From Shore to Shore

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What is an MS4 (Municipal Separate Storm Sewer System)?

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Water is a limited natural resource, and only 3% of all Earth's water is in the form of fresh water. Of that small amount, 99.7% of it is locked into glaciers and groundwater, leaving only 0.3% available as surface water. (View a graphic of this here: http://ga.water.usgs.gov/edu/2010/gallery/global-water-volume.html). The quality of this valuable natural resource is under stress from stormwater runoff, agriculture, and climate change.

Many communities own and operate an infrastructure of storm drains, pipes, ditches and ponds to capture, collect and convey rainwater runoff (a.k.a. stormwater) downstream. These Municipal Separate Storm Sewer Systems, or MS4s, are separated from sanitary sewer systems (i.e., where our household drains go). The benefit of separating stormwater from the sanitary sewer system is that it prevents overloading of wastewater treatment facilities. On the other hand, the stormwater carried by the MS4 is not treated before it is released to water bodies downstream; it would be expensive to treat stormwater like we treat wastewater. The *Minnesota Water Sustainability Framework* (http://wrc.umn.edu/watersustainabilityframework/index.htm) and the *National Water Quality Inventory-2004 Report to Congress* (http://water.epa.gov/lawsregs/guidance/cwa/305b/index.cfm) concluded that stormwater runoff is one of the leading sources of pollution for our water resources. MS4 operators in urban areas are required to obtain a stormwater discharge permit by developing and implementing a local stormwater management program. The purpose of these programs is to prevent and minimize pollutants such as excessive nutrients or harmful heavy metals from getting into their MS4 and being transported downstream. MS4 operators have found that the stormwater programs that mimic natural hydrology as much as possible are effective in reducing stormwater discharge and lowering pollutant loadings.

Each MS4 stormwater program has specific control measures and practices for reducing and managing excessive runoff. Over the past three decades, water resources professionals have developed various control measures and practices including educating the public to prevent the dumping of waste directly into storm sewer systems. Another popular innovation has been to construct raingarden basins to capture rain water so it can soak into the ground. The University of Minnesota continues to be a national leader and information resource for stormwater research. Visit http://stormwater.safl.umn.edu/ for the latest research, resources and educational programs about stormwater management. ■

Calendar of Events

A Salute to Lake Superior's Sustainable Fisheries
Date: November 13, 2012
Location: McNamara Alumni Center - Minneapolis Campus
Website: www.seagrant.umn.edu

NEW Watershed Game release and Metro NEMO Program Scoping Session
Date: November 27, 2012
Location: MWMO Headquarters – Minneapolis
Website: www.northlandnemo.org

MIDS Community Assistance Package and Model Ordinances – A NEMO workshop for implementation in St. Croix Pilot Communities
Date/Location: 12/5 - Cite of Lindstrom;
12/6 - Chisago City;
12/17 - Center City;
1/22 - City of East Bethel
Website: www.northlandnemo.org

Introduction to Stormwater BMPs – A Stormwater U workshop for water resource professionals
Date: December 13, 2012
Location: Hugo, MN
Website: www.extension.umn.edu/stormwater

Inside...

Area Growers Launch Nutrient Management Program: Results Indicate Reduction of Fertilizer Rates and Phosphorus Runoff

Reprinted with permission from the Clearwater River Watershed District, www.crwd.org

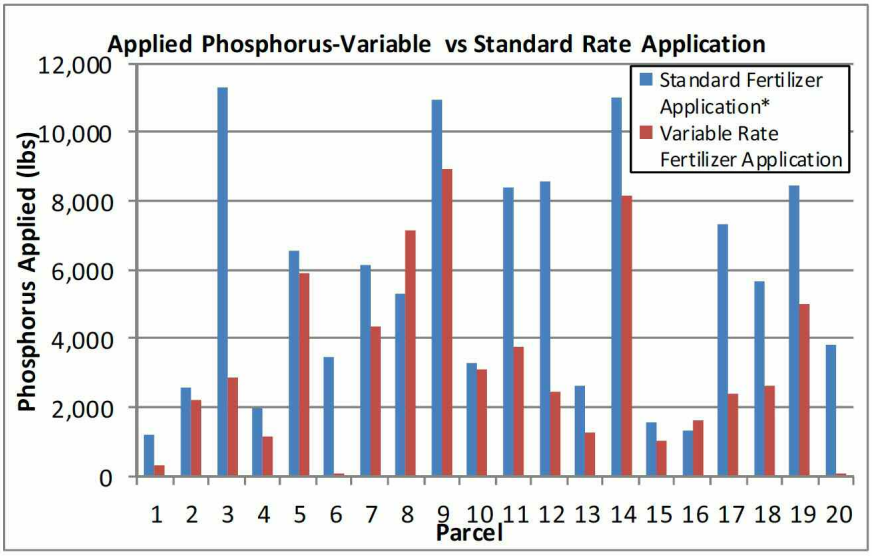
Overview In 2010 the Clearwater River Watershed District (CRWD), in cooperation with the Litchfield Cenex Consumers Co-Op and other partners, began a program to demonstrate the feasibility and utility of systematic soil testing in reducing fertilizer application and thus phosphorus load in agricultural runoff.

Soil fertilizers are used throughout the watershed and usually are applied at a standard rate, even though soil nutrient levels, soil type, and pH may vary significantly across a parcel. Soil was tested on a grid in each of 20 parcels to determine the proper amount of fertilizer to be applied to each section of the parcels. The applicators used the results of the soil tests and GPS technology to apply the precise amount of fertilizer needed in each grid section.

Agricultural runoff is a significant source of nutrients to the Clearwater River and impaired lakes in the watershed. Nutrient Total Maximum Daily Loads (TMDLs) completed for 11 impaired lakes in the Clearwater River Watershed District (CRWD) identified the need to reduce phosphorus load from agricultural sources by 80% to meet state standards.

Goals The goal of this program is a 10% reduction in fertilizer application rates on selected priority cropland in the portion of the watershed tributary to Clear Lake and Lake Betsy. This reduction in fertilizer application rate will result in a significant reduction of the annual phosphorus load to Clear Lake, Lake Betsy, and downstream water bodies. It is estimated that the program could potentially translate into a 10%-50% reduction in phosphorus runoff from the watershed.

Evaluation To evaluate the effectiveness of this program, the CRWD plans to conduct monitoring at drain tile outlets in fields participating in the program as well as at drain tile outlets in fields receiving fertilizer at standard application rates. The data will be analyzed to determine the connection between fertilizer application, soil phosphorus concentration, field sensitivity, and runoff concentration.



Process:

Property Selection The CRWD identified priority croplands within the watershed based on their proximity to water bodies, slope and soil type. Litchfield Cenex Co-Op then invited landowners in these areas to participate in the program and evaluated and selected fields for the study.

Soil Testing Soil sampling grids were set up based on field size. Fields larger than 20 acres were sampled on a 2.2 acre grid while fields smaller than 20 acres were sampled every 2 acres or in at least 10 locations.

A soil sample was collected at each point on the sampling grid, and samples were analyzed for phosphorus, potassium, zinc, sulfur, pH, and organic matter.

Fertilizer Application Based on the results of the soil tests at each point, an application rate was determined for each type of fertilizer to be applied. GPS technology was used by the fertilizer applicator to determine the correct rate at which to apply fertilizer in each grid in the crop field.

Phosphorus and Agricultural Runoff:

Phosphorus enters lakes and streams either as soluble (dissolved) phosphorus or in particulate form attached to soil particles in runoff.

The ideal range of phosphorus for crop uptake in agricultural fields is 25-30 ppm. Past soil tests have shown that phosphorus concentrations in the watershed often are in the range of 35-45 ppm and may be as high as 100 ppm in over-fertilized soils.

Once soil phosphorus levels exceed concentrations needed for crop uptake, additional applications of fertilizer will not provide any benefit to the crops and will increase the potential for phosphorus runoff.

What Does it Mean?

Analysis of 2010 results indicates that the use of soil testing and variable-rate fertilizer application reduced application rates and costs and results in less excess phosphorus available for runoff.

The application of this program on 1,427 acres in the watershed tributary to Lake Betsy resulted in a reduction of approximately 50,000 pounds of excess phosphorus fertilizer. If applied over the approximately 21,000 acres of land in row crop production in the entire watershed to Lake Betsy, the use of variable-rate fertilizer application potentially could reduce the amount of phosphorus fertilizer applied in the watershed by approximately 700,000 pounds. ■

Shoreline Erosion Control: A Missing Link

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For the past 20 years, a growing emphasis has been placed on providing environmentally friendly and effective erosion control for shorelines. "Soft armor," "soil bioengineering" and "shoreline restoration" have become part of practitioners' vocabulary. These terms refer to the process of establishing a plant community that will resist erosion – the preferred option to hard armor (e.g., rock riprap, etc.) when site conditions will allow it.

Numerous resources for shoreline erosion control have been developed. Shoreline soil bioengineering methods and installation protocols are found in the USDA Natural Resources Conservation Service Engineering Field Handbook (1992, 1996) and *A Soil Bioengineering Guide for Streambank and Lakshore Stabilization* (Eubanks 2002), as well as local adaptations of this material. Wisconsin DNR created an online Erosion Energy Calculator and Erosion Intensity Worksheet to help determine whether biological shore protection (live plants), vegetated armor, rock riprap or seawall is appropriate for properties experiencing shoreline erosion.

However, there is very little guidance on how to link these two types of resources (i.e., what specific combination of erosion control methods and products to use on a site with a given combination of site conditions) and what specific plants are needed to get the job done in our area – referred to as "workhorse species."

Available online by early 2013, a new resource – *The Shoreline Erosion Control Decision Tool* – will provide the missing link. This online tool was designed with input from an expert panel of experienced and innovative natural resource professionals, nursery and landscape professionals, consultants and contractors in Minnesota for their use while working with clients on-site, as well as a reference while designing

projects or responding to erosion control inquiries at their offices. This tool may be useful to other audiences as well.

This decision tool requires users to enter information about four distinct areas of their shoreline: offshore, nearshore, erosion toe, and upland/wetland. Data entries involve such parameters as fetch, frequency of ice damage, water level fluctuation and type of erosion present. When entries are complete, the user is presented with a summary of their entries, a visual cross-section of their shoreline, a list of general erosion control practices or combinations of practices to consider for each of the four zones. These general headings are color-coded according to their effectiveness and appropriateness for the particular set of shoreline parameters: *green* for effective and appropriate, *yellow* for use care/caution with this practice (limited or inconsistent data for these conditions), *red* for ineffective, and *orange* for inappropriate (i.e., more environmentally friendly and effective options are available). Clicking on a heading produces a drop-down box of more specific erosion control practices - also similarly color-coded. If the user wishes to find out more about this specific practice, clicking on it produces a printable information page. Most of these information pages are adapted from the NRCS Engineering Field Handbook with input from the Minnesota expert panel. They include a materials list, instructions for installation, a shoreline cross-section depicting the installed practice, appropriate plant species for Minnesota, and before/after installation images of a shoreline.

The erosion control recommendations are based upon a combination of existing references, data collected from existing erosion control projects and input from the Minnesota expert panel. These recommendations will be updated on the web decision tool as users provide constructive suggestions, additional data are collected, and new methods/materials are developed and tested.

Look for the decision tool web link in the next *From Shore to Shore* newsletter!

Funding for the research and development of The Shoreline Erosion Control Decision Tool was provided by a Minnesota Pollution Control Agency 319 grant. Numerous individuals from institutions, agencies, organizations and private businesses in Minnesota, Michigan and Wisconsin were instrumental in conducting the research for and development of this decision tool.

References:

Eubanks, C, et al. 2002. *A Soil Bioengineering Guide for Streambank and Lakshore Stabilization.* USDA Forest Service Volume 683. 187 pp.

United States Department of Agriculture - Natural Resources Conservation Service. 1992. Chapter 18: Soil Bioengineering for Upland Slope Protection and Erosion Reduction in *Engineering Field Handbook;* Part 650.

United States Department of Agriculture - Natural Resources Conservation Service. 1996. Chapter 16: Streambank and Shoreline Protection in Erosion Reduction in *Engineering Field Handbook;* Part 650.

Wisconsin Department of Natural Resources: Erosion Energy Calculator. http://dnr.wi.gov/topic/waterways/shoreline/erosioncalculator.html

Wisconsin Department of Natural Resources: Erosion Intensity Worksheet. http://dnr.wi.gov/topic/waterways/factsheets/Erosion_Intensity_Worksheet.pdf ■

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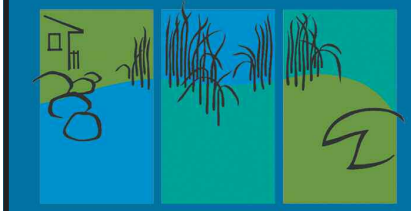

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Sea Grant Minnesota

University of Minnesota Extension

Green Infrastructure for Clean Water - The Essential Role of Soil

By John Bilotta, University of Minnesota Extension, (651) 480-7708, bilot002@umn.edu

Soil is our foundation and an essential component of green infrastructure in stormwater management. Soil provides structure beneath our feet, stores nutrients for plant growth, filters contaminants from runoff and regulates the movement of water. Green infrastructure refers to use of plants and natural systems in our built communities to help manage and treat stormwater runoff.

In September, more than 225 water resource professionals, soil scientists, urban planners, landscape architects, and others joined together in an all-day Summit addressing the concept of "living" soil, how it functions and the connection between healthy soil and clean water in our communities. Featured presentations included practices and policies related to soil and landscapes that can protect soil systems, rejuvenate disturbed ground, and effectively manage stormwater.

Photo courtesy of J.Bilotta, U of MN Extension. 2012 Clean Water Summit

Here are some soil concepts discussed at the Summit worth keeping in mind:

- Soil is a complex living system that sustains many forms of life on Earth.
- Soil is a medium for plant growth, but has many more functions.
- Soil stores and cycles nutrients.

Soil profile of the Lester series soil. Source MAPSS. Photo courtesy of the Minnesota Landscape Arboretum. 2012 Clean Water Summit

- Soil regulates water movement.
- Soil filters, buffers, degrades, immobilizes, and detoxifies pollutants.
- Soil provides support for structures.
- Urban agriculture can play a role in providing food, improving human health, bolstering the local economy, training youth, and connecting people to the land. A cornerstone of urban agriculture is healthy soil.
- Proper management is essential for maintaining a vibrant and functional soil.

More information and presentations from the Summit are available online at www.arboretum.umn.edu/2012greeninfrastructurecleanwater_essentialsoil.aspx.

Want to explore more soil concepts? Visit the "Dig It" exhibit at the Bell Museum of Natural History (www.bellmuseum.umn.edu) in Minneapolis November 8, 2012- July 31, 2013 in honor of the centennial celebration of the Department of Soil, Water, and Climate. ■