COLLEGE OF CONTINUING EDUCATION

Water Resources Center

Final Program and Book of Abstracts

Minnesota Water Resources Conference

October 27–28, 2008

NEW LOCATION
Saint Paul RiverCentre
175 West Kellogg Boulevard
Saint Paul, Minnesota

Sponsored by:
Water Resources Center, University of Minnesota
College of Continuing Education, University of Minnesota

Cosponsored by:
Department of Civil Engineering, University of Minnesota
Minnesota Section, American Society of Civil Engineers
Minnesota Sea Grant College Program, University of Minnesota
Natural Resources Research Institute, University of Minnesota

UNIVERSITY OF MINNESOTA

http://wrc.umn.edu/waterconf/

Minnesota Water Resources Conference

October 27-28, 2008

The **Minnesota Water Resources Conference** presents innovative and practical water resource management techniques and highlights research about Minnesota's water resources. The conference provides an opportunity to address: 1) **best practices** discovered in the **design and application** of water resource management techniques, 2) implications of **water policy** decisions, and 3) **research** into **current and emerging issues**. The conference facilitates interaction among water resources professionals including resource managers; researchers; local, state, and federal agency staff; consultants; practicing engineers; as well as students in the field.

Continuing Education Units (CEUs); Professional Development Hours (PDHs)

Conference attendees will receive .675 CEUs/PDHs for each day of the Minnesota Water Resources Conference. Participants who wish to receive full credit must attend all scheduled hours of the event. Forms will be available.

Cover Photo credit:
Mississippi River in St. Paul
Photo by Patrick Nunnally

2008 Water Resources Planning Committee

John Baker	U.S. Department of Agriculture and Department of Soil, Water, & Climate, University of Minnesota
John Blackstone	St. Paul Regional Water Services
Tina Carstens	Ramsey-Washington Metro Watershed District
Mark Edlund	St. Croix Watershed Research Station
Lisa Goddard	SRF Consulting Group, Inc.
Lori Graven	College of Continuing Education, University of Minnesota
Julie Bodurtha	College of Continuing Education, University of Minnesota
Lorin Hatch	HDR Engineering, Inc.
* *Andrea Hendrickson*	Minnesota Department of Transportation
Jon Hendrickson	U.S. Army Corps of Engineers
Karen Jensen	Environmental Services, Metropolitan Council
Suzanne Jiwani	Minnesota Department of Natural Resources
Maria Juergens	Water Resources Center, University of Minnesota
Ron Leaf	Short Elliott Hendrickson, Inc.
Barbara Liukkonen	Minnesota Sea Grant, University of Minnesota
Randy Neprash	Minnesota Cities Storm Water Coalition and Bonestroo
Jennifer L. Olson	Emmons and Olivier Resources, Inc.
Wayne Sicora	Ryan Companies US, Inc.
* *Faye Sleeper*	Water Resources Center, University of Minnesota
Gene Soderbeck	Minnesota Pollution Control Agency
James Stark	U.S. Geological Survey
Heinz Stefan	Department of Civil Engineering, University of Minnesota
Stew Thornley	Minnesota Department of Health
Rick Voigt	Voigt Consultants, LLC
Greg Wilson	Barr Engineering Company
Brad Wozney	Minnesota Board of Water and Soil Resources

* Committee Co-Chairs

Program at a Glance

Monday, October 27, 2008

7:00 a.m. **Registration and Continental Breakfast**

8:00 **Welcome,** *Ballrooms ABEF*
Faye Sleeper, Water Resources Center, University of Minnesota

8:10 **Dave Ford Water Resources Award**
Award Recipient: *Steven A. Heiskary*, Minnesota Pollution Control Agency

8:20 **Killer Aps for the Green Global Village**
Jack Bacon, Futurist and Author of *My Grandfather's Clock*

9:30 **Poster Session and Refreshment Break,** *Ballroom Concourse*

10:00 – 11:30 **Concurrent Sessions I**			
A *Ballrooms CD*	B *Meeting Rooms 1–3*	C *Meeting Rooms 7–9*	D *Meeting Rooms 4–6*
Innovative Storm Water BMPs: A Surf 'n' Turf Special	Managing Water Quantity and Quality in the Minnesota River Basin	Fresh Water Sustainability	Biologic Integrity of Streams

11:30 – 12:15 p.m. **Lunch,** *Ballrooms ABEF*

12:15 – 1:00 p.m. **Luncheon Presentation**
Moderator: *Andrea Hendrickson*, Minnesota Department of Transportation

Green Infrastructure for Great Cities
Janet L. Attarian, Project Director, Streetscape & Urban Design Program, Chicago Department of Transportation

1:15 – 2:45 **Concurrent Sessions II**			
A *Ballrooms CD*	B *Meeting Rooms 1–3*	C *Meeting Rooms 7–9*	D *Meeting Rooms 4–6*
Infiltration	Agricultural Drainage Impacts	Groundwater—Aquifer Characterization and Availability	Stream Erosion

2:45 – 3:15 **Poster Session and Refreshment Break,** *Ballroom Concourse*

3:15 – 4:45 **Concurrent Sessions III**			
A *Ballrooms CD*	B *Meeting Rooms 1–3*	C *Meeting Rooms 7–9*	D *Meeting Rooms 4–6*
Low Impact Development	Pesticides, Contaminants of Concern, and Emerging Contaminants	Hydrologic Impacts of Climate Change	Sediment Loading

4:45 – 5:45 **Reception and Poster Session,** *Ballroom Concourse*

Join us for the Water Conference Reception and Poster Session in the Ballroom Concourse — 4:45-5:45 p.m.

Program at a Glance

Tuesday, October 28, 2008

7:00 a.m. **Registration and Continental Breakfast,** *Ballroom Concourse*

8:00 **Welcome,** *Ballrooms ABEF*
Andrea Hendrickson, Minnesota Department of Transportation

8:10 **The SE Minnesota Floods of August 2007: In Historical and Future Context**
Mark Seeley, University of Minnesota Extension Climatologist, University of Minnesota

9:30 **Poster Session and Refreshment Break,** *Ballroom Concourse*

10:00 – 11:30 **Concurrent Sessions IV**				
A *Meeting Rooms 4–6*	B *Meeting Rooms 1–3*	C *Ballroom C*	D *Meeting Rooms 7–9*	E *Ballroom D*
Lake Pepin TMDL	Impact of Southeast Minnesota Floods	Policy and Permitting	Wetland Restoration and Mitigation Design Strategies	Lakes

11:30 – 12:15 p.m. **Lunch**, *Ballrooms ABEF*

12:15 – 1:00 p.m. **Luncheon Presentation**
Moderator: *Faye Sleeper*, Water Resources Center, University of Minnesota

Total Water Resources Management: Bringing Together Wetland, Storm Water, Floodplain, and Water Quality Management
Edward Thomas, Attorney, Michael Baker Corporation

1:15 – 2:45 **Concurrent Sessions V**				
A *Meeting Rooms 4–6*	B *Meeting Rooms 1–3*	C *Ballroom C*	D *Meeting Rooms 7–9*	E *Ballroom D*
Metro Lower Minnesota River Modeling Project	Mopping Up Once the Rain Ends: The 2007 Floods in SE Minnesota	Education/Planning	Understanding Trout Streams	Storm Water Monitoring: Cool Case Studies and Updating Particle Size Data

2:45 – 3:00 **Refreshment Break** *Ballroom Concourse*

3:00 – 4:30 **Concurrent Sessions VI**			
A *Meeting Rooms 4–6*	B *Meeting Rooms 1–3*	C *Ballroom C*	D *Meeting Rooms 7–9*
TMDL	35W Bridge	Urban Pollutants: Source, Transport and Treatment	Flood Reduction and Riverine Habitat

4:30 Adjourn

Program Schedule – Monday, October 27, 2008

7:00 a.m. **Registration and Continental Breakfast,** *Ballroom Concourse*

8:00 – 8:10 **Welcome,** *Ballrooms ABEF*
Faye Sleeper, Water Resources Center, University of Minnesota

8:10 – 8:20 **Dave Ford Water Resources Award**
Award Recipient: *Steven A. Heiskary*, Minnesota Pollution Control Agency

8:20 – 9:30 **Killer Aps for the Green Global Village**
Jack Bacon, Futurist and Author of *My Grandfather's Clock*

9:30 – 10:00 **Poster Session and Refreshment Break,** *Ballroom Concourse*

10:00 – 11:30 Concurrent Sessions I

TRACK A *Ballrooms CD*

Innovative Storm Water BMPs: A Surf 'n' Turf Special
Moderator: *Ron Leaf*
Co-Moderator: *Tina Carstens*

A Cooperative Approach to Innovative Storm Water Management
Todd Shoemaker, Wenck Associates, Inc. and *Mike Wyatt*, Minnehaha Creek Watershed District

City of St. Anthony Water Reuse Facility
Todd Hubmer and *Paul Hudalla*, WSB and Associates, Inc.

Football and Storm Water Management: A Look at the University of Minnesota's New On-Campus Football Stadium
Lisa Goddard, SRF Consulting Group, Inc.; *Brian Swanson* and *Van-Anh Tang*, University of Minnesota

TRACK B *Meeting Rooms 1–3*

Managing Water Quantity and Quality in the Minnesota River Basin
Moderator: *Leslie Everett*
Co-Moderator: *Adam Birr*

Rush River Hydrologic Study and Watershed Assessment Project
Bob Barth and *Emily Resseger*, Bonestroo

Evaluating Different Strategies for Reducing Nonpoint Source Pollution in Seven Mile Creek Watershed
Brent Dalzell and *David Mulla*, University of Minnesota

Effects of Restored Perennial Vegetation: Wetlands Complexes on Stormflow, Sediment, and Nutrient Loading From Small Watersheds in Southern Minnesota
Greg Fransen and *Kenneth Brooks*, University of Minnesota; *Christian Lenhart*, Kestrel Design Group, Inc.; and *Joe Magner*, Minnesota Pollution Control Agency

TRACK C *Meeting Rooms 7–9*

Fresh Water Sustainability
Moderator: *John Blackstone*
Co-Moderator: *Suzanne Jiwani*

Concepts of Freshwater Sustainability
John Nieber, *Roman Kanivetsky*, *David Mulla*, *Heidi Peterson*, and *Francisco Lahoud*, University of Minnesota; *Boris Shmagin*, South Dakota State University

Building a Framework for Sustainable Water Management in Minnesota
John Wells and *Princesa VanBuren*, Minnesota Environmental Quality Board

Water Use Conflicts
Julie Ekman, Minnesota Department of Natural Resources

TRACK D *Meeting Rooms 4–6*

Biologic Integrity of Streams
Moderator: *Greg Wilson*
Co-Moderator: *Gene Soderbeck*

Determination of Appropriate Metric(s) for Sediment-related Maximum Daily Loads (TMDLs)
Anne Lightbody, *Patrick Belmont*, *Jeff Marr*, *Cailin Orr*, *Chris Paola*, University of Minnesota

Relation of Nutrient Concentrations and Biological Responses in Minnesota Rivers: Implications for River Nutrient Criteria Development
Steven Heiskary and *Howard Markus*, Minnesota Pollution Control Agency

The Effectiveness of Various Stream Restoration Techniques on Restoring Biological Integrity
Diane Spector and *Ed Matthiesen*, Wenck Associates, Inc.

11:30 – 12:15 p.m. **Lunch,** *Ballrooms ABEF*

12:15 – 1:00 **Luncheon Presentation**
Moderator: *Andrea Hendrickson*, Minnesota Department of Transportation

Green Infrastructure for Great Cities
Janet L. Attarian, Project Director, Streetscape & Urban Design Program, Chicago Department of Transportation

1:15 – 2:45 Concurrent Sessions II

TRACK A *Ballrooms CD*

Infiltration
Moderator: *Tina Carstens*
Co-Moderator: *Greg Wilson*

Tillage and Compost: Do They Improve Infiltration Rates of Compacted Soil?
Nicholas Olson and *John Gulliver*, University of Minnesota

Understanding Bioretention in Cold Climates
Jim Davidson, Dakota Soil and Water Conservation District and *Nancy-Jeanne LeFevre*, Emmons & Olivier Resources, Inc.

The 1-Inch Infiltration Standard for Water Quality: One Year Later
Forrest Kelley, Capitol Region Watershed District

TRACK B *Meeting Rooms 1–3*

Agricultural Drainage Impacts
Moderator: *Lorin Hatch*
Co-Moderator: *Les Everett*

Effect of Tillage and Nutrient Sources on Dissolved Organic Carbon Fluxes From Soil
Holly Dolliver, University of Wisconsin-River Falls, *Satish Gupta*, University of Minnesota

Measuring and Modeling the Impacts of Shallow Subsurface Drainage in a Cold Climate
Gary Sands, *Wan Luo*, and *Jeffrey Strock*, University of Minnesota

Evaluating Field-Scale Agriculture Drainage and Best Management Practices on Water Quality
Lucas Bistodeau and *Shannon Fisher*, Minnesota State University, Mankato

TRACK C *Meeting Rooms 7–9*

Groundwater—Aquifer Characterization and Availability
Moderator: *James Stark*
Co-Moderator: *John Baker*

Case Studies and Local Ordinances Addressing the Importance of Interbedded Aquifers and Impermeable Shale Aquitards on Surface and Groundwater Resources of the Blufflands and Paleozoic Plateau of Southern Minnesota
Jeffrey Broberg, McGhie & Betts Environmental Services, Inc.

Improved Aquifer Characterization in an Urban Area: A Hydrochemical and Hydrostratigraphic Approach
Robert Tipping, Minnesota Geological Survey and *E. Calvin Alexander, Jr.*, University of Minnesota

Regional Groundwater Flow Modeling in the Twin Cities Metropolitan Area: Determining Groundwater Availability
Lanya Ross, Metropolitan Council

TRACK D *Meeting Rooms 4–6*

Stream Erosion
Moderator: *Suzanne Jiwani*
Co-Moderator: *Gene Soderbeck*

Estimation of Nutrient Loads From Streams Affected by Agriculture Land Retirement Using Continuous Monitoring and Laboratory Concentrations
Victoria Christensen, U.S. Geological Survey

Using Current Knowledge of River Channel Processes to Predict the Equilibrium Topography of a Sand-Bed Channel
Jeff Marr, *Anne Lightbody*, and *Chris Paola*, University of Minnesota

Spatial Analysis and Modeling of Stream Bank Erosion for Carver and Bevens Creeks, Minnesota
Steve Kloiber, Metropolitan Council

2:45 – 3:15 **Poster session and Refreshment Break,** *Ballroom Concourse*

3:15 – 4:45 **Concurrent Sessions III**

TRACK A *Ballrooms CD*

Low Impact Development

Moderator: *Wayne Sicora*
Co-moderator: *Lorin Hatch*

Amery Regional Medical Center – A Rural LID Precedent
Kevin Biehn, Emmons & Olivier Resources, Inc.

Low Impact Storm Water Management – Lessons Learned
Jessica Collin-Pilarski, *Daniel Bigalke*, Ayres Associates

Vegetation – Can It Fix Soils in Raingardens? Not in Your Lifetime!
Dave Bauer, Rice Creek Watershed District, and *Dan Wheeler*, University of Minnesota

TRACK B *Meeting Rooms 1–3*

Pesticides, Contaminants of Concern, and Emerging Contaminants

Moderator: *Mark Edlund*
Co-Moderator: *John Baker*

Fermentation Processes: Effect on Contaminant Partitioning and Water Quality
Denice Nelson and *Paige Novak*, University of Minnesota

Identification and Degradation of Industrial Phytoestrogens
Mark Lundgren and *Paige Novak*, University of Minnesota

A 2007 Assessment of Pesticides in Minnesota Lakes
William VanRyswyk, Minnesota Department of Agriculture, and *Steven Heiskary*, Minnesota Pollution Control Agency

TRACK C *Meeting Rooms 7–9*

Hydrologic Impacts of Climate Change

Moderator: *Rick Voigt*
Co-Moderator: *Randy Neprash*

Adapting Storm Water Management to Climate Change
Jennifer Olson and *Camilla Correll*, Emmons & Olivier Resources, Inc.

Devils Lake: Hydrologic Analysis of a Closed Basin System
Kari Layman and *Rick Hauck*, U.S. Army Corps of Engineers

Influence of Climate Change on Flow in the Minnesota River at Mankato
Jeramy Kulesa and *David Mulla*, University of Minnesota

TRACK D *Meeting Rooms 4–6*

Sediment Loading

Moderator: *Jon Hendrickson*
Co-Moderator: *Karen Jensen*

Sediment Loading in the Le Sueur River Basin
Stephanie Day and *Patrick Belmont*, University of Minnesota; *Karen Gran* and *Andrea Johnson*, University of Minnesota, Duluth; and *Carrie Jennings*, Minnesota Geological Survey

Wild Rice River Sediment Budget
Jonathan Petersen, *Jon Hendrickson*, and *Rebecca Soileau*, U.S. Army Corps of Engineers

Quantifying Erosion Rates from Ravines, Streambanks, and Bluffs
John Nieber, *Brad Hansen, Chris Lenhart, Jason Ulrich, Geoff Kramer, Zusana Kunesova, David Mulla, Shannon Wing,* and *Joel Nelson,* University of Minnesota

4:45 – 5:45 **Poster Session and Reception**

Minnesota Section, American Society of Civil Engineers (ASCE), Meeting

Monday, October 27, 2008 – 6 p.m. Social Hour, 7 p.m. Dinner, 8 p.m. Program
Location: Mancini's Char House and Lounge, 531 West Seventh Street, Saint Paul, Minnesota
Cost: $30. This meeting is open to anyone who is interested.

The Rain Falls, the Rain Runs Off. Should I Be Concerned?

Speaker: *John S. Gulliver*, Joseph T. and Rose S. Ling Professor, Department of Civil Engineering, University of Minnesota

As civil engineers, we should be concerned about storm water runoff because it is a significant portion of any civil engineering project and a large portion of maintenance requirements. For example, handling storm water runoff constitutes five percent of highway construction projects on average, and the maintenance of these storm water facilities can be up to 10 percent of their initial construction cost every year. In addition, a good design can reduce construction costs by up to 50 percent, reduce maintenance costs by up to 50 percent, and sometimes do both!

So, transportation, geotechnical, structural, and construction professionals, take note: Regulations for storm water handling can create substantial opportunities for cost savings; innovations with the use of the water can also create an improved human environment, and should be a part of your initial construction planning process.

This talk will address the construction process with innovative storm water planning. The result is the merging of landscape and infrastructure to provide for improved water quality, reduced water runoff quantity, and an improved environment.

For questions or additional registration information, contact Teresa Kes, Barr Engineering (tkes@barr.com), or John F. Blackstone, PE (jblackstone@comcast.net or 651-266-6324).

Reservations can be made online at www.ascemn.org or through voice mail at 952-832-2929.

Program Schedule – Tuesday, October 28, 2008

7:00 a.m. **Registration and Continental Breakfast,** *Ballroom Concourse*

8:00 – 8:10 **Welcome,** *Ballrooms ABEF*
Andrea Hendrickson, Minnesota Department of Transportation

8:10 – 9:30 **The SE Minnesota Floods of August 2007: In Historical and Future Context**
Mark Seeley, University of Minnesota Extension Climatologist, University of Minnesota

9:30 – 10:00 **Poster Session and Refreshment Break,** *Ballroom Concourse*

10:00 – 11:30 Concurrent Sessions IV

A *Meeting Rooms 4–6*

Lake Pepin TMDL
Moderator: *Gene Soderbeck*
Co-Moderator: *Tina Carstens*

Why Is Lake Pepin Filling up at a Rapid Rate?
Satish Gupta, University of Minnesota; *Heather Johnson*, Minnesota Department of Agriculture; and *Greg Spoden*, Minnesota Department of Natural Resources

Water Quality Model for Support of the Upper Mississippi River: Lake Pepin TMDL: Results of Load Reduction Scenarios
Joseph DePinto, *Hans Holmberg*, *Todd Redder*, and *Edward Verhamme*, LimnoTech; *Norman Senjem*, and *Hafiz Munir*, Minnesota Pollution Control Agency

Development of a Water Quality Model of the Upper Mississippi River: Brainerd to Ford Dam
Hans Holmberg, LimnoTech; *Hafiz Munir,* Minnesota Pollution Control Agency; *Pranesh Selvendiran,* LimnoTech; *Norman Senjem,* Minnesota Pollution Control Agency; *Ed Verhamme,* LimnoTech

B *Meeting Rooms 1–3*

Impact of Southeast Minnesota Floods
Moderator: *Stew Thornley*
Co-Moderator: *John Blackstone*

Flood Response
Paul Halvorson, Minnesota Department of Health

Flood Impact on Rushford
Windy Block, City of Rushford

Wells
Danny Nubbe, Mineral Service Plus

C *Ballroom C*

Policy and Permitting
Moderator: *Jennifer Olson*
Co-Moderator: *Lisa Goddard*

Wetland Conservation Act Rulemaking Process, Anticipated Changes, and Relationship to the Corps Mitigation Rule
Les Lemm, Minnesota Board of Water and Soil Resources

New Changes to the NPDES General Permit for Construction Activity
Todd Smith, Minnesota Pollution Control Agency

What Makes a Good TMDL Implementation Plan for Permitted MS4 Storm Water?
Michael Trojan, *Jeff Risberg*, *Anna Kerr*, *Brooke Asleson*, and *Chris Zadak*, Minnesota Pollution Control Agency

D *Meeting Rooms 7–9*

Wetland Restoration and Mitigation Design Strategies
Moderator: *Brad Wozney*
Co-Moderator: *Ron Leaf*

Wetlands Restoration to Improve Water Quality
Lorin Hatch and *Suresh Hettiarachchi*, HDR Engineering, Inc. and *Renae Clark*, Minnehaha Creek Watershed District

Wetland Mitigation Design: Flexibility From Concept to Construction
Lydia Nelson and *Tony Luft*, HDR Engineering, Inc.

Managing Storm Water and Restoring a Natural Wetland Corridor in an Urban Setting
Ron Leaf and *Jeremy Walgrave*, SEH, Inc.

E *Ballroom D*

Lakes
Moderator: *Heinz Stefan*
Co-Moderator: *Barb Liukkonen*

Predicting Phosphorus Releases From Lake Sediments
Sergei Katsev, University of Minnesota, Duluth; and *Maria Dittrich*, Swiss Institute For Environmental Science and Technology (EAWAG)

Establishing Statewide Nutrient Criteria Using a Stochastic Modeling Approach
Mark Deutschman, *Wesley Saunders-Pearce* and *Brennon Schaefer*, Houston Engineering, Inc. and *Michael J. Ell*, North Dakota Department of Health

A View From Space: Spatial and Temporal Water Clarity Trends of Minnesota 10,000 Lakes
Leif Olmanson, *Marvin Bauer*, and *Patrick Brezonik*, University of Minnesota

11:30 – 12:15 p.m. **Lunch,** *Ballrooms ABEF*

12:15 – 1:00 **Luncheon Presentation**
Moderator: *Faye Sleeper,* Water Resources Center, University of Minnesota

Total Water Resources Management: Bringing Together Wetland, Storm Water, Floodplain, and Water Quality Management
Edward Thomas, Attorney, Michael Baker Corporation

1:15 – 2:45 Concurrent Sessions V

A *Meeting Rooms 4–6*

Metro Lower Minnesota River Modeling Project
Moderator:
Gene Soderbeck
Co-Moderator:
Mark Edlund

Bridge Over Troubled Waters: Monitoring and Modeling the Lower Minnesota River
Catherine Larson, Metropolitan Council

Phosphorus Dynamics and Loading in the Turbid Minnesota River (USA): Controls and Recycling Potential
William James, U.S. Army Engineer Research and Development Center; and *Catherine Larson*, Metropolitan Council

Modeling the Hydrodynamics and Water Quality of the Lower Minnesota River Using CE-QUAL-W2
David Smith, *Tammy Threadgill*, and *Barry Bunch*, U.S. Army Engineer Research and Development Center; and *Catherine Larson*, Metropolitan Council

B *Meeting Rooms 1–3*

Mopping Up Once the Rain Ends: The 2007 Floods in SE Minnesota
Moderator:
Lisa Goddard
Co-Moderator:
Rick Voigt

"And the rain, rain, rain, came down, down, down…". Impacts to Mn/DOT Structures During the August 2007 Flooding
Petra DeWall, Minnesota Department of Transportation

Mn/DOT District 6 Repair Work for August 2007 SE Minnesota Flood
Dave Redig and *Kjersti Anderson*, Minnesota Department of Transportation

C *Ballroom C*

Education/ Planning
Moderator:
Randy Neprash
Co-Moderator:
Lorin Hatch

Engaging Diverse Groups in Environmental Education: A Case Study of the Hmong Community in Minnesota
Jenny Winkelman, Mississippi Watershed Management Organization; *Katherine Barton*, Barton and Associates; and *Foung Heu*, Digital Motion, LLC

Low Impact Design (LID) as a Shaping Element in the Urban Planning Process: A Case Study of the 46th and Hiawatha Transit-Oriented Development Strategy, Minneapolis, MN
Timothy Gross, Three Rivers Park District; *Mark Nolan*, Plan4

How Do Water Quality Projects Evaluate Impacts and Outcomes? The Minnesota NPS Project Survey
Karlyn Eckman, *Rachel Walker,* and *Lilao Bouapao*, University of Minnesota

D *Meeting Rooms 7–9*

Understanding Trout Streams
Moderator:
Barb Liukkonen
Co-Moderator:
Heinz Stefan

Trout Stream Spring Characterization Methods and Springshed Mapping
Scott Alexander, *Andrew Luhmann*, *E. Calvin Alexander, Jr.*, University of Minnesota; *Jeffrey Green* and *Andrew Peters*, Minnesota Department of Natural Resources

Stream Flow and Temperature Analysis of the Vermillion River
William Herb, *Ben Janke*, *Omid Mohseni*, and *Heinz Stefan*, University of Minnesota

An Innovative Approach to Setting Peak Flow Standards in the Vermillion River
Scott Sobiech, Brandon Barnes, and *Jamie Smedsmo*, Barr Engineering Company

E *Ballroom D*

Storm Water Monitoring: Cool Case Studies and Updating Particle Size Data
Moderator:
C. Bruce Wilson
Co-Moderator:
Wayne Sicora

Paired-Watershed Assessment of Retrofitted Storm Water Volume Reduction BMPs
Kristy Treichel, City of River Falls; *Rich Brasch*, Bonestroo; *Reid Wronski*, City of River Falls

Local Urban Storm Water Monitoring, Results and Implications for Future Management
Katie Huser and *Melissa Baker*, Capitol Region Watershed District

Storm Water Particle Size Distribution and Composition
Greg DeGroot and *John Gulliver*, University of Minnesota

2:45 – 3:00 **Refreshment Break,** *Ballroom Concourse*

3:00 – 4:30 **Concurrent Sessions VI**

TRACK A *Meeting Rooms 4–6*

TMDL

Moderator: *Gene Soderbeck*
Co-Moderator: *Faye Sleeper*

Water Quality Data for Lake Nutrient TMDLs: How Much Is Enough?
Rebecca Kluckhohn and *Diane Spector*, Wenck Associates, Inc.; *Merle C. Anderson*, Clearwater River Watershed District

Integrating Geomorphologic Field Assessment and Watershed Modeling for a Turbidity TMDL
Greg Johnson and *Karen Evens,* Minnesota Pollution Control Agency; *Troy Naperala*, URS Corporation; and *Julianne Socha*, U.S. Environmental Protection Agency

Setting Storm Water WLAs: TMDL Case Study
Andrea Plevan, Emmons & Olivier Resources, Inc.; *Michael Trojan* and *Chris Zadak*, Minnesota Pollution Control Agency; and *Mike Wyatt*, Minnehaha Creek Watershed District

TRACK B *Meeting Rooms 1–3*

I-35W Bridge

Moderator: *Rick Voigt*
Co-Moderator: *Andrea Hendrickson*

Hydraulic Design Considerations for Replacing the I-35W Bridge
Andrea Hendrickson, Minnesota Department of Transportation

Responding to the I-35W Bridge Collapse as a Hydraulic Engineer
Aaron Buesing, U.S. Army Corps of Engineers

Developing, Implementing, and Monitoring Pollution Discharge Prevention During the I-35W St. Anthony Bridge Removal Under the Clean Water Act NPDES Permit Program
Dwayne Stenlund, Minnesota Department of Transportation

TRACK C *Ballroom C*

Urban Pollutants: Source, Transport and Treatment

Moderator: *Karen Jensen*
Co-Moderator: *Brad Wozney*

Land Cover and Impervious Classifications of the Minneapolis/St. Paul Metropolitan Statistical Area
Marvin Bauer, University of Minnesota

Inventory and Hydrologic Transport of Road Salt in the Twin Cities Metropolitan Area
Eric Novotny, *Andrew Sander*, *Omid Mohseni*, and *Heinz Stefan*, University of Minnesota

Assessing Hydrodynamic Separators Under High Water Flow Conditions
David Saddoris, *Omid Mohseni*, and *John Gulliver*, University of Minnesota

TRACK D *Meeting Rooms 7–9*

Flood Reduction and Riverine Habitat

Moderator: *Barb Liukkonen*
Co-Moderator: *James Stark*

Impoundments: An Integral Part of the Overall Flood Damage Reduction Strategy in the Flood-Prone Red River of the North Basin
Nate Dalager, HDR Engineering, Inc.

Non-Invasive Solution to Prevent Flooding in the North Platte River at North Platte, Nebraska, to Allow for Increased River Flows During the Migratory Season
Rocky Keehn, Short Elliott Hendrickson, Inc.

Home on the Big River: Great River Habitat Quality Indices
Debra Taylor, *Mark Pearson*, *Theodore Angradi*, *David Bolgrien*, *Brian Hill*, *Terri Jicha*, and *Mary Moffett*, U.S. Environmental Protection Agency

4:30 **Adjourn**

Poster Display

The following posters will be displayed during the breaks and Monday reception.

Carver County TMDLs: Sharing Our Slice of the TMDL Pie
Tiffany Babich, Carver County Water Management

Development of an Ecological Assessment Method for Minnesota Lakes
Marcus Beck, University of Minnesota

NEMO Outdoors! Creating More Effective Water Resource Education and Outreach for Local Decision Makers
John Bilotta, University of Minnesota Extension and *Jenny Winkelman,* Mississippi Watershed Management Organization

Highway 36 Reconstruction: Erosion Control Is a Collaborative Effort
Nicole Danielson-Bartelt, Minnesota Department of Transportation; *Mike Goodnature*, Ramsey County Soil and Water Conservation District; *Dwayne Stenlund*, Minnesota Department of Transportation; *Paige Wein*, Ramsey-Washington Metro Watershed District

Linking Submerged Aquatic Vegetation Restoration to the TMDL for the Upper Mississippi River—Lake Pepin System
Joseph DePinto, *Wendy Larson*, *Todd Redder* and *Dan Rucinski,* LimnoTech; *Hafiz Munir* and *Norman Senjem*, Minnesota Pollution Control Agency

Reducing Uncertainty and Bounding Variability of Stream Ecosystem Indicators
Christine Dolph, University of Minnesota

The Mound Transit Station Parking Facility – Multifaceted Storm Water Management Along Lake Minnetonka
Troy Erickson, SRF Consulting Group, Inc. and *Carlton Moore*, City of Mound

Minnesota Pollution Control Agency's Environmental Data Access System
Jason Ewert and *David Fawcett*, Minnesota Pollution Control Agency

Flooding in Illinois, Iowa, Minnesota, and Wisconsin, August 17-23, 2007
James Fallon, U.S. Geological Survey; *Herb Garn*, U.S. Geological Survey, Wisconsin; *Marvin Harris*, U.S. Geological Survey, Illinois; *Kris Lund*, U.S. Geological Survey, Iowa

Stream Bed Slope Response to Gravel and Sand
John Gaffney, *Kimberly Hill*, and *Chris Paola*, University of Minnesota

Water Quality in Saint Paul: BMP Cards as Education/Outreach Tool
Joni Giese, SRF Consulting Group, Inc. and *Tim Griffin*, Saint Paul on the Mississippi Design Center

Bacterial Encapsulation for PCB Degradation
Jenna Grady, University of Minnesota; *Erin Surdo, Bill Arnold,* and *Paige Novak,* University of Minnesota

Application of Wireless and Sensor Technologies for Urban Water Quality Management: Pollutant Detection in Urban Streams
Michael Henjum, *William Arnold*, *Miki Hondzo*, *Paige Novak*, *Jim Kang*, and *Chris Wennen*, University of Minnesota

Brooklyn Center TIF District 3 Regional Storm Water Treatment Facility
Todd Hubmer and *Paul Hudalla*, WSB & Associates, Inc.; *Todd Blomstrom*, City of Brooklyn Center

Saint Paul's Water Comprehensive Plan Chapter, and Saint Paul's Water Comprehensive Plan: An Inclusive Approach to Meeting State and Local Requirements
George Johnson, SEH, Inc.; *Larry Soderholm,* City of Saint Paul, and *Andrew Jacobson,* Duke University

Policy Considerations in the Poplar River Turbidity TMDL Study
Greg Johnson, *Pat Carey*, *Karen Evens*, Minnesota Pollution Control Agency; *Troy Naperala*, URS Corporation

A General Method for Modeling Bacterial TMDLs Along the Texas Gulf Coast
Stephanie Johnson, University of Minnesota; *David Maidment* and *Mary Jo Kirisits,* University of Texas

Water: Recycle, Reuse, Protect the Environment, and Save Money
Michael Jungbauer, Landform

Development of Riverbank Stabilization Guidance for the Mississippi River
Dan Kalmon, Mississippi Watershed Management Organization; *Jeremy Grush, Hans Holmberg,* and *Todd Redder,* LimnoTech; *Todd Rexine,* Great River Greening

Regionalization of Groundwater Systems in Support of Water Resources Sustainability Atlases in Minnesota
Roman Kanivetsky and *John Nieber,* University of Minnesota; *Boris Shmagin,* South Dakota State University; *David Mulla, Heidi Peterson,* and *Francisco Lahoud,* University of Minnesota

Soil Seed Bank Analysis of a Drained Peatland in East-central Minnesota Pre- and Post-Grading: A Case Study for Wetland Restoration
Allyz Kramer, SEH, Inc.

Tower Harbor: Design Considerations for a Small Boat Harbor on Lake Vermilion
Michelle Schneider, SEH, Inc., and *Jeremy Walgrave,* SEH Inc.

Degradation of Persistent, Bioaccumulative, and Toxic Compounds in Groundwater by Dehalococcoides-like Organisms
Mark Krzmarzick, University of Minnesota; *Jevon Harding*, *Alessandra Leri*, *Satish Myneni*, Princeton University; *Paige Novak*, University of Minnesota

Expanding Storm Water Education and Outreach Through Private-Public Partnerships
Kate Kubiak, Regional Stormwater Protection Team; *Mindy Granley*, Minnesota Department of Natural Resources

Utilizing Beaver in Stream Restorations
Terry Lee, Olmsted County

Innovative Techniques to Use Plants and Soils for Storm Water Services in Ultra-Urban Environments With Limited Open Space
Peter MacDonagh, The Kestrel Design Group, Inc.

Targeted Stabilization of an Urban Stream
Stephanie McNamara, Vadnais Lake Area Water Management Organization; *Eli Rupnow,* Emmons & Olivier Resources, Inc., and *David Schuler,* St. Paul Regional Water Services

Ditched Stream Restoration
Tom Miller, Emmons & Olivier Resources, Inc., and *Renae Clark,* Minnehaha Creek Watershed District

Developing Aquatic Life Benchmarks for Pesticides
Phil Monson, Minnesota Pollution Control Agency; *Joe Zachmann,* Minnesota Department of Agriculture; and *Angela Preimesberger,* Minnesota Pollution Control Agency

Blue Thumb: Planting for Clean Water
Dawn Pape, Rice Creek Watershed District; *Angie Hong*, Washington Conservation District; *Elizabeth Storey*, Capitol Region Watershed District

Creating a Database of Empirical Watershed Characteristics for Atlases of Minnesota's Water Resources Sustainability
Heidi Peterson, *Roman Kanivetsky*, *Francisco Lahoud*, *David Mulla*, and *John Nieber*, University of Minnesota; *Boris Shmagin*, South Dakota State University

Spatio-Temporal Regime of Stream Runoff During Climate Change and the Influence on Minnesota's Water Resources Sustainability
Heidi Peterson and *John Nieber*, University of Minnesota; *Boris Shmagin*, South Dakota State University

Helping Small Minnesota Communities Solve Their Wastewater Issues
Valerie Prax, Doug Malchow and *Laurie Brown,* University of Minnesota, Extension

Development of a Practical Method to Analyze Sod Farm Wetland Hydrology
V. (Rama) Ramanathan, URS Corporation, and *Joel Toso,* URS Corporation

Wetland Web Map Connects Citizens, Staff, Data
Nancy Read, Metro Mosquito Control, and *Brian Fischer,* Houston Engineering, Inc.

Measuring the Volume of Lake Water Losses to Groundwater Through Wintertime Water Surface Elevation Surveys
Matthew Redington and *Adam Kessler*, HDR Engineering; *John Nieber*, Chisago Lakes Lake Improvement District

Vertical Agricultural Drains as a Source of Phosphorus to Streams
Jason Roth, University of Minnesota, and *Paul Capel,* U.S. Geological Survey, University of Minnesota

Variability in Nitrate Concentrations in Subsurface Drains Along a Reach of an Agricultural Stream
Erik Smith, US Geological Survey; *Paul Capel*, U.S. Geological Survey/University of Minnesota; *Jason Roth*, University of Minnesota

Hydroxylated Polybrominated Diphenyl Ether Photolysis Quantum Yields and Product Identification
Peter Steen, *William A. Arnold*, *Matthew Grandbois*, *Kristopher McNeill*, University of Minnesota

The Future of Energy and Minnesota's Water Resources
Sangwon Suh, Laura Schmitt Olabisi, and *Yowen Chin,* University of Minnesota

Citizen Stream Monitoring: Examples and Lessons Learned
Bill Thompson, Minnesota Pollution Control Agency

City Sustainability: Water as Part of the Big Picture
Lisa Tilman and *Brett Emmons*, Emmons & Olivier Resources, Inc.

Taming the Lower Sheyenne River
Jeffry Volk and *John Wirries,* Moore Engineering, Inc.

RoofBloom
Chris Wegscheid, Cermak Rhoads Architects; *Camilla Correll*, Emmons & Olivier Resources, Inc.; *Corrie Zoll*, Earth Wizards

Application of Wireless and Sensor Technologies for Urban Water Quality Management: Pollutant Loading in Storm Water Ponds
Christine Wennen, *Michael Henjum, James Kang, Shashi Shekhar, Miki Hondzo, Raymond Hozalski, Paige Novak* and *William Arnold,* University of Minnesota

Environmental Knowledge, Behaviors, Communication Preferences in the Hmong Community in Minnesota
Jenny Winkelman, *Erica Sniegowski,* and *Kaozouapa Elizabeth Lee*, Mississippi Watershed Management Organization; and *Foung Heu*, Digital Motion, LLC

The Red River Basin Commission: The Power of Relationships and a Dream in Land and Water Management
Lance Yohe, Red River Basin Commission

Responding to Acetochlor in Minnesota's Waters
Joe Zachmann, *Gregg Regimbal*, *Ron Struss,* Minnesota Department of Agriculture

Minnesota Water Resources Conference

October 27–28, 2008
Saint Paul RiverCentre
175 West Kellogg Boulevard
Saint Paul, Minnesota

Book of Abstracts

Arranged by session in order of presentation
Index of first authors on page 84

Contents

Plenary Session I 8:20–9:30

Killer Aps for the Green Global Village

Jack Bacon, Futurist and Author of *My Grandfather's Clock*

The Green Movement has grown faster than most governments would predict, led instead by both the private sector and surprisingly by third-world economies. Similar to the spreadsheet's "killer ap" catalytic effect on the growth of the personal computer market, there are a few technological and social developments that are driving the explosive growth of green energy, water, sanitation, and LEEDS construction. What are the drivers? Why now? Why so fast? How Fast? We'll explore the emerging "killer applications" for the green global village to see how things are progressing—especially in fresh water and waste water—in first world and in third-world economies.

Concurrent Sessions I 10:00–11:30

Track A: Innovative Storm Water BMPs: A Surf 'n' Turf Special

A Cooperative Approach to Innovative Stormwater Management

Todd Shoemaker, Wenck Associates, Inc., tshoemaker@wenck.com; Mike Wyatt, Minnehaha Creek Watershed District

The City of Mound is undergoing a redevelopment of its downtown area which encompasses a large amount of shoreline on both Lake Minnetonka and Langdon Lake. The Minnehaha Creek Watershed District (MCWD) is leading a partnership with the City of Mound and developer to reduce the overall amount of nutrient loading entering Lost Lake, Langdon Lake and ultimately Cooks Bay on Lake Minnetonka. The project includes the following components:

- Identification of partnership opportunities
- Engineering and design of improvements
- Shared implementation of improvements

MCWD identified this project as a significant opportunity to achieve its long-term loading goals for the area. The project incorporates innovative stormwater treatment measures (pervious concrete, filtration basins, pervious pavers, and a biofiltration trench) into the downtown redevelopment to minimize the loading of nutrients into adjacent waters. The presentation will discuss the project goals, the partnership framework, treatment measure design, installation pitfalls, and monitoring data.

City of St. Anthony Water Reuse Facility

Todd Hubmer, WSB & Associates, Inc., thubmer@wsbeng.com; Paul Hudalla, WSB & Associates, Inc.

Water reuse projects in Minnesota are a viable means to offset runoff volume and pollutant load increases that occur due to development. Furthermore, recent studies suggest that projected groundwater demands in the metro area may be unsustainable. Therefore, water reuse facilities are an important BMP to consider when planning water resource infrastructure.

This presentation will focus on a case study of the St. Anthony Water Reuse Facility Project. The project captures stormwater runoff and backwash water from treatment plant filters in an underground storage tank and uses the water to irrigate a 20-acre park. 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.

This presentation will provide information regarding site selection considerations for water reuse projects, as well as the water budget analysis and design features of the St. Anthony facility.

Concurrent Sessions I 10:00–11:30

Track A: Innovative Storm Water BMPs: A Surf 'n' Turf Special, *continued*

Football and Stormwater Management—a Look at the University of Minnesota's New On-Campus Football Stadium

Lisa Goddard, SRF Consulting Group, Inc., lgoddard@srfconsulting.com; Brian Swanson, University of Minnesota, Van-Anh Tang, University of Minnesota

The emerging East Gateway District around the new TCF Bank Stadium incorporates new and existing sports, academic and research facilities. An innovative stormwater plan was developed for this evolving 75-acre area of campus to respond proactively to campus stormwater management goals and to define landscaped spaces. The stormwater plan addressed each stage of the development in order to protect and improve the water flowing into the Mississippi River. The ultimate plan uses numerous water quality BMPs, including pervious concrete, bioretention, and proprietary devices. The plan also proposes to attenuate the peak discharge from a 100-year rain event to pre-development conditions. Design challenges included a significant number underground utilities, contaminated soil and groundwater, a high groundwater table and competing land use needs. One unique feature is an electronically actuated diversion structure incorporated to allow stormwater runoff from the open-air seating bowl to be treated by a media filtration system but divert detergent-laden water from cleaning operations into the sanitary sewer.

Concurrent Sessions I 10:00–11:30

Track B: Managing Water Quantity and Quality in the Minnesota River Basin

Rush River Hydrologic Study and Watershed Assessment Project

Bob Barth, Bonestroo, bob.barth@bonestroo.com; Emily Resseger, Bonestroo

Recently, there has been heightened interest in the hydrologic and water quality impacts of intensive agricultural land use in the Minnesota River basin. Increased agricultural production is made possible by draining wetlands and historic lakes. However, these drainage systems contribute to degraded water quality and increased bank erosion in the Minnesota River and its tributaries. Specifically, increased hydrologic variability leads to more flooding, causing bridge washouts, sedimentation, changes in stream alignment, and greater nutrient transport.

As part of a larger Clean Water Partnership project, a hydrologic study of the approximately 400 square mile Rush River watershed focused on surface and tile drainage processes to identify opportunities for volume reduction. A detailed hydrologic and hydraulic XP-SWMM model of the Rush River watershed was calibrated to monitored flow rates collected near the mouth of each of the Rush River's four main tributaries and in the River itself prior to joining the Minnesota River.

The model identified and assessed potential storage areas and their ability to reduce flow in the Rush River. One of the most compelling findings of this study was how subsurface tile drainage affected the timing and magnitude of outflow hydrographs. By characterizing the surface hydrograph separate from the hydrograph of subsurface tile drainage, the total basin hydrograph closely matched the monitored flows. The study concluded that a comprehensive program to restore key lakes and wetlands throughout the watershed is required in order to provide adequate storage and reduce peak flows to more sustainable levels.

Evaluating Different Strategies for Reducing Nonpoint Source Pollution in Seven Mile Creek Watershed

Brent Dalzell, University of Minnesota, bdalzell@umn.edu; David Mulla, University of Minnesota

Water quality models are routinely applied to assess the feasibility of alternative management practices or land use scenarios for the purpose of achieving improvements for stream water quality. One shortcoming of this approach is that alternative scenarios are often applied to the watershed in a uniform manner and the relative sensitivity of different portions of the landscape is not taken into consideration. In this study, we evaluate different land cover and land management scenarios in Seven Mile Creek watershed, a predominately-agricultural watershed located in the Minnesota River Basin. A suite of alternative management scenarios was developed based on historic land cover data (e.g., location of pre-settlement wetlands) as well as topographic characteristics. Further, we assess how decisions about identifying sensitive landscape components are influenced by input data by comparing results obtained from digital elevation models of varying resolution. The performance (and shortcomings) of different approaches for designing alternative management scenarios will be presented.

Concurrent Sessions I 10:00–11:30

Track B: Managing Water Quantity and Quality in the Minnesota River Basin, *continued*

Effects of Restored Perennial Vegetation- Wetlands Complexes on Stormflow, Sediment, and Nutrient Loading from Small Watersheds in Southern Minnesota

Greg Fransen, University of Minnesota, frans025@umn.edu; Kenneth Brooks, University of Minnesota; Christian Lenhart, Kestrel Design Group, Inc.; Joe Magner, Minnesota Pollution Control Agency

This paper discusses the hydrologic and water quality changes over four years following restoration of two wetlands with accompanying plantings of perennial vegetation in Martin County, south central Minnesota. These wetlands are situated in small catchments that consist of native perennial grasses and trees surrounding the wetlands. These perennial vegetation-wetland complexes intercept tile drainage and surface runoff from corn-soybean fields before emptying into the Blue Earth River tributary, Elm Creek. Tile flow and gully flow into wetlands, and outflow from wetlands, have been measured along with total phosphorus (P), soluble P, nitrate-N, and total suspended solids (TSS). The perennial vegetation-wetland complexes have reduced stormflow peaks and nitrate-N loading to Elm Creek. The effects on loading of soluble P, total P, and TSS are more variable, and are attributed in part to characteristics of the restored wetlands which were formally croplands. Management implications are discussed in the context of Total Maximum Daily Loads (TMDLs).

Concurrent Sessions I 10:00–11:30

Track C: Fresh Water Sustainability

Concepts of Freshwater Sustainability

John Nieber, University of Minnesota, nieber@umn.edu; Roman Kanivetsky, University of Minnesota; Boris Shmagin, South Dakota State University; David Mulla, University of Minnesota; Heidi Peterson, University of Minnesota; and Francisco Lahoud, University of Minnesota

Increasing demands on freshwater resources are putting the quantity and quality of water resources in the United States and most of the rest of the world at risk. To ward off detrimental effects in the future it will be necessary for mankind to adopt planning strategies that take full account of the principles of resource sustainability. Simply stated these principles mean that one should not use more of the resource than that part of the resource that is regularly replenished. In this presentation we will outline the details of the principles of sustainability as they apply to freshwater resources sustainability, and we will show how the concepts can be applied to planning for sustaining the water resources of Minnesota.

Building a Framework for Sustainable Water Management in Minnesota

John Wells, Minnesota Environmental Quality Board, john.wells@state.mn.us; Princesa VanBuren, Minnesota Environmental Quality Board

Minnesota needs a regional framework for evaluating how planning, policy and regulatory decisions may affect future water availability. Understanding the cumulative significance of future population and land use changes, commercial and industrial expansion, and energy development on Minnesota's human and ecological communities is a key to water sustainability. The need became apparent to the Pollution Control Agency in its environmental review of ethanol production facilities. And, as a result of that board's request, the Environmental Quality Board convened an interagency group to evaluate elements of a framework to ensure the sustainable management of water. The presentation will report on the results of the project, scheduled to be completed in September 2008, including its proposed framework and supporting GIS tool, as well as the information needed at both the regional and site-specific scales for ensuring that Minnesota manages its water resources on a long-term sustainable basis.

Water Use Conflicts and Resource Sustainability in Minnesota

Julie Ekman, Minnesota Department of Natural Resources, julie.ekman@dnr.state.mn.us

In 1937, near the end of the drought of the 1930's, the Minnesota legislature established a water policy for the state and a permit program to regulate water use. Droughts and increased demands for water continue to shape Minnesota's water use laws to this day. This presentation will provide a history of Minnesota's water use laws and how the water appropriation permit program addresses water use conflicts and the long-term sustainability of water supplies. Pressures and challenges facing the future of water resource management in Minnesota will be highlighted in case studies related to the rapid expansion of the ethanol industry and growing demands for public water supplies.

Concurrent Sessions I 10:00–11:30

Track D: Biologic Integrity of Streams

Determination of Appropriate Metric(s) for Sediment-related Maximum Daily Loads (TMDLs)

Anne Lightbody, University of Minnesota, annel@umn.edu; Partick Belmont, University of Minnesota; Jeff Marr, University of Minnesota; Cailin Orr, University of Minnesota; and Chris Paola, University of Minnesota, cpaola@umn.edu

The most common cause of impaired rivers and streams in the United States is sediment pollution. Sediment impacts on stream systems result from both its effect on water clarity and its physical characteristics. High levels of fine suspended sediment reduce aquatic health in numerous ways, including a reduction in light transmission, interference with aquatic organisms, and reduction in benthic habitat quality following deposition on the bed. There are many ways of measuring suspended sediment levels, including both direct measurements of concentration and indirect measures such as turbidity. Measurements of total suspended solids concentrations are obtained from water samples, which are then filtered and processed in a laboratory. Turbidity, on the other hand, is an expression of the optical property of a sample of water, in which the amount of light scattered by a given water sample is compared with that scattered by a standard sample. In many systems, particle size characteristics change rapidly both temporally and spatially, so turbidity does not always correlate well with suspended sediment concentrations. Therefore, since Minnesota has a water quality criterion based on turbidity alone, it is possible that stream habitat quality is being reduced by sediment pollution effects that are not captured by an analysis of water clarity alone.

Here, we asked the question of what is the most important aspect of sediment pollution. We tested the null hypothesis that turbidity is the most important factor by experimentally manipulating turbidity levels within an outdoor stream ecosystem and observing impacts of turbidity on this system. We introduced water with different compositions of suspended load (e.g., different proportions of fine sand, silt, mud, and different levels of organic matter and nutrients) but the same turbidity level into the Outdoor StreamLab facility at St. Anthony Falls Laboratory (SAFL), and compared the ecosystem response. Trials were performed under high flow conditions, which often accompany high turbidity levels and typically exert substantial stress on aquatic ecosystems. The results were analyzed to determine whether turbidity (i.e., NTU) most closely correlates with benthic habitat quality, or whether another metric or combination of metrics (e.g., suspended sediment concentration, transparency, net sedimentation, or embeddedness) provides a better understanding of the effect on benthic habitat. These results are needed by federal and State agencies to modify their TMDL program and better protect the water quality of America's rivers and streams.

Relation of Nutrient Concentrations and Biological Responses in Minnesota Rivers: Implications for River Nutrient Criteria Development

Steven Heiskary, Minnesota Pollution Control Agency, steven.heiskary@pca.state.mn.us; Howard Markus, Minnesota Pollution Control Agency

The Minnesota Pollution Control Agency recently completed promulgation of in-lake nutrient standards and is required by U.S. EPA to develop nutrient standards for rivers as well. This requirement led to several studies that demonstrated significant and predictable relationships among summer nutrient, chlorophyll a, and biochemical oxygen demand (BOD) in several medium to large Minnesota rivers. In an expansion of this work in 2000, diurnal dissolved oxygen (DO) flux (based on submersible data recorders) was found to be strongly positively correlated to TP and chlorophyll-a concentrations at several stream sites. These findings led to an expansion of this work on several additional rivers in 2006 in conjunction with USGS. These results, combined with those from 2000, demonstrate significant relationships among several invertebrate and fish metrics and TP, TN, chlorophyll-a and DO flux. Observations from these studies will be shared and their implications for development of river nutrient criteria discussed.

Concurrent Sessions I 10:00–11:30

Track D: Biologic Integrity of Streams, *continued*

The Effectiveness of Various Stream Restoration Techniques on Restoring Biological Integrity

Diane Spector, Wenck Associates, Inc., dspector@wenck.com; Ed Matthiesen, Wenck Associates, Inc.

Stream restoration projects in Minnesota range from simple streambank stabilization to total stream reconstruction. Often the most important factor in design is stabilizing and/or armoring the streambanks and channel to reduce erosion and scour, with little thought given to improving habitat and biological integrity.

These are not mutually exclusive goals. Stream stability can be improved while at the same time habitat is enhanced through judicious use of a variety of simple stream restoration techniques. We will present several before and after case studies of stream restoration projects that achieved different levels of stability and biologic improvements. Several projects on Shingle Creek, an urban stream; Pike Creek, a suburban stream; and Hardwood Creek, a rural/agricultural stream will be described and the before and after biologic improvement as measured by the macroinvertebrate Index of Biologic Integrity will be presented.

Our long-term goal is to develop guidance for water resources professionals on the most appropriate and cost-effective tools to achieve both stability and biologic integrity goals through stream restoration.

Luncheon Presentation 12:15–1:00

Green Infrastructure for Great Cities

Janet Attarian, Streetscape & Urban Design Program, Chicago Department of Transportation

Climate change and urban migration are forcing cities to be at the forefront of sustainable design. But what makes a city sustainable and what role does infrastructure play in a sustainable city? By virtue of their density, cities tend to use resources efficiently, but can we improve on this model? How will cities adapt? From earliest times access to water has determined the location and size of cities, and Chicago is no exception. Learn what Chicago is doing in its alleys and streets to rethink the role of water, and much more, in the urban realm.

Concurrent Sessions II 1:15–2:45

Track A: Infiltration

Tillage and Compost: Do they Improve Infiltration Rates of Compacted Soil?

Nicholas Olson, University of Minnesota, olso2113@umn.edu; John Gulliver, University of Minnesota

Soils on residential developments 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.

This presentation explores improvements to stormwater infiltration rates by amending soils on residential developments with tillage methods and compost application. Field studies to measure how these soil amendments perform under actual conditions and the practical aspects of using them have been performed. Three types of assessment techniques were used to document these improvements: (1) capacity testing, (2) synthetic runoff testing, and (3) monitoring.

The tillage and compost application improved infiltration rates over one season. The widespread application of our testing methods for the periodic assessment of infiltration rates will provide useful insight to proper design and maintenance schedules to achieve stormwater management goals.

Understanding Bioretention in Cold Climates

Jim Davidson, Dakota Soil and Water Conservation District, Jim.Davidson@co.dakota.mn,us; Nancy-Jeanne LeFevre, Emmons & Olivier Resources, Inc.; Gary Oberts, Emmons & Olivier Resources, Inc.

A Water Environment Research Foundation funded three year study of four bioretention systems has recently been completed. The study focused on the movement of water into systems located in Stillwater, Burnsville, Cottage Grove and West St. Paul. A small amount of data was also collected from a Ramsey-Washington Metro Watershed District office bioretention cell. The three year effort collected winter data on soil moisture, precipitation, air and water temperature, frost penetration, and response to direct discharge volume testing with control and salt-dosed synthetic runoff water. Measured responses reveal a dramatic range of performance including rapid infiltration during varying cold climate conditions. Design recommendations for creating or retrofitting effective bioretention systems will be given.

The 1' Infiltration Standard for Water Quality; One Year Later

Forrest Kelley, Capitol Region Watershed District, forrest@capitolregionwd.org

The Capitol Region Watershed District (CRWD), a densely populated urban watershed district located in St. Paul, MN adopted rules effective October 1, 2006. The rules require development and redevelopment projects over one acre to retain stormwater runoff onsite in the amount equivalent to the first 1"of rainfall over the entire site impervious area. The new rules apply to both public and private projects including street reconstruction.

In the first year of implementation, 28 permits were issued. A variety of emerging technologies have been used to achieve the infiltration and water quality standards. Municipalities have incorporated infiltration BMPs into street projects and documented the costs associated with achieving the new stormwater rules, and staff have collected cost data for the BMPs installed in the private sector. Alternative treatment options have been utilized to address site constraints such as bedrock conditions, contaminated soils, and space availability.

Concurrent Sessions II 1:15–2:45

Track B: Agricultural Drainage Impacts

Effect of Tillage and Nutrient Sources on Dissolved Organic Carbon Fluxes from Soil

Holly Dolliver, University of Wisconsin-River Falls, holly.dolliver@uwrf.edu; Satish Gupta, University of Minnesota

Soils are a crucial component of global carbon cycling. The soil organic carbon pool is highly dynamic and strongly influenced by tillage and other management practices. Fluxes of dissolved organic carbon from the terrestrial environment can substantially impact aquatic chemistry and biology. The objective of this field study was to quantify the effects of tillage and nutrient sources on both fluxes and storage of soil organic carbon. Tillage treatments included chisel plow and no-tillage. These tillage treatments have been in operation since 1993; however, the study was conducted from 2003 to 2007. The nutrient sources were two types of manure (hog and beef manure) and a synthetic fertilizer (urea). Both runoff and leachate were collected from 2003-2007. In addition, three soil cores to a depth of 120 cm were also taken from each plot to quantify soil carbon storage.

Measuring and Modeling the Impacts of Shallow Subsurface Drainage in a Cold Climate

Gary Sands, University of Minnesota, grsands@umn.edu; Wan Luo, University of Minnesota; Jeffery Strock, University of Minnesota

The hydrologic and water quality impacts of shallow subsurface drainage have been investigated for the previous seven years through field research at the University of Minnesota Southern Research and Outreach Center (south-central Minnesota). Seven-year pooled results from this study indicate that subsurface drains placed at 90cm discharge about 20 percent less water and nitrate compared to the more traditional drain depth of 120cm. A modeling study has been undertaken using the DRAINMOD NII model to investigate the influence of shallow drainage on drainage hydrology and water quality over a longer climatic record, additional soils types, and additional drain depths, than were previously studied in the field research. This paper will report on the progress of the modeling effort and will present the results of calibration and validation of the DRAINMOD NII model with data from the shallow drainage field experiment.

Evaluating Field-Scale Agriculture Drainage and Best Management Practices on Water Quality

Lucas Bistodeau, Minnesota State—Mankato, lucas.bistodeau@mnsu.edu; Shannon Fisher, Minnesota State—Mankato

Past research with plot-scale studies has addressed agricultural nutrient losses; however, applying this knowledge to field-scale applications has proven to be difficult. By understanding nutrient and pesticide transfer mechanisms in a field-scale setting, we can formulate land management practices to reduce non-point source pollution to surface waters. Our objectives were to 1) evaluate agricultural nutrient practices (NO_3-N, TP and OP) to reduce non-point source pollution and 2) evaluate the effect that subsurface tile drainage spacing has on nutrient and acetochlor losses. Nutrient results from 2007 and 2008, in a paired watershed, showed 15.2 and 24.3 meter spaced subsurface tiled systems using late fall, higher rate-applied anhydrous ammonia had higher nitrate-nitrogen flow-weighted mean concentrations (11.3 mg/L) than the BMP spring-applied urea fields (9.2 mg/L). Total phosphorus flow-weighted mean concentrations of variable rate applied P & K fields had a significant difference between BMP fields with concentrations of 0.14 mg/L and 0.05 mg/L. Quicker response time and higher peak flow values were observed in narrower tile spacing for both years.

Concurrent Sessions II 1:15–2:45

Track C: Groundwater—Aquifer Characterization and Availability

Case Studies and Local Ordinances Addressing the Importance of Interbedded Aquifers and Impermeable Shale Aquitards on Surface and Groundwater Resources of the Blufflands and Paleozoic Plateau of Southern Minnesota

Jeffery Broberg, McGhie & Betts Environmental Services, Inc., jsbroberg@mcghiebetts.com

The alternating sequence of Paleozoic carbonate, sandstone and shale bedrock units in the Upper Mississippi Valley show that aquitards like the Decorah Shale, Glenwood Shale and St. Lawrence Formation have a major influence on water supply, water quality and the interaction of groundwater and surface water. Work on the Decorah Shale Edge in the Rochester area has shown the importance of focused groundwater discharge and recharge. Case studies demonstrating the occurrence of fens and unique wetland habitats, property damage from focused groundwater discharge and impacts of land disturbance on groundwater quality will be presented followed by a discussion of how City of Rochester and Olmsted County Ordinances have been crafted and adopted to address both technical and community water management concerns.

Improved Aquifer Characterization in an Urban Area: A Hydrochemical and Hydrostratigraphic Approach

Robert Tipping, Minnesota Geological Survey, tippi001@umn.edu; E. Calvin Alexander, Jr., University of Minnesota

The goal of this project is to provide decision makers with a tool to assess changing ground-water quality conditions in an urban area. Research objectives are to classify ground-water types based on criteria of interpreted age and chemical composition, and display their three-dimensional distribution within the context of a revised hydrostratigraphic framework for Twin Cities bedrock aquifers and confining units. Historic chemical and isotopic ground-water data were assembled and interpreted in the context of geologic features not considered in previous hydrochemical studies. These features include proximity to buried valleys and recently mapped zones of preferential flow in bedrock aquifers. Results clearly illustrate three-dimensional pathways of recently recharged water, including areas influenced by pumping and areas where contamination has occurred. Specific applications include improved ground-water flow model calibration and contaminant transport assessments.

Regional Groundwater Flow Modeling in the Twin Cities Metropolitan Area: Determining Groundwater Availability

Lanya Ross, Metropolitan Council, lanya.ross@metc.state.mn.us

Since 2005, the Metropolitan Council has been working toward the development of a regional master water supply plan to improve the sustainability, reliability, security and cost-effectiveness of the Twin Cities metropolitan area water supplies. A regional groundwater flow model was developed to estimate the effects of projected metropolitan area land use development and water demand on groundwater levels and stream flow, with the goal of identifying and managing limits on groundwater availability. Model results indicate that continued reliance on traditional water supplies will cause significant changes to water resources in certain areas. New water supply sources, including community interconnections and surface water, may be needed to ensure adequate supplies for growing communities.

Concurrent Sessions II 1:15–2:45

Track D: Stream Erosion

Estimation of Nutrient Loads from Streams Affected by Agriculture Land Retirement Using Continuous Monitoring and Laboratory Concentrations

Victoria Christensen, U.S. Geological Survey, vglenn@usgs.gov

The U.S. Geological Survey, Minnesota Board of Water and Soil Resources, and the Legislative-Citizen Commission on Minnesota Resources conducted a study to describe the water quality of three Minnesota River sub-basins. Water-quality and aquatic-biology monitoring at Chetomba Creek, West Fork Beaver Creek, and South Branch Rush River was conducted from October 2005 through September 2008. Water quality was described using multi-parameter water-quality sondes that measured specific conductance, pH, water temperature, dissolved oxygen, and turbidity. Surrogate relations were developed between the sonde parameters and nutrient concentrations from laboratory analyses. The result was a continuous record of estimated nutrient concentrations and loads, that can be used to monitor the effects of agricultural land-retirement programs and large-scale best management practices (BMPs) on streams. Continuous loads can be used by resource managers to evaluate the success of agricultural BMPs and land-retirement programs and to indicate which sub-basins to concentrate efforts for improving stream quality.

Using Current Knowledge of River Channel Processes to Predict the Equilibrium Topography of a Sand-Bed Channel

Jeff Marr, University of Minnesota, marrx003@umn.edu; Anne Lightbody, University of Minnesota; Chris Paola, University of Minnesota

Stream restoration projects often seek to improve physical properties and rehabilitate ecological processes of a channel; however, project designs are often based on limited scientific knowledge. In the long term, a river within an alluvial flood plain will sculpt its banks to create a dynamically stable equilibrium (that is, although any position along the channel may change, the channel's mean properties will remain constant). Observations from natural rivers therefore allow the estimation of the stable equilibrium for a restored stream with known hydrology and bed material. Here, we present a design for a small sinuous sand-bed channel based on fundamental knowledge of equilibrium channel processes. Important parameters include the sediment size distribution; mean bankfull discharge, width, and depth; the variability in bankfull width and depth; and the baseflow depth. The channel design was compared to a reference reach with the same discharge and median grain size. To determine whether the equilibrium topography was predicted correctly, this channel design was created within the St. Anthony Falls Laboratory's Outdoor StreamLab during the summer of 2008, and its response to perturbation (floods) was assessed.

Concurrent Sessions II 1:15–2:45

Track D: Stream Erosion, *continued*

Spatial Analysis and Modeling of Stream Bank Erosion for Carver and Bevens Creeks, Minnesota

Steve Kloiber, Metropolitan Council, steve.kloiber@metc.state.mn.us

Streambank erosion can be a major contributor to stream impairment due to excessive sediment or turbidity. To formulate effective management plans, more information on the spatial distribution of streambank erosion is usually needed. This paper describes an effort that utilizes remote sensing and geographic information system data to perform a rapid assessment of 134 kilometers of stream in the Carver Creek and Bevens Creek watersheds located in central Minnesota. LiDAR and high resolution digital aerial photography were used along with soils and land cover data to develop an erosion assessment. Lateral erosion rates were measured by comparing streambank locations for selected stream segments digitized from 2000 and 2005 digital aerial photographs. Lateral erosion rates were significantly correlated to four independent variables with an r^2 = 0.68. The variables included in the model are mean bank slope, soil erodibility, specific catchment area, and sinuosity. The regression equation was then applied to the entire length of mapped streams to predict the spatial distribution of streambank erosion. Combining this information with bank height and soil bulk density, the estimated gross erosion mass from Bevens Carver Creeks is 65,000 metric tonnes/yr and 35,000 metric tonnes/yr, respectively. This information can then be used as an input in watershed sediment transport models or to help guide potential stream bank restoration efforts.

Concurrent Sessions III 3:15–4:45

Track A: Low Impact Development

Amery Regional Medical Center—A Rural LID Precedent

Kevin Biehn, Amery Regional Medical Center, kbiehn@eorinc.com

The initial site plan for the Amery Regional Medical Center (ARMC) was traditional in the basic sense. After exposure to low-impact development (LID) principals and benefits the ARMC resolved mid-stream to provide a facility that would promote human health and wellness through an ecologically enhancing environment.

The refocused objective of the ARMC site plan was to create a synergy between the hospital, the Apple River and the greater Amery community. Highlights of the plan include: ¾ of an acre of filtration and infiltration bioretention facilities, environmental education, porous fire access lane, ½ acre green roof, erection of a raptor nest, prairie restoration, trail system and an overlook of the Apple River.

Extensive water quality and quantity management surpasses both Polk County and WDNR NR-151 requirements. Peak discharge rates and total runoff volumes in post developed conditions will not exceed pre-development peak discharge rates and total runoff volumes for the 2-year and 100-year storm events. A 95% reduction in total suspended solids is estimated for post-developed conditions.

Project construction began in the spring 2006 and the hospital opened their doors in October 2007. Even prior to completion this project has become an LID precedent for rural Wisconsin and outstate Minnesota.

Presentation will feature the accomplishments discussed above; design challenges; construction sequencing to protect the integrity of the infiltration facilities; and a post occupancy evaluation.

Low Impact Stormwater Management- Lessons Learned

Jessica Collin-Pilarski, Ayres Associates, Collin-PilarskiJ@AyresAssociates.com; Daniel Bigalke, Ayres Associates

Tii Gavo is a Low Impact Development (LID) located near Scandia, Minnesota on the shore of Big Marine Lake. This 160 acre development includes the 20-acre Rasmussen Pond, numerous wetlands, native prairie grasses and an abundance of heritage trees. As an LID the stormwater management plan calls for infiltration basins, grass swales, rain gardens and other techniques that mimic nature and promote groundwater recharge. In the fall of 2007 excessive rainfall amounts during construction caused an increase in erosion. The perimeter controls kept Big Marine Lake and Rasmussen Pond from being affected, but there was extensive sedimentation damage in areas preserved for LID stormwater facilities. This presentation discusses the contractor's responsibility in implementing the SWPPP; actions taken to rehabilitate the proposed LID stormwater facilities; and measures that are necessary to prevent this type of damage from occurring in the future.

Concurrent Sessions III 3:15–4:45

Track A: Low Impact Development, *continued*

Vegetation—Can it Fix Soils in Raingardens? Not in Your Lifetime!

David Bauer, Rice Creek Watershed District, dbauer@ricecreek.org; Dan Wheeler, University of Minnesota

Planting vegetation is commonly considered an effective raingarden remediation strategy for compacted or fill soils. While vegetation has beneficial properties, it is only one of many important factors that influence water movement through soil materials. Processes that make soil more permeable in nature take hundreds to thousands of years, as shown in our native soils. Over the past few years, hundreds of rain gardens and biofiltration cells have been installed in Rice Creek Watershed District. Failures are usually linked to problems in interpreting the soils or damage to the soils during construction. Comparisons will be made to the performance standards of raingarden soils and the soil treatment areas of septic systems. Plants are important for aesthetics, filtering sediment, and trapping nutrients. Infiltration, a raingarden's most important function in meeting Rice Creek Watershed District Stormwater Rules, is dependent on the soils.

Concurrent Sessions III 3:15–4:45

Track B: Pesticides, Contaminants of Concern, and Emerging Contaminants

Fermentation Processes: Effect on Contaminant Partitioning and Water Quality

Denice Nelson, University of Minnesota, nels1083@umn.edu; Paige Novak, University of Minnesota

The addition of carbon to a groundwater aquifer can be intentional, as in the case of bioremediation applications, or unintentional, as in a spill of readily degradable compounds that can serve as substrate for microbial growth. The addition of carbon, regardless of intent, promotes the growth of a fermentative community capable of producing cosolvents (some of which are regulated in groundwater) or biosurfactants that affect the physical and chemical structure of water, thereby influencing the behavior of hydrophobic contaminants. In addition, potentially large volumes of methane gas can be produced as a result of these fermentative processes. Our research quantifies the type, quantity and effect of fermentation products stemming from carbon inputs through partitioning and column experiments. Data can be used to optimize bioremediation systems to enhance removal of contaminants, mitigate formation of regulated compounds, and manage spills of other degradable carbon sources.

Identification and Degradation of Industrial Phytoestrogens

Mark Lundgren, University of Minnesota, lund0583@umn.edu; Paige Novak, University of Minnesota

Plants produce a range of phytochemicals that, due to their chemical similarity to naturally produced hormones, have the ability to cause estrogenic and antiestrogenic effects. These phytoestrogens are known to be present in many plants that are processed industrially. The goal of this research is to identify plant-processing industries whose effluent contains detectable levels of phytoestrogens and to understand the fate of these compounds under typical wastewater treatment regimes. Other researchers have measured genistein, a common phytoestrogen, at levels up to 10.5 μg/L in wastewaters from the pulp and paper industry. Our work has shown that ethanol processes contain similar levels of genistein. Once more industries have been identified that have the potential to produce estrogenic waste streams, discharges can be monitored and treatment plants can be upgraded if necessary. This research is especially innovative because the investigation of industrial effluents for estrogenic compounds is nearly absent from the literature.

A 2007 Assessment of Pesticides in Minnesota Lakes

William VanRyswyk, Minnesota Department of Agriculture, bill.vanryswyk@state.mn.us; Steven Heiskary, Minnesota Pollution Control Agency

In 2007 the Minnesota Department of Agriculture (MDA) cooperated with the Minnesota Pollution Control Agency (MPCA) in a statewide assessment of pesticides in Minnesota lakes as part of the National Lakes Assessment coordinated by US EPA. Fifty two lakes were randomly selected and sampled by MPCA and EPA staff around the state. Samples were analyzed by the MDA laboratory for 38 common pesticides and their degradates. Pesticides and/or degradates were detected in 91 percent of the samples collected. Atrazine was the most frequently detected compound. All detections were well below established water quality standards or reference values. Pesticide detections were widespread including lakes from many non-agricultural areas of the state.

Concurrent Sessions III 3:15–4:45

Track C: Hydrologic Impacts of Climate Change

Adapting Stormwater Management to Climate Change

Camilla Correll, Emmons & Olivier Resources Inc., ccorrell@eorinc.com; Jennifer Olson, Emmons & Olivier Resources, Inc.; Gary Oberts, Emmons & Olivier Resources, Inc.

The certainty of climate warming and changing weather patterns means that standard practices of the past for stormwater managers must also change. Summers that will be warmer, drier, and stormier, and winters that will be wetter and stormier both imply a need for adaptive practices beginning immediately, since change has already begun. An increase in extreme events has been evidenced over the past 20-30 years and threatens to double in the future. A look at changing weather patterns, hydrologic/hydraulic response, water quality, surface and ground water levels, model paradigms, and BMP approaches are all necessary if we are to adapt without major infrastructure disruption. Secondary impacts on water supply and wastewater will also be briefly mentioned.

Devils Lake: Hydrologic Analysis of a Closed Basin System

Kari Layman, US Army Corps of Engineers, kari.l.layman@usace.army.mil; Rick L. Hauck, U.S. Army Corps of Engineers

The Devils Lake basin is a 3,810 square-mile closed sub-basin of the Red River of the North. There is zero outflow prior to the lake exceeding the natural overflow elevation of 1459.0 ft. Between July 1993 and July 2005, precipitation levels within the Devils Lake basin caused the water surface elevation of Devils Lake to increase from 1422.6 to 1449.3 ft. The 26.7 foot vertical rise resulted in an increase in lake surface area from 53,300 to 136,700 acres.

The rising lake waters impacted the City of Devils Lake flood protection project and the existing transportation system. A risk based analysis was completed to evaluate the flood protection project for Federal Emergency Management Agency certification. Given the current conditions, the analysis demonstrated, with reasonable assurance, that the project will safely contain the one-percent event. In addition, hydrologic dam safety analyses were completed to determine the appropriate top elevation for transportation routes that now impound water.

Influence of Climate Change on Flow in the Minnesota River at Mankato

Jeramy Kulesa, University of Minnesota, kulesa@umn.edu; David Mulla, University of Minnesota

The effects of increasing precipitation on streamflow have been extensively studied extensively. Results of those studies indicate that there is a relationship between increasing precipitation and flow, but the correlation is not always high. Precipitation is just one component of both the changing climate and the hydrologic cycle that drives flow. Rather than using precipitation as a metric for climate change, the Palmer Drought Severity Index (PDSI) was used. This index takes precipitation into account, but also temperature and evapotranspiration to get a better measure of the overall hydrologic effects of climate change. Results showed a strong ($p<.001$) increasing trend in flow of the Minnesota River over the period of record (1932-2006) for all flows (annual peakflows and annual mean flows as well as monthly maximum, mean, and minimum flows during the months of April, May, June, July, and August). Results also showed that climate change, as measured by changes in PDSI, can predict 57-99% of those observed increases. When the effects of climate change on flow are removed, the trend in residuals is either non-existent or greatly reduced. This seems to indicate that climate change accounts for a significant proportion of the observed increases in flow, and that land-use changes and agricultural drainage have had a lesser effect.

Concurrent Sessions III 3:15–4:45

Track D: Sediment Loading

Sediment loading in the LeSueur River Basin

Stephanie Day, University of Minnesota, dayxx196@umn.edu; Patrick Belmont, University of Minnesota; Karen Gran, University of Minnesota; Carrie Jennings, Minnesota Geological Survey; Andrea Johnson, University of Minnesota

The LeSueur River is the largest contributor of sediment to the Minnesota River system. There are a many features within the LeSueur Basin which may contribute sediment, including, bluffs, banks, ravines, uplands, and tile drains. We have employed a variety of techniques to constrain the sediment contribution from each of these potential sources. These techniques include side scanning LiDAR to survey bluffs and banks, repetitive sediment sampling in the river and ravines, repeat surveys in the main stem channels, as well as in ditches and ravines, sediment sampling of active channel alluvium for cosmogenic nuclide analysis as an indicator of sediment provenance, grain size distributions, and optically stimulated luminescence (OSL) dating.

The LeSueur River cuts through a series of glacial tills, blanketed throughout much of the basin by a thin mantle of glaciolacustrine sediment. The river was formed after a rapid incision of what is today the Minnesota River, due to an outburst flood of Glacial Lake Agassiz 11,500 years before present. This incision caused two knickpoints to propagate upstream forming the LeSueur River. As a result the lower 35 km of each of the three main branches of the LeSueur are highly incised, contain slopes of 0.002, and have developed large bluffs and ravines, both of which feed the main channel with sediment.

Preliminary results of bluff and bank erosion indicate that the erosive potential varies widely for each individual feature. Most variation is probably due to the sediment composition and stratigraphy of the bluff. Turbidity measurements on the main stems demonstrate substantial seasonality in sediment export from the system. The highest sediment flux accompanies spring thaw, when the agricultural uplands are typically bare earth and tilled and bluffs and ravines are most susceptible to slumping as they thaw. High sediment loads continue until a ground cover is formed on the agricultural uplands, which functions to physically trap sediment and greatly reduce flow in the river due to the high evapotranspiration rates.

Wild Rice River Sediment Budget

Jonathan Petersen, U.S. Army Corps of Engineers, jonathan.w.petersen@usace.army.mil; Jon Hendrickson, U.S. Army Corps of Engineers, and Rebecca Soileau, U.S. Army Corps of Engineers

In-stream sources and sinks of sediment, sediment transport capacity, and geomorphic characteristics in the lower 90 miles of the Wild Rice River, the lower 35 miles of the South Branch Wild Rice River, and the lower 7 miles of Marsh Creek were estimated. Information used included modern and historic cross sections, aerial photographs, past studies and research, and data from USGS gages. Techniques and tools used included geomorphic analysis, field reconnaissance, sediment sampling and analysis, aerial photo analysis, river cross section surveys, and hydraulic modeling. Analysis was done by 5 mile river reach. Hydraulic modeling was completed with the sediment transport capacity function in HEC-RAS. The focus of the sediment budget was determining sediment sources from bank and watershed erosion to the flood control projects and planned ecosystem restoration project.

Concurrent Sessions III 3:15–4:45

Track D: Sediment Loading, *continued*

Quantifying Erosion Rates from Stream Banks, Bluffs and Ravines in the Minnesota River Basin

John Nieber, University of Minnesota, nieber@umn.edu; Brad Hansen, University of Minnesota; Chris Lenhart, University of Minnesota; Jason Ulrich, University of Minnesota; Geoff Kramer, University of Minnesota; Zuzana Kunesova, University of Minnesota; David Mulla, University of Minnesota; Shannon Wing, University of Minnesota; and oel Nelson, University of Minnesota

The Lake Pepin TMDL targets the Minnesota River basin as its major sediment producing source. The lack of data defining potential sediment sources and loads has inhibited the HSPF modeling effort of the Lake Pepin TMDL. The University of Minnesota is conducting a study to determine the contribution of ravine, stream bluff and streambank erosion to the sediment load of the Minnesota River. MPCA desires to have preliminary independent estimates of sediment delivery from these erosional features for use in the HSPF model.

To estimate sediment loading from these sediment sources a number of different methodologies are being used or developed including: 1) GIS methodology to identify quantities and locations of ravines and stream bluffs; 2) aerial photography to quantify historic channel migration rates; 3) monitoring runoff and sediment loads at ravine outlets; 4) cross-sectional ravine surveys and surveys of stream banks; and 5) modeling of sediment production and transport with the CONCEPTS model.

This presentation will cover a discussion of the different methodologies and present some up-to-date results.

Poster Session 4:45–5:45

Carver County TMDLs: Sharing Our Slice of the TMDL Pie

Madeline Banschbach, Carver County Land & Water Services, mbanschbach@co.carver.mn.us; and Tim Sundby, Carver County Water Technician

Beginning in 2003, Carver County decided to take a front-of-the-line approach to complete nearly 20 TMDLs. This poster displays the timeline of two approved TMDLs from start through Implementation Plan. These timelines offer an insight to the Implementation Plan strategy and time necessary to complete a TMDL. Carver County takes a progressive role in the Implementation plan hoping to speed up the time it takes to determine if pollution reduction strategies are working. Both TMDL Implementation Plans follow a similar set of methods to reduce pollutant loads consisting of three steps. Within the Fecal TMDL, the entire watershed was broken up into sub-watersheds and strategies were focused on priority sub-watersheds. This allowed funds to be focused in problem areas. Second, the major pollutant loading sources were addressed in each sub-priority watershed. Lastly, incentive programs were created in order to encourage participation in reducing loads. Similarly, in the Burandt Lake's Implementation Plan, locations for urban stormwater best management practices (BMPs) were first chosen and then methods to reduce major loading sources were chosen. Lastly, incentive programs for lakeshore restoration served as outreach and encouraged participation in reducing loads. This poster gives informative examples of expected timelines and Implementation strategies.

Development of an Ecological Assessment Method for Minnesota Lakes

Marcus Beck, University of Minnesota, beckx226@umn.edu; Lorin Hatch, HDR Engineering Inc.; and Bruce Vondracek, University of Minnesota

Current methods of ecological health assessment of lakes within the state of Minnesota are not adequate for meeting the requirements of the 1972 Clean Water Act and assessing the condition of affected biota within these aquatic systems. The Index of Biotic Integrity (IBI) offers an effective ecological health assessment method for Minnesota lakes. The objective of this study is to provide a general framework for ecological health assessment of Minnesota lakes with the successful development and implementation of an aquatic macrophyte-based IBI. The macrophyte IBI will play a complementary role to the Minnesota fish-based IBI developed by Minnesota Department of Natural Resources personnel. The macrophyte-based IBI will be developed from existing MNDNR macrophyte point intercept surveys and will follow the general framework of the Aquatic Macrophyte Community Index. The 2008 field season will be followed by development and initial analyses of discriminatory abilities of the index.

NEMO Outdoors! Creating More Effective Water Resource Education & Outreach for Local Decision Makers

John Bilotta, University of Minnesota Extension, jbilotta@umn.edu; and Jenny Winkelman, Mississippi Watershed Management Organization

The Northland NEMO Program, together with the U of MN Extension and various local partners, has instrumented innovative and effective education and outreach to local decision makers and elected officials by getting them out and on the water resources they manage. Programs like "A View From the Big River" have created rich learning environments for NEMO based programs that include hands-on, interactive simulations such as the Watershed Game. A guided tour component demonstrates water quality monitoring programs and the results of project investment by the local unit. Another component has included an activity for local decision makers to calculate impervious surface area. This presentation will reflect on the various components of these "on the water" programs, how they were developed, what they offer to the participants, the effectiveness in achieving desired outcomes, and how participants have applied what they have learned.

Poster Session 4:45–5:45

Highway 36 Reconstruction: Erosion Control is a Collaborative Effort

Nicole Danielson-Bartelt, Mn/DOT, nicole.danielson-bartelt@dot.state.mn.us; Paige Wein, Ramsey-Washington Metro Watershed District; Mike Goodnature, Ramsey County Soil and Water Conservation District; Dwayne Stenlund, Minnesota Department of Transportation

The Highway 36 Reconstruction in North St. Paul is a project recognized for having a number of innovative construction and contracting techniques including total closure of the road during construction, intelligent compaction, and machine control, among others. Due to these innovations, the project was watched and visited regularly by many interested parties. All aspects of the project were open to increased examination, including erosion control.

The objectives of the Highway 36 erosion control plan were to follow the Stormwater Pollution Prevention Plan (SWPPP) in a timely and appropriate manner, use available materials and labor to protect natural resources onsite, and communicate effectively between all erosion control partners.

The methods used to meet the goals of the erosion control plan focused on the "team effort" between the erosion control partners. The following are some of the tools used to keep all parties informed of important issues: regular on-site meetings, preemptive notification if there were any erosion control issues and how they were being addressed, follow-up after any incidents, documentation of issues, solutions, and all regular best management practices (BMP). The contractor and project partners also worked together to identify unique best management practices, such as use of slash mulch for tracking control and washout pits, and a floating silt curtain as a last outfall protection for the season.

The Highway 36 Reconstruction Team was recognized for the efforts of all partners with respect to environmental excellence. Communication and cooperation were the keys to addressing erosion and sedimentation control issues and maintaining good rapport between all interested parties.

Linking Submerged Aquatic Vegetation Restoration to the TMDL for the Upper Mississippi River-Lake Pepin System

Joseph DePinto, Limno Tech Inc., jdepinto@limno.com; Wendy Larson, Limno Tech Inc.; Dan Rucinski, Limno Tech Inc.; Todd Redder, Limno Tech Inc.; Norman Senjem, Minnesota Pollution Control Agency; Hafiz Munir, Minnesota Pollution Control Agency

The State of Minnesota is developing a TMDL for a 90 mile section of the Upper Mississippi River that is driven by 303(d) priority listings for both turbidity and nutrient enrichment (total phosphorus and chlorophyll *a*). In addition to the turbidity and nutrient enrichment water quality concerns, the frequency of submerged aquatic vegetation (SAV) in the shallow and backwater areas of the system in 2002 is well below what was observed at the start of the USGS Long Term Monitoring Program (LTRMP) in 1991. We have developed a GIS-based model that computes SAV biomass production on a spatially distributed basis for *Vallisneria americana* (Wild Celery) and *Potamogeton pectinatus* (Sago Pondweed) based on USACE-ERDC models for these two species. It has been calibrated to lower Pool 4 aquatic vegetation data from the LTRMP, and then applied to three different areas in Pool 2, Pool 3, and upper Pool 4. The model results demonstrate how reduction of turbidity and phytoplankton biomass as a function of TMDL implementation will increase light penetration, thus creating an environment that is more conducive to increased SAV growth and areal coverage.

Poster Session 4:45–5:45

Reducing Uncertainty and Bounding Variability of Stream Ecosystem Indicators

Christine Dolph, University of Minnesota, dolph008@umn.edu; Bruce Vondracek, USGS, Minnesota Cooperative Research Unit, University of Minnesota

Increasingly, biological indices such as the Index of Biological Integrity (IBI) are used to help make policy and management decisions regarding impaired waters. Minnesota Rules Chapter 7050, for example, requires that the biological quality of any surface water body be assessed and compared to the biological integrity of reference conditions. However, the degree and sources of variability associated with IBI values are not well understood. This uncertainty leads to concerns about the confidence with which such values should be used to list a water body as impaired. The Minnesota Pollution Control Agency (PCA) has assembled a dataset of fish and macroinvertebrate information for approximately 1500 stream sites across the state, and has developed regional IBIs for several major river basins. Here use information from the PCA database to examine the variability of stream ecosystem indicators, and to develop improved methods for assessing and monitoring stream integrity.

The Mound Transit Station Parking Facility – Multifaceted Stormwater Management along Lake Minnetoka

Troy Erickson, SRF Consulting Group, Inc., terickson@srfconsulting.com; Carlton Moore, City of Mound

As part of the Mound Harbor Renaissance Project, the City of Mound created additional parking with a ramp to serve park-and-ride customers, office/restaurant space, adjacent redevelopment, a farmer's market and the future LRT corridor. Because of the project's proximity to Lake Minnetonka and watershed regulatory requirements, SRF developed innovative stormwater treatment methods to reduce the quantity and improve the quality of runoff from the site. A study of available technology resulted in a site that is environmentally friendly, economically feasible, and aesthetically pleasing, allowing the City to maximize a Minnehaha Creek Watershed District grant. These methods include permeable pavers, an underground sand filter, and a rain garden as well as a stormwater pond with a re-circulating pump and boulder stream that enhances the area's aesthetics while maintains water, clarity and reduces algae production. The presentation outlines the design and construction of the treatment train of BMPs and expected system performance.

Minnesota Pollution Control Agency's Environmental Data Access System

Jason Ewert, Minnesota Pollution Control Agency, jason.ewert@state.mn.us; David Fawcett, Minnesota Pollution Control Agency

Easily and readily accessible monitoring data helps Minnesotans play an active role in protecting and improving their environment. Although the MPCA and other organizations collect large quantities of environmental data, much of it has been difficult to access.

Citizens and environmental professionals now have access to surface water, ground water and air quality data through the MPCA's Environmental Data Access system. In addition to data collected by the MPCA, the system also links to information collected by other organizations such as the Minnesota Department of Health, Minnesota Department of Natural Resources and the U.S. Geological Survey.

The Web-based EDA system allows users to find environmental data and information using text-based searches or an interactive, GIS-based mapping tool.

Attendees will learn how to find and download environmental data using the EDA system.

Poster Session 4:45–5:45

Flooding in Illinois, Iowa, Minnesota, and Wisconsin, August 17–23, 2007

James Fallon, U.S. Geological Survey, jfallon@usgs.gov; Herb Garn, U.S. Geological Survey; Marvin Harris, U.S. Geological Survey; Kris Lund, U.S. Geological Survey

Record rainfall occurred August 17–23, 2007 causing severe floods in parts of the Upper Mississippi River Valley and killing 14 people. Widespread, slow-moving thunderstorms developed and redeveloped along a stationary front, stretching from northern Iowa through northern Illinois, while the low-level jet stream transported warm, moist air from the remnants of Tropical Storm Erin into southern Minnesota and southern Wisconsin (National Weather Service, 2007a). The rain broke drought conditions in parts of Minnesota and Wisconsin, but fell on saturated ground in Iowa and Illinois.

The greatest rainfall occurred in southeast Minnesota and southwest Wisconsin. Many locations exceeded the 100-year recurrence interval for 24-hour rainfall (6–7 inches) and 100-year 5-day rainfall (9–10 inches) (Huff and Angel, 1992). Record amounts of rainfall for August were recorded, including 15.18 inches in Madison, Wisconsin (National Weather Service, 2007b). The 24-hour rainfall record was broken for Minnesota in Houston County when 15.10 inches of rain fell August 18–19.

Flooding was severe in parts of the four states. In Iowa, flooding occurred in the north central and south central portions of the state beginning August 17. The most severe flooding occurred in the Des Moines and Chariton River Basins, with recurrence intervals ranging from approximately 15 to 60 years. Streams in northeastern Iowa generally had peak streamflows with recurrence intervals of less than 10 years.

In northern Illinois and the Chicago area, flooding occurred on the Kishwaukee River, Fox River tributaries, the Skokie River, and the Little Calumet River tributaries. Additional precipitation on August 23 caused flooding at the 100-year recurrence interval on the South Branch Kishwaukee River, Tyler Creek, and Deer Creek near Chicago Heights. Streamflows in larger rivers, including the DuPage and Fox, reached or exceeded recurrence intervals of 25–50 years.

In southeast Minnesota, the most severe flooding occurred in and adjacent to the Whitewater and Root River basins. Two streamgages in the Root River basin recorded peak flows of record. One gage on the Root River recorded greater than a 100-year recurrence interval while the other on a tributary is likely to exceed the 500-year recurrence interval. In the Zumbro River basin, flooding was less severe with peaks of 10-year recurrence intervals.

In southern Wisconsin, flooding was most severe in the Lower Wisconsin River, Grant/Sugar/Pecatonica River basins, southern Lake Michigan tributaries, Illinois/Fox River, and the Rock River. Recurrence intervals ranged from 2–100 years.

Federal disaster areas were declared for 14 counties in Iowa, 6 in Illinois, 8 in Minnesota, and 14 in Wisconsin (http://www.fema.gov/news/disasters.fema). Flood and storm damages were estimated at greater than $240.6 million for the four states. Damages were estimated at $10.7 million in Iowa (Iowa Homeland Security and Emergency Management, 2007), $22.6 million in Illinois (Illinois Government News Network, 2007), $157.3 million in Minnesota, (Minnesota Office of the Governor, 2007), and $48 million in Wisconsin (Wisconsin State Journal, 2007).

Poster Session 4:45–5:45

Stream Bed Slope Response to Gravel and Sand

John Gaffney, St. Anthony Falls Laboratory, gaff0050@umn.edu; Kimberly Hill, St. Anthony Falls Laboratory; Chris Paola, St. Anthony Falls Laboratory

Best practice in stream restoration requires prediction of the stable slope of a gravel bed river on the basis of specified sediment sizes. However, a restored gravel bed will likely be subjected to influxes of finer sediments and the resulting bed slope is largely unknown. We report on experiments designed to study the slope response of a gravel bed river to an influx of sediments finer than those present in the bed. We compare the slope of a gravel feed system to the slope produced after doubling the total feed rate by adding finer sediment at a rate equal to the original gravel feed. We frame our experimental results using theoretical predictions that (1) for size ratios close to 1 the bed slope will increase, (2) for intermediate size ratios the bed slope will decrease and (3) for very large size ratios the bed slope will be unchanged.

Water Quality in Saint Paul: BMP Cards as Education/Outreach Tool

Joni Giese, SRF Consulting Group Inc., jgiese@srfconsulting.com; Tim Griffin, Saint Paul on the Mississippi Design Center

Objectives

Although existing water quality manuals contain useful technical information, they are not easily understood by residents or policy-makers. Therefore, water quality best management practice (BMP) cards were developed by the Saint Paul on the Mississippi Design Center to present water quality concepts, treatment strategies, and design approaches in an illustrative and easily understood format. These interactive cards educate policy-makers and city residents about the important relationship between water quality and the health of the Mississippi River.

Methodologies

The cards are designed to initiate a conversation at the beginning of the design process, not to provide detailed guidance. Each card provides a basic BMP illustration, definition, associated treatment goals, a local example, and additional technical resources.

Results

The presenters will describe how the cards have been received by the community and how the Design Center has used the cards as part of their design workshop process.

Bacterial Encapsulation for PCB Degradation

Jenny Grady, University of Minnesota, grady038@umn.edu; Erin Surdo, University of Minnesota; Bill Arnold, University of Minnesota; Paige Novak, University of Minnesota

Polychlorinated biphenyl (PCB) contamination is a persistent and widespread problem in lake, river, marine, and estuarine sediment. Biodegradation is severely limited by the bioavailability of PCBs, which results in a low population of organisms capable of degrading or dechlorinating PCBs. Our research focuses on the development of a novel membrane system that would deliver a large population of aerobic PCB degrading bacteria (*Burkholderia xenovorans* strain LB400) along with oxygen to the contaminated sediment, providing an environment where growth and survivability were enhanced. Coupled with an abiotic containment membrane, the technology would both remediate and contain PCB contamination. Data on the PCB degradation capability of LB400 and the viability of polyacrylamide-encapsulated LB400 over time will be presented.

Poster Session 4:45–5:45

Application of Wireless and Sensor Technologies for Urban Water Quality Management: Pollutant Detection in Urban Streams

Michael Henjum, University of Minnesota, henj0016@umn.edu; Chris Wennen, University of Minnesota; Jim Kang, University of Minnesota; Miki Hondzo, University of Minnesota; Paige Novak, University of Minnesota; William Arnold, University of Minnesota

Widespread water quality threats including insecticides, herbicides, pharmaceuticals, estrogens and other anthropogenic pollutants have recently been detected within our urban water systems. Direct detection of these compounds is labor intensive and expensive, thus surrogate measurements are desirable. Using a real-time wireless network and high frequency sensor to collect data throughout the 2008 year, correlations between fundamental water quality parameters and emerging chemical contaminants will be established. These results will subsequently enable mechanistically-based scaling and forecasting of water quality in urban streams and rivers. Future planning and management of stormwater best management practices can be enhanced accordingly.

Results will be presented in the fall 2008 conference.

Brooklyn Center TIF District 3 Regional Stormwater Treatment Facility

Todd Hubmer, WSB & Associates, Inc., thubmer@wsbeng.com; Todd Blomstrom, City of Brooklyn Center; Paul Hudalla, WSB & Associates, Inc.

As available land becomes scarce and land costs increase in Minnesota's metropolitan areas, underground stormwater treatment systems become a more economically feasible means to treat stormwater runoff. After considering several options to treat stormwater runoff from areas in Brooklyn Center slated for redevelopment, the City determined that an underground regional treatment system was the best solution to serve the needs of the community.

Construction of the underground facility that serves a 490-acre drainage area (the largest facility of its type in the State) was completed in November 2008. The facility is designed to retain total suspended solids and floatable pollutants that flow through the trunk storm sewer that discharges to the Mississippi River.

This presentation will provide results of a cost-benefit analysis used to evaluate stormwater treatment options, design considerations for the underground facility, and calculated and observed sediment volumes retained in the facility.

Poster Session 4:45–5:45

Saint Paul's Water Comprehensive Plan Chapter, and Saint Paul's Water Comprehensive Plan: An Inclusive Approach to Meeting State and Local Requirements

George Johnson, SEH Inc., gejohnson@sehinc.com; Larry Soderholm, Planning Administrator City of Saint Paul; Andrew Jacobson, Duke University

Minnesota statute, section 473.864 directs local government units within the seven county metropolitan area to update their local Comprehensive Plans and submit them to the Metropolitan Council. This round of Comprehensive Plan updates includes, for the first time, a chapter dedicated to water resources.

Saint Paul, with its history of citizen engagement, invited regulatory, nongovernmental and advocacy groups to participate in a citizen task force to create the plan. City staff and planning commissioners were the conveners and drafters. Participants include several city departments, watershed districts, neighborhood and advocacy groups, industry professionals, University of Minnesota professors, and state and federal employees.

Following the broad theme of sustainability, the Water Comprehensive Plan integrates information about water supply, surface and ground water management, and sanitary sewers. The plan will set City policy until 2020 to ensure safe and affordable water supply and sanitary sewer services while also protecting surface and groundwater quality.

Policy Considerations in the Poplar River Turbidity TMDL Study

Greg Johnson, Minnesota Control Agency, Gregory.Johnson@pca.state.mn.us; Karen Evens, Minnesota Pollution Control Agency; Pat Carey, Minnesota Pollution Control Agency; Troy Naperala, URS Corporation

A TMDL study was initiated on the Poplar River along the North Shore of Lake Superior in Minnesota given significant interest by some watershed stakeholders by the MPCA. Contracts with an EPA contractor and local unit of government were developed to complete the technical and stakeholder activities for the study, respectively. Several policy and program issues and concerns arose during the EPA contractor portion of the study including the role and participation of stakeholders in the study, especially in the review of draft contractor reports; application of the turbidity standard given likely significant "natural" background contributions; consideration of a process to establish a site-specific standard; and a need to address turbidity issues along all of the North Shore. This presentation will describe the issues and work that were and are continuing to be done to address the issues and concerns.

A General Method for Modeling Bacterial TMDLs Along the Texas Gulf Coast

Stephanie Johnson, University of Minnesota, sljohnson@mail.utexas.edu; David Maidment, University of Texas; Mary Jo Kirisits, University of Texas

With over 300 bacterial TMDLs to complete, the Texas Commission on Environmental Quality (TCEQ) has recommended the use of "simple" water quality models for initial modeling efforts. Within this paper we will discuss our attempts to expand previously used methods to develop a "simple" GIS-based modeling scheme for calculating bacterial TMDLs along the Texas Gulf Coast. Progress to date includes developing an approach to transfer the concept of load duration curves to model bacterial loading in non-riverine systems. Results also include a delineation of the watershed based on the likelihood of contributing viable bacteria to the violating waterbody. Methodologies are being developed with nationally available datasets to encourage the transfer of these concepts to other watersheds across the United States.

Poster Session 4:45–5:45

Water: Recycle, Reuse, Protect the Environment, and Save Money

Michael Jungbauer, Landform, mjungbauer@landform.net

In an age of diminishing fresh water supplies, battles over water allocations, and increasing regulations on every aspect of water, practitioners need real tools and real information on available solutions. Business as usual will continue to drive us to the brink of impending water disasters as we've seen in other parts of the country.

This presentation is focused on providing the tools necessary to start planning for the future, based on technological solutions that are proven and available today. A variety of solutions that are available for use in residential and commercial applications that can be applied to stormwater, wastewater, and lake restoration projects will be covered. The bio-chemistry associated with water problems is also discussed.

Detailed topics include utilizing the existing hydrology and geology of a site in an effort to place treated water into rapid recharge areas to facilitate recharging the aquifers, as well as cities using intentional zoning to locate businesses such as car washes, laundromats, and greenhouses that can reuse recycled water.

Technology is available today that is economical and is already being used on sites around the country. The goal of this presentation is to provide long term solutions that are available now and can be used to recycle, reuse, protect the environment, and save money.

Development of Riverbank Stabilization Guidance for the Mississippi River

Dan Kalmon, Mississippi Watershed Management Organization, dkalmon@mwmo.org; Jeremy Grush, LimnoTech; Hans Holmberg, LimnoTech; Todd Redder, LimnoTech; Todd Rexine, Great River Greening

The Mississippi Watershed Management Organization (MWMO) is developing a riverbank classification system for the Mississippi River upstream of Ford Dam. Physical characteristics of the riverbank, along with predicted shear stresses across a full range of flows, will be used to classify and recommend bio-engineering applications to restore and protect the riverbanks. This presentation will describe the field survey and data collection, modeling, and data synthesis efforts being conducted to support this project. Field surveys are being conducted to collect information on bank profiles and slope, vegetative cover, soil type, and existing structures or protection measures. Two-dimensional hydrodynamic modeling of the Mississippi River from the Hwy 694 bridge to Ford Dam has been conducted to assess shear stress and critical bank elevations. A data management and visualization tool is also being developed to allow property owners to select locations, review physical data and modeling results, and choose from applicable bio-engineering applications for their site.

Poster Session 4:45–5:45

Regionalization of Ground Water Systems in Support of Water Resources Sustainability Atlases in Minnesota

Roman Kanivetsky, University of Minnesota, kaniv001@umn.edu; John Nieber, University of Minnesota; Boris Shmagin, South Dakota State University; David Mulla, University of Minnesota; Heidi Peterson, University of Minnesota; Francisco Lahoud, University of Minnesota

Organizing knowledge for water resources sustainability requires a new approach in regionalization of terrestrial hydrologic system. We propose an approach based on a definition of the hydrological unit as the land area that integrates all components of the terrestrial hydrologic system. Such nomenclature provides not only a much fuller characterization of the hydrologic system than using just the component parts such as aquifers or confining beds, but it is also a prerequisite to study water resources sustainability. The hydrologic response of such hydrologic units, once established based on measurements at an appropriate scale, can be directly related to the hydrologic response of geometrically similar hydrogeologic units elsewhere. This similarity allows the scaling (up or down) of hydrologic response based on the absolute size of the unit.

Soil Seed Bank Analysis of a Drained Peatland in East-central Minnesot Pre- and Post-Grading: a Case Study for Wetland Restoration

Allyz Kramer, SEH Inc., akramer@sehinc.com

This study evaluated native seed bank viability in a peatland subjected to prolonged drainage for sod production in Ham Lake, Minnesota. The study area was within a proposed wetland restoration and mitigation site, and included assaying the soil seed bank prior to, and immediately after, site grading. The goals of the study related to wetland restoration and future management activities were to quantify viable plant species present in surface and subsurface seed banks; evaluate native origins of viable germinants; and, determine relative densities of viable hydrophytes in the seed bank. Both assays included a high density of weedy species associated with moist, disturbed sites and waste places, which provide a strong argument for scraping and removing extant vegetation prior to attempting native vegetation reestablishment. Spreading surface soils around the site during grading activities should be avoided because of relative densities of undesirable weedy species contained in surface soils.

Poster Session 4:45–5:45

Degradation of Persistent, Bioaccumulative, and Toxic Compounds in Groundwater by Dehalococcides-like Organisms

Mark Krzmarzick, University of Minnesota, krzma006@umn.edu; Paige Novak, University of Minnesota; Jevon Harding, Princeton University; Alessandra Leri, Princeton University; Satish Myneni, Princeton University

Anthropogenic chlorinated compounds such as chlorinated ethenes, PCBs, and dioxins are often persistent, bioaccumulative and toxic (PBT). These compounds pose significant threats to surface waters and aquifers therefore low cost methods of remediation are of critical importance. This research tests the hypothesis that dehalorespirers, which are able to degrade several PBTs, are natural components of uncontaminated ecosystems and that their presence is linked to the existence of natural chlorinated organic compounds. Six soils cores were collected from an uncontaminated area of the New Jersey Pine Barrens. Quantitative real-time polymerase chain reaction has been used to quantify the numbers of *Dehalococcoides*-like species in the soil cores. These numbers will be correlated with the quantity of chlorinated organic matter. The ability of dechlorinators to respire natural chlorinated organics will be tested in batch reactors, which will enable more cost effective methods of stimulation for the degradation of anthropogenic PBTs.

Expanding Stormwater Education and Outreach Through Private-Public Partnerships

Kate Kubiak, South St. Louis Soil and Water Conservation District for the Regional Stormwater Protection Team, kate.kubiak@southstlouisswcd.org; Mindy Granley, Minnesota DNR Lake Superior Costal Nonpoint Pollution Control Program for the Regional Stormwater Protection Team

The Regional Stormwater Protection Team is a cooperative effort between 26 communities and entities in the Twin Ports region of Duluth/Superior. The group's mission is to protect and enhance the region's shared water resources by providing coordinated educational programs and technical assistance aimed at reducing stormwater pollution. In an effort to expand its outreach, the group launched the Superior Streams Partner Program in 2008. This program seeks to involve businesses in reducing stormwater pollution by inviting them to support the group's outreach efforts with a monetary donation and implementing stormwater BMPs in their business practices. Using the marketing plan created for the program in 2007, the group will implement the project over the spring and summer of 2008. Success will be determined by how many partnerships the group is able to develop and the degree to which the nature of those partnerships can or will lead to reduced stormwater pollution.

Utilizing Beaver in Stream Restorations

Terry Lee, Olmsted County, lee.terry@co.olmsted.mn.us

Few animals have had as big an impact in shaping the landscape of North America as the beaver and few are as controversial amongst natural resource managers. Although the fur trade nearly decimated the beaver, today they are making a comeback. Scientists are beginning to value the role of beaver in stream ecosystems and resource managers in western states have begun to utilize them in stream restorations. This presentation will summarize information that could be used in evaluating utilizing beaver in Minnesota stream restorations.

Poster Session 4:45–5:45

Innovative Techniques to use Plants and Soils for Stormwater Services in Ultra Urban Environments with Limited Open Space

Peter MacDonagh, The Kestrel Design Group, Inc., pmacdonagh@tkdg.net

Opportunities for bioretention abound even in ultra urban areas dominated by impervious surfaces. This presentation will discuss various innovative techniques to maximize bioretention and improve our urban ecology in urban areas by growing plants on roofs and walls, as well as increasing bioretention potential on the ground by extending plant rooting volume under paved surfaces for maximum bioretention volume and tree growth. Qualitative and quantitative benefits will be discussed as well as local, national, and international case studies. Innovative techniques like these are invaluable in ultra urban areas dominated by impervious surfaces where there is a high premium on open space, and all the more so in areas with inadequate storm sewer capacity, like Washington DC, where even a tenth of an inch rain event results in a combined sewer overflow and stormwater discharge. These techniques could also be invaluable in alleviating inadequate storm sewer capacity in many urbanized parts of the Twin Cities.

Targeted Stabilization of an Urban Stream

Stephanie McNamara, Vadnais Lake Area Management Organization, Stephanie.o.mcnamara@vlawmo.org; Eli Rupnow, Emmons & Olivier Resources, Inc.; David Schuler, St. Paul Regional Water Services

A feasibility study commissioned by Ramsey Conservation District (RCD) was completed in 2005 with the charge of stabilizing a downstream reach of Lambert Creek in Vadnais Heights. Vadnais Lake Area Watershed Management Organization (VLAWMO) has coordinated implementation of the three highest priority locations identified in the plan, beginning winter 2007. Numerous erosion concerns were addressed as part of this first phase of the feasibility study implementation. Large gully remediation, gabion failure, bank weeping, discharge outlet scour, and headcuts were all addressed using a variety of constructed practices including a rock vane, large gabion replacement, drain tile installation, rip rap armament, drop structure construction and coir log toe protection.

The stabilization construction effort concluded the final phase of a Minnesota Pollution Control Agency Clean Water Partnership Project aimed at reducing phosphorus loading in Lambert Creek, a tributary to Vadnais Lake, reservoir for the St. Paul water supply. Monitoring flumes were replaced at two locations along Lambert Creek to better monitor the pollutant loading to Vadnais Lake. RCD contributed grant funding toward the stabilization design. VLAWMO considers this multifaceted project a pilot. The watershed hopes to partner with the St. Paul Regional Water Services, local municipalities and agencies, as well as neighbors along to creek to continue to restore targeted reaches of Lambert Creek.

Results of the 2008 monitoring effort are not known at this time, but will be discussed. The creek is listed for bacterial impairment on the 2008 MN impaired waters list.

Poster Session 4:45–5:45

Ditched Stream Restoration: Painter Creek, Minnetrista

Tom Miller, Emmons & Olivier Resources, Inc., tmiller@eorinc.com; Renae Clark, Minnehaha Creek Watershed District

A stream restoration project was implemented in March of 2008 on Painter Creek in an effort to improve water quality in Jennings's Bay, Lake Minnetonka. This restoration project was implemented after the wetland was identified as having a high phosphorus sorption potential. The main project components include:

- creation of 2,500 LF of natural stream channel within a 58-acre ditched wetland,
- weir modification,
- sheet pile weir construction,
- bypass channel filling,
- native seeding and plantings,
- and reed canary grass management.

The new channel was seeded and planted in spring of 2008 and will be allowed one full year to establish before it is brought on-line. This presentation will highlight aspects of the design and construction, focusing on successes and lessons learned.

Developing Aquatic Life Benchmarks for Pesticides

Phil Monson, Minnesota Pollution Control Agency, phil.monson@state.mn.us; Joe Zachman, Minnesota Department of Agriculture; Angela Preimesberger, Minnesota Pollution Control Agency

Gathering and assessing toxicological research data is essential for developing decision-making tools to assess the quality of Minnesota waters. This project examined the utility of pesticide aquatic life benchmarks developed using a range of data primarily from public agency, pesticide registrant, and open literature sources. Methods used in this effort were assessed for their effectiveness to develop benchmarks using limited data sets. Toxicological data for pesticides was assessed for quality assurance and examined for defensible outcomes by comparing benchmarks developed from the selected data sources. Data gaps, method refinements and policy considerations will be discussed.

Poster Session 4:45–5:45

Blue Thumb—Planting for Clean Water

Dawn Pape, Rice Creek Watershed District, dpape@ricecreek.org; Angie Hong, Washington Conservation District; Elizabeth Storey, Capitol Region Watershed District

This talk is geared for: MS4s and Cities working to achieve (or exceed!) their SWPPP requirements in Education and Outreach and Public Participation. and water resource educators looking to work with a team of 37 partners to achieve change across the state.

The Blue Thumb—Planting for Clean Water program makes it easy for residents interested in doing their part to protect water quality to plan, purchase and plant native gardens, raingardens and shorelines with native plants. The Blue Thumb program was started by the Rice Creek Watershed District as an outreach program to meet water quality goals identified in their strategic plan and to help their cities meet their federal Clean Water Act mandates. Now Blue Thumb reaches beyond the Rice Creek Watershed District boundaries into the Twin Cities metro area and greater Minnesota. There are currently 37 Blue Thumb partners.

Get involved with this award winning partnership has launched an extensive media campaign, held scores of workshops for residents, trained professional landscapers on lake shore restoration and raingardens, had representation at hundreds of fairs and events, created an incredible raingarden guide and have built a partnership of 36 member organizations.

Creating a Database of Empirical Watershed Characteristics for Atlases of Minnesota's Water Resources Sustainability

Heidi Peterson, University of Minnesota, pete6495@umn.edu; John Nieber, University of Minnesota; Roman Kanivetsky, University of Minnesota; David Mulla, University of Minnesota; Francisco Lahoud, University of Minnesota; Boris Shmagin, South Dakota State University

Creating a watershed characteristic database is the first and most significant step in the analysis of spatio-temporal distributions of Minnesota's water balance components. The database spatially associates hydrologic data (annual discharge, monthly proportion, and yield) with topographical, soil and vadose zone, ecological and hydrogeological conditions and properties. USGS stream flow data for 129 gauging stations located within Minnesota was manipulated to display within ArcGIS. The boundaries for the corresponding drainage areas (watersheds) were delineated using ArcHydro. Characteristics of the 129 watersheds (drainage areas 100-10,000 square miles) were summarized to create a matrix database (1947-1971 (79 watersheds), 1955-1979 (93), and 1976-2006 (74)). Statistical exploratory techniques can be used with this database to transform initial matrices of watershed characteristics into linear components and residual matrices, thereby establishing watershed interconnections. To account for Minnesota's future developments in water sustainability, the watershed characteristics database can be upgraded to include monitoring the surface and ground water regimes.

Poster Session 4:45–5:45

Spatio-Temporal Regime of Stream Runoff During Climate Change and the Influence on Minnesota's Water Resources Sustainability

Heidi Peterson, University of Minnesota, pete6495@umn.edu; John Nieber, University of Minnesota; Boris Shmagin, South Dakota State University

Depicting the spatio-temporal regime of stream runoff quantities influenced by climate dynamics onto a map, enables a definitive understanding of water resources diversity and promotes confident planning of water resources sustainability in Minnesota. By using the longest time series of Minnesota stream runoff data available through the USGS database and applying multivariate exploratory data analysis techniques, four main Minnesota regions with fuzzy boundaries were defined with either a positive, negative or absence of trend in annual stream discharge. In each of these regions, the watersheds with the highest variability of annual discharge differ in both the number of months that comprise each drainage season and the number of defined drainage seasons. The production of a regional hydrological map not only opens the door to the study of interconnections of air temperature and precipitation regimes, but also provides quantitative criteria for better management of water resources sustainability in a changing climate.

Helping Small Minnesota Communities Solve Their Wastewater Issues

Valerie Prax, University of Minnesota Extension, malmq002@umn.edu; Doug Malchow, Regional Extension Center—Rochester; Laurie Brown, Regional Extension Center—Cloquet

A survey by the Minnesota Pollution Control Agency in 2007 identified 1,043 small Minnesota communities facing wastewater treatment issues. University of Minnesota Extension developed a process to help small communities solve their wastewater problems. The community needs to control the decision-making process to successfully implement appropriate and affordable wastewater treatment solutions. A successful outcome is often more dependent on the process the community follows rather than the solutions available. This process assists communities as they deal with the issues.

A group of agencies are working as a team. These include the University of Minnesota Onsite Sewage Treatment Program Team, Public Facilities Authority, Minnesota Pollution Control Agency, USDA Rural Development, Minnesota Rural Water Association and the Midwest Assistance Program.

This poster will explain the Small Community Wastewater Solutions Process as utilized by University of Minnesota Extension.

The first step is to prepare a Community Assessment Report (CAR). This better ensures that communities consider a full range of treatment options, including soil-based treatment. Information is collected on individual parcel characteristics. This process includes soil type/characteristics, building location, utilities placement, well location, setback requirements, the status of the current wastewater treatment/disposal system and other data. This data is combined for the entire community to assess the viability of soil-based wastewater treatment. Substantial interaction between homeowners, community leaders and the individuals gathering the data increases the likelihood of an open decision-making process.

Poster Session 4:45–5:45

Development of a Practical Method to Analyze Sod Farm Wetland Hydrology

V. (Rama) Ramanathan, URS Corporation, v_ramanathan@urscorp.com; Joel Toso, URS Corporation

A practical technique to delineate wetland areas within sod farms has been developed based on the drainage rates indicated by field data obtained from monitoring wells. The water table elevations midway between parallel ditches at the end of an eight day drainage period have been used to develop site specific correlations to determine soil drainage rates as a function of peat depth and the initial height of the water table above the ditch water surface. A method has been developed to predict the water table profiles taking into account the variation of peat depth across the cross sections. The predicted water table profiles have been compared to actual field observations, and close agreement between the predicted values and field data have been demonstrated.

Wetland Web Map Connects Citizens, Staff, Data

Nancy Read, Metro Mosquito Control, nancread@mmcd.org; Brian Fischer, Houston Engineering, Inc.

Citizens call the Metropolitan Mosquito Control District every year asking if particular wetlands in their area are being treated to prevent mosquito problems. In 2007 we launched a web-based wetland look-up application that presents our maps of 70,000 metro-area wetlands and 2+ years of complete data about each wetland, with a backdrop of publicly-available map layers such as streets, city boundaries and aerial photos (see www.mmcd.org). The intent was to make map and treatment data easily available to staff at disparate locations as well as allowing citizens to answer questions directly. The site has worked well and received hits from over 3,500 unique users in 2007, with spikes of activity after media reports. It was assembled using the free open source software GeoMoose (www.geomoose.org) and MapServer plus an open source geocoder for address lookup, and most of the map layers are public Web Mapping Services.

Poster Session 4:45–5:45

Measuring the Volume of Lake Water Losses to Groundwater through Wintertime Water Surface Elevation Surveys

Matthew Redington, HDR Engineering, matthew.redington@hdrinc.com; Adam Kessler, HDR Engineering; John Nieber, Chisago Lakes Lake Improvement District

There are approximately 22 lakes within the CLLID, many of which are connected by wetlands, channels or pipes. Water budget analyses had been performed in the past for some of the lakes. These studies indicated there were water losses occurring from the lake system that could not be explained through evaporation or surface flow. It was suspected that water losses from the system were related to interaction between lakes and groundwater.

In order to confirm and quantify water losses from lakes, 10 lakes were monitored over the winter of 2007-8. Ice cover on the lakes limited the evaporation and inflow factors of the water budget. Fluctuations in water level during the winter could then be attributed primarily to groundwater interactions. The lake monitoring involved biweekly measurements of water surface elevation through holes cored in the lake ice. By tracking elevation changes through the winter, and pairing elevation changes with aerial contour data, volume losses were confirmed and quantified. The presentation will include methodology, results, and conclusions.

Vertical Agricultural Drains as a Source of Phosphorus to Streams

Jason Roth, University of Minnesota, roth0293@umn.edu; Paul Capel, U.S. Geological Survey, University of Minnesota

Subsurface drainage networks are common in agricultural areas which have poorly-drained, glacially-deposited soils. In local topographical depressions, a vertical drain is often connected to the horizontal subsurface drainage network to expedite the removal of the ponded water from the field. These vertical drains act as sources of particle-associated phosphate and sediment to the stream via the subsurface drain network. For this study, the concentrations of major anions, nutrients and sediment are measured in the ponded areas around vertical drains, in the water moving through these vertical drains, and in the horizontal subsurface drain in a field in north-central Iowa. After a June 2007 precipitation event of 1.3 cm of rain, concentrations of orthophosphate increased from 0.05 mg/L to 0.12 mg/L-in a tile drain connected to vertical drains. Orthophosphate concentrations in the ponded water surrounding a drain after the precipitation event was observed at concentrations up to 0.30 mg/L.

Poster Session 4:45–5:45

Tower Harbor: Design Considerations for a Small Boat Harbor on Lake Vermillion

Michelle Schneider, SEH Inc., mschneiderr@sehinc.com; Jeremy Walgrave, SEH Inc.

The City of Tower and SEH, Inc. are completing the preliminary and final design work needed to construct the harbor and surrounding development in Tower, Minnesota. The total project includes Environmental Assessment (EA), dredging plan and obtaining required dredging permits, jetty/breakwater study, geometric layout (design) of the harbor, design of three bridges that cross the East Two River, wetland permitting and possible mitigation plan, design of future development in Tower that will take place in conjunction with the harbor construction, and all other required permits from state agencies. By focusing residential and commercial redevelopment in Tower, the concept is to provide economic benefits to the area while reducing the negative impacts to the lake that often occur with development.

Variability in Nitrate Concentrations in Subsurface Drains Along a Reach of an Agricultural Stream

Erik Smith, U.S. Geological Survey, easmith@usgs.gov; Jason Roth, University of Minnesota; Paul Capel, U.S. Geological Survey, University of Minnesota

Elevated nitrate concentrations in surface waters is a well recognized issue in many agricultural areas. A wide variety of agricultural management practices, nitrogen inputs, stream hydrology, and anthropogenic alterations (subsurface drainage, tillage) can have a strong influence on nutrient concentrations in streams. During two synoptic studies in 2006 and 2007, the variability in subsurface drain effluents was measured along 4.75-mile stream in north-central Iowa. This reach had at least 110 drains that included overland flow outlets, subsurface drainage district network outlets, field tile outlets and surface ditch outlets. During the 2006 study period, nearly 100 percent water in the stream originated from the subsurface drains. The nitrate concentrations were extremely variable, ranging from <1 to >50 mg-N/L. The study demonstrates the heterogeneous input of nitrate from tile lines, even within a small (~12 square miles) watershed.

Poster Session 4:45–5:45

Hydroxylated Polybrominated Diphenyl Ether Photolysis Quantum Yields and Product Identification

Peter Steen, University of Minnesota, stee0219@umn.edu; William Arnold, University of Minnesota; Matthew Grandbois, University of Minnesota; Kristopher McNeill, University of Minnesota

Hydroxylated analogues of the ubiquitous polybrominated diphenyl ethers (PBDEs) have recently been found in surface waters, snow, rain, and wastewater/sewage treatment plant effluent. In addition to being natural products and known metabolites of PBDEs, OH-PBDEs are potentially produced during the wastewater treatment process. This study investigated the photolysis of 6-OH-BDE47 and three chlorinated derivatives, 3-Cl-6-OH-BDE47, 5-Cl-6-OH-BDE47 and 3,5-Cl-6-OH-BDE47, which are hypothesized to be produced upon disinfection with chlorine. Quantum yields were determined for both the protonated and deprotonated species, and photoproducts were identified.

The Future of Energy and Minnesota's Water Resources

Sangwon Suh, University of Minnesota, sangwon@umn.edu; Laura Schmitt Olabisi, University of Minnesota; Yi-Wen Chiu, University of Minnesota

Minnesota's water resources are poised to undergo significant changes in the coming decades. There is an urgent need to integrate an analysis of demands on Minnesota's water resources with scenarios of future energy production. We are developing an integrated spatial model to analyze the future of MN's water budget with particular attention to changes in water demand under different scenarios. Key trends incorporated into the scenarios include (1) biofuel production (considering water needs for irrigation of the biofuel feedstock as well as for processing); (2) changes in the electricity grid mix considering Minnesota's Renewable Energy Standards; (3) demographic changes; and (4) climate change. We combine scenarios of water demand with GIS mapping and water balance techniques to deliver spatially and temporally explicit water budget projections for each scenario. Our findings will allow us to better understand the interactions between agricultural policy, energy policy, demographic changes and Minnesota's water budget, so that policymakers can be better informed about how their decisions affect water resources. We present our initial findings through a series of maps depicting Minnesota's potential spatial water budgets in the future.

Citizen Stream Monitoring—Examples and Lessons Learned

Bill Thompson, Minnesota Pollution Control Agency, bill.thompson@pca.state.mn.us

Citizen stream monitoring (CSM) is an important component in many of Minnesota's watershed and water quality improvement projects. It is useful for assessment, education, awareness-building, water quality data collection, and evaluation purposes. Volunteer data has been used to "fill-in-the-gaps" temporally and spatially. Several projects using CSM will be highlighted, including the Watonwan River Watershed and the Whitewater River Watershed. The dedication and resourcefulness of the many volunteers and local staff will be highlighted. Examples of the data that is produced, the information that is developed, and the lessons learned from various projects will be covered. Possible changes to improve upon some of the basic CSM formats will be introduced and assessed.

Poster Session 4:45–5:45

City Sustainability—Water as Part of the Big Picture

Lisa Tilman, Emmons & Olivier Resources, Inc., ltilman@eorinc.com; and Brett Emmons, Emmons & Olivier Resources, Inc.

A City Sustainability Plan, one of the first in the state, is being prepared to guide the City of Burnsville in implementation of fourteen Sustainability Best Practice Areas identified by the City. The Sustainability Plan translates the city's best practice goals into measurable implementation actions through a plan development process that combined the expertise of a diverse project team with the ideas of a broad group of city staff. This poster includes the activities developed for consideration by Burnsville to guide sustainable surface and groundwater management and highlights the strong inter-relationship between water management and other sustainability areas.

Taming the Lower Sheyenne River

Jeffry Volk, Moore Engineering, Inc., jvolk@mooreengineeringinc.com; John Wirries, Moore Engineering, Inc.

Flooding in the Red River Valley has been a challenge for Minnesota and North Dakota communities. The Sheyenne River winds through deep ravines in Eastern North Dakota before spilling into the flat lake bottom of ancient Lake Agassiz, where intermixing river systems give rise to overland flooding. In Cass County, North Dakota, the local water resource districts have, for decades, searched for solutions to this flooding. These solutions included levees, diversions, and upstream retention on both the Sheyenne and Maple Rivers. In 2006, the last piece of a four part solution was implemented, retention on the Maple River.

Maple River Dam is located 40 miles southwest of Fargo, ND. The Maple River is a major tributary of the Sheyenne River, making up nearly 40% of the watershed. Maple River Dam has available over 60,000 acre feet of storage. Yet as a "dry dam" it retains no water except during a flood event. The use of a dry dam allows for flood control while minimizing the environmental impacts of a dam. Together with other improvements, the Maple River Dam helps to reduce flood damage in the lower Sheyenne River Watershed.

Poster Session 4:45–5:45

RoofBloom

Chris Wegscheid, Cermak Rhoads Architects, Cwegscheid@cermakrhoades.com; Camilla Correll, Emmons & Olivier Resources, Inc.; Corrie Zoll, Earth Wizards

RoofBloom is a set of resources for homeowners in the Twin Cities interested in installing a green roof on their garage, shed or other small outbuilding. Initially funded by the Minnehaha Creek Watershed District, RoofBloom is a cooperative effort of the Minnesota Green Roofs Council, Cermak Rhoades Architects and Emmons & Olivier Resources, Inc. Our goals are to make green roofs accessible to the general public and to increase awareness of stormwater quality and other sustainability issues.

The primary RoofBloom resource is "Green Your Garage: A Homeowner's Guide to Small Green Roofs," a comprehensive document that introduces the homeowner to the benefits of green roofs, the types of systems available and the structural, construction and maintenance considerations associated with this scale of project. "Green Your Garage" can be freely downloaded at www.roofbloom.org. RoofBloom also offers detailed assembly drawings, plant lists, and plans for garages and sheds specifically designed to accommodate green roofs.

The RoofBloom System is a green roof assembly designed to use inexpensive, off-the-shelf parts available from most home and garden centers. The design is simple enough that an ambitious homeowner can do much of the installation themselves, with a bit of help and guidance from local professionals. The total cost of materials is about $5 per square foot, or between $2,000 and $3,000 for a two-car garage.

In addition to the guides, RoofBloom hosted a series of workshops to educate homeowners interested in green roofs. These workshops were extremely well attended and have since spun into what is called the RoofBloom Guild: a group of local homeowners who meet regularly to compare what they've learned, share resources, combine orders for supplies, and trade labor. The hope is to see its members install at least half a dozen small green roofs this summer.

Application of Wireless and Sensor Technologies for Urban Water Quality Management: Pollutant Loading in Stormwater Ponds

Christine Wennen, University of Minnesota, wenne052@umn.edu; Michael Henjum, University of Minnesota; James Kang, University of Minnesota; Shashi Shekhar, University of Minnesota; Miki Hondzo, University of Minnesota; Raymond Hozalski, University of Minnesota; Paige Novak, University of Minnesota; William Arnold, University of Minnesota, arnol032@umn.edu

The water quality of streams is being degraded by increasing urbanization. Stormwater ponds have been implemented in many urban areas to mitigate the effects of direct runoff to urban streams. This research uses high frequency, real-time water quality data collected via a wireless sensor network to calculate the pollutant loading in a series of stormwater ponds that discharge to Shingle Creek, located in the northwestern Twin Cities metropolitan area. The results are compared to data collected concurrently by traditional grab sampling techniques in order to assess the magnitude of the difference in pollutant loading calculated between the two sampling frequencies.

Results from the data collected during the 2008 monitoring season will be presented at the conference.

Poster Session 4:45–5:45

Environmental Knowledge, Behaviors, and Communication Preferences in the Hmong Community in Minnesota

Jenny Winkelman, Mississippi Watershed Management Organization, jwinkleman@mwmo.org; Erica Sniegowski, Mississippi Watershed Management Organization; Kaozouapa Elizabeth Lee, Mississippi Watershed Management Organization; Foung Heu, Digital Motion, LLC

For many immigrant and minority groups environmental information is not relevant or accessible due to communication and language barriers.

To increase the effectiveness and reach of pollution prevention education in the Hmong community, the Mississippi Watershed Management Organization and the City of Minneapolis conducted a telephone survey in Hmong to learn about environmental knowledge, behaviors and communication preferences. The Hmong, forced to flee Laos after the Vietnam War, have a large established population in Minnesota.

Respondents were 17 to over 65 years old and most were foreign-born. Their knowledge of water issues was low compared to state-wide averages. Respondents clearly prefer to communicate verbally, and in Hmong. Most prefer not to read or write either language.

Findings are being used to inform water education in the Hmong community. By understanding how people receive and share information, environmental information can be delivered in a way that has greater impact on the community.

The Red River Basin Commission: The Power of Relationships and a Dream in Land and Water Management

Lance Yohe, Red River Basin Commission, lance@redriverbasincommission.org

The Red River of the North is an interstate and international river, shaping the landscape, ecology, and people living in Minnesota, North Dakota, Manitoba, and South Dakota. The Red River Basin Commission was founded 25 years ago to promote collaborative solutions to natural resource problems affecting the basin. Today, the Commission has 41 board members representing all levels of government of each jurisdiction, Federal agencies, First Nations and tribes, environmental groups, and Congressional and Parliamentary delegations. The Commission has a Natural Resource Framework Plan (NRFP) to address and coordinate issues ranging from water quality, flood reduction, drought management, and heritage concerns. This poster will discuss the history and organization of the Red River Basin Commission, the importance and advantages of stakeholder collaboration in addressing basin-wide concerns that cross state boundaries, and the initiatives that the Commission is leading or participating in.

Poster Session 4:45–5:45

Responding to Acetochlor in Minnesota's Waters

Joe Zachmann, Minnesota Department of Agriculture, joesph.zachmann@state.mn.us; Gregg Regimbal, Minnesota Department of Agriculturel Ron Struss, Minnesota Department of Agriculture

The Minnesota Department of Agriculture (MDA) monitors and responds to pesticide impacts to Minnesota's groundwater and surface water resources. Acetochlor is a commonly used corn herbicide which is frequently detected in some Minnesota streams and rivers as a result of normal agricultural use. Elevated levels of acetochlor in some surface waters pose a risk for potential impairment.

This presentation will highlight activities by the MDA and others to address acetochlor being found at concentrations of concern in Minnesota surface waters. The frequency and concentrations at which acetochlor has been detected led to the development of acetochlor voluntary best management practices (BMPs). A history of the key efforts will be discussed including: Authority and guidance for protecting water resources; BMP development, education, outreach, and evaluations; demonstrations and research; pesticide use surveys; water quality monitoring; pesticide modeling work; pesticide enforcement activities.

Presentation results will provide an update of efforts, lessons learned and emerging issues for future focus.

Plenary Session 8:10–9:30

The SE Minnesota Floods of August 2007: In Historical and Future Context

Mark Seeley, University of Minnesota Extension Climatologist, University of Minnesota, mseeley@umn.edu

The severe thunderstorms of August 18–20, 2007, produced unprecedented amounts of rainfall in some southeastern Minnesota counties. Observers in Fillmore, Winona, and Houston Counties reported 36 hour rainfall amounts of 14 inches or greater. For historical context, the observer at Hokah (Houston County) reported all-time state records for 24-hour rainfall (15.10 inches), storm total rainfall (16.27 inches), and monthly total rainfall (23.86 inches). The resulting flash floods on the Root River and Whitewater River in SE Minnesota were fast, fierce, and highly destructive. The gage at Houston along the Root River registered the highest flash flood crest on record there, 18.15 feet (flood stage is 15 ft). Historically, this was only exceeded by the destructive spring snowmelt flood crest of 1965 when a crest of 18.32 feet was measured on March 2nd. Upstream from Houston, the town of Rushford was almost wiped out. Additionally, a flood crest of 19.24 feet, highest of record was recorded on the Whitewater River at the state park in northwestern Winona County. This caused severe damage to the popular state park. For future context, it is important to understand that the Minnesota climate is changing and producing amplified variation in precipitation. In addition there is a problematic character change in precipitation that manifests itself as a higher contribution from thunderstorm rainfall to the annual hydrologic cycle. These changes in climatic attributes and their implications are deserving of widespread community discussion as adaptation is required to sustain economic stability and protect our land and water resources from dramatic degradation.

(More on Minnesota's weather history can be found in the new book by Mark Seeley, Minnesota Weather Almanac, available at all bookstores or through the Minnesota Historical Society Press.)

Concurrent Sessions IV 10:00–11:30

Track A: Lake Pepin TMDL

Why is Lake Pepin Filling-up at a Rapid Rate?

Satish Gupta, University of Minnesota, gupta002@umn.edu; Heather Johnson, Minnesota Department of Agriculture; Greg Spoden, Minnesota Department of Natural Resources

Based on core data from Lake Pepin, scientists at St. Croix laboratory have shown that sedimentation rates have been increasing in recent years. Average lake filling rate varied from 1.15 cm yr^{-1} in mid 1970s to1.6 cm yr^{-1} in mid 1990s. In upper reaches of the Lake, the sedimentation rates were greater than 3 cm yr^{-1} over the last three decades. The question is: why is Lake Pepin filling up at a rapid rate in recent years when flow adjusted TSS concentration have been either decreasing or stable? In this paper, we present the trend analysis in TSS concentration in the Minnesota River using parametric and non-parametric statistical methods. Then we show how recent wet climate (increased precipitation as well as frequency of larger storms) in the region have contributed to increased flow and thus increased sediment loads in the Minnesota River. We believe these increased sediment loads are the reasons for increased rate of sedimentation in Lake Pepin.

Water Quality Model for Support of the Upper Mississippi River—Lake Pepin TMDL: Results of Load Reduction Scenarios

Joseph DePinto, LimnoTech, jdepinto@limno.com; Hans Holmberg, Limno Tech; Todd Redder, Limno Tech; Edward Verhamme, Limno Tech; Norman Senjem, Minnesota Pollution Control Agency; Hafiz Munir, Minnesota Pollution Control Agency

Nationally, nutrients and sediment/siltation rank among the top four impairments reported by states on their 303(d) lists. The State of Minnesota is developing a TMDL for the Upper Mississippi River and its watershed for both turbidity and nutrient enrichment (total phosphorus and chlorophyll *a*). This stretch of the river receives both point and non-point source loads of solids and nutrients from an extremely large contributing watershed (48,634 square miles, encompassing about 48% of the State of Minnesota and a portion of Wisconsin. The impaired river reach contains two impoundments, Spring Lake and Lake Pepin, located behind two of the four Lock & Dam control structures that bound the three morphometrically and hydraulically distinct "pools" of the system. Under contract to the State, LimnoTech has developed, calibrated, and confirmed a linked hydrodynamic-sediment transport-eutrophication model (the UMR-Lake Pepin model) to support the computation of the TMDLs for this system. Subsequent to the calibration and confirmation, the model has been applied to predict the response of the system to a series of load reduction scenarios that will aid in computation of the TMDLs, and the allocation of allowed loads from various sources in order to most efficiently meet the TMDLs. This presentation will illustrate the results of those load reduction scenarios and discuss how those results will be applied to support the TMDL. Results of the model application suggest that significant sediment and phosphorus load reductions will be required for major tributaries, accompanying the phosphorus effluent reductions being implemented at wastewater treatment plants, will be required to achieve both turbidity and chlorophyll *a* targets for the system.

Concurrent Sessions IV 10:00–11:30

Track A: Lake Pepin TMDL, *continued*

Development of a Water Quality Model of the Upper Mississippi River: Brainerd to Ford Dam

Hans Holmberg, LimnoTech, hholmberg@limno.com; Hafiz Munir, Minnesota Pollution Control Agency; Pranesh Selvendiran, LimnoTech; Norman Senjem, Minnesota Pollution Control Agency; Ed Verhamme, LimnoTech

A water quality model of the Mississippi River from Brainerd to Ford Dam is being developed by MPCA to assess the fate of phosphorus loadings from various point and non-point sources in the watershed. The results of this modeling will be used to inform the Lake Pepin TMDL allocation process. This presentation will describe the development and application of the USGS FEQ 1-dimensional hydraulic model and the RCA water quality model. Configuration and calibration of the models are being supported by existing data. Model applications will be used to support load allocations within the watershed, to understand point source versus non-point source impacts under varying climatic conditions, and to evaluate potential pollutant trading scenarios. The FEQ-RCA model framework is also a good foundation for potential future development to support other water quality management objectives for the Upper Mississippi River, including drinking water concerns, bacteria and PCB impairments, and watershed protection and restoration planning.

Concurrent Sessions IV 10:00–11:30

Track B: Impact of Southeast Minnesota Floods

Flood Response

Paul Halvorson, Minnesota Department of Health, Paul.Halvorson@state.mn.us

The heavy rains of August 18-19, 2007 caused tragic, widespread flash flooding in many communities in Southeast Minnesota. The public water supply most impacted by the flooding was the City of Rushford in Fillmore County, which will be the focus of this presentation. Two of the three deep wells that supply the City were overtopped by floodwaters and were contaminated. With the initial power outage and service line breaks, the water system lost pressure. There was a large scale response, with much volunteer effort, to help the City of Rushford. The process of getting the water supply back up and running was complicated by two factors: 1) The two municipal wells that were flooded were not getting cleared of the coliform bacteria contamination after repeated disinfection and flushing attempts, raising concern that these wells could not provide safe water for the foreseeable future, leaving the City with just one safe well; and 2) The discovery of many deep and shallow wells within the City that needed to be evaluated to find out what threat they posed to the City supply.

Flood Impact on Rushford

Windy Block, City of Rushford

In the very early morning hours of August 19, 2007, the 1,780 citizens of Rushford were awakened rudely by a disaster that would change the community forever. As the one remaining functioning emergency siren sounded its alarm, the race was already on for the heart of the community. In only a few short minutes, the normally tranquil Rush Creek had turned into a flooding torrent, attacking the city from a position that the community had never experienced before.

City Administrator Windy Block will share his reflections of the harsh realities of this 2007 flood event. He will also illustrate the multitude of impacts that such a flood can have on a community and the resources that are necessary for recovery. Finally, he will update his audience on the progress to date as Rushford has worked so hard to renew itself. This is a story of despair and hopes all wrapped into one illustrative presentation. It is also a great reminder of a single type of disaster that many other cities may yet need to endure.

Concurrent Sessions IV 10:00–11:30

Track B: Impact of Southeast Minnesota Floods, *continued*

Wells

Danny Nubbe, Mineral Services Plus, danny@mineralserviceplus.com

August 18–20, 2007 the south eastern corner of Minnesota received 8 to 20 inches of rain fall. Several counties and communities were devastated, many people were left homeless and the City of Rushford was completely shut down. The water and sewer services were knocked out completely. After several weeks of attempting to disinfect the two city water wells, we had not yet been successful. An extensive search was completed by the City of Rushord Public Works personnel, Minnesota Rural Water Association, Minnesota Department of Health personnel, Licensed water well contractor personnel (Mineral Service Plus). Mineral Service Plus obtained city record of 40 known wells in town. After a house by house search, we discovered more than 300 wells. (Most of which were open).

Give the fact that the sewer treatment plant was one of the first areas to go under water, most basements were flooded with raw sewage that entered the open wells. Approximately 150 wells have been cleaned out and sealed. City well #3 could not be disinfected and it was sealed as well. City well #4 was cleaned, disinfected and passed MDH water testing requirements. A new city well (#5) has been constructed. This terrible incident should serve as a wake up call for all communities.

Questions to consider:

- Do you know how many wells have been constructed in your community?
- What year was your community water system constructed and put into service to each home?
- What year was your community originally established?

Please note: If your historical records indicate homes existed before the construction of your public water supply, there are definitely wells that have not been sealed that are not on record. They are possible channels or conduits for contamination of the community water supply.

Now that you know you have a ticking time bomb, whose job is it to diffuse the bomb?

Concurrent Sessions IV 10:00–11:30

Track C: Policy and Permitting

Wetland Conservation Act Rulemaking Process, Anticipated Changes, and Relationship to the Corps Mitigation Rule

Les Lemm, Minnesota Board of Water and Soil Resources, les.lemm@state.mn.us

The Minnesota Board of Water and Soil Resources is currently in the process of revising the permanent Wetland Conservation Act Rule. The purpose of the rulemaking is to address recent statute changes, changes made in the recent "exempt" rulemaking process, issues identified in the BWSR/Corps of Engineers MOU, and other issues identified by BWSR staff and stakeholders. The effective deadline for adoption of the permanent rule is August 5, 2009; the date the exempt rule expires. Many issues have been discussed and explored thus far in the permanent rulemaking process. The Corps/EPA mitigation rule was also released during WCA rulemaking. This presentation will discuss the process used to develop the rules and where the rule is at in that process, major issues and comments received, anticipated rule changes, and the relationship to the Corps of Engineers mitigation rule.

New Changes to the NPDES General Permit for Construction Activity

Todd Smith, Minnesota Pollution Control Agency, todd.smith@pca.state.mn.us

All construction activity over one acre requires an NPDES construction stormwater general permit issued by the Minnesota Pollution Control Agency (MPCA). Stormwater discharges from land in which the vegetation has been removed can result in erosion rates up to 100 times more than natural conditions. The NPDES construction permit requires Best Management Practices to prevent erosion and control sediment during construction in addition to providing post construction stormwater treatment systems. On August 1, 2008 the permit was reissued with several changes. This presentation will highlight the major changes to the permit in addition to an overview of the process involved with the issuance of a general permit. The revised permit includes a new process for transferring a permit, discharges to impaired waters, new soil stabilization requirements and training requirements for different individuals with a role in this program.

What Makes a Good TMDL Implementation Plan for Permitted MS4 Stormwater?

Michael Trojan, Minnesota Pollution Agency, mike.trojan@pca.state.mn.us; Jeff Risberg, Minnesota Pollution Control Agency; Anna Kerr, Minnesota Pollution Control Agency; Brooke Asleson, Minnesota Pollution Control Agency; Chris Zadak, Minnesota Pollution Control Agency

Meeting Total Maximum Daily Load (TMDL) requirements can be a challenging and expensive task for Municipal Separate Storm Sewer System (MS4) communities. TMDL Implementation Plans offer an opportunity for linking MS4 permit requirements to specific actions that meet the TMDL Wasteload Allocation (WLA). An effective Implementation Plan should contain information on four broad topics:

1. a summary of the TMDL requirements;
2. a stormwater management strategy, including information on Best Management Practices (BMPs);
3. a discussion of how progress toward the TMDL will be measured and tracked; and
4. a general compliance schedule for achieving the TMDL.

Recently completed MPCA guidance provides a detailed discussion of these four topics, as well as an overview of the relationship between the TMDL Implementation Plan and MS4 permit requirements. Implementation of the guidance will prove a valuable tool for permittees as they attempt to meet TMDL requirements through the MS4 permit.

Concurrent Sessions IV 10:00–11:30

Track D: Wetland Restoration and Mitigation Design Strategies

Wetlands Restoration to Improve Water Quality

Lorin Hatch, HDR Engineering, Inc., lorin.hatch@hdrinc.com; Suresh Hettiarachchi, HDR Engineering, Inc.; and Renae Clark, Minnehaha Creek Watershed District

The overall goal of this project is to decrease phosphorus (P) loading from Classen Creek to Stubbs Bay (Lake Minnetonka). We are examining the feasibility of a Classen Creek wetland restoration project, located between Classen Lake and Watertown Road, which is necessary to filter out sediment and P. As part of this project, students from the University of Minnesota participated in a capstone project during the Fall 2007 semester to update the water quantity/quality model in the Classen Creek watershed. The students also ran simulations and concluded that construction of a berm to hold back water during spring runoff offered the best opportunity to retain P in the wetland. 2008 work includes further refinement of the model and an examination of the vegetation community in the wetland.

Wetland Mitigation Design: Flexibility from Concept to Construction

Lydia Nelson, HDR Engineering, Inc., Lydia.nelson@hdrinc.com; and Tony Luft, HDR Engineering, Inc.

Objective

The TH 212 Design-Build Project impacted 68 acres of wetland in the southwest Twin Cities Metro area. The conceptual wetland mitigation approach initially focused on restoring previously drained/impacted wetlands, rather than creating wetland from upland. The Design-Build contract required the on-site creation of 33 acres of new wetland credits and 68 acres of public value credits, with the remaining mitigation made off-site. The final mitigation plan was a combination of on-site new wetland and public value credits, off-site mitigation, and wetland banking credits.

Methodology

The challenges for the project included a rapidly urbanizing setting, limited right-of-way availability, and highway drainage requirements. Of the eleven sites identified in the conceptual plan, only five sites remained as feasible options once the highway drainage design was completed. This presentation documents the design process, key issues, key compromises, and successful completion of the mitigation requirements.

Conclusion

Large projects require a flexible and multi-faceted approach to meet regulatory requirements from multiple agencies, to work within tight site constraints, and to fulfill the design requirements.

Concurrent Sessions IV 10:00–11:30

Track D: Wetland Restoration and Mitigation Design Strategies, *continued*

Managing Stormwater and Restoring a Natural Wetland Corridor in an Urban Setting

Ron Leaf, SEH, Inc., rleaf@sehinc.com; and Jeremy Walgrave, SEH, Inc.

This former 50-acre golf course in Maplewood is undergoing developedment with a mix of commercial land uses. Within the core of the development is a unique restored wetland and open space system. The project required overcoming several hydraulic design challenges and wetland design constraints to accommodate stormwater conveyance/management and wetland mitigation needs. The primary challenge was roughly 1200 feet of twin 48-inch pipe that dissected the site and connected wetland systems to the north and south. The challenge proved to be part of the solution—removing a segment of the pipe system to create new wetland. The remaining challenge was to "sneak" around the wetland drainage system to provide adequate storm water drainage for more than half of the site. The presentation will cover the design challenges, the design-build approach to construction, winter construction issues, and highlight the performance of the system to date including two seasons of growth on the restored wetland plantings.

Concurrent Sessions IV 10:00–11:30

Track E: Lakes

Predicting Phosphorus Releases from Lake Sediments

Sergei Katsev, University of Minnesota, Duluth, skatsev@d.umn.edu; and Maria Dittrich, Swiss Institute for Environmental Science and Technology (EAWAG)

Phosphorus is typically released from lake sediments when oxygen in the overlying water is depleted during summer stratification. These releases are traditionally associated with the reductive dissolution of sediment Fe oxyhydroxides to which phosphorus is adsorbed. Nevertheless, past restoration activities demonstrated that long-term phosphorus retention is often unimproved when oxygen is artificially injected into the bottom waters. Using Lake Sempach (Switzerland) as an example, and with the help of diagenetic reaction-transport modeling, we analyze factors that control sediment phosphorus fluxes on longer-than-seasonal time scales. The analysis leads to a reevaluation of the classical "oxygen-iron-phosphorus" paradigm. Restoration measures, such as artificial oxygenation, alum deposition, or reduction of external P load, depend on the balance of organic matter, oxygen, and Fe oxyhydroxide fluxes, rather than on their absolute values. Biogeochemical cycling of phosphorus in the anoxic sediment layers is important, and the measures effectiveness may vary with time scale.

Establishing Statewide Nutrient Criteria Using a Stochastic Modeling Approach

Mark Deutschman, Houston Engineering, Inc., mdeutschman@houstonengineeringinc.com; Wesley Saunders-Pearce, Houston Engineering, Inc.; Brennon Schaefer, Houston Engineering, Inc.; and Michael Ell, North Dakota Department of Health

In 1998, the U.S. Environmental Protection Agency (EPA) published the *National Strategy for the Development of Regional Nutrient Criteria* (i.e., the National Strategy). States are now required by EPA to develop nutrient criteria protective of the beneficial uses of lakes, rivers and wetlands. Because of a lack of water quality data for reference lakes, North Dakota is using a unique approach to establish nutrient criteria for their lakes and reservoirs. This presentation will focus on the development and use of regionalized stochastic loading and receiving water models to establish nutrient criteria, where environmental variability and uncertainty are explicitly quantified. The approach also has broad applicable to the development of TMDLs.

A View from Space: Spatial and Temporal Water Clarity Trends of Minnesota 10,000 Lakes

Leif Olmanson, University of Minnesota, olman002@umn.edu; Marvin Bauer, University of Minnesota; and Patrick Brezonik, University of Minnesota

Landsat imagery was used to create a 20-year comprehensive water clarity database for the ~1985, ~1990, ~1995, ~2000 and ~2005 time periods of Minnesota's 10,000 lakes. Analysis of the database indicates that lake clarity has strong geographic patterns in Minnesota; lakes in the south and southwest have low clarity, and lakes in the north and northeast tend to have the highest clarity. Mean water clarity in central and northern Minnesota remained stable from 1985 to 2005 while decreasing water clarity trends were detected in southern Minnesota, where agriculture is the predominant land use. Further statistical analyses of the database, in conjunction with demographic, morphometric and land use data, will be used to describe temporal and spatial water clarity trends. Results of this analysis are expected to aid local and state lake managers to make informed decisions about development policy and improve the management of lake resources.

Luncheon Presentation 12:15–1:00

Total Water Resources Management: Bringing Together Wetland, Stormwater, Floodplain, and Water Quality Management

Edward A. Thomas Esq., Michael Baker Jr., Inc.

Increasingly we realize that "today's floodplain is not tomorrow's floodplain." Wetland loss, loss of natural valley storage, and loss of permeable surface area, will often have a serious and predictable deleterious effect on future flood conditions. Newly developed computer simulations, known as future conditions hydrology, can calculate future flood heights, should development to take place in accordance with local zoning rules presently in effect. These studies have shown that even were a community to comply with the minimum standards of the National Flood Insurance Program as required by the existing FIRM Study, future flood heights in streams and rivers may increase, in some cases, by nearly six feet over previous calculations.

In the United States, the folks who are concerned with reducing the misery caused by floods on the human environment do not usually have a close relationship to those who protect our nation's wetlands and its water quality.

However, we are finding that activities designed to protect humans from flood disasters also can help protect wetlands and help protect and restore water quality.

Stormwater, water quality and floodplain managers must become increasingly aware of the enormous flood protective qualities of our precious wetlands. Destruction of wetlands, and poor land use practices has had severely deleterious effects on water quality and resulted in increased flooding in this nation.

Working together to treat water as the precious resource that it is, in a unified and coherent manner, has a significant potential for helping ease our Nation into a productive and safe new millennium.

Concurrent Sessions V 1:15–2:45

Track A: Lower Minnesota TMDL

Bridge Over Troubled Waters: Lower Minnesota River Model

Catherine Larson, Metropolitan Council, Cathy.Larson@metc.state.mn.us

The Minnesota River carries high nutrient and sediment loads as it flows through one of only four national wildlife refuges in a metropolitan area. The lower reach experiences stress from a large agricultural watershed to the west and rapidly expanding urban area to the east. Two large modeling efforts are addressing impairments upstream of Jordan and downstream in the Mississippi River, leaving a 40-mile gap in the lower Minnesota River. The Metropolitan Council coordinated a six-year project with federal, state, and local partners to develop a water-quality model to fill the gap. The partners designed a comprehensive monitoring program to support the model, including biweekly sampling of the river, tributaries, and discharges over three years. Intensive monitoring was added at low summer flows to capture critical conditions. To support specific model settings, we conducted special studies of oxygen, phytoplankton, nutrient, and sediment dynamics. An overview and results will be presented.

Phosphorus Dynamics and Loading in the Turbid Minnesota River (USA): Controls and Recycling Potential

William James, U.S. Army Engineer Research and Development Center, William.F.James@erdc.usace.army.mil; Catherine E. Larson, Metropolitan Council

Phosphorus dynamics were examined in the lower 40-mile reach of the Minnesota River in relation to hydrology, loading sources, suspended sediment, and chlorophyll to identify biotic and abiotic controls over soluble phosphorus (SRP) and the recycling potential of particulate phosphorus (PP) during transport to the Upper Mississippi River. Wastewater treatment plant contributions as SRP were greatest during low flows and declined with increasing flow and nonpoint source phosphorus loading. SRP declined during low flow in conjunction with increases in chlorophyll, suggesting transformation to PP via phytoplankton uptake. During higher flows, SRP was constant at 0.115 mg/L and coincided with an independently measured equilibrium P concentration for suspended sediment in the river. PP accounted for ~66% while redox-sensitive PP, estimated using extraction procedures, represented 43% of the annual PP load. Recycling potential of this load via anoxic diffusive phosphorus flux was estimated as ~17 mg m^{-2} d^{-1} using published regression equations.

Modeling the Hydrodynamics and Water Quality of the Lower Minnesota River Using CE-QUAL-W2

David Smith, U.S. Army Engineer Research and Development Center, David.L.Smith@usace.army.mil; Tammy Threadgill, U.S. Army Engineer Research and Development Center; Barry Bunch, U.S. Army Engineer Research and Development Center; Catherine Larson, Metropolitan Council

The U.S. Army Engineer Research and Development Center with assistance from the Metropolitan Council and partners developed a water-quality model of the lower Minnesota River, Jordan to the mouth, using the 2-D laterally averaged CE-QUAL-W2 model (version 3.5). The objective was to produce a water-quality model that could be used to forecast changes in water quality as a function of management actions. Our approach was to develop a comprehensive database of hydrodynamic (discharge, elevation, and temperature) and water-quality (total dissolved solids, inorganic suspended solids, phosphate, ammonia, nitrate, silica, biological oxygen demand, three algal groups, and dissolved oxygen) data to assess model performance. Performance was measured with correlation coefficients, mean error, root mean square error, and absolute mean error statistics at eight longitudinal locations in the river. Model performance demonstrates that the CE-QUAL-W2 model is a sound tool for assessing and forecasting water-quality impacts of management actions in the watershed.

Concurrent Sessions V 1:15–2:45

Track B: Mopping Up Once the Rain Ends: The 2007 Floods in SE Minnesota

"And the rain, rain, rain, came down, down, down" Impacts to MnDOT Structures During the August 2007 Flooding

Petra DeWall, Minnesota Department of Transportation, petra.dewall@dot.state.mn.us

August 18–20, 2007 a major storm hit the south east part of Minnesota. The storm was wide-spread and has been estimated to be a 2000 year storm event. One TH Bridge over Money Creek failed; a 30 foot scour hole remained at the location. The Bridge Office and District 6 working together managed to replace the bridge in 3 months.

Garvin Brook was also hit by the August mega-storm. Several railroad bridges failed when the channel widened. The widened channel left buildings literally hanging off a cliff. The bridge on old TH 61 remained standing but the approach panel washed out. The scour analysis identified this abutment as scour critical and in need of monitoring. The piling at the new TH 61 bridge over Garvin Brook had become exposed. In order to design the repair and size the riprap, the existing Flood Insurance Study model had to be completely reworked to account for the new channel configuration. This involved obtaining survey information and repair plans from the NRCS, the railroads and our district staff in order to create a HEC-RAS model for the area. A comparison of the pre-flood and post-flood stream profiles showed some dramatic changes to the channel.

Mn/DOT District 6 Repair Work for August 2007 SE Minnesota Flood

Kjersti Anderson, Minnesota Department of Transportation, kjersti.anderson@dot.state.mn.us; Dave Redig, Minnesota Department of Transportation

The flood of August 2007 devastated SE Minnesota and took a toll on the transportation infrastructure in that part of the state. Mn/DOT spent many man hours cleaning debris from the roadways, ditches and culverts, repairing roadway inslopes and backslopes, ditches and culverts, and assisting cities and counties with their cleanup efforts. Mn/DOT also designed and let several emergency contracts to make major repairs to their damaged highways, bridges and roadway slopes. Some of the roadway repairs utilized innovative technology, soil nailing, which was new to Mn/DOT and the State of Minnesota to repair very steep roadway inslopes which were damaged and compromised during the floods. Dave and Kjersti will discuss the repair work that Mn/DOT District 6 did to their roadways and share many photos and stories from the flood, as Dave was present during the flood.

Concurrent Sessions V 1:15–2:45

Track C: Education/Planning

Engaging Diverse Groups in Environmental Education: a Case Study of the Hmong Community in Minnesota

Jenny Winkelman, Mississippi Watershed Management Organization, jwinkleman@mwmo.org; Katherine Barton, Barton and Associates; Foung Heu, Digital Motion, LLC

Nonpoint source pollution continues to be the major cause of pollution in United States waterways. Pollution prevention efforts in Minnesota still rely primarily on written materials, usually in English, and distributed in conventional ways. This information is not accessible nor designed to be relevant to increasingly diverse populations.

In 2005, the Mississippi Watershed Management Organization and the City of Minneapolis piloted a study in the Hmong community to increase the effectiveness and reach of pollution prevention efforts. The Hmong comprise a large, established community in Minnesota forced to flee Laos after the Vietnam War.

Knowledge of water issues, the cultural context for water and communication preferences were identified through focus groups, in-depth interviews and a phone survey (conducted in Hmong). The resulting water education plan focuses on three major outcomes: building community leadership and capacity, increasing environmental literacy and stewardship actions, and modeling best practices for education in diverse communities.

Low Impact Design (LID) as a Shaping Element in the Urban Planning Process: A Case Study of the 46th and Hiawatha Transit-Oriented Development Strategy, Minneapolis, MN

Timothy Gross, Three Rivers Park District, tgross@threeriversparkdistrict.org; Mark Nolan, Plan4

The 46th & Hiawatha Transit Oriented Development (TOD) Strategy has elevated urban planning standards by incorporating sustainable and high performance infrastructure as a fundamental element of urban design. The purpose of this study was to develop and define strategic infrastructure, policy and development tools to be used for shaping the 46th Street and Hiawatha Avenue light-rail transit station area into a neighborhood that could fully embrace a multi-modal lifestyle. Beyond just a competing demand that must be considered, this planning study purposefully used the planning process to examine need; review function and form; win public and regulatory support; and influence policy and funding mechanisms to stimulate and encourage LID improvements.

The objectives of this presentation are to highlight methodologies and strategies used in the 46th & Hiawatha TOD Strategy and to provide a framework for future planning studies to shape and influence the use of LID as an inherent component of the urban fabric. Conclusions and recommendations stemming from this process include:

1. Policies affecting the appropriate implementation of LID need to be done on the planning level, not the design level.
2. Effective stormwater management is site specific; from both a functional and socio-economic perspective.
3. Sustainable infrastructure and economic development incentives can work together.
4. Public and private involvement in the LID analysis and implementation process can change the perception of LID from an occasional stormwater management tool, to a standard practice.

Concurrent Sessions V 1:15–2:45

Track C: Education/Planning, *continued*

How Do Water Quality Projects Evaluate Impacts and Outcomes? The Minnesota NPS Project Survey

Karlyn Eckman, University of Minnesota, eckma001@umn.edu; Rachel Walker, University of Minnesota; Bouapao Lilao, University of Minnesota

The University of Minnesota Water Resources Center (WRC) conducted an Internet survey of local agencies about their evaluation methods. Our goal was to discover if staff of water quality projects evaluate changes in human behaviors and attitudes of target audiences that result from project activities, The WRC surveyed staff of approximately 180 local watershed and conservation districts (SWCDs), municipalities and other public agencies about their evaluation practices, focusing on human dimensions of projects. We analyzed whether project coordinators characterize their target audience, their use of various evaluation methods, how they determine adoption and maintenance of best management practices, and how training practices are included in project evaluation. The survey identified numerous gaps, needs and opportunities in evaluation practices. The results were used to develop new practical evaluation tools.

Concurrent Sessions V 1:15–2:45

Track D: Understanding Trout Streams

Trout Stream Spring Characterization Methods and Springshed Mapping

Scott Alexander, University of Minnesota, alexa017@umn.edu; Andrew Luhmann, University of Minnesota; E. Calvin Alexander, Jr., University of Minnesota; Jeffery Green, Minnesota Department of Natural Resources; and Andrew Peters, Minnesota Department of Natural Resources

Southeastern Minnesota's karstlands support numerous trout streams. Dye tracing has been the primary tool for mapping springsheds supporting trout streams. A two-year study funded by the Minnesota Environment and Natural Resources Trust Fund aims to significantly increase the number of mapped springshed by integrating a variety of old and new tools.

Techniques used in combination with dye tracing include temperature and discharge monitoring, detailed structural mapping, chemical and isotopic studies. New methods to define springsheds can be tested against existing, dye trace defined basins. In previously untraced basins these tools can produce more efficient dye tracing programs.

Trout streams have been traditionally managed as surface water resources yet are fundamentally supported by clear, constant temperature groundwater. In karst areas groundwater resources are as vulnerable as surface waters to human activities. Designing Best Management Practices (BMPs) to protect ground water fed springs should improve the overall protection of Minnesota's trout streams.

Stream Flow and Temperature Analysis of the Vermillion River

William Herb, University of Minnesota, wrherb@comcast.net; Ben Janke, University of Minnesota; Omid Mohseni, University of Minnesota; and Heinz Stefan, University of Minnesota

Stream temperature and stream flow are important parameters for aquatic habitat preservation in river and stream systems. Water temperature is particularly important for coldwater stream systems that support trout. Summer base flow conditions with low flows and high water temperatures can be critical for maintaining trout habitat. Surface runoff from rainfall events can lead to increases in stream temperature, particularly in developed watersheds. To better understand the interactions between stream temperature, land use, and climate, an unsteady stream flow and temperature model has been developed for the Vermillion River. This river is at the southern fringes of the Twin Cities metropolitan area and has a world-class brown trout fishery. Stream flow was modeled using two existing tools, HEC-RAS and EPA-Riv1. A stream temperature model was developed at St. Anthony Falls Laboratory, UofM, to model stream temperature response to climate variations and surface runoff on short time-scales. The 1D model includes advective transport of heat downstream, water-atmosphere heat exchange and water-sediment heat transfer. The stream temperature model uses simulated unsteady flows and observed climate data as input. The hydro-thermal response of the stream to surface runoff during storm events is simulated at 1 hour time steps and distance increments of about 200 m using summer baseflow conditions as an initial condition. In addition to detailed temperature and flow time series, the model provides broad scale characterizations of heat transport in the Vermillion, including the relative importance of groundwater temperature, atmospheric heat transfer, and surface water inputs in determining stream temperature. The stream temperature model can therefore be used as a tool to determine what management practices (e.g. stormwater BMPs, bank shading, groundwater conservation) are best to maintain cold water temperatures for trout habitat.

Concurrent Sessions V 1:15–2:45

Track D: Understanding Trout Streams, *continued*

An Innovative Approach to Setting Peak Flow Standards in the Vermillion River

Scott Sobiech, Barr Engineering Company, ssobiech@barr.com; Brandon Barnes, Barr Engineering Company; and Jamie Smedsmo, Barr Engineering Company

An innovative approach was used to build a hydrologic model of the 230-square mile Vermillion River watershed, Minnesota. The model was used to set peak flow standards at locations where the Vermillion River or one of its tributaries crosses a community boundary. XP-SWMM was chosen because it is well-suited to detailed modeling of urban watersheds—making the model "expandable" for more detailed assessments of local communities.

A combination of ground-truth and NEXRAD precipitation data was used to account for spatial and temporal variability of rainfall. In order to build confidence in modeling results and facilitate stakeholder buy-in, the model was calibrated using seven streamflow gages located throughout the watershed. The PEST parameter estimation software package was used for automated calibration of hydrologic parameters. A detailed uncertainty analysis for flow estimates was also completed.

Concurrent Sessions V 1:15–2:45

Track E: Storm Water Monitoring: Cool Case Studies and Updating Particle Size Data

Paired-Watershed Assessment of Retrofitted Stormwater Volume Reduction BMPs

Kristy Treichel, City of River Falls, ktreichel@rfcity.org; Rich Brasch, Bonestroo; and Reid Wronksi, City of River Falls

This presentation reports on retrofitting small-scale volume reduction practices into an older city neighborhood. The City, Trout Unlimited, Kinnickinnic River Land Trust, Kinnickinnic Priority Watershed, WiDNR, and private property owners worked together on this demonstration project with the following objectives:

1. Survey the willingness of property owners to make changes on their property to better manage stormwater.
2. Design and implement a variety of retrofitted infiltration BMPs within the public right-of-way.
3. Monitor stormwater runoff from control and experimental paired-watersheds, before and after BMP installation.
4. Use project outcomes to:
   a. gauge the feasibility of small-scale retrofit practices
   b. understand the actual benefits of volume reduction BMPs
   c. guide the City's implementation of infiltration BMPs in other areas

BMPs implemented include:

- Mowable grass infiltration basins
- Rainwater gardens
- Porous concrete gutters
- Porous paver alleys
- Rain barrels
- Rain gutter redirection

Local Urban Stormwater Monitoring, Results and Implications for Future Management

Katie Huser, Capitol Region Watershed District, katie@captiolregionwd.org; and Melissa Baker, Capitol Region Watershed District

Capitol Region Watershed District (CRWD), located in Ramsey County, is completely urbanized, with 42% coverage by impervious surfaces and is drained almost solely by storm sewers. CRWD began its water quality monitoring program in 2005 with 8 stormwater water quality monitoring stations and has grown to 18 stations in 2008. At each station, flow is measured continuously and composite water quality samples are collected during storms and baseflow. Water samples are analyzed for nutrients, solids and metals. Results are discussed for 10 subwatershed stations. Pollutant loadings and yields are calculated for TP and TSS. With no water quality standards for stormwater, flow weighted average concentrations are compared to concentrations in the receiving waters (Mississippi River), to surface water quality standards and national averages for stormwater. CRWD is now assessing how monitoring data compares to model predictions and what our results mean for load reductions required by future TMDLs.

Concurrent Sessions V 1:15–2:45

Track E: Storm Water Monitoring, *continued*

Stormwater Particle Size Distribution and Composition

Greg DeGroot, University of Minnesota, degro048@umn.edu; and John Gulliver, University of Minnesota

A sampling methodology has been developed to accurately sample stormwater particle characterization and size distribution. This methodology is currently being evaluated for its effectiveness, as well as its ability to be transferred to engineering and environmental practice. Emphasis is being placed on ensuring the methodology is scalable in scope and cost, allowing a method of particle sampling which fits specific users and their projects.

Concurrent Sessions VI 3:00–4:30

Track A: TMDL

Water Quality Data for Lake Nutrient TMDLs: How Much is Enough?

Rebecca Kluckhohn, Wenck Associates, Inc., rkluckhohn@wenck.com; Merle Anderson, Clearwater River Watershed District; Diane Spector, Wenck Associates, Inc.

Current approaches to setting lake nutrient TMDL's involve expensive data collection modeling efforts. This paper compares implementation plans developed for lakes using large and small data sets and asks the question: How different is a $5,000 Implementation Plan from $50,000 plan? Due to pressure from lakeshore residents concerned over rapidly declining water quality in Cedar Lake, we used an Implementation Strategy Ranking System (ISRS) in conjunction with a small but robust set of data and tools to draft an implementation plan for the lake. The ISRS was used to understand the relative costs and uncertainty associated with each implementation strategy. Additional data was collected to reduce the uncertainty and refine the implementation plan; however the differences between the draft and final plans resulted mostly from stakeholder input and logistical limitations, not from a reduction in uncertainties afforded by the additional data. Lessons learned have implications for all TMDLs in Minnesota.

Integrating Geomorphologic Field Assessment and Watershed Modeling for Turbidity TMDL

Greg Johnson, Minnesota Pollution Control Agency, gregory.johnson@state.mn.us; Troy Naperala, URS Corporation; Karen Evens, Minnesota Pollution Control Agency, Julianne Socha, USEPA

The Poplar River turbidity TMDL was developed using total suspended sediment (TSS) as a numeric target. Sediment sources were quantified by analyzing water quality data, a physical channel assessment and computer modeling. Results of the data analysis indicated that: 68% to 85% of the TSS was originating in the lower Poplar River watershed; 73% of the turbidity exceedances occurred during high flow, and; 55% of the TSS reached the stream during April and May.

The results of the physical channel assessment and WEPP computer modeling showed that:

- Near stream land slides contributed 428 to 1,024 tons/ year;
- Gullies and ravines contribute 50 to 400 tons/ year;
- Disturbed lands (ski runs, roads, trails) contributed 330 to 990 tons/ year;
- Forest land contributed 140 to 421 tons/ year and;
- Other sources (channel incision, golf courses, and developed areas) contributed 38 to 140 tons/ year.

Concurrent Sessions VI 3:00–4:30

Track A: TMDL, *continued*

Setting Stormwater WLAs: TMDL Case Study

Andrea Plevan, Emmons & Olivier Resources, Inc., aplevan@eorinc.com; Michael Trojan, Minnesota Pollution Control Agency; Chris Zadak, Minnesota Pollution Control Agency; and Mike Wyatt, Minnehaha Creek Watershed District

TMDL studies incorporate wasteload allocations (WLAs) for stormwater. There are many acceptable approaches to setting WLAs for stormwater; this presentation will describe the pros and cons of several approaches. We also present a case study for the Minnehaha Creek Watershed District (MCWD) Lakes TMDL. The following questions were addressed in the MCWD Lakes TMDL:

- Should individual or categorical WLAs be set for municipal stormwater?
- How should the construction WLA be set?
- How should WLAs be set for road authorities?
- How should future growth be taken into account?

Answers to these questions depend on specifics of the water body, local partners, and available data. In our presentation, we discuss why a specific approach was taken for the MCWD Lakes TMDL and compare these approaches to other TMDLs.

Concurrent Sessions VI 3:00–4:30

Track B: I-35W Bridge

Hydraulic Design Considerations for Replacing the 35W Bridge

Andrea Hendrickson, Minnesota Department of Transportation, andrea.hendrickson@dot.state.mn.us

August 1, 2007, marks a day the citizens of Minnesota are not likely to forget. While bridge scour did not play a role in the 35W bridge failure, scour was an important consideration in the RFP for the replacement bridge. At the heart of the discussion was whether to allow a pier in the main channel of the Mississippi River or not. The U.S. Army Corp of Engineers assisted Mn/DOT by providing bathymetry and 2D modeling of the site. That model along with data from the City of Minneapolis provided valuable documentation in the decision making process. Due to the need for rapid construction, the bridge replacement was let as a Design-Build project. An overview of the waterway analysis process used to model and design the new St. Anthony Bridge will also be presented.

Responding to the I-35W Bridge Collapse as a Hydraulic Engineer

Aaron Buesing, US Army Coprs of Engineers, Aaron.W.Buesing@usace.army.mil

The collapse of the I-35W Bridge resulted in three significant hydraulics-related questions that needed to be answered in relatively short order. The questions were:

1. How can the water level and flow be controlled for the recovery effort?
2. Should a permit be issued for a debris removal road extending into the river?
3. Should contractors be allowed to propose a new bridge that has a pier in the river?

This presentation will cover coordination efforts and hydraulic studies that were performed over a period of about three weeks to answer these three questions. The goal of this presentation is to share knowledge regarding what was involved in coordinating with other agencies and how a two-dimensional numerical model was used to help answer questions 2 and 3.

Concurrent Sessions VI 3:00–4:30

Track B: I-35W Bridge, *continued*

Developing, Implementing, and Monitoring Pollution Discharge Prevention During the 35W St. Anthony Bridge Removal Under the Clean Water Act NPDES Permit Program

Dwayne Stenlund, Minnesota Department of Transportation, dwayne.stenlund@dot.state.mn.us

1. Prior to collapse, active concrete rehabilitation of the roadway and bridge deck was performed under requirements of the NPDES permit. As this was the largest discharge of construction debris and private property under the Clean Water Act NPDES permit program, rapid response to control further discharge seemed obvious. The objectives of this portion of the project were to rapidly develop a Storm Water Pollution Prevention Plan under circumstances of sensitive recovery efforts, no soils nor surface runoff data, no original grading plan, and limited or restricted site access.

2. The methodologies used in the development of the Storm Water Pollution Prevention Plan included aerial photo reviews, uniform aerial photo grid of collapse area, ground reconnaissance, and guesses of direction of flow and locations of storm drains. Using concepts of Desktop Publishing, aerial and ground photos were inserted into Microsoft Publisher, overlaid with colored doodles representing best management practices and materials, and narrative descriptions to form rapid and active management plans. Due to rapid changes during human and equipment recovery, demolition removals, and environmental discoveries, the same methods were used for daily program updates and addendums to the pollution prevention plan.

3. As a result of the process developed during this crisis, several new and innovative practices and materials were developed. The presentation will discuss methods of oil and debris capture in the Mississippi River, access into the river for structure and debris removals, heavy metal trapping in storm water conveyance locations, groundwater dewatering methods, rapid erosion control, and dust control. The main conclusion was the development of a communication tool for implementation of pollution prevention plan under constant change due to construction operations, at multiple locations.

This is part of a program discussing the 35W Bridge Response Team: Andrea Hendrickson, Petra DeWall, Aaron Buesing, Peter Leete, and Keri Aufdencamp.

Concurrent Sessions VI 3:00–4:30

Track C: Urban Pollutants: Source, Transport and Treatment

Land Cover and Impervious Classifications of the Minneapolis/St. Paul Metropolitan Statistical Area

Marvin Bauer, University of Minnesota, mbauer@umn.edu

Land cover and land use are critical drivers of environmental change and improved information and understanding of their spatial and temporal dynamics is essential for effective land and water management and policy. Over large geographic areas satellite remote sensing represents the most effective means to map and monitor land cover. Impervious surface area is a key component of land cover-use and an important indicator of environmental quality, affecting stormwater runoff to streams and lakes and water quality of surrounding lakes and streams.

This presentation will describe the results of classifications of multispectral Landsat data acquired in 2007 of the Minneapolis–St. Paul Metropolitan Statistical Area and the St. Croix River Basin of Minnesota and Wisconsin. The data will provide new, current maps and information quantifying the spatial patterns of land cover and impervious area of this region that can used as inputs to hydrology, stormwater and water quality models.

Inventory and Hydrologic Transport of Road Salt in the Twin Cities Metropolitan Area

Eric Novotny, University of Minnesota, nov00002@umn.edu; Andrew Sander, University of Minnesota; Omid Mohseni, University of Minnesota; Heinz Stefan, University of Minnesota

Over 330,000 tons of road salts (NaCl) are applied annually for road de-icing in the Twin Cities Metropolitan Area (TCMA). Observed salinity exceeds standards in a few streams and lakes seasonally. The hydrologic transport of salt, including road salt and water softener salt, through the TCMA watershed was analyzed. A hydrologic salt budget for TCMA watersheds was constructed using salinity data from major rivers, salt application rates, and wastewater treatment plant effluents. A residual of the amount of salt imported and used in the TCMA but not carried away by the Mississippi River was determined. Potential retention in soils, lakes and wetlands, and ground water is being investigated. Physical and chemical effects of saline water runoff into urban lakes were investigated, including (1) formation of a saline layer at the lake bottom, (2) long-term salinity increases in surface waters (3) seasonal salinity patterns and (4) penetration of salt into lake sediments. Field measurements and historical data were interpreted. Results will be reported.

Assessing Hydrodynamic Separators under High Water Flow Conditions

David Saddoris, University of Minnesota, saddo002@umn.edu; Omid Mohseni, University of Minnesota; and John Gulliver, University of Minnesota

Underground hydrodynamic separators are widely used in urban areas for removal of suspended solids and floatables from stormwater due to limited land availability for the installation of above ground stormwater BMPs. Hydrodynamic separators are sized for applications based on design stormwater flow rates. However, during less frequent storm events, design flow rates are exceeded and previously captured sediments can be scoured and washed out of these devices. A new methodology will be introduced to assess the scouring potential of these devices under flow rates exceeding their maximum treatment rates. The test method involves pre-loading the devices with sediments of known particle sizes, flowing water at flow rates above maximum treatment rates, and measuring the amount of sediments remaining inside the devices. The results of controlled field testing and laboratory testing on three commercial devices using this methodology will be presented, and implications of the findings on design and maintenance will be discussed.

Concurrent Sessions VI 3:00–4:30

Track D: Flood Reduction and Riverine Habitat

Impoundments—An Integral Part of the Overall Flood Damage Reduction Strategy in the Flood Prone Red River of the North Basin

Nate Dalager, HDR Engineering, Inc., nate.dalager@hdrinc.com

Covering thousands of square miles, the Northwest Minnesota portion of the Red River of the North basin has some of the most fertile farmland in the nation, yet is often flooded. Many of the communities are also flood prone.

A system of ditches running east to west was constructed almost every mile around the early 1900s to settle and farm the area. Most of these ditches are undersized for their respective drainage areas and the farmland that was opened up over the last century. A typical ditch has the capacity to handle runoff from a 1-2 year frequency event (~2 inches in 24 hours). Because of the low capacity, flooding and crop losses occur on an almost annual basis in many areas.

The Red River Watershed Management Board (RRWMB), a local governmental unit with water management responsibilities in the region, is pursuing flood damage reduction goals using structural and non-structural measures, but primarily through the construction of gated impoundment floodwater storage, incorporating an environmentally friendly systems approach. The RRWMB has developed an objective project evaluation system that quantifies a project's flood damage reduction effectiveness locally and on the main stem of the Red River. In addition, the State of Minnesota and RRWMB coordinate these projects using a "Mediation Agreement", whereby all relevant parties are involved in all phases of project planning, design, and implementation. Ultimately, the process is intended to yield projects that are acceptable to all interests, including private landowners and State and Federal permit agencies.

Goals, objectives and benefits:

- Provide 100-year protection to urban areas
- Protect flood prone farmland, roads, and structures from a 10-year frequency storm event (~3.5 inches in 24 hours) through the development of flood storage
- Prevent erosion damages to land, reduce turbidity downstream, and increase fish and wildlife habitat

Concurrent Sessions VI 3:00–4:30

Track D: Flood Reduction and Riverine Habitat, *continued*

Non-Invasive Solution to Prevent Flooding in the North Platte River at North Platte, Nebraska to Allow for Increased River Flows During the Migratory Season

Rocky Keehn, Short Elliott Hendrickson, Inc., rkeehn@sehinc.com

In April 2007 SEH began plans and specification of a project to increase flow rates through about two miles of the North Platte River in Nebraska upstream of the Highway 83 Bridge north of North Platte, Nebraska for the Platte River Recovery Implementation Program (PRRIP). The PRRIP started in 1997 when the states of Colorado, Wyoming and Nebraska and the Department of Interior came together in a unique partnership to develop a shared approach to managing the Platte River. Water users from the three states and conservation groups joined the effort and together, these stakeholders developed an innovative approach to better manage the Platte for the health of the ecosystem and the people that depend on it. The PRRIP is the culmination of that planning effort and is focused on implementing this shared vision for restoration on the Platte. One of the Program elements is enhancing, restoring and protecting least tern, piping plover, and whooping crane habitat lands which includes doing a "pulse" flow which are a result of controlled flow releases from Kingsley Dam during the migratory season.

The SEH project was to be the first construction project to be completed by the PRRIP to allow for the pulse flows to occur in the river during key migratory times. The project (as identified in a previous study not completed by SEH) was to be an over one-half million dollar "ditch" improvement project which should prevent flooding of several homes upstream of the Highway 83 bridge north of North Platte, Nebraska during the pulse. flow. During the initial reconnaissance stages of the project to collect survey data, it was discovered that the original proposed project would not be able to be completed due to issues with the landowners and permit requirements. SEH then began a revaluation of the original project components to determine if the goal of the project, which was to allow for an increase flow in the river, could still be accomplished.

The project went from an engineered project (ditches) to one in which the problem was addressed through a better understanding of the river flow system and the removal of the main problem that was reducing the flow, phragmites (an invasive species that grows to over six feet tall and is as thick as a jungle and is blocking natural flow path over sandbars and in floodplains in several rivers in Nebraska). The presentation will focus on several areas including: discussion on correct data collection requirements (relate story of how stakeholders used in the original study were not the right group to meet with), looking at non-invasive solutions to projects (phragmite project eradication by helicopter which started in the fall of 2007 verses re-digging a bunch of channels), cost savings of the project (final project will save about $500,000) and impacts of invasive species on flow rates in rivers which can impact flooding, flood studies and other natural species (very interesting results in HEC-RAS modeling in the reach).

Concurrent Sessions VI 3:00–4:30

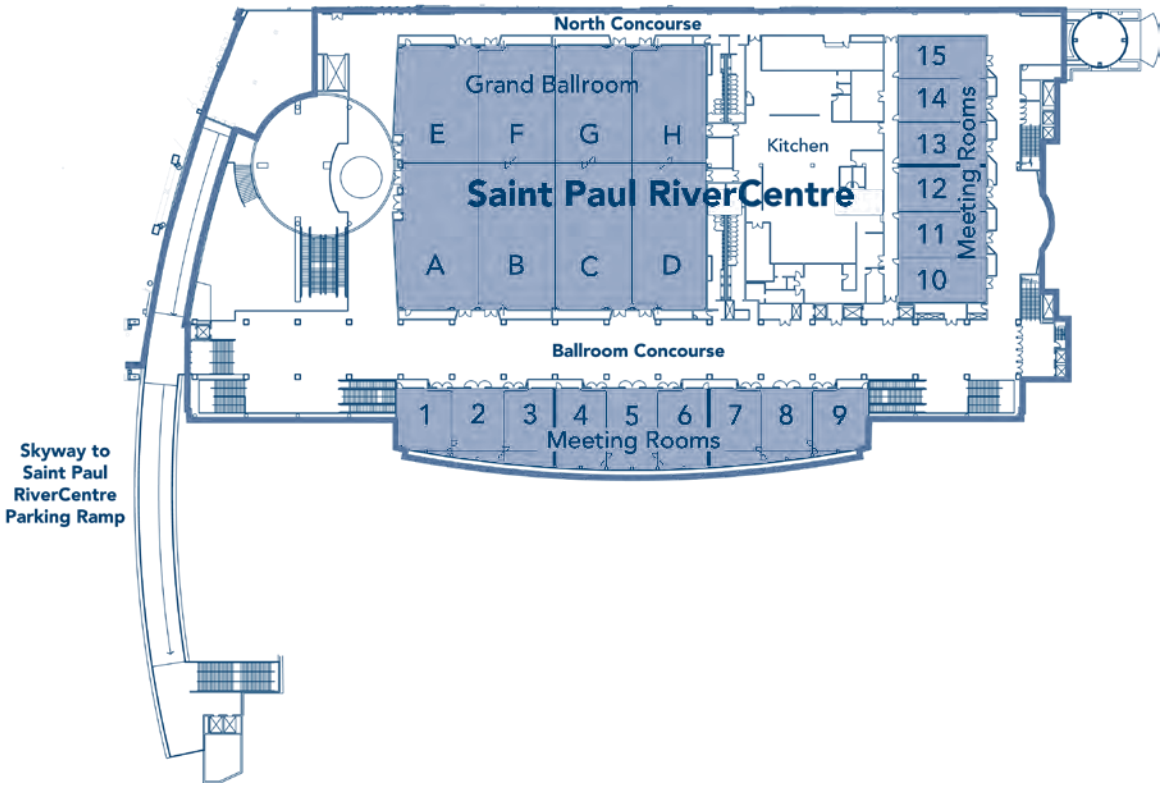
Track D: Flood Reduction and Riverine Habitat, *continued*

Home on the Big River: Great River Habitat Quality Indices

Debra Taylor, U.S. Environmental Protection Agency, taylor.debra@epa.gov; Mark Pearson, U.S. Environmental Protection Agency; Theodore Angradi, U.S. Environmental Protection Agency; David Bolgrien, U.S. Environmental Protection Agency; Brian Hill, U.S. Environmental Protection Agency; Terri Jicha, U.S. Environmental Protection Agency; and Mary Moffett, U.S. Environmental Protection Agency

The U.S. EPA's Environmental Monitoring and Assessment Program sampled the Upper Mississippi, Missouri and Ohio Rivers from 2004 through 2006 as part of an integrated assessment of ecological condition. We developed site-scale fish habitat indices by dividing the components of habitat into four categories: Channel complexity, substrate, littoral structures, and human impacts. Once site-scale indices were established, we evaluated if landscape-scale land use and cover metrics could improve the site-scale indices. On the Impounded reaches of the Mississippi, channel complexity, substrate, and landscape-scale measures of forest, shrub, and grass cover explained 49 percent of the variation in the fish community. On the Lower Missouri and the unimpounded reaches the Mississippi downriver from the Mississippi/Missouri confluence, the fish community was related to channel complexity, substrate, and the proportions of shrub land cover, grassland, and pasture. Fish communities on the Ohio River were correlated with distance to nearest upriver dam, substrate, and the proportions of land cover in shrubs and grasslands.

Index of First Authors


North Concourse
Grand Ballroom
E
F
G
H
A
B
C
D
Kitchen
Saint Paul RiverCentre
15
14
13
12
11
10
Meeting Rooms
Ballroom Concourse
1
2
3
4
5
6
7
8
9
Meeting Rooms
Skyway to
Saint Paul
RiverCentre
Parking Ramp