



UPDATES

MAY 2009

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- Accurate sampling: implications for meeting TMDLS*

FIELD APPLICATIONS OF ENHANCED SAND FILTRATION

Contributed by Andy Erickson (eric0706@umn.edu)
**Funded by Local Road Research Board
 Ramsey-Washington Metro Watershed District**

Sand filtration enhanced with steel wool has been shown to effectively remove dissolved phosphorus from stormwater runoff in laboratory experiments (see “Enhanced Sand Filtration...” in *Journal of Environmental Engineering*, volume 133, issue 5, pg 485-497). Sand filtration captures particulate pollutants within the pore spaces in the sand media, but has no mechanism by which to capture dissolved pollutants. Dissolved phosphorus, however, adsorbs to the surface of iron oxide. Steel wool rusts to form iron oxide. The combination of sand filtration with steel wool (iron rust medium) is an effective method for treating stormwater runoff for particulate pollutants and dissolved phosphorus.

Several field applications of this innovative stormwater treatment device have been installed. One such application, the Lakemont treatment facility in King County, Washington is composed of two surface sand filters: the north filter (no steel wool) and south filter (steel wool mixed with sand). Phosphorus capture in the north and south filters was determined by monitoring to be approximately 3% and 43%, respectively. The results from column studies as part of the aforementioned laboratory experiments were similar: approximately 2% capture of dissolved phosphorus in columns with no steel wool, and 25-99% for columns with steel wool.

This technology has also been recently installed in Maplewood, MN (picture at left). An adapted design for this facility includes iron filings instead of steel wool to capture phosphorus. Iron filings might have a higher surface area as compared to steel wool and may result in a higher rate of phosphorus capture. Tests were conducted prior to installation to ensure adequate hydraulic conductivity, but phosphorus adsorption was not measured. Some of the iron filings will be tested at St. Anthony Falls Laboratory for phosphorus adsorption and the results will be compared to a model developed from the steel enhanced sand filtration experiments.



SAND FILTER ENHANCED WITH IRON FILINGS TO REMOVE DISSOLVED PHOSPHORUS FROM STORMWATER (MAPLEWOOD, MN).
 Figure courtesy A. Erickson

WELCOME

Thank you for reading our newsletter! Readers like you create opportunities for partnerships which are crucial to our quest for improving the methods for assessment and maintenance of stormwater BMPs.

This newsletter is an outreach effort of a project sponsored by the Minnesota Pollution Control Agency (MPCA) and in cooperation with other agencies and organizations. The project team developed the online manual "Assessment and Maintenance of Stormwater Best Management Practices" (<http://wrc.umn.edu/outreach/stormwater/bmpassessment>) and continues research to revise the manual with the most current information.

UPDATES is a quarterly newsletter designed to share news, current stormwater research efforts, and contact information related to the development of assessment methods and O&M education for stormwater best management practices. For information, contact Andy Erickson (eric0706@umn.edu).

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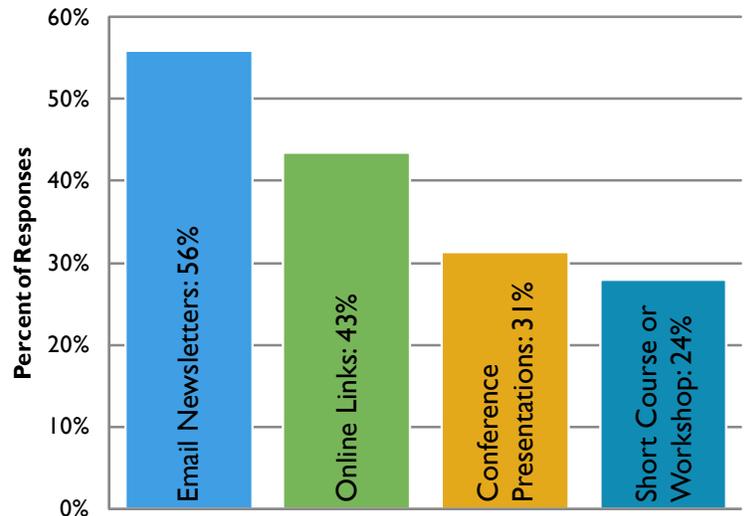
ONLINE SURVEY ON STORMWATER RESEARCH TOPICS

Contributed by Andy Erickson (eric0706@umn.edu)
Funded by Minnesota Pollution Control Agency

Recently the University of Minnesota conducted an online survey on stormwater research topics. The goals of the survey were 1) determine how interested individuals would like to hear about stormwater-related research, and 2) which future topics are most important.

The survey was active for one month (March 23rd to April 24th, 2009) and a link to the survey was sent to our Stormwater Assessment Listserv (approximately 1,700 subscribers), the MN Runoff Listserv (approximately 145 subscribers), and to contacts through the U.S. Environmental Protection Agency (approximately 350). These recipients were chosen because they are individuals and organizations interested in stormwater topics. It's uncertain if the link was forwarded to other individuals or organizations, but the survey received approximately 560 responses (approx. 25% response). Approximately 75% of survey responses that provided geographic information are from Minnesota. Approximately 24% of responses represent all ten United States Environmental Protection Agency (EPA) regions (including 33 states and Puerto Rico), and 1% of responses are from Canada (Ontario) and New Zealand.

Respondents were asked if they would like to receive more information on current research topics and how they would like to receive information. Most respondents wanted more information on "Operation and maintenance of stormwater BMPs" and "Infiltration Practices." More than half wanted information in the form of



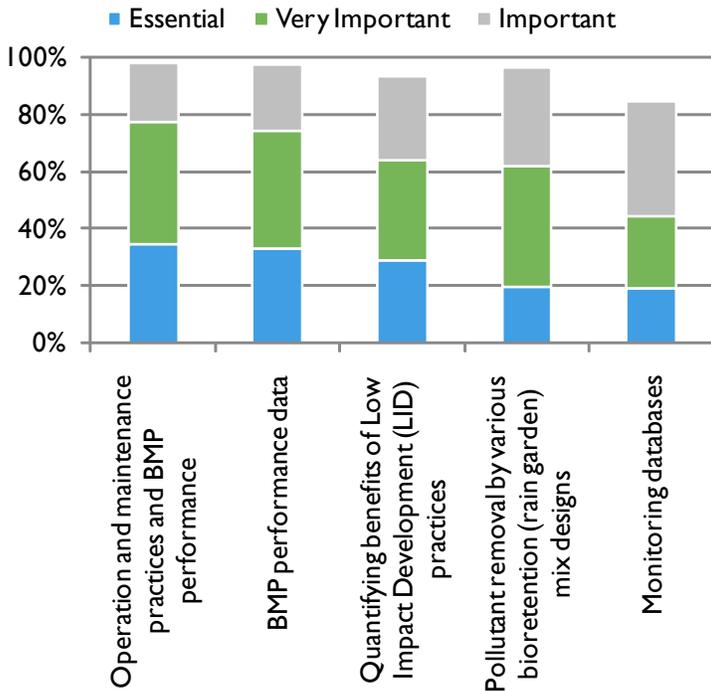
SURVEY RESPONSE FOR "HOW WOULD YOU LIKE TO RECEIVE INFORMATION?"

Figure courtesy A. Erickson

STORMWATER RESEARCH TOPICS SURVEY (CONT'D)

newsletters and over 40% preferred online links. Our primary method for communicating information is through this quarterly newsletter that includes several online links to projects, publications, and presentations.

Respondents were also asked to rate the importance of 29 possible research topics in ten categories. Regardless of how the data was analyzed, the top two most important research topics consistently were 'operation and maintenance practices and BMP performance' and 'BMP performance data.' The five research topics rated the most important are shown below.



MOST IMPORTANT RESEARCH TOPICS.
Figure courtesy A. Erickson

The Stormwater Assessment Project team is currently working on updates to the assessment manual (link in footer) which will address operation and maintenance practices and performance for stormwater BMPs. BMP performance has also been the topic of recent research. Members of the project team completed a comprehensive study of BMP cost and effectiveness in 2005 which was published in the ASCE Journal of Water Resources Planning and Management (Volume 133, Issue 3, pg. 218-229). The full report is available online at no cost: <http://www.cts.umn.edu/Publications/ResearchReports/reportdetail.html?id=1023>.

EVENTS CALENDAR

NOTE: All travel paid for by the University of Minnesota



STORMWATER U: POND MANAGEMENT WORKSHOP IN NORTH ST. PAUL, MN (JULY, 2008).
Photo courtesy J. Schilling

May 6: Stormwater U: Stormwater Pond Management: Pond Sediment Excavation (North St. Paul, MN)

- *Pond Mapping, Quantity, Particle & Chemical Analysis*
- *Field Exercise: Sediment Mapping, Quantities & Sampling*
- *Sediment: Testing Results, Permit, Guidance, & Disposal*
- *Contracting for Sediment Removal & Disposal*
- *Stormwater Wetland Management*

The cost is \$50, register online at www.extension.umn.edu/stormwater

May 17-21: World Environmental & Water Resources Congress (Kansas City, MO)

- *Accurate Sampling for Suspended Solids*
- *Assessing Hydrodynamic Separators under High Water Flow Conditions*
- *Assessment of Standard Sumps for Stormwater Treatment*
- *Laboratory Testing Guidelines for Certification of Manufactured Stormwater BMPs*
- *Maintenance of Stormwater BMPs*
- *Proposed Scaling Relations for Manufactured Stormwater BMPs*

August 16-20: StormCon (Anaheim, CA)

- *Stormwater Sediment Particle Size Distribution and the Impact on BMP Performance*
- *Accurate Sampling: Implications for Meeting TMDLs*

PETROLEUM HYDROCARBON DEGRADATION IN RAIN GARDENS

Contributed by Greg LeFevre (Contact: John Gulliver at gulli003@umn.edu or Ray Hozalski at hozal001@umn.edu)
Funded by National Science Foundation

Petroleum hydrocarbons are a known constituent of urban stormwater, but little research has been conducted regarding their fate in bioretention areas (raingardens). Leading hydrocarbon pollutant sources include leaking automobiles and leachates from asphalt sealants. Many of these pollutants are carcinogenic, harmful to aquatic life, and carefully regulated. Therefore, determining the efficacy of bioretention for the removal of petroleum hydrocarbons is vital to protecting the groundwater to which the infiltrate is directed.

Preliminary research indicates that petroleum hydrocarbons can be readily adsorbed to organic matter in bioretention media, and the majority is removed in the upper few centimeters. Little is known, however, about the ultimate fate of these contaminants; are they building up as residual hydrocarbons in raingardens and forming toxic “pollutant depots?” Because these pollutants are organic in nature, biodegradation is a possibility. To test this hypothesis, soil samples were collected from raingardens at 75 sites in the Twin Cities metro area. Extractions were performed for each soil sample, and extracts were run on a gas chromatograph with flame ionization detection using total petroleum hydrocarbons (TPH) as a standard (method detection limit: 0.15µg/L). Results indicated that TPH soil residual is very low (approximately 0.001 mg TPH / kg dry soil), and that there is little correlation to land use, loading factor (ratio of catchment area to infiltration area), or moisture content. Because the residual concentrations are lower than expected (based upon typical stormwater values) and values observed do not correlate to loading, it is suspected that biodegradation is an important removal mechanism.

To further examine the biodegradation capacity, bacterial DNA was extracted from the same raingarden field soil samples. Currently, methods from molecular biology are being adapted and optimized prior to final analysis to enumerate enzymatic genes required to break down petroleum hydrocarbons. This will help establish if raingardens with higher loading factors respond with higher degrader bacteria populations. Further work on the fate of petroleum hydrocarbons will involve radio-labelled tracers in controlled laboratory columns to determine ultimate fates such as mineralization, volatilization, sorption, etc.



RAIN GARDEN IN COTTAGE GROVE, MN (2008).

Photo courtesy G. LeFevre

PUBLICATIONS

1. Wilson, M. A., Mohseni, O. M., Gulliver, J. S., Hozalski, R. M., and Stefan, H. G. (2009). “Assessment of Hydrodynamic Separators for Storm-Water Treatment.” *ASCE Journal of Hydraulic Engineering*, 135(5), 383-392.
2. Hettler, E., Gulliver, J.S., Erickson, A., and Weiss, P.T. (2009). “Stormwater Sediment Particle Size Distribution and the Impact on BMP Performance.” *Proceedings of the 8th Annual StormCon*. August 16-19, Anaheim, CA.
3. DeGroot, G., Gulliver, J.S. (2009). “Accurate Sampling: Implications for Meeting TMDLs.” *Proceedings of the 8th Annual StormCon*. August 16-19, Anaheim, CA.