

Will Great Lakes water become a trade commodity?

by Marcey Westrick

The contentious issue of exporting Great Lakes water in bulk was elevated to international importance last spring when the Ontario provincial government granted the Nova Group, Inc., a permit to take up to 600 million liters of water a year from Lake Superior for export to Asia. The action resulted in such strong public outcry from both Canada and the United States that Ontario eventually revoked the permit.

The Nova Group incident has focused a great deal of attention on the question of bulk water removal for export and has forced both federal governments to re-evaluate existing policies concerning these transboundary waters.

With one-fifth of the world's freshwater located in the Great Lakes basin, it comes as no surprise that these waters are in high demand. Increased competition within the domestic and global economies, coupled with an ever increasing demand for freshwater, has prompted economists to refer to water as the "oil of the twenty-first century." The long-feared struggle for Great Lakes water has begun.

Water exports may prove to be economically viable and environmentally acceptable but ramifications are not yet clearly understood. What is understood is that if bulk water proposals such as the one put forth by the Nova Group, Inc., are accepted, a precedent will be set under the North American Free Trade Agreement (NAFTA). NAFTA makes exporting water an extremely complicated issue.

According to trade officials, once export begins, the water of the Great Lakes becomes a tradable commodity similar to oil or natural gas and subject to non-discriminatory management. This entrenchment of water as a commodity would place the control of Great Lakes water in the decision-making domain of trade tribunals and beyond the reach of government control. If water is exported, both governments will be subject to investors' compensation suits if they later decide to stop or reduce exports for environmental reasons. Under NAFTA, companies have the right to file claim for lost investments and lost business opportunities.

The Canadian and U.S. governments have asked the International Joint Commission (IJC), a bipartisan advisory board created under the 1909 Boundary Waters Treaty, to examine and report on the use and diversion of water along their common border and provide interim recommendations by August of this year. The IJC has appointed a binational multidisciplinary study team to aid the investigation and has held public hearings in eight Great Lakes cities in an attempt to understand citizens' concerns about this issue.

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Sea Grant

Images of tankers withdrawing quantities of water from the Great Lakes raise concern over exporting water in bulk for profit.

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Around the state

WATER RESOURCES UPDATES

Rural areas to get millions for clean water projects

The Department of Agriculture is promising more than \$200 million for clean water improvements in rural communities in 44 states and Puerto Rico. The amount is the largest single allotment for rural wastewater projects in USDA's history, according to Agriculture Secretary Dan Glickman.

About \$155 million of the money will come in the form of loans and grants from the USDA. An additional \$52.4 million will come from public and private sources.

While it is easy to take the luxury of clean and safe drinking water and

adequate waste disposal for granted, it is reported that more than 2.3 million Americans live in homes without safe drinking water or with no running water at all. In addition to these numbers, approximately 4 million rural residents are connected to substandard sewage disposal systems that often pollute their drinking water, rivers and streams.

The grants and loans will be used primarily to improve wastewater systems where the infrastructure has had minimal upgrades. The USDA is hoping that these grants and loans will help eliminate the health problems associated with unsanitized water, prevent groundwater contamination and encourage economic development.

exerpted from U.S. Water News Online

Get the lead out

The MNDNR, the University of Minnesota Raptor Center, the Minnesota Office of Environmental Assistance, local retailers and tackle manufactures have launched a campaign to eliminate lead sinkers in Minnesota waters. Governor Jesse Ventura helped kick off the campaign in March by releasing a bald eagle that had been treated for lead poisoning.

Lead, in sufficient quantities, can damage the nervous and reproductive systems of mammals and birds. This metal, found in most fishing sinkers, is poisoning wildlife such as loons and eagles.

When lead fishing sinkers are lost, birds scoop them up from the bottom of the lake or river with the pebbles they consume to help grind their food. A bird with lead poisoning will display physical and behavioral changes, including loss of balance, tremors, and an impaired ability to fly. The weakened bird is more vulnerable to predators, and often has

trouble feeding, mating, or caring for its young. Birds often die within two or three weeks of consuming the lead.

While it is hard to get an accurate count of the number of birds that die of lead poisoning, estimates indicate that lead is a serious threat. The University of Minnesota's Raptor Center has reported that up to 20% of the eagles they treat have lead poisoning. For more information on the hazards of lead, contact the Minnesota Office of Environmental Assistance at (800) 657-3843 or visit their website at <http://www.moea.state.mn.us>.

Phosphorus fertilizer ban proposed

The City of Plymouth, MN, has developed a new city ordinance banning all phosphorus fertilizer applications. According to the proposed ordinance, no person, firm, or franchise will be allowed to apply lawn fertilizer that contains any amount of phosphorus or other compound containing phosphorus, such as phosphate. If passed, the ordinance will be effective immediately. Plymouth is not the first city in the Twin Cities Metro Area to ban phosphorus fertilizer, but part of a growing trend to eliminate excess nutrients from the environment.

Building Name Change

The Old Health Services Building, which houses the Water Resources Center, Conservation Biology, the Institute for Social, Economic, and Ecological Sustainability, and the Center for Rural Design has changed its name. The building is now known as the Natural Resources Science Building. The name change is reflects the common discipline shared by those now occupying the building.

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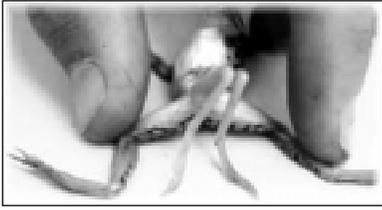


photo courtesy of MPCA

Parasite linked to frog deformities

New research conducted by Pieter Johnson, recently published in the magazine, *Science*, suggests that the cause of recent increases in malformed frogs is due to a naturally occurring parasitic flatworm called a "trematode." While some scientists from California believe this new report is one of the most important papers published on frog deformities, scientists from Minnesota and around the country do not agree that parasites are the cause of what is happening in Minnesota. Although the research raises interesting questions, scientists from the Minnesota Pollution Control Agency (MPCA) say that the type of parasite and the species of frog tested do not occur in Minnesota and warn that this new work shouldn't be interpreted as having found the sole cause of malformations.

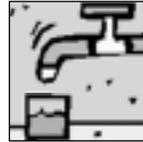
Johnson, a researcher at Claremont McKenna College in Southern California, conducted a laboratory study in which he exposed tadpoles of the Pacific tree frog to various concentrations of two kinds of parasites. The hypothesis was that the parasites burrow into the pelvic area of tadpoles and form cysts that interfere with development just as the tadpoles are beginning to sprout limbs.

Johnson found that the tadpoles exposed to one species of parasite either died or developed abnormalities. The severity of deformities was directly related to the concentration of parasites. These deformities produced in the lab were reported to be of the same type as those documented by Johnson in several California ponds.

While the recent news about parasites is interesting and seems to show that parasites can be the cause of some malformations, biologists from the MPCA say that parasites have always been considered one possible cause of frog deformities and no evidence so far suggests that they are the primary cause for the deformities found in Minnesota. The MPCA reported that they will continue to investigate what roles pesticides, other chemicals and ultraviolet radiation play in frog malformations.

Arsenic in drinking water a growing concern

The Water Resources Center (WRC) sponsored an all-day conference in Morris, Minnesota, on April 14 to address the growing concern of arsenic in drinking water. Dr. Rebecca Calderon, a nationally renowned arsenic expert from the USEPA, discussed the potential human health risks associated with arsenic in drinking water. Rich Soule and Jean Small-Johnson from the Minnesota Department of Health talked about arsenic in Minnesota's groundwater and the Minnesota Arsenic Study. Other topics included removal of arsenic from public drinking water supplies and removal of arsenic from household wells. The conference drew approximately fifty participants. Mary Renwick, WRC Education Coordinator, appeared on the WCCO This Morning to answer questions about arsenic in Minnesota drinking water. Minnesota Public Radio reported on the conference and The Great Lakes Radio Consortium aired an expanded version of the story during the week of May 17 on public radio stations throughout the Great Lakes states and Canada.



Concerns about Arsenic

Serious health problems associated with high levels of arsenic in drinking water have surfaced recently in India and

Bangladesh, spurring more in-depth investigations in the United States concerning the effects of this naturally occurring element in drinking water. Although arsenic has a reputation for being a lethal poison, the fatal dose of arsenic is a one-time oral dose of 60,000 micrograms. The current EPA drinking water standard of 50ppb is 1,000 times smaller and is equivalent to one drop of arsenic in 16,000 gallons of water.

The growing concern stems from low-level exposure to arsenic over an extended period of time. Arsenic has been associated with skin cancer and other disorders, and a scientific debate continues over what level of exposure should be considered acceptable over the course of a lifetime. In March 1999, the National Research Council (NRC) released a new study suggesting that drinking water with high levels of arsenic can also lead to bladder and lung cancer. The study also suggests that there may be an increased risk of long-term health effects from exposure to arsenic at levels as low as 2 ppb. The NRC is recommending that the EPA enforce more stringent drinking water standards for arsenic and advise the standard to be lowered to less than 20 ppb.

Arsenic in Minnesota

Since arsenic varies from one geographical location to the next, the Minnesota Department of Health (MDH) is studying Minnesota's groundwater to determine if certain areas are more prone to contain arsenic. Currently, the MDH has detected arsenic in the groundwater in approximately two-thirds of Minnesota. Private drinking water wells are not required to meet the state and federal standards for arsenic. However, if arsenic is found at more than 50 ppb, the MDH recommends that the water not be used for drinking or cooking.

Residents concerned about arsenic levels in a private well should have their water tested by a laboratory certified by the MDH. To find a laboratory in your area, call your country health department or visit the Water Resources Center website at <http://wrc.coafes.umn.edu>.

Bulk water continued from page 1

Historically, the IJC has managed the boundary waters in terms of regulated levels and flows. Not until recently have they become more involved in policy.

The complexities of NAFTA are compounded by the eight states and two provinces that are reliant upon Great Lakes water. Water withdrawals and consumption within the Great Lakes basin are extensive, and the policy implications of these activities are in every way as consequential as those related to exports. With five of the states and one province having access to more than one of the lakes, it is nearly impossible to compute how much water is currently being used by each of the countries.

To further complicate management, water use decisions are made at several levels: state, provincial, national, and international. Thus, in addition to multiple conflicting uses and users, there are multiple authorities governing water allocation and use. Therefore, water regulation has fallen between the cracks of federal, provincial and state jurisdictions.

Without the legal framework or policy needed to track their own water consumption, the Great Lakes States and the two Canadian Provinces are not in the position to make informed decisions about future withdrawals.

To many, the Great Lakes seem to be an infinite resource, available to quench the thirst of an increasingly water-poor world. Those in favor of free trade argue that water is a renewable resource that the U.S. and Canada has in excess. Ecologists and other scientists say that even a small removal of water from the Great Lakes basin can offset the chemical and biological equilibrium to the point of irreversible harm. In reality, the impacts of diversion are not well studied. For example, only 1%

of the water in Lake Superior is renewable. The remaining 99% of the water is an inheritance from the last glacial melt. Questions arise over the way in which large withdrawals from the basin will affect this ecosystem. Global climate change is another concern. Scientific



Over one-fifth of the world's freshwater supply is found within the Great Lakes Basin.

consensus exists that climate change will lower Great Lakes levels up to 1.5 meters via reduced tributary flows and increased evaporation. Changing the water levels and flows in the Great Lakes means unpredictable and potentially harmful consequences to basin habitat and biodiversity as well as accompanying impacts on employment and recreation.

The transboundary waters of the Great Lakes have always played an important role in the economy and culture of Canada and the United States. Since the turn of the twentieth century, efforts have been made to reduce disputes over these resources. In 1909, the United States and Canada signed the Boundary Waters Treaty. The treaty was enacted to regulate water in the shared basin for use as potable water, navigation and power generation. While the

Boundary Waters Treaty was a milestone for the two countries, it did not address the issues of interbasin diversions or using lake water for consumptive uses.

It was not until the early 1980s that the IJC recommended both countries develop policy to deal with consumptive uses within the basin and diversions out of the basin. The growing concern over protecting the Great Lakes from large interbasin diversions provided the impetus for the US-Canadian Great Lakes Charter of 1985 and the U.S. Water Resources Act of 1986. These pieces of legislation provide vehicles for the regulation of diversions and consumptive uses. The Charter established non-binding cooperative rules of access and conduct such as prior notice and consultation among the Great Lakes States and Provinces regarding consumptive uses and diversions. While the Charter seeks to control water withdrawals from the Great Lakes through voluntary compliance, the Water Resources Act regulates those Great Lakes diversions made by the U.S.

The Water Resources Act assures that diversions of water out of the Great Lakes basin will not be undertaken without a consensus of approval from all of the Great Lakes States. Until recently, Canada has not had such an agreement among provinces. However, the current situation has spurred the Canadian Parliament to develop a comprehensive approach to bulk water removal and to enact a moratorium prohibiting the export of water until a national accord is reached. While both pieces of legislation set regulations within their respective countries to reach a consensus before allowing withdrawals or diversion, there is still no policy mandating international consensus.

MinnAqua moves to Water Resources Center

by Roland Sigurdson



The Urban Angling program, now known as the MinnAqua program, recently moved in with the Water Resources Center on the St. Paul campus of the University of Minnesota. MinnAqua was created in 1989 as a collaboration between the Minnesota Department of Natural Resources—Section of Fisheries and the University of Minnesota Center for 4-H Youth Development. Its creation was in response to a growing urban population that no longer had close associations with water resources located in the metropolitan area. By encouraging people, young and old, to try the age-old tradition of sport fishing, MinnAqua aims to encourage citizens to take a more active interest in the waters that support aquatic life.

MinnAqua combines aquatic education and sport fishing in an attempt to foster the understanding of natural resource management and stewardship. Instructors, interns, and volunteers teach youth about habitat quality, Minnesota fish diversity, water quality, water/land stewardship, natural resource management, and fishing techniques through curricula that involve hands-on activities. Instructors arrive at a site in the neighborhood of the participants, often with all the necessary equipment including rod/reel combos for the participants to use during the program. By encouraging organizations and citizens to use the water resources around them, MinnAqua hopes that participants will see the value of the resources “in their own backyard.”

MinnAqua has expanded to a statewide program that works with youth organizations of all types across the state. Last year the program interacted with nearly 43,000 children and adults statewide. MinnAqua has also been active in special outreach programs to the Native American, Afro-American, Hispanic and Southeast Asian communities. There are three aquatic education specialists in Minnesota. Roland Sigurdson, housed at the Water Resources Center, supports DNR Region 6 (Metro), Linda Bylander in the Brainerd regional office supports DNR Regions I, II, III, and Kathy Beaulieu in the New Ulm regional office supports DNR Regions IV, V.

Mercury elimination project at UMD

experted from Environmental Health News, Spring 1999

Several departments at the University of Minnesota-Duluth (UMD) along with many individual faculty are working to reduce mercury discharge to Lake Superior. By using mercury-free products and cleaning sewer lines, participating staff and faculty have significantly reduced the amount of mercury discharged from UMD into the lake to levels below the stringent standards set by the Environmental Protection Agency and the Western Lake Superior Sanitary District (WLSSD).

Mercury is a naturally occurring element and is used in the production of many products. In high concentrations, mercury is a contaminant. Once it enters

water, mercury becomes a concern due to its high availability to biologic organisms.

In an effort to reduce mercury levels in the environment, manufacturers have been asked to provide metal content data sheets for their products. Based on this data, researchers can choose those products with the lowest mercury concentrations. These choices have led to the substitution of mercury-free boiler treatment and housekeeping products for those containing mercury.

Sources of metallic mercury are also being eliminated on the UMD campus by replacing power and light switches that contain mercury with those that do not.

Mercury thermometers are being replaced by alcohol or electronic thermometers and electronic pressure sensors will replace those with a bolus of mercury.

A more surprising effort being undertaken involves removing biomass from drain lines. Bacteria and fungi in slow-moving wastewater take up and concentrate mercury. Periodically, biomass builds to the point where it is shed. The shed biomass causes the release of somewhat concentrated mercury into the waste stream. By cleaning the drain lines, biomass can be collected and packaged for disposal, greatly reducing mercury concentrations.



Minnesota Water Community News

Deborah Swackhamer (Dept. of Environmental and Occupational Health) was invited by the US-Canada International Joint Commission to serve as a scientific expert at a two-day workshop in Ontario that focused on a new Water Quality Agreement between the two countries. **Swackhamer** was also invited to give a presentation to the American Chemical Society on the preferential accumulation of AHH-inducing PCB congeners in aquatic foodwebs and to give a plenary speech to the North American Benthological Society on the persistence of bioaccumulative toxic compounds in the Great Lakes. In addition, **Swackhamer** has recently published the article, "A new testing apparatus for assessing the interactive effects of suspended solids and chemical stressor on plankton invertebrates," in the journal *Environmental Toxicology and Chemistry*.

Mary Renwick (Water Resources Center) is on a three-month leave of absence in Sri Lanka. **Renwick** is working for the 2001 World Water Congress developing a conceptual framework for valuing different uses of water, examining the interactions between irrigation and wetlands in Bundala National Park, and reviewing world water demand and supply scenarios.

Robert Sterner (Dept. of Ecology, Evolution, and Behavior) received a three-year grant from the NSF to study elemental homeostasis at the individual, guild and ecosystem levels. Sterner and **Pat Nunnally** from CURA (Humphrey Center) also received a one-year grant from the MPCA for "Ecological trends in the Upper Mississippi Basin: A combined historical and ecological approach."

Pamela Davis (Water Resources Science) will be attending the NSF-

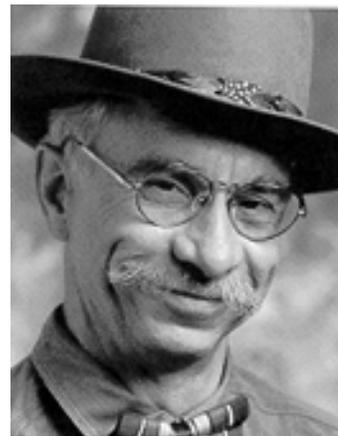
sponsored Case Studies in Science Workshop at the University at Buffalo in June. In addition, **Davis**, along with **Jim Perry** (Dept. of Forest Resources), and **Timothy Delmont** (Dept. of Human Resources), have recently published "The Minnesota Team Based Approach" in the *Journal of Excellence in College Teaching*.

Perry presented, "The Minnesota-Wisconsin collaboration model increases impact," at the 10th International Conference on Teaching and Learning in Jacksonville, FL. **Perry** also received two new grants. The first grant, in collaboration with **Patrick Brezonik** (Director and Professor, WRC and Dept. of Civil Engineering), **Marv Bauer** (Dept. of Forest Resources), and **Richard Osgood** (University College), will be used to investigate the effects of cumulative development on lakes through remote sensing techniques. The second grant, in collaboration with **Bruce Vondracek** (Dept. of Fisheries and Wildlife), involves work on the generic environmental impact study being conducted by the EQB on the impact of animal agriculture on Minnesota environments.

Kimberly Schulz (Dept. of Ecology, Evolution, and Behavior), a postdoc in Robert Sterner's lab, will begin a position as Assistant Professor at SUNY-Syracuse in January 2000.

Tracy Thomas, WRC principal secretary, won the Mark David Clawson prize for best summa cum laude thesis in the Department of English for the 1998-1999 academic year.

Pat Brezonik (Director, WRC) was an invited speaker at the Lakes 99: International Conference on Lake Management in Denmark. Brezonik's talk focused on using remote sensing to monitor lake water quality.



Tom Foley

Perry wins teaching award

Water Resources Science faculty member Dr. Jim Perry (Dept. of Forest Resources) received the Horace T. Morse-University of Minnesota Alumni Association Award for Outstanding Contributions in Undergraduate Education in May. This award recognizes faculty who exhibit excellence in contributing directly and indirectly to undergraduate learning through research, advising, academic program development, and educational leadership.

An innovator in the classroom, Dr. Perry's main mission as a professor is to dispel the notion of an external source of wisdom, to instill a sense of confidence and curiosity, and to empower students to develop a new understanding of the world. Dr. Perry's newest endeavor is an emerging stream and wetland project that he predicts will be the center of many on-campus teaching activities that are much more field-based and experiential than any current programs offered at the University.



Upcoming Events

July 8-11. **Fifth Annual Mississippi River Basin Alliance Conference Membership Meeting.** St. Louis, MO. The conference will focus on issues impacting environmental and community health within the Mississippi River Basin. For further information, contact James Falvey at (612) 870-3441.

August 2-6. **9th Annual National Gap Analysis Program Meeting.** Duluth, MN. Sponsored by the USGS, the conference will focus on large-area biodiversity science. Speakers Stewart Pimm, Malcolm Hunter, and Eric Dinerstein will lead plenary sessions on biodiversity conservation. For further information, call (208) 885-3555, E-mail: gap@uidaho.edu, or visit the GAP meeting website at <http://www.gap.uidaho.edu/gap>.

August 5-8. **The 1999 Midwest Environmental Education Conference: At the Crossroads.** Stillwater, MN. Sponsored by the Minnesota Association for Environmental Education, the conference will feature speakers, concurrent sessions, exhibits, and field trips. The theme, "At the Crossroads," represents the many challenges in environmental education as we move into the new millennium. For further information, visit the state calendar website at <http://www.seek.state.mn.us/cal/calendar.cfm>.

September 1. **8th Annual Ohio Lake Erie Conference.** Bowling Green, Ohio. The main focus of the conference will be discussions of current cutting-edge issues affecting Lake Erie and the Great Lakes region. Presentations will include status reports on the health of Lake Erie as well as all of the Great Lakes. This event is geared toward concerned citizens, researchers, and Great Lakes representatives, along with regional, state,

federal, and Canadian officials. For further information, contact the Ohio Lake Erie Office at (419) 245-2514 or E-mail: oleo@www.epa.state.oh.us.

September 15-16. **1999 Conference on the Hydrology of the Black Hills.** Rapid City, SD. The conference will focus on topics related to the hydrology of the Black Hills area and will cover issues such as karst hydrology, GIS, forestry related to water quality, and mining effects on water quality. For further information, contact Michael Strobel at mstrobel@usgs.gov. Visit the conference website at <http://www.sd.cr.usgs.gov/projects/bhhs/conf.html>.

September 15-17. **Conference on Mercury in the Environment.** Bloomington, Minnesota. The conference will be a forum for the exchange of information surrounding mercury and its environmental impacts. Topics will include health and environmental effects, measurement and control, pollution prevention, and regulations and policies. Sponsored by the Air & Waste Management Association, Upper Midwest Section, the Minnesota Pollution Control Agency, Minnesota Department of Health, the University of Minnesota Water Resources Center, the Energy and Environmental Research Center, and Metropolitan Council Environmental Services of Minneapolis-St. Paul. For further information, contact Melba Hensel at (651) 602-1072 or E-mail: melba.hensel@metc.state.mn.us.

September 21-22. **Vegetation of the Upper Mississippi and Illinois River system: status, management, and ecological linkages.** La Crosse, WI. This conference will highlight water-related research in the Upper Midwest on river and floodplain vegetation as well as

collateral work that describes the relationship and importance of floodplain vegetation in the ecosystem. For further information, contact Ron Rada at (608) 785-8221.

September 24-26. **International Joint Commission's 1999 Biennial Forum On Great Lakes Water Quality.** Milwaukee, WI. For further information, contact Jennifer Day at (313) 226-2170 ext. 6733 or E-mail: dayj@windsor.ijc.org.

October 13-15. **The Midwest Groundwater Conference.** St. Paul, MN. Hosted by the Minnesota DNR, this conference will provide an opportunity for groundwater scientists from different states to meet and discuss mutual problems in the midwest and summarize results of field data. For further information, contact James Lundy at (800) 657-3864 or E-mail: jim.lundy@pca.state.mn.us.

November 8-9. **Lake Michigan: State of the Lake '99.** Muskegon, MI. The U.S. Environmental Protection Agency Lake Michigan Forum and the Robert B. Annis Water Resources Institute of Grand Valley State University will be hosting this conference. Policymakers, scientists, agencies, and the general public will have an opportunity to be brought up-to-date on Lake Michigan issues and research as well as to assist in providing input for the Lakewide Management Plan. Highlights include the Lake Michigan Mass Balance Study, habitat and fisheries, and fluctuating lake levels. For further information, contact Dr. Janet Vail at (616) 895-3048 or E-mail: vailj@gvsu.edu.



New Publications

Pigmented Skin Tumors in Gizzard Shad from the South Central United States. May, 1999. G.K. Ostrander, D.R. Geter, W.E. Hawkins, J.C. Means. Project Report A-131. Available from the Oklahoma State University Environmental Institute; call: (405) 744-9994.

Relation of Fish Community Composition to Environmental and Land Use Factors in Part of the Upper Mississippi River Basin, 1995-97. R. M. Goldstein, K. Lee, P. Talmage, J.C. Stauffer, and J. P. Anderson. USGS-Water Resources Investigations Report 99-4034. Available from the USGS; call: (612) 783-3100.

New Publications of the US Geological Survey, Publications issued October-December 1998. USGS Permanent catalog, list 1083-1085. Available from the USGS; call: (612) 783-3100.

Effects of Land Use on Ground Water Quality - St. Cloud Area, Minnesota, 1998. May 5, 1999. Available from the MPCA; call: (651) 296-6300.

Physical and chemical data on sediments deposited in the Missouri and the Mississippi River flood plains during the July through August 1993 flood. G. K. Schalk, R. R. Holmes, Jr. and G. P. Johnson. Available from the MPCA; call: (651) 296-6300.

Summary of Observations and Analysis of Field Techniques for Assessing Hydrology and Water Quality of Ground Water. March, 1999. Available from the MPCA; call: (651) 296-6300.

Baseline Water Quality of Minnesota's Principal Aquifers - Metro Region Report Summary. April, 1999. Available from the MPCA; call: (651) 296-6300.

A New Apparatus for Assessing the Interactive Effects of Suspended Solids and a Chemical Stressor on Plankton Invertebrates. 1999. C.P. Herbrandson, S.P. Bradbury, and D.L. Swackhamer. *Environmental Toxicology and Chemistry*, 18:679-684.

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