Minnesota Landscape ARBORETUM

LAND CONSERVATION & CLEAN WATER SUMMIT

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POSTER SESSION ABSTRACTS

Abstract #1

Development of a macrophyte-based index of biotic integrity for Minnesota lakes

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Traditional approaches for managing aquatic resources have often failed to account for effects of anthropogenic disturbances on biota that are not directly reflected by chemical and physical proxies of environmental condition. The Index of Biotic Integrity (IBI) is a potentially effective health assessment method to integrate ecological, functional, and structural aspects of aquatic systems. A macrophyte-based IBI was developed for Minnesota lakes to assess the ability of aquatic plant communities to indicate environmental condition. The index was developed using quantitative point intercept vegetation surveys for 97 lakes representative of a range of limnological and watershed characteristics.

We followed an approach similar to that used in Wisconsin to develop the aquatic macrophyte community index (AMCI). Regional adaptation of the AMCI required the identification of species representative of macrophyte communities in Minnesota. Metrics and scaling methods were also substantially modified to produce a more empirically robust index. Regression analyses indicated that IBI scores reflected statewide differences in lake trophic state, agricultural, urban, and forested land uses, and county population density.

Further work to improve discriminatory ability of the index should consider metric normalization to account for natural variability such as maximum lake depth or alkalinity. Our analysis shows that a macrophyte IBI calibrated for Minnesota lakes could be useful for identifying differences in environmental condition attributed to anthropogenic disturbance gradients.

Abstract #2

Development of a Green Build-Out Model to Quantify Stormwater Benefits of Green Infrastructure

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The Casey Trees Endowment Fund and LimnoTech received a grant from the EPA Office of Wastewater Management to build a modeling tool to quantify the cumulative contribution that green infrastructure makes toward reducing stormwater runoff and combined sewer overflow events in Washington, D.C. LimnoTech developed a *Green Build-out Model* to calculate potential reductions in stormwater runoff, wet weather discharge volumes and discharge frequencies associated with the application of green stormwater infrastructure practices across the District of Columbia. Green infrastructure practices offer alternatives to traditional wet weather controls in urban areas where land is limited and traditional sewer infrastructure is unable to provide adequate storage and treatment capacity.

The first phase of the project quantified the stormwater management benefits of trees and green roofs, and received a 2007 Honor Award from the American Society of Landscape Architects. The second phase of the project entailed performing similar modeling analyses for a suite of additional green infrastructure technologies and practices including permeable pavement, two types of streetside bioretention, rain barrels, and downspout disconnection to rain gardens. Both phases involved detailed analysis of GIS land cover data, development of model scenarios and assumptions, integration of green infrastructure practices and associated hydrologic processes into the model framework, running model scenarios, and post-processing the model results.

The preliminary findings demonstrated the efficacy of green infrastructure practices applied on a city-wide scale, and showed the value of including green infrastructure in the City's long-term water management plans.

Abstract #3

Arlington Pascal Stormwater BMP Performance and Cost Effectiveness

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During 2005 – 2007 the Capitol Region Watershed District (CRWD) constructed BMPs for the Arlington Pascal Stormwater Improvement Project to alleviate flooding and reduce nutrients and sediment reaching Como Lake, which is impaired. The BMPs included a 2 ac-ft underground infiltration facility, eight infiltration trenches constructed beneath city streets, seven raingardens within road right-of-way and a rain garden and regional pond within Como Park.

In 2007 and 2008, the CRWD monitored BMPs for pollutant removal effectiveness through empirical and measured data. In addition to documenting pollutant removal effectiveness, CRWD also documented all design and construction costs and full maintenance costs for each year(s) studied.

Results of the pollutant removal effectiveness will be presented. In addition, comprehensive construction costs as well maintenance practices and costs will also be discussed. Analyzing life cycle costs of Stormwater BMPs along with pollutant removal effectiveness has provided a good method to develop a cost per pound of pollutant removal comparison.

Abstract #4

Crystal Loon Mills CWP project

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The Crystal Loon Mills Clean Water Partnership (CWP) is a locally managed project that addresses water quality issues in three Southern Minnesota lakes: Crystal, Loon, and Mills Lakes. Priority issues include reducing phosphorus, decreasing harmful algal bloom intensity and frequency, and educating citizens on lake related environmental concerns. The diverse watershed includes rural and agricultural land, lakeshore property, and urban areas. Complex interactions between stakeholder groups and conflicting interests among the groups have required a multi-pronged approach to education and implementation.

Water quality improvement efforts have focused on value-added and economically sound best practices. The CWP has been most successful in promoting urban practices such as raingardens and rain barrels, and agricultural practices such as alternative tile intakes, grid soil sampling, and nutrient management. Through its partnerships with the Blue Earth County Soil and Water Conservation District and the Water Resources Center at Minnesota State University-Mankato, the CWP will have access to comparative monitoring data on two tile outlets, one surface inlet and one rock-tile inlet.

This poster will share our experiences with a water quality implementation project on typical Western Corn Belt Plains multi-use lakes and showcase some of the challenges and opportunities for other potential projects in the region.

Abstract #5

Conservation Marketplace of Minnesota: Establishing an Ecosystem Service Market to Support Conservation Efforts

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Conservation Marketplace of Minnesota is creating three ecosystem service markets in Minnesota. Each of the three project areas will establish local, self-sustaining infrastructure and support systems that will encourage agricultural participation in ecosystem service production. We are pursuing multiple ecosystem market opportunities, such as credit trading for water quality, carbon sequestration, habitat, source water protection, and production of renewable biomass fuels. To increase the sustainability of Best Management Practices, the project is stacking appropriate credit payments from ecosystem service buyers. This means that a single BMP, such as buffer strips, will receive credits for each of the services it provides—water quality, carbon sequestration, habitat, etc. Stacking credit payments creates a cost- effective method for promoting and sustaining desired land uses.

The Greater Blue Earth River, Lower and Middle Minnesota River, and Sauk River watersheds have been selected for their diversity in land use, geomorphology, political settings, and market interests. These watersheds are creating independent frameworks that will provide local experts with the tools and ability to connect credit generators to multiple buyers. The CMM framework will provide the necessary site assessments, credit valuation, record-keeping, and reporting for buyers and sellers. These locally developed market structures will eventually be available to be shared with watersheds throughout the Upper Mississippi River Watershed. Approved credit transactions will begin in 2010. Future improvements to the structure will be supported through 2011 with grant funds while we approach the goal of becoming a fully self-sustaining program.

Abstract #6

Forests, Water and People: Drinking water supply and forest lands in the Northeast and Midwest United States

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The Forests, Water and People analysis uses maps produced in a geographic information system (GIS) highlighting the connection between forests and the protection of surface drinking water quality. This connection of "forest to faucet" is of vital importance to people in the Northeast and Midwest. Forests are the crucial first barrier to protection of drinking water, and managing forests for source water protection is becoming more important as the population and water demand increase. Approximately 50 to 75 percent of the Northeast and Midwest population relies on surface water as their municipal drinking water source. These water supplies are protected largely by private forest lands. This analysis identifies these water supplies and the forests that protect them.

The watersheds in northeastern Minnesota scored above average in each step of the analysis. Minnesota contains large protected forest areas in the northeast, an even mix of private and publicly owned forest (51 percent private), and high development pressure around the Twin Cities. Those Minnesota watersheds that scored highest in their ability to produce clean water are located in the northeastern part of the State, where there are large areas of forested land. Watersheds were also ranked based on their development pressure and land ownership status (private lands ranking higher because they can be subject to conversion). The two most threatened watersheds were the Pine and Rum watersheds, located north of the Twin Cities region.

Abstract #7

No title submitted

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Across Minnesota, boat launches have been flagged as a significant source of impairment to the state's lake systems. As an artifact of their design, many of these launches effectively act as stormwater chutes, carrying quantities of sediment and nutrients (often from sizeable watershed areas) directly into the associated lake. In 2008, Great River Greening – in collaboration with Washington Conservation District and Minnesota Pollution Control Agency – initiated the development and implementation of a standardized assessment protocol to evaluate boat launch design relative to stormwater impact, and followed with an evaluation of all 14 public Washington County boat launches within the St. Croix River watershed.

Evaluations gathered data to determine the volume, speed and condition of water flowing through a launch site (e.g. slope, watershed area, watershed cover type, soil erodibility, water flow pattern) and visually assessed sites to identify evidence of resource degradation stemming from stormwater runoff (e.g. sediment accumulation, shoreline undercutting, stormwater gullies). Both sets of data were used to prioritize launches for retrofit action and inform the design of those retrofits.

This boat launch evaluation protocol can be used statewide to set priorities and determine actions. In 2009, Washington Conservation District, Middle St. Croix Watershed Management Organization, Carnelian-Marine Watershed Management Organization, Great River Greening and the City of Stillwater collaborated on the installation of the first two retrofits stemming from this effort.

Abstract #8

View your wetlands on Google Earth

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This is a poster showing how you can view wetlands mapped on Google Earth. It is a simple step-by-step procedure to quickly overlay National Wetland Inventory maps on the Google Earth Globe. There will also be a laptop available to show anyone directly how it is done. The importance for this tool is to better 'visualize the landscape for infrastructure planning. With the availability of multiple date imagery on Google Earth, one can see the variability of the landscape in order to better plan green infrastructure and conservation projects.

(GO TO: http://www.fws.gov/wetlands/Data/GoogleEarth.html)

Abstract #9

EFFECTIVE FLOW CONTROL: A CRITICAL PIECE IN OUR QUEST FOR SUSTAINABLE URBAN RUNOFF MANAGEMENT

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The management of stormwater in our increasingly urbanizing catchments in the period leading up to the 21st century has been dominated by a design process of "convey and discharge" as quickly as possible to local watercourses. With the recognition of the polluting aspects of stormwater runoff from urban catchments, there is an increasing movement towards the addition of stormwater management processes to achieve water quality objectives.

These water quality improvement practices, by virtue of their downstream end-of-pipe location, come into play only after all the runoff from the catchment has been collected and mixed, resulting in the need for larger end of line treatment systems, an approach that is at variance with the way nature manages stormwater.

In most urbanized catchments, increased stormwater runoff rates and volumes convey a wide range of pollutants including oils, trash, sediments, and associated pollutants (e.g. nutrients and heavy metals); leading to the impairment of the receiving environments.

In recognition of the adverse impacts on aquatic ecosystems and the environment in general of stormwater runoff from urban catchments, there is a need for responsible design practices and use of tools that restore the ecological balance, ensuring further damage is prevented and impaired ecosystems are restored to health.

It has become evident that the control and attenuation of stormwater runoff rates is a critical component in sustainable integrated stormwater management.

This poster presents flow control mechanisms and schemes, that used in conjunction with available storage and treatment controls enables designers to engineer systems that provide sustainable and integrated stormwater management practices.

Abstract #10

METRO METALS RECYCLING CORP.

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Metro Metals Corporation, Inc. broke new ground in 2008 with its innovative approach to storm water management: keeping its storm water effluent clean through the creative use of recycled tire shreds in an underground storm water management system.

The system, designed by Wenck Associates, Inc., enables this salvage business to exceed current regulatory requirements for on-site storm water treatment while conserving valuable real estate for its business activities. The innovative design is the first of its kind in a fully-contained storm water management system. In addition, this environmentally conscious solution provides a tremendous savings over alternative designs as well as a cost-effective beneficial reuse of waste product that would have otherwise been burned as a fuel supplement.

Wenck proposed a lined system using a front-end storm water management system for sediment removal and collection of immiscible liquids, and a tire-shred storage system. The innovative design is the first of its kind to use tire shreds as fill in a fully-contained storm water management system. Compared to traditional aggregate, tire shreds have 60% more void space and are 80% lighter; therefore, the size of the pond could be reduced through the use of tire shred as fill. In addition, the structural capacity of tire shreds is roughly equivalent to aggregate. Metro Metals would have lost at least 1.4 acres of surface area critical to business operations with an aboveground system.

The system is a model of innovation in storm water management. It demonstrates a cost-effective, proactive approach other businesses can use to mitigate storm water impacts of their operations without sacrificing valuable operating space. In addition, the project enhances public perception of the client and the industry as environmentally responsible.

Abstract #11

Blattner Energy Corporate Headquarters Achieves LEED® Platinum

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The U.S. Green Building Council recently certified the Blattner Energy Corporate Headquarters building as LEED® Platinum, the highest level within the rating system. The 52,000 sq. ft., two story office building is only the second LEED® Platinum project in Minnesota and one of less than 100 such projects nation wide. In addition, this project won the Green Building of America Award – Midwest, sponsored by Real Estate Construction & Review magazine.

The collaborative process and innovative design features that made Blattner Energy a success, also make it an excellent case study for communities and organizations interested in integrating low impact design into their development projects. To achieve LEED® Platinum a project must obtain a minimum of 52 of the 69 available credits. Blattner Energy reached 57 credits by incorporating numerous sustainable features in all disciplines.

This technical excellence is substantiated through the individual credits and points awarded the project, including key credits related to land conservation and water efficiency. The building promotes development density and land conservation by being within ½ mile of an urban setting with 10 or more services such as a bank, church, grocery, and higher density housing. It minimizes parking areas while encouraging the use of high efficiency vehicles and alternative transportation. It maximized open space and restored habitat with native plants that minimize the need for irrigation. A rain garden and on-site detention help manage stormwater runoff quantity and quality. These and other innovations associated with this study will be highlighted in our poster.

Abstract #12

Minnehaha Creek Restoration: A healing bridge between patients and the environment

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In the 1800s, Minnehaha Creek was relocated near the present site of Park Nicolet's Methodist Hospital. The river was channelized and ran through a straight ditch between Louisiana Avenue and Highway 3 (Excelsior Boulevard). In January of 2009, this segment (approximately 2000 feet) of Minnehaha Creek was restored to an alignment reflective of its natural condition, although not in its original location. Inter-fluve, the HR Green Company, the Minnehaha Creek Watershed District, and Park Nicollet Health Services worked together to develop a restoration design that not only allowed for public access to the restored area, but also provided hospital patients with window views and direct access via wheelchair accessible boardwalk. The project partners believe that exposing patients to a project that heals the creek will provide inspiration for personal healing. The design features stream restoration, pond creation, native wetland plantings, and 2,000 feet of elevated boardwalk with viewing platforms through the wetland and stream restoration area.

Abstract #13

Remediation of Compacted Soils as a Stormwater BMP

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Soils in urban environments typically have lower stormwater infiltration rates than the soils they replace due to reduced topsoil depth and increased subsoil compaction from land development. Loss of infiltration leads to increased stormwater runoff and associated downstream problems: flooding, pollutant transport, and warming stream temperatures.

A field experiment was conducted to determine the effectiveness of remediation techniques to alleviate soil compaction and increase infiltration. Tillage and compost addition are two techniques commonly used in agricultural practices to reduce the level of soil compaction. These techniques were implemented on three sites in the metropolitan area. Each site was divided into three plots: tilled, tilled with compost addition, and a control plot for comparison.

To determine the effectiveness of each remediation techniques, before and after measurements of the level of compactness were used. Saturated hydraulic conductivity, soil bulk density, and soil strength were used to assess the level of compactness.

The plots that were tilled with compost addition showed the highest average saturated hydraulic conductivities and were 2-5 times greater than the average hydraulic conductivities in the control plot. Plots that were just tilled had minimal improvement in permeability. Bulk density was lowest in composted amended plots due to the increase in organic matter. Comparisons in soil strength show that tilled and tilled with compost plots were lower than the control plots to a depth of 12” or more.

The results of these findings will be useful in revising stormwater best management practices to include guidelines on soil compaction prevention and remediation of compacted sites.

Abstract #14

Best Practices for Lakeshore Residential Landscapes: Master Gardener and Master Naturalist Volunteer Education

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[Shirley,

I am not sure if this is exactly what you are looking for, but it is a way of utilizing volunteers to help spread the word about protecting water resources.

Also, I have a display the I used at the Waterosity, Make a splash weekend – that might fit perfectly with this conference. Let me know if you are interested. I will need to make sure I don't let the plants freeze for the display if you want it there! I attached a photo that shows part of the display.

Eleanor Burkett]

ABSTRACT

The University of Minnesota Extension has two premier volunteer programs: Master Gardeners and Master Naturalists; this effort was designed to bring them together, enhancing both groups while increasing the capacity of the Water Resource Management Educational Programs. Educators used this opportunity to train volunteers simultaneously with the goal of creating better access for Minnesotans to University-based research. Likewise, new efficiencies for educators were recognized through this collaboration in the form of sharing experiences and expertise through team teaching educational sessions, online class development, creating shared materials, etc. Two initial face-to-face train-the-trainer workshops were provided, to prepare the volunteers in: onsite sewage treatment, shoreline management, and design for residential properties with specific focus on stormwater management and plant selection. Then, modules were created in developing an online training for volunteer access for throughout Minnesota. Volunteers have then since staffed major consumer events (such as the Lake Home and Cabin Show and Waterosity) as well as staffing booths at lake education events and county fairs, and presentations for lake associations. Following trainings, evaluations were given and findings

used subsequent training development to ensure volunteer educational needs and project goals were met.

Goals (outcomes and impacts):

1) Educate Master Gardeners and Master Naturalists on research-based, environmentally-sound issues and practices in the areas of:

a) shoreline management for homeowners
b) plant selection (invasive species, native plants / cultivars)
c) low impact design (raingardens, use of rain barrels, pervious surfaces)
d) onsite sewage treatment for homeowners

2) Prepare volunteers for answering related questions at events such as the Lake Home and Cabin Show, the Home and Garden Show, environmental and county fairs, the state fair, and horticulture days;

3) Integrate educators from Natural Resources and Agriculture, and Master Gardener and Master Naturalists in this collaborative Extension education effort.

Abstract #15

Volume Reduction BMPs to Reduce Stormwater Runoff and Improve Water Quality in Como Lake, Saint Paul, MN

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Capitol Region Watershed District along with Saint Paul, Falcon Heights, Roseville and Ramsey County constructed a series of stormwater best management practices to address flooding and water quality issues in Como Lake subwatershed. The BMPs were constructed between 2005 and 2007 and include the Arlington-Hamline Underground Storage Facility (AHUG), the Como Park Regional Pond, eight underground infiltration trenches and eight raingardens. Since their completion, these BMPs have been monitored for their effectiveness in improving water quality and reducing stormwater volume.

AHUG is an underground stormwater retention and infiltration system located beneath parkland. It comprises 10-foot diameter, perforated pipes that drain 47 acres and are designed to remove 12 pounds of phosphorus annually. The Como Park Regional Pond is a stormwater pond constructed on a golf course that has approximately 10 ac-ft of storage and should result in annual phosphorus reduction of 41 pounds. Eight infiltration trenches were constructed beneath Arlington and Nebraska Avenues; the first of their type in Saint Paul. The trenches have a combined drainage area of 23 acres and a combined storage volume of 37,000 cubic feet. The eight raingardens were constructed within the street right-of-way and drain an area of 16 acres to provide nearly 25,000 cubic feet of infiltration.

BMP monitoring data indicates that this project has resulted in significant water quality treatment and reduction of flooding in a dense urban area. The project has received two awards: 2007 Sustainable Saint Paul Award and 2009 Minnesota Association of Watershed Districts Project of the Year Award.

Abstract #16

Evaluation of qualitative stream channel stability assessment tools and their application in the Minnesota River Basin

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Streambank instability is one of the causes of high sediment loads in the Minnesota River basin (MRB). Since European settlement, streams within the MRB have sought a dynamic equilibrium that corresponds with the current hydrologic conditions of the landscape. Consequently, excessive channel erosion and in-stream sediment threatens riparian areas, aquatic biota, and hydrologic structures. To identify stream reaches experiencing heightened instability, a channel stability assessment specific to the low-gradient alluvial streams of southern Minnesota is needed. Three qualitative stream channel assessment tools were tested to determine their effectiveness in evaluating stability in the MRB: (1) the original Pfankuch Stability Index (OPf), (2) the Modified Pfankuch Stability Index (MPf), and (3) the Rapid Geomorphic Assessment (RGA). Comparisons of the qualitative assessments with the more quantitative Bank Erosion Hazard Index (BEHI) were made at each of the 30 study sites in the Blue Earth River basin (the largest sediment contributing watershed to the MRB). Both the MPf and the RGA were found to be correlated to the geomorphic condition of the stream, although certain metrics within each assessment proved to be more influential in determining this relationship than others. The results of this study will be utilized to recommend an assessment tool appropriate for stream stability evaluation in the MRB.

Abstract #17

Saint Anthony Water Reuse Facility

Presented by: City of Saint Anthony Village and WSB & Associates, Inc.

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The reuse of stormwater runoff for irrigation or other means can significantly reduce runoff volumes and pollutant loads discharged to surface waters, and can help offset volume and pollutant load increases that occur due to land development. Recent studies suggest that projected groundwater demands in the Twin Cities Metropolitan area may be unsustainable or that other sources of drinking water may need to be identified. This makes water reuse facilities an important BMP to consider when planning water resources infrastructure as they not only protect or lakes and streams, but conserve our valuable groundwater resources for future growth.

This poster presentation will focus on a case study of the Saint Anthony Water Reuse Facility Project. The project captures stormwater runoff and backwash water from treatment plant filters in a 500,000 gallon underground cistern and recycles the water to irrigate a 20-acre park, and City Hall Campus. The facility substantially reduces runoff volumes and pollutant loads discharged to Mirror Lake and the Mississippi River, and conserves ground water resources of the region.

The project was initiated and constructed by the City of Saint Anthony with financial support from Mississippi Watershed Management Organization, Rice Creek Watershed District, and Hennepin County. The City of Saint Anthony recently received the 2009 City of Excellence award from the League of Minnesota Cities in recognition of this innovative project.

Abstract #18

Urban Retrofit Stormwater Best Management Practices and Low Maintenance Landscape Techniques Eliminates Flooding and Creates Calming Place of Refuge at West Suburban Teen Clinic

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The West Suburban Teen Clinic is located in Excelsior, MN approximately 1 mile south of Lake Minnetonka, a class 2B lake protected for aquatic life and recreation. Significant flooding at the clinic entrance creating a year-round safety hazard was the primary on-site issue requiring correction. The local drainage area included a 2,000 sq. ft. lime aggregate parking lot which discharged sediment to the city's street and significant roof drainage.

Redesigning greenspace around the clinic called for the elimination of on-site flooding and creation of an affordable, welcoming, low maintenance landscape for patients and staff to enjoy. Initial drainage area and infiltration measurements determined available greenspace could support a rain garden to capture up to a 10-year rainfall event (4.15" in 24 hours).

The design incorporated several stormwater Best Management Practices including permeable pavements, three pipeconnected rain gardens of approximately 1,250 sq.ft., a curb cut capturing all runoff from a newly paved parking lot and low maintenance fescues as a turf alternative to accent planted areas. Low maintenance goals were achieved by planting native perennials with trees and shrubs as a backdrop creating small areas of refuge on the property.

One year after installation, the rain garden and upland area plants are thriving, the permeable pavement is functioning well, the rain gardens are draining properly and the low maintenance fescues were mowed twice during the season. Combined, the stormwater retrofit and low maintenance landscape have successfully created a cost effective flooding solution and a retreat for patients and staff.

Abstract #19

Interactive web-based data visualization for discovery and decision-making: LakeSuperiorStreams.org

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Urbanization and rural development are placing pressure on western Lake Superior streams and nearshore zones. www.LakeSuperiorStreams.org (LSS) uses web-based delivery and interactive animations of real-time water quality data to address sustainability issues in Minnesota watersheds at the headwaters of the Great Lakes. The website delivers intensive real-time values of flow, temperature, turbidity and conductivity in conventional formats and via a unique data animation tool from seven urban and rural trout streams tributary to Lake Superior. Data are incorporated as vignettes into interpretive information, curricula, case studies and a site design toolkit to educate a wide spectrum of users including the general public, homeowners, contractors, consultants, developers, students, teachers, agencies, decision-makers and scientists about stormwater issues and links to watershed activities. The Superior Regional Stormwater Protection Team of >25 partner organizations now delivers common educational messages and provides tools and training with the LSS website as a common educational hub. The website also disseminates information from the Weber Stream Restoration Initiative including a widely distributed newsletter. The project evolved from its predecessor real-time lake data based projects www.WaterontheWeb.org and www.LakeAccess.org and has also created animation and mapping utilities for displaying Lake Superior Beach Monitoring fecals/E. coli data via www.MNbeaches.org in collaboration with the Minnesota Pollution Control Agency. The LSS website now averages about 500,000 requests (hits)/mo and 100,000 page requests/mo.

Abstract #20

Sap-Flux Rates and Changes in Water Yield in Response to Uplands Aspen Clearcutting and Conversion to Conifers

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Research is underway to explain processes that control water yield differences following forest canopy conversion in the Marcell Experimental Forest. In 1980, the upland portion of the S6 watershed was clearcut and subsequently converted from aspen (*Populus temuloides*) to red pine (*Pinus resinosa*) and white spruce (*Picea glauca*). Comparisons of streamflow between S6 and that predicted from the S2 aspen control watershed suggest that streamflow from S6 has decreased over the past two decades as the conifers have matured. This study measures sap-flux rates of aspen in S2 and conifers in S6 to determine transpiration differences. Granier-style heat dissipation probes are used to quantify sap-flux in 36 trees throughout the growing season. Sample trees include mature aspen in S2 and young white spruce and red pine trees in S6. Sample tree plots are arranged to represent areas within the watershed where sap-flux rates may differ. Trees were selected based on basal area estimates of the watersheds. Each watershed contains plots on both north and south aspects which are further subdivided by slope position into upslope and toeslope locations. Data collected will give the rate of sap flux as volume per sapwood area. Estimates of total sapwood area in each sample tree are used to estimate whole-tree transpiration. Water use by the entire upland forest is estimated with knowledge of the species and diameters of the upland stands. Ultimately upland transpiration will be compared to treatment differences in water yield between the S2 and S6 watersheds to determine the contribution that changes in transpiration have on water yield. To further account for treatment differences a companion study is measuring through fall in the respective watersheds.

Abstract #21

Identify and Protect Southeastern Minnesota's Rare Groundwater-Fed Wetlands

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Rare, groundwater-fed wetlands have important functions and values in SE MN, including the removal of nitrates from waters supplying streams and aquifers, provide support for critical habitats (e.g., trout streams and calcareous fens), and provide shelter to many threatened and endangered plant species. Their location within the hill-slope positions of the Decorah and St. Lawrence bedrock units enables them to receive and remove excess nitrates, a critical function in areas where water quality is increasingly degraded. Unlike prairie-pothole wetlands, groundwater-fed wetlands are undervalued and remain unprotected by the Wetland Conservation Act (WCA); therefore these sites are especially susceptible to loss from land use pressures.

The City of Rochester and Rochester-Olmsted Planning Department has developed an inventory of these rare, groundwater-fed wetlands (based on hydric soil units, and bedrock geology) and adopted a county wide Decorah Edge Zoning Ordinance to guide planning and development. As a result, development of this ordinance has minimized the loss of these rare features. Specific examples of how these features are identified will be provided and the Olmsted County Decorah Edge Zoning Ordinance can be used as a model for the development of similar ordinances throughout the SE Minnesota region. Removing barriers that inhibit protection of these wetlands and development of zoning ordinances are replicable techniques that can be used to achieve goals to protect wetland loss and aquifer contamination in the karst area of SE MN.

Abstract #22

No title submitted

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Some stormwater pond sediments contain polycyclic aromatic hydrocarbons (PAHs) at levels that require those sediments to be disposed of in a confined facility. Composting PAH-contaminated sediments has been identified as a potential method to decrease these hazardous concentrations of PAHs to acceptable levels. A bench-scale reactor system designed to simulate a full-scale composting pile was used to investigate whether PAH bioremediation can be an effective remediation approach for PAH-contaminated pond sediments. The reactor system, consisting of four 4 L aerated reactors, allowed for self-heating of the compost to mimic the natural temperature progression of a compost pile. The variable investigated in these initial experiments was the ratio of contaminated sediment to compost . Compost containing a higher volume of contaminated sediment self-heated to a lower temperature than compost with a lower volume of contaminated sediment. The evolved carbon dioxide, a measure of total metabolic activity in the compost, was also greatest in the reactor with the lowest sediment. Compost samples collected on days 0,10,25 and 50 will be used to determine the total loss of PAHs. The portion of PAH loss due to volatilization will be tested using orbo tubes.

Abstract #23

No title submitted

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The University of Minnesota (UofM) retained Howard R Green Company to reconstruct two of the parking lots at the Como Student Housing site. Complication to the project include poor site drainage due to area development and an insufficient stormwater sewer system. The project also had to meet the UofM's strict stormwater management requirements - runoff from the site could not exceed pre-settlement conditions. After considering several options along with their related costs and maintenance requirements, HR Green and the UofM decided to reconstruct the parking lot using permeable pavers. This Best Management Practice resulted in a 95% reduction in impervious pavement. Almost all the stormwater runoff will be infiltrated and temporarily stored in the ground under the parking lot, thus eliminating over 95% the stormwater runoff going into the existing storm sewer system.

Abstract #24

Riparian corridor-channel restoration for enhanced channel stability and reduced sediment loads in Elm Creek, southern MN

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Anthropogenic land use alterations and stream channel modifications in the Elm Creek watershed of southwestern Minnesota have induced basin-wide hydrologic changes since post-European settlement. At present, Elm Creek is in varying stages of stream disequilibrium which is geomorphically evidenced by channel entrenchment, stream bank failures, and high suspended sediment loads. Subsequently, Elm Creek has been listed on the EPA 303(d) list for turbidity impairments due to excess sediment. Stream reach restoration has been proposed as a potential solution to remediate the water quality problems caused by sediment.

The goal of this study was to implement a reach-scale restoration project along an impaired reach of Elm Creek to demonstrate cost-effective ways to (1) enhance channel stability, (2) reduce channel erosion, (3) reduce sediment load, and (4) enhance riparian vegetation and connectivity. A 900-meter reach on the main stem of Elm Creek was selected and restoration efforts were carried out during November 2007.

The restoration design was based on the principles of the Rosgen method: the floodplain along the stream reach was reconnected by restoring bankfull elevations; log vanes and root wads were installed in the channel to divert erosive currents; a cross-vane was emplaced in-stream to redirect high flows into an abandoned oxbow to increase channel sinuosity; and the riparian corridor was restored using native perennial prairie species. Following project completion, a monitoring plan was developed to observe the positive effects of the restoration design overtime. Future work involves the development of a rotational grazing plan with the landowner and the establishment of high-value perennial species in the riparian corridor.

Abstract #25

A Field Study to Quantify Petroleum Hydrocarbon Residual and Biodegradation Functional Genes in Rain Gardens

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Concern has been raised that petrochemicals present in stormwater could accumulate during infiltration and form “pollutant depots” in raingardens, creating an environmental liability for the property owner. This study seeks to discover if petroleum hydrocarbons exist at elevated concentrations in raingardens, what factors may influence hydrocarbon concentrations, and if bacteria present in raingardens are capable of degrading petroleum hydrocarbons.

An extensive field survey in the Minneapolis / St. Paul metropolitan area of raingardens of various ages and sizes was conducted. Soil samples were collected and total petroleum hydrocarbons (TPH) and bacterial DNA were extracted and quantified. Functional genes utilized by bacteria to degrade petroleum hydrocarbons and total bacteria were enumerated using real time quantitative polymerase chain reaction (qPCR). TPH was found in most raingarden soils at low levels (< 3 µg/kg), while upland samples were uniformly non-detect. In addition, TPH levels did not correlate to site characteristics such as drainage source, catchment area, or vegetation type. Functional gene quantities did not correlate with TPH concentrations, loading factor, or vegetation. Certain functional genes were, however, significantly greater at sites draining residential roofs than at sites draining parking lots or streets, perhaps in response to pollutants leached from asphalt shingles. Overall, we observed a significant “toxic depot” effect did not occur; TPH levels in raingarden were several orders of magnitude below typical concentrations of concern. Furthermore, the ubiquity of genes indicative of petroleum hydrocarbon degradation suggests that accumulation of TPH is not of deep concern and is likely biodegraded in raingardens.

Abstract #26

Incorporating Innovative Stormwater Management Technologies Into a Sustainable Integrated Use System

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A sustainable approach to water management has been implemented for the AquaShield International's corporate headquarters building in Chattanooga, TN. The integration of stormwater management technologies serve to reduce pollution from stormwater runoff, limit the disruption to the natural site hydrology by reducing impervious cover, increase infiltration, utilize water that would otherwise have been lost, and minimize potable water use. The integrated technologies provided for 100% of the land use, compared to 89% of the land use if a conventional stormwater management design had been used. The reduction in potable water use serves to improve the availability of drinking water for community use. Additionally, a return on investment can be achieved in less than one year through this property development approach. Innovative, cost-effective technologies designed to capture, treat, harvest, and reuse water derived from both stormwater and roof run-off is described.

Stormwater and roof run-off are captured into an underground Brentwood Storm Tank and piped to an underground, AquaShield treatment filter train system that is constructed of HDPE. The Brentwood Storm Tank System provides water storage and The AquaShield Filter System provides hydrodynamic separation and filtration technologies. The separator removes debris, course sediment and free floating oil; while filtration removes fine-grained sediment, residual oil and water borne pathogens using an antimicrobial filtration technology. Pathogens are destroyed on contact with the filter media. Treated, non-toxic water is subsequently harvested within the 13,000 gallon Brentwood Storm Tank. Stored water is used for non-potable property applications including toilets, landscape irrigation, and an outdoor fountain. Infiltration on the property is enhanced through the combination of load supporting grass and gravel paving technologies in the vehicle parking areas.

The implementation of this system addresses environmental health concerns related to open ponds, utilizes water that would have been lost, and reduces potable water demand.

Abstract #27

From Door Knocking to Nature Preserve – FMR takes a comprehensive approach to land conservation

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Friends of the Mississippi River has followed a process for land protection and restoration that begins and ends with science, but is imbued with and dependent on personal relationships and trust every step of the way. Important lands are first identified based on ecological criteria. Landowners are contacted, beginning a long-term relationship that is fundamental to the process. As the decision for long-term protection is reached, project partners are solicited to negotiate the acquisition. An ecological management plan is created and ultimately implemented as funding is secured. In 1999, FMR initiated the process that resulted in creation of the 250-acre Pine Bend Bluffs Scientific and Natural Area and has led the effort to manage, restore, and monitor the natural communities at the site since 2003.