Title: Natural Vegetative Restoration to Reduce Stormwater Effects on Lakes and Watersheds

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Purpose: The purpose of this paper is to identify vegetative best management practices for enhancing stormwater quality and reducing stormwater quantity and other ill effects on lakes and watersheds. The paper will discuss the importance of native plant materials and their benefits as well as present in-situ options such as vegetative swales, wetland shelves, raingardens, vegetative forebays, and shoreline/riparian buffers. Qualitative information regarding the removal of total suspended solids, nitrates, and other pollutants will be discussed. Additional benefits such as aesthetics, habitat, and biological diversity will be discussed.

Format: Oral

Charles County Watershed Restoration

William Frost, PE, Senior Watershed Planner, KCI Technologies, Inc.
Michael Pieper, Senior Environmental Scientist, KCI Technologies, Inc.

Charles County, Maryland, was issued its second 5-year stormwater NPDES permit in July, 2002. One of the requirements in the permit is to use the data gathered as a result of prior NPDES activities to prioritize all watersheds within Charles County in the context of water quality and propose restoration measures to treat ten percent of the untreated impervious area. This work was completed by, using a GIS-based analysis of restoration needs for the County's watersheds.

Prioritization was determined utilizing a weighted model employing the raster data capabilities of ESRI'S Spatial Analyst extension to ArcView. This model was built using available GIS data from a variety of sources, including wetlands, forest cover, modeled pollutant loads, land use, imperviousness, and riparian zones.

A weighting factor was applied to each grid based upon how well it discriminated between areas of high and low quality. The weighted grids were then added together utilizing the raster utilities in Spatial Analyst to produce a composite raster representing areas of potential watershed impact. The result was a ranking of Charles County's watersheds showing which are in most need of restoration, and which have the highest priority for preservation.

Five of the highest priority areas were selected for further assessment and identification of restoration opportunities. In these areas stream monitoring was conducted, which included a visual and habitat assessment to identify locations of physical and water quality problems. A restoration survey was carried out in each of the selected watersheds to identify the main impairment in each area, identify constraints, and select potential improvements from a wide range of BMPs, including source controls, retrofits, new ponds or wetlands, onsite controls such as swales or bioretention, and stream restoration.

Preliminary cost estimates were prepared based on unit costs per surface area or volume for structural BMPs and length for stream restoration. Recommendations included:

- lawn care education
- pet waste disposal education
- rain barrels
- riparian easements
- pond retrofits
- new ponds and wetlands
- porous pavers
- dry swales
- stream restoration

The impact of monthly rainfall on the chemistry and biology of Hamilton County Park Lakes.

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Hamilton County Park District has been maintaining rain gauges and routine monitoring of its lakes for physical/chemical parameters since 1981 on a monthly or weekly frequency. We propose the hypothesis that subsequent to major rain events the loading of phosphorus and nitrogen in these lakes should cause an algal response detected by increases in oxygen production (supersaturation), elevated pH from photosynthetic carbon uptake, and increased chlorophyll biomass. The data were examined at that scale for the period. Drought years included 1982, 1988, 1989, 1994, 1995, and 2000 with about 30"/year. Wet years included 1984, 1986, 1990, 1996, 2003. April, May and November were the wettest months over the period from 1982 to present. Statistically significant correlations of percent dissolved oxygen with rainfall were found for most stations in three lakes considered. The modal oxygen tensions were higher and supersaturated near the dam and lowest near the major inlet. These data confirm the dependence of primary production of oxygen on nutrient loading by rainfall events during the month of consideration. A more precise event-based response to rainfall was not possible with the data set; however, these data confirm a likelihood of higher primary production with nutrient loading.

2006 OHIO LAKE MANAGEMENT SOCIETY
"STOMWATER EFFECTS ON LAKE MANAGEMENT"
PROPOSAL ABSTRACT
Tuesday, March 21, 2006

PROPOSED TITLE Modeling the Effectiveness of "Green BMPs" in Stormwater Quantity and Quality

FORMAT OF SESSION
☐ _Oral presentation_____

LEARNING OBJECTIVES By the end of the session, attendees will be able to:
1) Understand the effectiveness of non-structural, "green" Best Management Practices on improving stormwater quality and moderating stormwater quantity on a site and a watershed basis.

2) Understand the land use, pollution loading, hydrologic, and infrastructure cost differences between conventional and conservation design on a residential, commercial, and industrial development site, and how the principles of conservation design may be incorporated into development plans and subdivision regulations.

3) Have information on how to have access to this highly educational stormwater model to use for themselves, colleagues, and clients.

BREIF SUMMARY OF THE PROPOSED SESSION

A computer animated, interactive model demonstrates the effectiveness of *Green* BMPs on the quality and quantity of stormwater runoff on site-specific and watershed levels and compares stormwater statistics when engineered, structural solutions and *Green* BMPs are used. The end product is a highly valuable educational

EXPANDED DESCRIPTION OF THE SESSION CONTENT

The Davey Resource Group and the Sanitation District No. 1 of Northern Kentucky jointly developed an educational tool to promote environmentally sensitive planning and to demonstrate how "green" best management practices (BMPs) can be incorporated into site design with the purpose of improving regional stormwater management.

The objective of this project was to develop a scientifically based model to predict the quality and quantity of stormwater runoff on residential, commercial, and industrial development sites. The model and computerized visualizations are used to demonstrate the effectiveness of "green" BMPs and appropriate land use planning on site-specific levels and a watershed level where urban growth is projected to occur.

This project produced a scientifically based, highly educational stormwater computer model. The interactive, user-friendly model and the graphic visualizations are available for users over the Internet and on CD-ROM. Instructions on how to use the model and links to technical fact sheets on various BMPs are included. This educational tool is appropriate for engineers and stormwater managers as well as urban foresters, government representatives, elected officials, planners, developers, and the public.

This project was partially funded by a grant from the U. S. Forest Services' National Urban and Community Forestry Advisory Council and has broad regional applicability.

AUDIO & VISUAL EQUIPMENT: Laptop with CD, and LCD projector.

SPEAKER INFORMATION:

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Linda Merchant-Masonbrink

Ohio EPA is re-developing its Inland Lakes Monitoring program. An organizational meeting will be held in March at the Ohio EPA Central Office to begin discussions on preparing an assessment methodology that will lay a foundation for how monitoring data will be assessed and related to other Ohio EPA programs including water quality standards, TMDLs, 303(d), and source water protection. This assessment methodology will be completed by December 31, 2006.

Ohio EPA's Robert Davic, PhD, Division of Surface Water, and Linda Merchant-Masonbrink of the Source Water Protection Program will give a short oral presentation on Ohio EPA's historical involvement in inland lake sampling and initial thoughts on how we may address inland lakes sampling in the future. We will welcome open and candid discussion about how Ohio EPA may be able to partner with OLMS in this endeavor.

Improving Water Quality through Homeowner Education: Retention Ponds in the City of Mason, OH.

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Well-managed stormwater retention ponds can be effective in collecting non-point source pollution from stormwater runoff and in providing flood control. However, some retention ponds cause homeowner complaints about fish kills and algal blooms. Problems associated with these ponds may be due to homeowner activities. Providing homeowners with a better understanding of the purpose of retention ponds, watershed dynamics, and homeowner impacts on these systems can significantly improve water quality.

Our hypotheses are that the fish kills and algal blooms are caused by excess nutrients, and nutrient loading can be controlled by homeowner activity. We monitored the water quality (pH, O_2, nitrates, phosphates) of three retention ponds located within two different watersheds and assessed homeowner habits concerning fertilizer application.

To ensure a minimum of pollutants enter residential retention ponds, homeowner habits need to be addressed. Research indicates that homeowners may not be aware of their impact on water quality of nearby retention ponds. The team will maintain or improve the water quality in retention ponds throughout Warren County, mainly by increasing homeowner awareness of the impacts of their activities.

This project will be presented in a poster only format

Community Resistance of Inland Lakes and the Distribution of an Exotic Cladoceran, *Daphnia lumholtzi*

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Format: Poster

There has been increased concern in recent decades regarding the growing rate of invasion of non-indigenous species to aquatic habitats and their potential to disrupt the integrity of freshwater systems. A recent invader to Ohio lakes is the cladoceran, *Daphnia lumholtzi* which was first reported within the state in 1993. Samples from the Ohio Environmental Protection Agency from the years 1991 to 1997 and contemporary samples taken during the summer of 2005 were used to investigate the current distribution and establishment of *D. lumholtzi* in Ohio lakes. The presence of *D. lumholtzi* was detected in 20 of the 72 public lakes surveyed. Many of the invaded localities exhibit heavy boating traffic or are downstream from invaded lakes, indicating that flowing water and human vectors are important means for dispersal of the species.

Many of the lakes surveyed have strong potential for invasion by *D. lumholtzi*, yet have been able to resist invasion thus far. The presence or absence of cladoceran species within the lakes was examined to investigate if interactions with native species may be responsible for controlling the establishment of *D. lumholtzi*. The organisms that exhibited the highest correlation with *D. lumholtzi* were *Daphnia longiremis, Daphnia parvula*, and *Ceriodaphnia* species. Low correlations were associated with *Bosmina longirostris* and *Diphanosoma birgei;* furthermore the populations of these species often exhibited decreasing trends following the arrival of *D. lumholtzi*. Whether this decline is due to the establishment of the exotic species or the result of natural cyclical abundances of zooplankton requires further investigation.

Interactions of Piedmont Lake and its Associated Watershed in Ohio

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Piedmont Lake of Ohio constructed in 1937 has a surface area of 9.32 km^2 (2,273 acres) with a maximum water depth of 9.1 m at conservative pool level, i.e., 278.3 m above the mean sea level. The corresponding watershed that supplies the lake is approximately 221.5 km^2. The reservoir was constructed for controlling floods, maintaining and enhancing the recreational opportunities, and improving the quality of life for residents and users of all the facilities. Over the years, sediment deposits have significantly affected flood control operations and the natural resource preservation including recreation, navigation, and water quality. This study introduced the use of geographical information systems for investigating sediments at Piedmont Lake and the soil erosion of the corresponding watershed.

The bathymetric data of Piedmont Lake were obtained from the surveyed results by the Ohio Department of Natural Resources in 1998. On the other hand, those of the original bathymetric surfaces in 1937 were digitized by using the existing map. The map subtraction of these two images using GIS was applied to estimate the amount of the sediment deposits over these years. It was found that the annual average amount of sediment deposits in the lake was about 6.26 x 10^5 m^3/yr or 3.18 x 10^7 kg/yr for the years investigated. The associated watershed area of the Piedmont Lake was divided into 25 x 25 m grids using GIS. The parameters of the Revised Universal Soil Loss Equation (RUSLE), including factors of rainfall-runoff erosivity, soil erodibility, slope length, slope steepness, cover-management, and support practice, were evaluated. The average annual soil loss carried by runoff was estimated using the RULSE to obtain the total amount of the soil loss for the watershed. It was estimated to be about 14.4 x 10^7 kg/yr. Compared with the annual average amount of sediments estimated in the lake, about 22.2% of the soils eroded from the watershed was deposited in the lake for the period studied. Furthermore, based on the estimation in the corresponding watershed, a cumulative histogram for the annual soil loss can be constructed. The result shows that the 50% value of the annual soil loss for the watershed is 0.11 kg/m^2/yr and 0.81 kg/m^2/yr for 99%.

Removal of Microcystin-LR from drinking water using ultrafiltration and activated carbon

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The presence of cyanobacteria (blue-green algae) and associated toxins in surface waters is of increasing concern. The most common cyanobacterial toxins are microcystins, of which microcystin-LR is the most toxic and most frequently occurring derivative. Ingestion of microcystins can lead to liver damage and initiate liver tumor-promoting activity. Due to adverse health effects, the World Health Organization (WHO) set a provisional concentration limit of 1 ppb for microcystin-LR in 1996. In this study, we investigate the removal of microcystin-LR from drinking water using a bench-scale PAC-UF system. We examine the effect of PAC type and dosage, membrane characteristics, and NOM on the removal of microcystin-LR by this process. Experimental results showed that wood-based carbon had four times higher adsorption capacity for microcystin than coconut-based carbon due to greater mesopore volume. Cellulose acetate (CA) membranes with a molecular weight cutoff (MWCO) of 20 KDa did not reject or adsorb microcystin, however, polyethersulfone (PES) membranes with similar pore size adsorbed microcystin, presumably through hydrophobic interactions. PES membranes with a MWCO of 5000 Da had an average rejection of 8.4% for microcystin compared to no rejection by the 20 KDa-PES membranes. The PAC-UF system with PES membranes was more effective at removing microcystin than the use of CA membrane due to the potential of sorption to PES membrane surface. The presence of fulvic acid reduced the removal of microcystin by a PAC-UF because of competitive adsorption between fulvic acid and microcystin.

Format: Oral Presentation for OLMS conference

Word Count: 238

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Todd Houser is the Storm Water Program Manager for the Cuyahoga Soil and Water Conservation District. He has a B.Sc. in Natural Resources and a M.Sc. in Soil Science from The Ohio State University. Todd is a Certified Professional Soil Scientist (CPSSc), Certified Professional in Erosion and Sediment Control (CPESC), and accredited by the Association of Ohio Pedologists (AOP) as a Certified Soil Scientist (CSSc).

Todd also serves as the Ward 1 Planning Commission representative for the City of Norton, Summit County, and assists with implementation of riparian and wetland setbacks as non-structural, community Best Management Practices (BMPs).

Abstract

A 1970 survey completed by the Northeast Ohio Regional Sewer District identified 147 flooding and severe streambank erosion problems. Their 1998 survey found that 59 of those problems still existed and also identified 246 additional problems. The Northeast Ohio Areawide Coordinating Agency projection through 2025 indicates continued urban sprawl and emphasizes that growth will occur in watersheds with some of the best water quality in the Northeast Ohio. Storm water is impairing streams and wetlands throughout Northeast Ohio now, and in spite of our efforts to manage storm water, problems continue to multiply. Continued development will increase the spread of problems unless change occurs in the way we manage storm water quantity and quality. In response, the Cuyahoga Soil and Water Conservation District is working to demystify the concept, need and application of post-construction water quality best management practices, riparian setbacks, and wetland setbacks.