WRC awards five grants in 2004 competition

The WRC is pleased to announce the selection of five research projects for funding in the 2004 WRC grant competition. The projects include a study on the integration of biological indicators in the TMDL process, the effects of low-level antibiotics in surface waters, phyto-enhanced remediation of chlorinated solvent pollution, the effects of alkylphenols on biota, and timber management effects on water quality. Four of the projects are new, and one is in its third year and will receive continued funding. Funding for the projects is provided by the Water Resources Research Institute program of the U.S. Geological Survey (USGS), and the Center for Agricultural Impacts on Water Quality, a program of the College of Agricultural, Food and Environmental Sciences.

Development of a rapid bioassessment technique for integrating biological data into TMDL assessments in urban streams

Biological data are typically integrated into the establishment of Total Maximum Daily Loads (TMDLs) to assist in development of designated use categories, and in monitoring efforts to ensure that water quality standards are met. Prediction of biological responses resulting from the attainment of a TMDL is not currently a fundamental part of the TMDL process.

The goal of this project, led by Leonard Ferrington, Jr. (Entomology), is to develop and refine a rapid bioassessment technique using chironimid pupal exuviae to integrate biological data into a current TMDL study of Minnehaha Creek in Hennepin County, Minnesota. Rapid bioassessment protocols developed from this research will then be tested for broader effectiveness on a local scale in several urban streams in the Minneapolis-Saint Paul metropolitan area. Analysis of results from a companion study based in several streams of Baltimore, Maryland, will assess application of the technique as a generalized model for integrating biological data

***WRC grants** continued on page 4*

Senator Dayton meets with state mercury experts

The WRC organized a scientific briefing on mercury issues for Senator Mark Dayton (D-MN) on March 15, 2004. Attending were (l to r) Anne Jackson, MPCA; Dan Engstrom, St Croix Watershed Research Station; Dave Grigal, Professor Emeritus, University of Minnesota; Deb Swackhamer, Professor and Co-Director of the WRC, University of Minnesota; Senator Mark Dayton; Ed Swain, MPCA; Steve Balogh, Met Council Environmental Services; Ed Nater, Professor and Dept Head, University of Minnesota.

Dr. Gleick was named a MacArthur Fellow in October 2003.

World water expert, Peter Gleick, to give Kolshorn Lecture on global water issues

Dr. Peter Gleick, President of the Pacific Institute for Studies in Development, Environment, and Security and an internationally recognized water expert will deliver the Kolshorn Lecture at 5:15 p.m. on April 20 in the Bell Museum Auditorium as part of the President's 21st Century Interdisciplinary Conference Series. Dr. Gleick will speak on improving the future of global water. A reception will be held at 4:30 p.m. in the Bell Museum.

Around the State

WATER RESOURCES UPDATES

Minnesota fish producers report losses to cormorants and other birds

The University of Minnesota Sea Grant Program recently funded researchers to look into aquacultural losses to fish-eating birds in Minnesota. Linda Wires and Francie Cuthbert from the University Department of Fisheries, Wildlife and Conservation Biology surveyed 54 commercial fish producers to correlate bird-related fish losses with the distribution and abundance of double-crested cormorants, American white pelicans, and great blue herons.

Highlights of their research:

- Fish losses to double-crested cormorants were generally considered more severe than losses to American white pelicans and great blue herons.
- Fish losses to great blue herons occurred most frequently, but were generally not considered severe.
- 87 percent of fish producers experienced losses to fish-eating birds.
- 41 percent of fish producers defined their losses as severe.
- Concentrations of fish-eating birds were greatest at facilities during the birds' migratory periods.

Populations of cormorants and pelicans have rebounded over the past 30 years in response to policy and improved environmental conditions. In Minnesota, there are an estimated 8,000-10,000 breeding pairs of each species. Wires and Cuthbert are poised to conduct a statewide census of Minnesota's breeding cormorants and pelicans during the 2004 nesting season.

"Cormorants aren't the only fish-eating birds that visit fish production ponds but they can be a fish producer's biggest problem bird," said Wires. "People have very polarized opinions about how cormorants should be handled. On one level, it's miraculous that we have cormorants in the state at all given that environmental contaminants and persecution greatly reduced populations by the 1950s. From another perspective, the growing number of cormorants and pelicans aren't making many friends among fish producers and anglers."

The major results of Wires' and Cuthbert's report are available in the "Minnesota Fish Producers Report on Losses to Birds" fact sheet. For a free copy, contact the Minnesota Sea Grant Program at seagr@d.umn.edu or call (218) 726-6191.

Excerpted from a MN Sea Grant news release

From the Director's Desk

Building bridges across oceans

I write this letter on the eve of leaving for South East Asia for two weeks to meet with members of the Mekong River Commission (MRC). They sent a delegation in October to view development and environmental issues in the Mississippi River Basin (see December 2003 *Minnegram*) and now a group from the Mississippi Basin will return that visit. It turns out that we have a lot more in common than one might think and there appears to be a lot that we can both gain through establishment of a long-term partnership.

The Mississippi River Basin Alliance (MRBA) represented by Executive Director Tim Sullivan is the major U.S. partner in this effort, which is funded and supported through the Council of State Governments' State Environmental Initiative.

Our visit to the Mekong Basin has two purposes: First, we are going there to listen and learn from the MRC and the involved countries: Cambodia, Laos, Thailand and Vietnam. The more we understand about Mekong Basin circumstances, issues, and needs, the better prepared we will be to develop a long-term partnership, from which all parties can benefit.

Second, we are going to tell our story—the Mississippi Basin story—to a much wider audience than the delegation that visited here last fall. The focus of the story is on the impacts of basin development; the need to balance competing interests (social, economic and environmental), and development strategies to resolve conflicts and provide for inclusive, transparent, and informed policy and decision-making processes.

We will identify the resources and expertise that our partnership has to offer the MRC and its member countries as we try to tackle similar problems here at home. The WRC represents a multi-disciplinary "hub" in a land grant university system that can work and deliver across the Mississippi Basin. As such, we are committed to coordinating the future exchange of expert technical, research and management information, and resources between the basins.

Our goal is to implement a long-term exchange/partnership in SE Asia. Whether we will be successful remains to be seen, but if we are, both basins should benefit greatly in the future because of this exchange of ideas, strategies and methods. This is why we establish partnerships. The degree to which we are successful will impact development in these basins and others far into the future. Stay tuned for future updates!

James Anderson, WRC co-director

DuluthStreams.org uses technology to bring area watersheds to life

by June Kallestad, Natural Resources Research Institute

Researchers at the University of Minnesota Duluth's Natural Resources Research Institute (NRRI) have teamed up with the University of Minnesota Sea Grant Program, UMD Education, the City of Duluth, and other area agencies to increase public understanding of streams and watersheds. Living in a watershed brings with it many responsibilities. Citizens unfamiliar with the concept of a watershed may not realize that their actions can significantly affect the health and functioning of nearby lakes and rivers.

The concepts of living in and caring for watersheds are particularly important in the city of Duluth. The entire city is one big, fast-moving watershed that flows into Lake Superior, one of the most valuable fresh water resources on the planet. The hilly city of Duluth is streaked with 42 streams that wind through town and discharge into the great lake. Everyone in Duluth lives within 10 minutes of one of its 12 sensitive trout streams. To better educate Duluth citizens and others about the city's unique watershed, NRRI, Sea Grant, and their partners designed *DuluthStreams.org*, a unique Web site that shows what can be done to help citizens understand their role in water pollution and protection. The site is loaded with facts about the environment in the Duluth area, citizen involvement opportunities, and stormwater issues. Pictures and land-use data related to all 42 of Duluth's streams are available with the sweep of a computer cursor over a map. An especially interesting feature of the site is the computerized monitoring of four Duluth streams. "Real time" data are downloaded regularly to the site, making it easily available to teachers, students, scientists, and citizens. This feature makes it possible to watch changes in the streams' temperature, turbidity and water chemistry through the seasons. The site's monitoring feature is accompanied by a graphing tool developed at NRRI that animates and colorizes the data, giving viewers a peek at the "pulse" of three of the streams.

To keep residents informed on how their urban streams are faring, the City of Duluth is using *DuluthStreams.org* as the backbone of their public awareness campaign, which starts this spring. The site is also expanding to include surrounding communities.

"One of the funny things about living here is that living is so good that people don't see the problem," said Marnie Lonsdale, Duluth's Stormwater Coordinator. "We have a wealth of natural characteristics right in town that haven't been damaged, and we want to keep it that way."

"We're better off than most cities that are faced with the enormous cost of fixing their 'broken' streams," explained Carl Richards, Sea Grant director. "We know how important the natural resources are to the people who live here. Our goal is to help everyone understand their responsibility in keeping the streams healthy." But development and bad habits are having an impact on water quality. Long term monitoring of Miller Creek, which runs

DuluthStreams *continued on page 6*

Bringing it all together

DuluthStreams.org was created through a partnership between the City of Duluth, NRRI, the University of Minnesota Sea Grant Program, UMD-Education, the Western Lake Superior Sanitary District, and the Minnesota Pollution Control Agency. Funding for *DuluthStreams.org* was provided by the EPA's EMPACT (Environmental Monitoring for Public Access and Community Tracking) program. *DuluthStreams.org* is a spin-off of the Water On the Web (wateronthewеb.org) science and water curriculum project, and Lake Access (lakeaccess.org), another EMPACT-funded project, focused on Lake Minnetonka, Medicine Lake, and urban lake issues in the Minneapolis area. The University's Principal Investigator team for the three projects includes Rich Axler and George Host (NRRI), Cindy Hagley and Carl Richards (University of Minnesota Sea Grant Program) and Bruce Munson (Sea Grant and UMD-Education).

Speaker raises doubts about Atrazine's safety

Tyrone Hayes, Associate Professor of Integrative Biology at UC Berkeley, presented the University of Minnesota Environmental Health Sciences Bond Memorial Lecture on February 26. This lecture was co-sponsored by the WRC.

Tyrone Hayes presents his research on atrazine and amphibians.

Hayes' research focuses primarily on the role of hormones in amphibian development. His presentation outlined his current research, which suggests that the widely used pesticide atrazine (long considered harmless) may be functioning as an endocrine disruptor in wild amphibians, and may be responsible for the population declines seen in recent years.

Hayes' highly energetic presentation was well attended by faculty and students from across the University community.

***WRC grants** continued from page 1*

into TMDL assessments of urban streams in major metropolitan areas across the United States.

The effects of long-term low-level antibiotic exposure on the development of antibiotic resistance

The presence of pharmaceutical and personal care products (PPCPs) in natural waters has gained national attention as a cause for potential concern. The occurrence of one class of PPCPs, antibacterial compounds, is particularly alarming because it is widely believed that the presence of antibiotics can lead to antibiotic resistance in exposed microorganisms. That resistance may then be transferable by various pathways to bacteria associated with humans.

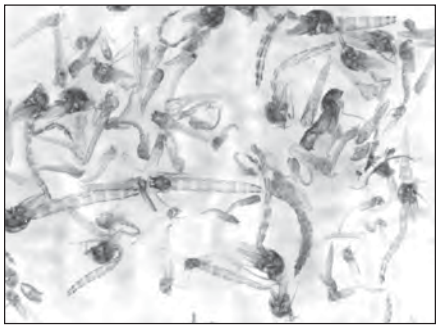
Antibiotics have been detected thus far mostly at low, subtherapeutic levels. There is a concern that long-term exposure at these levels may result in an increase in antibiotic resistance among environmental bacteria, but the causality of this relationship has not yet been established.

Kristine Wammer's (Environmental Health Sciences) main objective will be to determine if the proportion of bacteria that are resistant to antibiotics increases with long-term exposure at the low levels found in the environment. The results of this work will help with evaluation of the acceptability of the current levels of these compounds in natural waters.

Phyto-enhanced remediation: A wetland treatment system for surface water protection

Chlorinated solvents such as tetra- and trichloroethylene are frequently detected at Superfund sites, including those in Minnesota. Despite years of cleanup efforts, chlorinated solvents are a persistent, pervasive problem, especially in groundwater. Phyto-enhanced remediation (using living plants to help remove contaminants from the environment) is a potentially low-cost and aesthetically pleasing remediation alternative.

With this study, William Arnold and Timothy LaPara (Civil Engineering) propose the use of wetlands to remediate



In a project by Leonard Ferrington, Jr., chironomid pupal exuviae will be used to integrate biological data into TMDL studies.

chlorinated solvent pollution. Wetlands possess unique characteristics that make them prime candidates for the remediation of chlorinated solvents; however, a thorough investigation of the effectiveness of these characteristics has yet to be undertaken.

The specific goals of this study are to 1) determine the ability of wetland plants to stimulate the growth of methanotrophic bacteria populations and 2) elucidate the specific roles of the soil and plants and the impact of plant-microbial interactions in the removal of chlorinated ethylenes.

Assessing the ecotoxicology of 4-nonylphenol, a ubiquitous environmental estrogen, in two organismal bioassays

Little attention has been paid to the fate of alkylphenols entering the aquatic ecosystem, despite the large quantities of these compounds being discharged annually via municipal, agricultural, and industrial effluents. Environmental estrogens such as alkylphenols are known to disrupt normal endocrine hormones that are central to maturation and reproduction in fish, and the presence of these biologically active compounds in surface waters should be an environmental and human health concern.

In this study by St. Cloud State assistant professors of biology Heiko Schoenfuss and Matthew Julius, and Larry Barber, a research scientist at USGS in Denver, the effects of 4-nonylphenol exposure on two organismal bioassays will be examined. The first will test whether male fathead minnows experience reduced reproductive success if exposed for 21 days to realistic concentrations of 4-nonylphenol. The second will examine the physiological response of a diatom to 4-nonylphenol exposure to determine effects lower on the food chain.

The study of these two bioassays in the context of endocrine disruptive environmental estrogens will constitute the most comprehensive study of its kind, and will provide much needed information for the risk assessment of these contaminants on surface waters.

Effects of riparian forest harvest on instream habitat and fish and invertebrate communities

Timber harvest activities have the potential to degrade water quality and aquatic resources. Timber harvest best management practices (BMPs) are often implemented to protect aquatic resources, but the effectiveness of these BMPs is rarely evaluated. The goal of this study by Ray Newman (Fisheries, Wildlife and Conservation Biology), Jim Perry (FWCB), and Bruce Vondracek (FWCB) is to evaluate the effects of various riparian management practices on aquatic communities. This project is in its third year of funding with WRRI funds.

This study applied four levels of riparian harvest (control, low harvest, moderate harvest, and high harvest) to five replicate stream sites. The effects of the varying harvests then will be monitored and evaluated based on fish and invertebrate habitat, benthic macroinvertebrates, and stream fish communities.

The results of this study will be used to inform water quality managers and policy makers of the efficacy of current and alternative forest harvest BMPs to protect aquatic resources.

Nat Hemstad takes stream habitat measurements at one of the riparian test sites.

Extension water quality programs in agriculture continue to make progress

by Les Everett, WRC and University of Minnesota Extension Service

Although the University of Minnesota Extension Service reorganization of 2003 was prominent in the news, Extension water quality and agricultural programs were still on schedule and meeting goals. One of these programs was the WRC-managed "Small-group preparation of manure and nutrient management plans." By the end of 2003, this project had assisted 326 farmers to develop two-field manure and nutrient management plans for their farms. Over half of these participants were livestock producers whose operations are required to have a manure and nutrient management plan by January 2005. By the end of March 2004, 50 manure and nutrient management planning workshops will have been completed across the state. In order to allow this program to reach more producers and enable the project to continue into a third year, the Minnesota Department of Agriculture augmented the original Minnesota Pollution Control Agency-EPA 319 grant. The University of Minnesota Manure Management web site, http://manure.coafes.umn.edu, has been enhanced as part of the same 319 project.

Strip-tillage demonstration at Mark Muller's farm in Cottonwood County.

Extension programs have also addressed strip-till and other variations on zone tillage. Interest in these topics is high, evidenced by standing-room only attendance at the recent "Midwest Ridge and Strip Till Conference" in northern Iowa, and by a recent series of articles in farm magazines. The "Conservation Tillage Demonstration Project" was launched in the fall of 2003 with 319 grant funds. Five on-farm demonstration sites were prepared under University of Minnesota Extension Service management and the Monsanto Company prepared an additional four sites. Four field-length strip treatments (strip-till, no-till, fall chisel, and spring one-pass) were established in triplicate at each site. Demonstration days and winter workshops associated with these sites will be held this summer and following winter, along with a second year of field plots in 2005. University Soil Scientists Gyles Randall and Jeff Vetsch, who have considerable research station experience with these tillage practices, will publish yield and other data in an Extension bulletin. Economic analyses of these systems will be featured in the demonstration days and workshops along with crop management and soil conservation information.

Curly leaf workshops offered in response to growing problem

by Barb Liukkonen, WRC and Minnesota Sea Grant Program

Curly leaf pondweed has been identified in over 500 water bodies in Minnesota. This non-native aquatic plant is often characterized as an invasive nuisance species: the growth and spread of curly leaf pondweed over the past few years have caused problems for many shoreland property owners. In response to increased requests for information and assistance with managing curly leaf infestations over the past two years, the University of Minnesota Extension Service Shoreland Education Program recently offered three workshops to help property owners, local units of government, and lake association leaders better understand how to manage this nasty invader.

Workshops in Big Lake, Nisswa, and Richfield attracted nearly 150 participants who learned about the value of preserving native aquatic plants, the life cycle and characteristics of curly leaf, various management methods (cutting, harvesting, chemical and physical options), recent research studies, and the permitting process for curly leaf control. Speakers included representatives from the DNR, local governments, the Minnesota Lakes Association, and private consultants and lake management professionals. Lake association leaders also shared their experiences in trying to manage curly leaf.

The curly leaf workshops were co-sponsored by the Water Resources Center, Sea Grant Program, Minnesota Extension Service, Minnesota Lakes Association, and the Initiative Foundation.

U of M Water Community News

Richard Axler, **George Host**, and **Joe Mayasich** (NRRI-CWE) will collaborate with the Great Lakes Inventory and Monitoring Network of the National Park Service under the grant "Assessment and development of water quality monitoring for parks in the National Parks Service Great Lakes Network, USDI National Park Service." The purpose of the partnership is to compile water quality data from the nine national parks in the network, subject the data to critical analysis, and recommend a strategy for an integrated monitoring program.

Larry Baker (WRC) and **John Gulliver** (Civil Engineering) presented "Evaluation of stormwater BMPs in Minnesota" at Minnesota's Interagency Stormwater Design Team meeting on February 4.

Ph.D. student **Meghan Brown** (WRS) and her advisor **Donn Branstrator** (UMD Biology) recently published "A 2001 survey of crustacean zooplankton in the western arm of Lake Superior" in the *Journal of Great Lakes Research*.

Jeffrey Gunderson (Minnesota Sea Grant) assistant director, received a $245,762 grant from the Great Lakes Protection Fund for a two-year project entitled, "ANS-HACCP training initiative: To prevent the spread of biological pollution." The goal of the project is to minimize the spreading of aquatic nuisance species via aquaculture and baitfish farming operations. Minnesota Sea Grant is leading this project, which involves Sea Grant programs throughout the Great Lakes states.

Doug Jensen (Minnesota Sea Grant Aquatic Invasive Species Information Center) received the "School/Institution Award" from the St. Louis River Citizens Action Committee in January. Jensen earned the award for education efforts he led concerning invasive species in the St. Louis River system.

Barb Liukkonen (Sea Grant and WRC) served on a three-member national panel, to review Carleton College's Environmental and Technology Sciences (ENTS) program. The 15-year-old ENTS program is an interdisciplinary environmental studies program that includes faculty and course work from physical and social sciences as well as the humanities. The review took place at Carleton College, January 25–27, 2004.

Dr. **Euan Reavie** will join the Center for Water and the Environment (CWE) as a new Research Associate. Reavie will work with **John Kingston** (UMD Natural Resources Research Institute) at the NRRI/Ely Field Station. Reavie received his Ph.D. in Biology from Queen's University in Kingston, Ontario, and has most recently worked as a researcher for the US Air Force at the EPA-designated Otis SUPERFUND site in Cape Cod, MA. His areas of interest include limnology, paleolimnology, and diatom ecology.

Steven P.K. Sternberg (UMD Chemical Engineering) presented "Laboratory measurement of dispersion in a saturated two-dimensional flow field" at the American Geophysical Union 2003 Fall Meeting in San Francisco, CA. Sternberg also recently published "Dispersion measurements in highly heterogeneous laboratory scale porous media" in the journal *Transport in Porous Media*.

Robert Sterner (Ecology, Evolution and Behavior) presented a research seminar entitled "Redfield today: Constancy and variability in Ecological Stoichiometry" at Dauphin Island Sea Lab in Alabama on January 30. Sterner also presented "An assessment of zoo- and phytoplankton biodiversity in Twin Cities lakes and ponds: Effects of urbanization on pelagic communities" to the Minnesota Pollution Control Agency on February 10. The paper's co-authors included graduate students **Jim Hood** (EEB), **Kiyoko Yokota** (EEB) and **Fei Yuan** (Forest Resources).

Deb Swackhamer (WRC and Environmental Health Sciences) gave the first seminar in the Women and Science Seminar series at SUNY College of Environmental Sciences and Forestry, in Syracuse, NY, on January 29.

DuluthStreams *continued from page 3*

through Duluth's heavily developed mall shopping district, shows signs of heat stress from pavement run-off, and deteriorated plant and animal life due to excess sediment and contaminants during heavy rains. Bad habits carried over from a less environmentally aware time haunt Duluth's waterways, too. Residents can still be seen sweeping spring salt and gravel from their yards into the streets and down storm drains, fertilizing lawns near creeks and dumping toxic chemicals down storm drains. After a rain, those pollutants quickly impact down-stream organisms in the creeks, and reach Lake Superior or the harbor within minutes.

NRRI's technical expertise, with the University of Minnesota Sea Grant Program's outreach experience and the City of Duluth's stormwater program knowledge, bring a depth of information to *DuluthStreams.org*, and to the public. The team's skills in planning, designing, and editing make the information on the site accessible and easy to understand. The partners hope that watershed knowledge will lead to public understanding, and even sympathy for the waterways we live near. They also hope that the site can become a model for similar projects across Minnesota.

Upcoming Events

Small Community Wastewater Education Program (SCWEP) Seminars. Minnesota has thousands of rural unsewered communities—incorporated and unincorporated areas located on prairie, forest, and shore lands. The University of Minnesota Extension Service is conducting half-day and full-day seminars across the state to familiarize people with solutions to meet their wastewater needs using an informed decision-making process to address financial, environmental, and community issues.

The half-day seminars, scheduled from 9 a.m. to noon, will provide attendees with options related to wastewater treatment systems, legal entities, and new developments in financing. The full-day seminars provide an opportunity to learn more details and apply them to community case studies.

For seminar schedules, registration, and more information about these seminars, visit http://septic.umn.edu/SCWEP/ or call (800) 657-3516.

Half-day seminars:
Cloquet – 4/6/04
Melrose – 4/7/04
Thief River Falls – 4/14/04
Park Rapids – 4/15/04

Full-day seminars:
Hutchinson – 4/19/04
Pequot Lakes – 5/5/04

March 23–24, 2004. **Minnesota Water 2004: Policy and Planning to Ensure Minnesota's Water Supplies.** Radisson Metrodome, Minneapolis, MN. The ninth Minnesota Water biennial conference will provide research, policy, and planning perspectives on issues of water quality and quantity in Minnesota. Governor Tim Pawlenty will give a plenary address on his Clean Water Initiative for Minnesota. Other plenary sessions will address policy and planning related to population expansion, climate change and microbial contamination in the Great Lakes, and geological mapping for groundwater management. A conference schedule, brochure, and book of abstracts can be found at http://wrc.coafes.umn.edu/Water2004/.

March 31–April 1, 2004. **Shallow Lakes Conference.** Best Western Conference Center, North Mankato, MN. Shallow lakes and wetlands in Minnesota, and throughout the entire prairie pothole region, have either disappeared, been seriously degraded, or are threatened by development. This conference will provide an opportunity for stakeholders to come together to share knowledge and understanding of the region's shallow lakes, as well as to determine management practices that will preserve these important resources. An agenda and registration form are available at www.shallowlakes.info, or contact Shannon Fisher, MN DNR, at shannon.fisher@dnr.state.mn.us or (507) 359-6073.

April 29–May 1, 2004. **2004 Lakes and Rivers Conference: Citizen Stewards of Minnesota's Waters.** Ruttger's Bay Lake Lodge, Deerwood, MN. Citizen stewardship and management of Minnesota's lakes and rivers will be the focus of the 2004 Lakes and Rivers Conference, hosted by the Minnesota Lakes Association (MLA) and the Rivers Council of Minnesota (RCM). Five concurrent session tracks will be featured during the conference to help build citizen skills and understanding of protection, restoration, and management of water resources. For more information contact MLA at (800) 515-5253, RCM at (320) 259-6800, or visit www.riversmn.org/2004_Rivers_Conference.html.

July 24–28, 2004. **Soil and Water Conservation Society (SWCS) Annual Conference.** Radisson Riverfront Hotel, St. Paul, MN. The SWCS annual conference brings together researchers, practitioners, and policymakers at all levels of government, along with a broad cross-section of other interest groups to explore current issues in natural resource management and planning. Program topics include soil and environmental quality; assessing the effectiveness of conservation and environmental programs; and geo-spatial technology for conservation: soil, water, and land. For more information, please visit http://www.minnesotaswcs.org/conv2004.htm.

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Publications and Resources

NPDES permit writers' guidance manual and example NPDES permit for concentrated animal feeding operations. U.S. EPA. 2003. This manual provides information to NPDES permitting authorities, owners and operators of animal feeding operations, and the general public on how to implement the Clean Water Act CAFO regulations, including information to help permitting authorities ensure that NPDES permits conform to the CAFO regulations. The manual is available online at http://cfpub.epa.gov/npdes/afo/info.cfm#cafo_pub. Copies are also available from EPA's Water Resources Center at (202) 566-1729; the document number is EPA-833-B-04-001.

MPCA Statewide phosphorus report. Minnesota Pollution Control Agency. 2004. The Minnesota Pollution Control Agency (MPCA) has made public a report on the first detailed assessment of phosphorus sources in Minnesota's major watersheds. The study was ordered by the 2003 Legislature in response to lack of information on the phosphorus content of dishwashing detergents. The assessment was funded by the Legislative Commission on Minnesota Resources and conducted for the MPCA by Barr Engineering. The full study and executive summary are available on the MPCA Web site at www.pca.state.mn.us/hot/legislature/reports. Questions, comments and requests for additional information can be directed to Mark Tomasek at the MPCA, (651) 296-7241 or mark.tomasek@pca.state.mn.us.

Upper Mississippi River system flow frequency study (UMRS FFS). U.S. Army Corps of Engineers. 2004. This study was carried out by the USACE in collaboration with other Federal and State agencies. The principal product of this study is updated and improved flood profiles for the Upper Mississippi, Lower Missouri, and Illinois rivers. These profiles present the expected flood stages for a range of potential flood events. The final products of the UMRS FFS are available by visiting: www.mvr.usace.army.mil/pdw/pdf/FlowFrequency/flowfreq.htm. A CD of the products can be obtained by contacting Jerry Skalak at (309) 794-5605 or jerry.a.skalak@usace.army.mil.

Water in storage and approaches to ground water management, High Plains aquifer, 2000. USGS Circular 1243. U.S. Geological Survey. 2004. This report describes changes that have taken place in the High Plains (or Ogallala) aquifer from the time that significant ground water pumping began in the 1940s to the year 2000. The results show a six percent decrease in the volume of water stored in the aquifer. The change in storage by state ranges from an increase of about 4 million acre-feet in Nebraska to a decline of about 124 million acre-feet in Texas. The report also includes a state-by-state summary of approaches to ground water management in the eight states overlying the aquifer. The report can be obtained by contacting USGS Information Services at (888) 275-8747.