BMPs) as they relate to the most commonly used storm water management approaches including dry ponds, wet ponds, infiltration trenches, infiltration basins, constructed wetlands, grassed swales, bioretention cells, sand filters and porous pavements. They provide a framework for considering cost of practices, negative impact on

infrastructure, results from a BMP-related survey of highway design and maintenance professionals and cost-estimation formulas for each of the most commonly used storm water management approaches in urban Minnesota.

Availability: National Technical Information Service

URL: <http://www.lrrb.org/PDF/200549B.pdf>

Industrial Water Pollution Controls: Effluent Guidelines for the Construction and Development Industry. Web site. An activity of the U.S. Environmental Protection Agency. On March 31, 2004, EPA's Administrator signed a Federal Register notice opting to rely on the range of existing programs, regulations and initiatives at the federal, state and local level for the control of stormwater runoff from construction sites rather than establish a new effluent guideline. This site provides details on the final action, agency contacts, and related links for more information.

<http://www.epa.gov/waterscience/guide/construction/>

Low Impact Development Methods for Stormwater Management. Research Notes. Washington State Department of Transportation. Office of Research and Library Services. October 2006. Conducted in cooperation with Washington State University, this research evaluated how stormwater naturally disperses and infiltrates by using rainfall/runoff data collected primarily in eastern Washington. This information was coupled with a numerical model. The study looked at the effects of slope, length, and amount of impervious coverage in the runoff area on natural dispersion applications. A simplified equation was established, termed the LID Design Equation, to analyze natural dispersion performance. The equation can be used with inputs from site specific conditions, allowing highway engineers to tailor natural dispersion requirements for various locations throughout eastern Washington.

<http://www.wsdot.wa.gov/NR/rdonlyres/BB661BEC-8727-4AFB-A97D-396CA944E7A5/0/StormwaterOctober06.pdf>

Mapping the Rainfall Event for Stormwater Quality Control

Author: Young, C Bryan

Publication Date: July 2006

Abstract: Stormwater runoff from transportation facilities and urban areas can contain significant concentrations of suspended solids, metals, and oil and grease. In some cases, best management practices (BMPs) are required for treatment of this contaminated runoff. Current Center for Watershed Protection (CWP) guidelines suggest that BMPs be designed to treat 90% of the annual runoff. A survey of state BMP design manuals shows that many states are adopting the 90% runoff guideline. The objective of this study was to determine the daily rainfall depth that should be used for sizing BMPs in Kansas. This report presents two methods for determining this rainfall depth: (a) the 90th percentile daily rainfall and (b) the 90% volume daily rainfall. Records for 623 raingages in and within 100 mi of Kansas were analyzed to determine the design rainfall event using these two methods. Results are presented as contour maps and maps showing the design depths for all Kansas counties.

Availability: National Technical Information Service

Managing Stormwater: Best Management Practices. Web site w/streaming video. An activity of the Perkiomen Watershed Conservancy, Schwenksville, PA, in cooperation with the GreenWorks.tv/ GreenTreks Network, Inc. Municipalities may be unfamiliar with stormwater best management practices, or BMPs. This series describes what BMPs are and where each is effective.

<http://www.greenworks.tv/stormwater/index.htm>

Measuring Pollutant Removal Efficiencies of Stormwater Treatment Units

Author: Zhang, Xiaoqi

Publication Date: September 27, 2005

Abstract: This study evaluated the bacteria removal efficiency, and bacteria distribution and survivability within a structural best management practice (BMP) called Vortechs System (manufactured by Stormwater 360, formerly Vortechtechnics, Inc.) installed at two different sites in Providence, Rhode Island. Twelve rain events with precipitations greater than 0.1 inch were sampled over a two year period. Five pathogenic indicator bacteria, E. coli, Enterococci, Fecal Streptococci, Total Coliform, Fecal Coliform, were analyzed. Based on the author's research, maintenance strategies such as more frequent sediment removal may be

necessary to prevent pathogen-rich washouts to receiving waters. Structural BMPs near busy streets and highways should be cleaned out more frequently.

Availability: National Technical Information Service

National Pollution Discharge Elimination System (NPDES) Stormwater Program. Web site. An activity of the U.S. Environmental Protection Agency. This page contains technical and regulatory information about the NPDES stormwater program. It is organized according to the three types of regulated stormwater discharges and provides a link to stormwater outreach materials. Information specific to the Phase I and Phase II stormwater regulations is also available.

http://cfpub.epa.gov/npdes/home.cfm?program_id=6

Optimal Location of Infiltration-Based Best Management Practices for Storm Water Management

Authors: Perez-Pedini, Cristina; Limbrunner, James F; Vogel, Richard M

Journal Title: *Journal of Water Resources Planning & Management*

Publication Date: November 2005

Abstract: A distributed hydrologic model of an urban watershed in the northeast United States was developed and combined with a genetic algorithm to determine the optimal location of infiltration-based best management practices (BMPs) for storm water management. The distributed, event-based hydrologic model integrates the curve number method with a distributed hydrologic network model of the catchment using a system of 4,533 hydrologic response units (HRUs). The infiltration-based BMP was conceptualized as an element that alters the infiltration/runoff partitioning of the HRUs in which it was applied. The results indicate that the optimal location and number of BMPs is a complex function of watershed network connectivity, flow travel time, land use, distance to channel, and contributing area, requiring an optimization approach of the type introduced here. A Pareto frontier describing the trade-off between the number of BMPs, representing project cost, and watershed flooding was developed.

Performance and Whole Life Costs of Best Management Practices and Sustainable Urban Drainage Systems

Author: Les K. Lampe, Ph.D., Black & Veatch

Abstract: Assesses the use and application of BMPs/SUDS for stormwater treatment and retention.

Provides information essential to make comparisons between various options for pollutant removal and to plan for the ongoing maintenance and end of life costs for BMP/SUDS. Published by the Water Environment Research Foundation. WERF Stock No. 01CTS21Ta. Phase 1 and 2 Report.

<http://www.werf.org>

Pollutant Loadings to Stormwater Runoff from Highways: The Impact of a Freeway Sweeping Program

Authors: Martinelli, T J; Waschbusch, R; Bannerman, R; Wisner, A

Publication Date: June 2002

Abstract: The Wisconsin Department of Transportation is required to control the quality of storm water runoff from the state highway system in response to the Environmental Protection Agency National Pollution Discharge Elimination System and the Wisconsin Department of Natural Resources regulations. A method to control roadway storm water runoff pollutants on urban freeways is by the use of street sweepers to remove pollutants before they enter storm water runoff and runoff control structures. This study evaluates the effectiveness of an improved highway sweeping program using a high efficiency sweeper as a best management practice (BMP) for reducing pollutants in urban highway storm water runoff.

URL: <http://www.dot.wisconsin.gov/library/research/docs/finalreports/45-82sweeping-f.pdf>

State Stormwater BMP Manuals. Web site. An activity of the U.S. Environmental Protection Agency. This site provides links to the BMP manuals available online from various states/localities around the country.

<http://yosemite.epa.gov/R10/WATER.NSF/0/17090627a929f2a488256bdc007d8dee?OpenDocument>

Stormwater BMP Recognition Program. Web site. An activity of Philadelphia Water Department, Office of Watersheds. The BMP Recognition Program recognizes innovative stormwater best management practices (BMPs) in the southeastern region of Pennsylvania (targeted counties are specified under Recognition Eligibility Criteria). The goals of the Stormwater BMP Recognition program are to recognize innovative

stormwater management BMPs in the region; to increase awareness and understanding of innovative stormwater management; to create incentives to continue the development of stormwater BMPs.

<http://www.stormwaterbmp.org/>

Stormwater GIS: Managing State-Wide Stormwater BMPs

Authors: Sanghavi, S; Mattejat, P

Journal Title: *Public Works*

Publication Date: July 2003

Abstract: This article describes different ways of managing statewide stormwater best management practices (BMP) facilities. The Maryland State Highway Administration is working to inventory and assess its existing facilities in order to protect the Chesapeake Bay watershed, which is heavily affected by runoff from the agency's more than 5,100 miles of roads. The BMPs are also critical for the state's permit for its storm sewer systems. The inventory and assessment permits the administration to prioritize and rank maintenance needs. With a consultant, it developed a comprehensive field maintenance manual and a relational database for storing the inspection results and spatially characterize the BMPs through GIS data. Then it and its consultant developed what is called BMPview in Visual Basic, allowing easy searching of the database. Among the many improvements are: standard data formats, instant preparation of work orders, summary or detailed reports instantly available, annual report support and progress tracking. Availability: Public Works Journal Corporation. Available from UC Berkeley Transportation Library through interlibrary loan or document delivery

Order Document: <http://www.lib.berkeley.edu/ITSL/services.html>

Stormwater Manager's Resource Center. Web site. An activity of the U.S. Environmental Protection Agency in cooperation with the Center for Watershed Protection. This site is designed specifically for stormwater practitioners, local government officials, and others that need technical assistance on stormwater management issues.

<http://www.stormwatercenter.net/>

Stormwater Manuals and Handbooks [Web site]

Publisher: California Department of Transportation

Publication Date: September 30, 2003

Abstract: Caltrans has a comprehensive program for preventing water pollution during construction activities on the state highway system. Caltrans has developed a number of resources to assist Caltrans staff and construction contractors achieve this goal. Caltrans water pollution control manuals provide direction on how to prepare a Storm Water Pollution Prevention Plan (SWPPP) and Water Pollution Control Program (WPCP). Caltrans has also developed and obtained the State Water Resources Control Board (SWRCB) approval of numerous Best Management Practices (BMP) for preventing water pollution. The Caltrans Division of Construction has gathered these materials and linked them from this page to assist the visitor. The page also has related links, including to the Storm Water Quality Handbook - Project Planning and Design Guide under the Division of Design and the Storm Water Program under the Division of Environmental Analysis.

URL: <http://www.dot.ca.gov/hq/construc/stormwater/manuals.htm>

Testing of Ultra-Urban Stormwater Best Management Practices

Authors: Yu, Shaw L; Stopinski, Monika D

Publication Date: January 2001

Abstract: Ultra-urban areas where conventional best management practices (BMPs) are neither feasible nor cost-effective present a challenge to stormwater management. Although new BMPs have been developed for such space-limited environments, the field performance of these technologies is still largely undocumented. This study monitored the field performance of four ultra-urban BMPs: three oil and grit separators [Isoilator, Stormceptor (Trademark), and Vortechs Stormwater Treatment System (Trademark)] and a bioretention area. Storm sampling data for each site were analyzed to calculate the removal efficiency for each constituent monitored. Because the Vortechs system was installed improperly, its removal efficiency results in this study are not reliable. Therefore, the system could not be fully evaluated. The results of the study are site specific. The performance of the BMPs was affected by varying factors. The study, thus, concludes that the data and study site conditions must be evaluated carefully before results

can be extrapolated to compare the relative and potential performance of a particular BMP under different site conditions.

Availability: National Technical Information Service

URL: Document: http://www.virginiadot.org/vtrc/main/online_reports/pdf/01-r7.pdf

Water Quality and Stormwater Management. Web site. An activity of the Federal Highway Administration. This site provide publications, guidance and information, Clean Water Action Plan, National Highway Runoff Water-Quality Data and Methodology Synthesis, training and education opportunities, and links to related sites.

<http://www.fhwa.dot.gov/environment/h2o.htm>

Water Quality – Stormwater Program. Web site. An activity of the Washington State Department of Transportation, Office of Environmental Services.

<http://www.wsdot.wa.gov/Environment/waterquality/>

2006 Stormwater Report

Author: Washington State Department of Transportation

Publication Date: September 2006

Abstract: This report documents the progress made by WSDOT to protect water quality within the NPDES permit areas between July 1, 2005, and June 30, 2006. Progress is described using performance measures designed to gauge compliance with Stormwater Management Plan commitments, permit conditions, and water quality standards. Major sections include a summary of stormwater priorities and spending, maintenance activities to protect water quality, construction site erosion control effectiveness, stormwater treatment facility effectiveness testing and research, and stormwater treatment facility construction. The greatest achievements in this reporting period include 1) completing the construction of the 759th stormwater treatment facility since the permits were issued and 2) greatly expanding the data set documenting the effectiveness of WSDOT's stormwater treatment facilities.

URL: Document: <http://www.wsdot.wa.gov/NR/rdonlyres/09450DED-E0BC-4568-BFF6-341BD96434C9/0/2006StormwaterReport.pdf>