

Minnesota Ground Water Association

www.mgwa.org

Volume 21, Number 3: September, 2002

President's Column

What a great year for the Minnesota Ground Water Association on its 20th Anniversary. It has been a very busy year. It feels like we just finished the Spring Outdoor Conference and now it's September already. Time sure flies when you're having fun. The past year has also seen many disturbing changes including cuts by the Minnesota DNR to the Minnesota Geological Survey for atlas program funding, caused by cuts by the legislature to the DNR's budget. We sent a letter to Deputy Commissioner Steve Morse of the DNR in this regard, expressing our support of the Minnesota Geologic Survey, and our wish that DNR preserve full funding for the atlas program. MGS's participation plays a critical role in preparation of the County Atlas and Regional Hydrogeologic Assessments and it strategically benefits our members in many ways.

We are currently finalizing the plans for the Fall Field Trip September 27-28, 2002. We will be going to the Mississippi River Valley and to see some karst areas near and around Rochester, MN. Three main features of this trip will be: 1) How we delineate karst hydrogeomorphic units, 2) Issues and hydrology of the Decorah edge and 3) Geomorphology and hydrology of the Mississippi River. This will be a great and informative field trip to attend. If you would like to help, or if you have any questions about the field trip, call Marty Bonnell at (651)227-6500 ext 3140.

We are also in the midst of planning the Fall Conference for November 12, 2002, at the Earle Brown Continuing Education Center at the Saint Paul Campus of the University of Minnesota. The title of this conference is **Municipalities and Ground Water Supply Issues**. We will have speakers on Rural Water Issues, Treatment Issues, How to Develop a New Well

for a Municipality, and Case Studies. This also will be a great conference to attend. More information will be coming soon. Please register early as recent conferences have filled to capacity.

I would personally like to thank Jennie Leete and Sean Hunt for hosting the MGWA 20th Anniversary/Birthday Party – Hog Roast. They worked very hard pulling this event together. The weather didn't cooperate, which affected the turnout, but the people who did make it had lots and lots to eat and good MGWA-officer-brewed beer to drink!

Times are changing. We will be going to an electronic distribution of the newsletter instead of raising dues to pay for increasing printing and postage costs. The changeover to electronic distribution as the primary way of getting the newsletter will be completed starting next year. You can currently view past issues of the newsletter online on the MGWA web site. You will find more information in the Capillary Fringe article. If you still want to receive the paper version of the newsletter, it will be available for an additional cost; in essence, you can choose to increase your dues to pay to have a paper newsletter mailed to you.

We will be looking for new officers (Treasurer and President-Elect) for the coming year very soon. Please give this some thought and call any one of the board if you want more information. This great organization can only continue to exist if people step up to the plate and volunteer their time each year. Our influence and impact on ground water issues is a direct result of the leadership and vision of the membership and the board.

I hope to see everyone at the Fall Field Trip and Fall Conference.

Rob Caho, MGWA President

Capillary Fringe

Newsletter in Transition

Norm Mofjeld and Aaron Fredrikson, of the MGWA Newsletter Team

"Capillary Fringe" has been defined as the zone immediately above the water table, where water is drawn by capillary attraction (Applied Hydrogeology, 2nd edition, C.W. Fetter, 1988). Capillary pores in the zone of aeration can draw water up from the zone of saturation beneath the water table. The capillary fringe, then, is a transition zone where the soil is saturated with water yet the water held in the zone is under tension.

This newsletter is also in transition. We have entered a new age where the computer is allowing us to transfer knowledge without relying on paper. Many professionals have easy access to computers, which allow them to read and communicate information electronically. Many organizations are now offering their newsletters to their members in an electronic format.

The cost of printing and mailing this newsletter in its present form has risen significantly in the past few years. This is due to a number of

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newsletters and to conduct
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field trip business transactions.

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Capillary Fringe, cont.

factors. There has been another rise in postal rates recently. The cost of paper and printer services has increased steadily. Advertising in the newsletter provided a source of revenue in the past that helped offset the cost of producing the newsletter. This source of revenue has declined significantly in the last few years, although with the advent of corporate members it has begun to increase slightly. If the MGWA were to continue to mail the newsletter in a paper form to its members, the membership dues would need to be increased by \$10 to cover the increased costs of paper, printing services and postage.

To reduce the costs of bringing the newsletter to our members and to avoid increasing membership dues, the MGWA Board has decided to distribute the newsletter via the web site. The continuity of the newsletter will be preserved, advertising will be sold in the familiar formats and the newsletter will now be in color. This is an exciting change and we predict that most of the membership will want to access the electronic newsletter.

The MGWA newsletter team is aware that some members will still wish to continue to receive a paper newsletter in the mail. In the past, because more than 500 copies were printed for each issue, a professional publishing company printed our newsletter at a discounted rate. We also received discount pre-sorted postage. Now that the paper newsletter will be printed and distributed on a much smaller volume, the cost of each paper issue will be significantly higher. The MGWA Board has approved the policy of passing these costs (paper, printing and postage) on to the members. The cost of newsletter production labor is still covered by dues and advertising. An additional fee of \$10/year will be assessed on the 2003 dues statement for members who want the newsletter mailed to them next year. There will be no cost for the newsletter for members who choose to print it themselves from the web site. (All members will be mailed the December 2002 issue.)

At the time of membership renewal, you will be asked whether you would

like to receive the newsletter online via the MGWA web site or continue to receive the newsletter in paper form. If you would like to receive it online, you will be asked to provide your e-mail address if you have not already done so for the directory. If you do not have an e-mail address, you will be asked to provide a mailing address. When the electronic newsletter is released on the Internet next year, a password for accessing the issue will be provided to each member by e-mail or in the US Mail.

Members may be concerned that providing their e-mail addresses will increase the number of unwanted solicitations that they receive on their computer. The MGWA directory, which contains the e-mail addresses of members, is only accessible by MGWA members. Furthermore, when MGWA e-mails its entire membership, all recipients are anonymous; therefore, nobody else in the membership will see your e-mail address.

The newsletter will have the same page-formatted look. Over the next year, the newsletter team will be studying ways to make it more compatible with viewing on a computer screen. The newsletter team would like input from you as this proceeds. You can access past issues of the MGWA newsletter from the MGWA web site. If you have any suggestions for modifying the present format, please let us know. Please send comments to office@mgwa.org.

MGWA Dues Unchanged

The MGWA Board has voted not to increase annual membership dues for 2003. Membership dues will remain \$25. Newsletter printing and mailing costs have increased significantly (see Capillary Fringe article) while advertising revenue has declined. This would have resulted in dues of \$35, but the Board has decided to distribute the newsletter electronically, eliminating the postage cost and transferring the printing costs to the individuals. Members will still have the option of receiving paper copies next year in the mail, at an annual cost of \$10, paid at the time of membership renewal, in essence choosing the dues increase.

Carrie Jennings Patterson of MGS Elected as GSA Fellow

At the Spring 2002 meeting of the Geological Society of America (GSA) Council, Carrie Jennings Patterson of the Minnesota Geological Survey (MGS) was elected as a GSA Fellow. A GSA member is elected to Fellowship in recognition of significant contributions to the science of geology. Further criteria for election as a GSA Fellow are:

Nomination by a Fellow of the GSA

At least eight years of professional experience in geology or related fields

Documentation of nominee's contributions to the science (publications, applied research, training of geologists, administration of geological programs, contributions towards the public awareness of geology, participation in professional organizations, editorial responsibilities, or other).

Congratulations to Carrie from the MGWA.

47th Annual Midwest Ground Water Conference October 2-4, 2002

The 47th Annual Midwest Ground Water Conference will be held October 2-4, 2002, at the Holiday Inn in Fargo, North Dakota. The conference also plans a one-half day field trip to visit the Sheyenne Delta Aquifer. For conference session topics, registration details, and other information, see the conference web site at www.swc.state.nd.us/mwggwc.html.

CURA arsenic and groundwater grant awarded to WRS student and advisor

Mindy Erickson, Water Resources Science Ph. D. candidate, and her advisor, Randall Barnes (Civil Engineering) were awarded a one-year grant from the University of Minnesota Center for Urban and Regional Affairs to determine the impact of arsenic in Minnesota groundwater on drinking water supply.

The study entails gathering data from the field and assembling existing data. The research will contribute to the identification of field geologic indicators of likely high arsenic levels in well water, and development of new regulations and guidelines for installing and sampling drinking water wells in high arsenic areas.

reprinted from the University of Minnesota Water Resources Center "Minnegram", June 2002

Two MGWA Officer Positions Open for 2003

Call for Nominations: The MGWA membership needs to fill two officer positions—Treasurer and President-Elect—for the year 2003.

The Treasurer handles MGWA financial matters and assists with meeting planning. The President-Elect takes a leadership role in the planning of one or more of the MGWA meetings while "learning the ropes" of MGWA leadership. Here's a chance for you or someone you nominate to get in on the front end of ground water resource protection in Minnesota.

The Treasurer serves a two-year term, and the President-Elect serves for one year before becoming President in 2004, followed by a year as Past-President.

Send your nominations by November 1, 2002 to MGWA, 4779 126th Street North, White Bear Lake, MN 55110-5910, or by e-mail to Office@mgwa.org.

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The primary objectives of the MGWA are:

- Promote and encourage scientific and public policy aspects of ground water as an information provider;
- Protect public health and safety through continuing education for ground water professionals;
- Establish a common forum for scientists, engineers, planners, educators, attorneys, and other persons concerned with ground water;
- Educate the general public regarding ground water resources; and
- Disseminate information on ground water.

Monitoring Wells Should Be Resurveyed Periodically

Michael D. Hayes, PG, Summit Envirosolutions, Inc.

Elevation changes for the top of casing due to frost heave at both flush and above-grade monitoring wells have been observed at numerous sites over the last eight years. In addition, top-of-casing elevation changes due to "settling" on newly completed shallow flush grade wells after a period of several days have also been observed. This article presents data on three sites comprising a limited study on the potential for monitoring wells to settle within several days of initial completion.

Four monitoring wells were installed in June 1993 at a site in Ogilvie, Minnesota. The monitoring wells were sampled in July and October 1993. Additional site activities were not performed until April 2002. One of the monitoring wells was damaged and had to be replaced. The installation of two monitoring wells was observed at the site in late April 2002. One monitoring well was installed to replace the damaged well and one was installed to further evaluate downgradient concentrations in groundwater. The saturated lithology at the site is predominantly silty sand and sandy silt and the monitoring wells are completed to approximately fifteen feet below grade.

The elevations of the top-of-casings for the new monitoring wells were measured using an engineer's level. The published top-of-casing elevation at one of the 1993 monitoring wells was used as a benchmark. As a quality assurance and control measure, the top-of-casings of the other 1993 monitoring wells were also surveyed. The surveyed elevations of the top-of-casings for the 1993 monitoring wells were observed to be up to 0.25 feet lower than what had been previously published. The top-of-casing elevations at the monitoring wells were re-measured three days later as a check on the discrepancies found with the published elevations for the 1993 monitoring wells.

On the second survey, the top-of-casing elevations for the 1993 monitoring wells were exactly the same as the survey three days prior. However, the two new flush-grade monitoring wells had decreased in elevation by 0.03 and 0.04 feet.

Two monitoring wells were installed in May at a site in Cloquet, Minnesota. One was an above grade well completed to 16 feet below grade and the other was a flush grade well completed to 15 feet below grade. The lithology at the site is predominantly silty sand and sand.

Top-of-casing elevations at the monitoring wells were measured the day of completion and re-measured 10 days later. The top-of-casing elevation for the above grade well was measured to be the same as the previous survey. However, the top-of-casing elevation for the flush grade well was measured to be 0.02 feet lower than the previous survey.

Two above grade and two flush grade monitoring wells were installed in June at a site in Princeton, Minnesota. The monitoring wells were completed to approximately 32 feet below grade in a silty sand and sand lithology. Top-of-casing elevations at the monitoring wells were measured the day of completion and re-measured 5 days later. The top-of-casing elevations for the monitoring wells were the same as the initial survey.

In conclusion, the three shallow flush grade monitoring wells at the Ogilvie and Cloquet sites were observed to settle by 0.02 to 0.04 feet over a period of several days. The shallow above grade monitoring well at the Cloquet site was not observed to have settled. Settling was not observed at the deeper above grade and flush grade monitoring wells at the Princeton site.

The observed negative elevation changes at the shallow flush grade monitoring wells may be due to settling of the newly placed sand and grout. The cement seal for the shallow above grade well at Cloquet may have helped keep that well from settling. The Princeton monitoring wells were constructed with 15-foot

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Stoner Named USGS Minnesota Water Chief

Jeffrey D. Stoner has been selected as Chief for U.S. Geological Survey (USGS), Minnesota District. Stoner, a Minnesota native, will lead the \$5.1 million program for the USGS water-resources discipline.

The staff of 50, located in Mounds View and Grand Rapids, Minn., is responsible for monitoring and assessing the quantity and quality of surface water and ground water across the state. Stoner and his team also conduct water-resources investigations, research, and foster partnerships with regional and other federal organizations.

"It's great to be back and once again I look forward to working with the competent and dedicated community of water-resources professionals in this Headwaters State of diverse landscapes," Stoner said.

Stoner holds degrees in Geological Engineering from the University of Minnesota and Civil Engineering from Colorado State University. Dur-



ing his career as a USGS hydrologist, he has participated in numerous studies of ground water and water quality in Montana, Pennsylvania, Minnesota, and North Dakota. He has led hydrologic investigations in Minnesota and the Red River of the North National Water-Quality

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Well And Boring Rules Being Revised

Ron Thompson, MDH

The construction, repair, and sealing of wells and borings is regulated in Minnesota by the Minnesota Department of Health (MDH) under Minnesota Statutes, Chapter 103I, and Minnesota Rules, Chapters 4725 and 4727. Wells include excavations used to remove groundwater for: domestic or public consumption; monitoring or testing; remediation; dewatering; groundwater heat pumps; and irrigation or other extractive uses. Borings include: metallic mineral, kaolin clay, or petroleum exploratory drill holes; vertical closed loop heating and cooling boreholes; elevator jackholes; and certain piezometers, vent/sparge systems, and test holes.

The statute, and rules, pertaining to exploratory drilling were enacted in 1980 and 1981 respectively, largely in response to uranium exploratory drilling. The statute and rules address exploratory drilling for metallic minerals, oil, natural gas, and kaolin clay. The exploratory boring rules, Minnesota Rules, Chapter 4727, are being revised. A formal rule-making process is planned to begin in the fall of 2002.

Minnesota Rules, Chapter 4725, establish the standards for wells, and for borings except exploratory borings. Eight regional meetings were held during spring 2002 to hear suggestions, discuss rule issues, and consider potential rule revisions. Some proposed rule revisions include:

- Reducing the continuing education requirement for limited license contractors from 6 hours to 2 hours annually; and requiring that the 2 hours for limited licensees, and 2 of the 6 hours required for fully licensed and registered contractors, be obtained at an MDH provided continuing education program;

- Increasing the minimum grout depth;

- Establishing standards for hydrofracturing;

- Allowing certain alternative casing connections for remedial wells, and for repair of existing wells;

- Strengthening the requirements for repair of substandard wells:

- Reducing the annular space requirement between multiple casings;

- Reducing some requirements for flowing wells;

- Requiring that newly-constructed potable wells be tested for arsenic;

- Establishing minimum standards for well treatment chemicals;

- Requiring more stringent standards for public supply wells;

- Revising contaminant isolation distance requirements for sewers, land-spreading sites, manure storage, and others.

The MDH will be discussing potential rule revisions with numerous groups, and drafting proposed rule language in 2002 and early 2003.

A formal rule-making process is tentatively slated to start in 2003, with an effective date later the same year.

If you have comments or recommendations on possible rule revisions, please contact a MDH well program staff person, or Ron Thompson at (651)643-2108.

Monitoring Wells Should be Resurveyed Periodically, cont.

screens in order to intersect dissolved impacts at the site. Perhaps the larger sand pack to grout ratio associated with the 15-foot screens kept the Princeton monitoring wells from settling.

Based on the data collected to date, it appears that shallow flush grade monitoring wells completed in a sandy lithology may be prone to settle within the first few days after completion. In the interest of collecting accurate groundwater flow directions, regulatory agencies should include recommended survey timelines for newly installed groundwater monitoring wells in their documents.

Periodic surveying is recommended for older sites where groundwater flow is determined by several hundredths of a foot in elevation difference (especially if the calculated groundwater flow has changed over the years). For now, it is recommended that crews be instructed to wait several days before surveying newly constructed shallow flush grade monitoring wells.

Please contact me with questions or comments at (651)842-4205 or via email at mhayes@Summite.com. If you send me email, please use "MGWA Article" in the subject line.

Stoner is back, cont.

Assessment Program (NAWQA). Most recently, he directed the nutrients synthesis project for the NAWQA Program in Denver, Colo.

The USGS Minnesota District monitors flow, levels, and quality of water resources at more than 100 stations continuously, and at about 145 sites periodically throughout the state. Cooperative research and hydrologic investigations currently include defining quantity, physical processes, and chemistry of ground water and recharge; emerging contaminants in streams and rivers; fate and transport of contaminants in ground-water systems; physical, chemical, and biological processes in interaction zones between surface water and ground water; and effects of contamination from urban, agricultural, and atmospheric sources on water used for drinking and for sustaining stream biota.

The USGS, a bureau within the Department of the Interior, serves the nation by providing reliable scientific information to describe and understand the Earth; minimize the loss of life and property from natural disasters; manage water, biological, energy and mineral resources; and enhance and protect our quality of life.

USGS press release

MGWA Fall Field Trip Scheduled For September 28, 2002

Mark your calendar for the Mississippi River Valley Field Trip. The field trip departs from the Park and Ride in Burnsville at Highway 13 and Interstate 35W on Friday, September 27th at 8:00 (registration is at 7:30) and from the downtown Rochester Hilton at 10:00 (registration is at 9:30). The bus will return to the Hilton Saturday, September 28th at about 3 pm and to the Park and Ride at about 4:30 pm. Field trip registration will cost \$110 for MGWA and AIPG members, \$135 for nonmembers, and \$50 for full-time students. Topics will include karst hydrogeomorphic units, the hydrology of the "Decorah edge", and geomorphology and hydrology of the Mississippi River Valley. Tour stops will include views of the "Decorah edge", karst hydrogeomorphic units, paleokarst, sinkhole plains, limestone quarry, gravel pit, and the Mississippi River valley.

Registration will include the field trip, bus transportation from the Burnsville Park and Ride, a field trip guidebook, Friday night dinner, and box lunches on Friday and Saturday.

Hotel rooms for Friday night are being held at the Hilton Garden Inn, Downtown Rochester, at a group rate of \$79.00 (plus tax). Make reservations by calling Hilton Worldwide Reservations at 800-HILTONS or call the Hilton Garden Inn Rochester at 507-285-1234. Mention the MGWA rate when making reservations.

Further information on field trip registration has been emailed to all for whom we have email addresses and mailed to those for whom we do not. So - if you didn't get an email announcement - and you have email - just send us a note at office@mgwa.org with your email address.

MGWA Fall Conference November 12, 2002, St. Paul

The MGWA will hold the annual fall conference on Tuesday November 12, 2002, at the Earle Brown Continuing Education Center on the St. Paul campus of the University of Minnesota in St. Paul. The full day conference is entitled "Municipalities and Ground Water Supply Issues". Although the conference is still in the planning stages, possible topics to be covered include wellhead protection, rural water projects, water conservation and regulatory issues, treatment issues, and several interesting case studies. Conference registration for members will be \$85, including lunch. Watch for flyers in the mail, or consult the MGWA web page at www.mgwa.org for further information.

USGS report summarizes June floods in the Red River of the North Basin

The U.S. Geological Survey has published a report documenting the June 2002 floods in the Red River of the North Basin in Minnesota and North Dakota. Peak flows on some rivers in Minnesota exceeded 200- to 500-year occurrence intervals.

The report is titled "June 2002 Floods in the Red River of the North Basin in Northeastern North Dakota and Northwestern Minnesota" (by G.J. Wiche, K.G. Guttormson, S.M. Robinson, and G.B. Mitton, U.S. Geological Survey and B.J. Bramer, National Weather Service, USGS Open-File Report 02-278), and may be downloaded from <http://nd.water.usgs.gov/pubs/ofr/ofr02278/>. Paper copies may be obtained soon from:

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U.S. Geological Survey
2280 Woodale Drive
Mounds View, MN 55112
(763)783-3100
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The Downward Gradient — News about Ground Water in Minnesota

Limited Success before the LCMR

The Minnesota Pollution Control Agency's LCMR proposal to establish a statewide ground water monitoring network was rejected. The \$850,000 proposal included extensive drilling, preliminary sampling from a network of up to 300 wells and springs, and a position for education and outreach. The network, which would have been maintained long-term by the MPCA, was designed for trend analysis and identification of emerging issues.

The Metropolitan Council submitted a proposal for funding totaling \$328,200 to the Legislative Commission on Minnesota Resources for application of the Minnesota Pollution Control Agency's Metro Model to assess water supply availability in the northwest metro area. Part of the funding was to be used to update the regional models for other applications in the metro area. Another portion was slated to go to the USGS to study the impact of increasing impervious surface due to urbanization on groundwater. The LCMR did not recommend this project for funding. However, the Metropolitan Council still plans to conduct an assessment, on a limited scope, of the groundwater resources and their adequacy to supply projected demand in the northwest metro area while protecting natural resources.

On a positive note, Washington County and a coalition of communities and other interested parties requested \$300,000 in funding from the Legislative Commission on Minnesota Resources to prevent impacts from groundwater withdrawals necessary to supply projected demand on natural resources in the area. A surface and groundwater monitoring network would be developed in the area near Valley Creek in Washington County to gather information on the

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Downward Gradient, cont.

groundwater system and prevent impacts from groundwater withdrawals on the surface water features in the area. Groundwater modeling based on the Minnesota Pollution Control Agency's Metro Model would be used to evaluate potential impacts of proposed pumping and to identify optimal well locations and pumping rates that sustain both growing community needs and natural resources in the area. The project was funded by the LCMR in the amount of \$250,000. If there any questions or comments regarding this proposal contact Jon Michels of Washington County at (651)275-7301 or michels@co.washington.mn.us.

MGWA Sends Letter of Support for MGS to DNR

This past summer, the Minnesota DNR proposed cutting \$200,000, or 50%, of the funding for the Minnesota Geological Survey (MGS) portion of the County Geologic Atlas and Regional Hydrogeologic Assessment Program for the period July 2002 through June 2003. The amount is part of the legislative reductions to state agencies passed by the last session. At the request of the MGS, the MGWA Board of Directors sent the attached letter of support to DNR Deputy Commissioner Steven Morse:

June 11, 2002

Deputy Commissioner
Steven J. Morse
Minnesota DNR
500 Lafayette Road, Box 50
St. Paul, MN 55155-4050

Dear Mr. Morse,

On behalf of the Minnesota Ground Water Association (MGWA), I am writing this letter to express our support of the Minnesota Geologic Survey's role in the preparation of the County Atlas and Regional Hydrogeologic Assessment Program. The MGWA's mission is to: promote and encourage scientific and policy aspects of groundwater, as an information provider; protect public health and safety through

continued education of groundwater professionals; establish a common forum for those concerned with groundwater; educating the general public about groundwater; and disseminating information about groundwater.

The information and products from the County Atlas and Regional Hydrogeologic Assessment Program, directed by the Minnesota Department of Natural Resources helps our organization meet its objectives of educating both the general public and our membership about the geology and hydrogeology of Minnesota.

Many of our past Newsletters include articles either detailing information on currently available County Atlases and Hydrogeologic Assessments or updating the Membership on the progress of the various assessments currently underway. In addition, the information and data produced by this program provides a fundamental building block for subsequent assessments and investigations undertaken by our members in their various practices.

Please feel free to contact me if you have any questions or comments regarding the MGWA's concerns related to the County Atlas and Regional Hydrogeologic Assessment Program.

Sincerely,

Rob Caho, President
Minnesota Ground Water
Association

The letter from the MGWA was one of many letters of support for the atlas program that Deputy Commissioner Morse received from atlas users on the proposed MGS reduction.

DNR Waters reports, however, that fiscal realities required that the cut be instituted. The anticipated result is slower progress on existing projects and delay in starting new projects.

Possible Changes to the Petrofund Rules Predicted for Mid-2003

The Petroleum Tank Release Compensation Board (Petro Board) is nearing completion of a final draft proposal that would make many changes to the Petrofund administrative rules (Minn. Rules, Chapter 2890). The goals driving the changes include simplifying the reimbursement process and better aligning the administrative rules with the requirements of the Minnesota Pollution Control Agency.

A strike-through copy of Minn. Rules, Chapter 2890 that shows the proposed rule changes is available for review by visiting Department of Commerce Web site at www.commerce.state.mn.us. You may also request a copy of the draft rule revision proposal by contacting Petrofund staff at (651)297-1119 or (800)638-0418 (outside the Twin Cities).

The draft proposal must still be reviewed by the Governor's office and key legislative leaders, and must go through the formal rulemaking process, which includes a formal 30-day comment period (to be announced). As a result, it is anticipated that any changes to the Petrofund rules will take place in mid-2003.

Petrofund staff encourages you to share your comments on the proposed changes. Please submit your written comments via e-mail to petrofund.commerce@state.mn.us, or send them to the following address:

Petroleum Tank Release
Compensation Board
c/o Minnesota Dept. of Commerce
Attn: Mr. James Pearson
85-7th Place East, Suite 500
St. Paul, MN 55101

May Ground Water Education Committee Meeting

Date: May 30, 2002

Present: Dan Hunter, Gordie Hess, Cathy Villas-Horns, Chris Elvrum, Mark Ferrey, Mary Christopherson, Mike Trojan, Jim Lundy

Welcome new members Dan Hunter (West Central Environmental Consultants, WCEC) and Mary Christopherson.

Activities since last meeting

Earth Day, Patrick Henry School, Minneapolis (Mike Trojan, Mark Ferrey)

Classroom visits in Mahtomedi, Sauk Center, Roseville

Environmental Education clinic

Several requests for a ground water classroom presentation have come in through the web page

GW Education web page at <mgwa.org>

Functional, but still needs some work

Need to recheck links to make sure they work (Mike Trojan)

State Fair booth (Mike Trojan)

MGWA booth at DNR building (state fair grounds) scheduled for 11:00 AM, September 1. Perhaps add musical talent from amongst the hydro-community, to attract visitors. Need commitments from those willing to appear.

DNR Project WET (Mike Trojan)

April Rust would like to coordinate with MGWA to plan a Project WET module or event that focuses on ground water.

Wide ranging discussion on how to target teachers

Posters in teacher lounges

Members who have kids in school

Make it easy for teachers known to be interested in ground water

Connect with PCA speakers' bureau

Minnesota Science Teachers' Association

Volunteer coordinators at school districts

Possible Science Museum Exhibit on ground water (Chris Elvrum and Cathy Villas-Horns)

Science Park, an outdoor educational center, is being designed now and is expected to open by summer 2004. Chris and Cathy talked with Patrick Hamilton of the museum, who is interested in coordinating a ground water display into the outdoor educational center. Since the site is a VIC site (PAH, petroleum, metals contaminants), he would like to incorporate a way for visitors to actually pump and treat some of the contaminated water. We might like to look for a way to make the display talk about recharge and the interaction between ground water and the river. Perhaps corporate sponsors could provide some wells—we would like to install the exhibit so as to provide future flexibility to expand. Real time plotting of heads and ground water flow direction to river? Cathy and Chris will bring more information to the next committee meeting.

Review of pending legislation (Mark Ferrey)

Mark attended the May 2, 2002 MGWA board meeting, where it was resolved that the ground water education committee should "look at the process other organizations use to provide official comment on public issues." Mark presented the idea as a means of providing comment on technical merit, not lobbying, and he reports that the board was enthusiastic about it. The problem will be how to construct a process that results in comments representative of the entire organization. We could use a "dummy issue" to try out the process. Perhaps John Helland (House research department, MGWA member) could be helpful. The committee expressed some concern that members could be alienated in this process. We would have to be clear on whether we are commenting or informing. We could set up another web page that lists legislative issues of interest to members. Some things to get started on:

how do other organizations do this? (Mark is doing this)

criteria (who comments, what issues, how molded into a single opinion, etc.)

tracking of legislative issues that we might comment on.

July Ground Water Education Committee Meeting

Date: 7/25/02

Attendees: Barb Liukkonen, Chris Elvrum, Jim Lundy, Mike Trojan

1.No updates to educational activities conducted since the last meeting. Barb mentioned it would be a good idea to follow-up past activities with surveys to see if the information we presented was useful, how it was useful, how it could be changed, and if there is further interest. This type of information could go into the database.

2.Database –should include not just contact information but a summary of the activities we conducted, including materials used (see Item 1 above).

3.Web – modifications to the GW Education web page at <mgwa.org>. The first modification adds two boxes on the main Education page. These take educators to text describing opportunities for us to conduct educational activities. Second, most links are now live in the website. Finally, the link to other Education Websites was wired to the MGWA Links. There was a suggestion to update our Activities section, since the material is outdated. Reference to meeting notes should be removed and put into the Resources section, where we can provide a link to the newsletter. The Newsletter contains the Education Committee minutes. We need to find out how often the Activities section can be updated so that timely information can be incorporated into this section.

4.Letter to St. Paul School District Superintendent – a letter is to be sent to the St. Paul School District Superintendent indicating the availability of the Education Committee to become more active in classroom

— continued on next page

Ground Water Education Committee, cont.

education. Meeting or conversation to follow.

5.Science Museum – Education Committee decided there should be a design in hand so that if the exhibit went up quickly, we would not be caught off guard. Barb suggested finding a way to get involved in the Committee working on the exhibit. Chris and Cathy will continue working on this.

6.State Fair demonstration – A game show format will be used for the 45-minute presentation, modeled after the TV show The Weakest Link. Five or six 3-minute segments will focus on different general areas, such as Water, Ground Water Basics, Ground Water Quality, etc. Between each segment, a short demonstration on some water-related topic will be conducted. Each participant will receive a prize.

7.Project WET – We will work with April Rust of the DNR to conduct a Project WET workshop in March or April of next year. Mike will talk to April about the format (a ground water WET or a WET with a separate ground water component). This workshop should be advertised in the MGWA Newsletter as a way of trying to promote members to attend if they work with schools. Mike will talk to April about giving MGWA a write-up for the Newsletter. Barb mentioned the possibility of having the Foundation sponsor four people to attend the workshop, at a cost of \$25 per person.

8.Children's Water Festival – September 25. Chris will see if MGWA can have a spot to provide ground water education.

9.Funding for prizes and give-aways – Mike mentioned that he will be giving prizes to participants at the State Fair demonstration. This brought up the larger question of whether MGWA should be funding give away items for some of the activities it participates in. Examples include t-shirts, low flow showerheads, mugs, pencils, books, and posters. Mike will follow up with Gordie Hess, since the foundation would probably be the funding source for these give-aways.

This Newsletter brought to you by:

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Remaining MGWA Newsletter Deadline for 2002

Issue	Copy to Editor	Copy to Publisher
December (Vol. 21 No. 4)	11/15/02	11/22/02

10.Karst CD – there was a short discussion about an educational CD for SE MN related to karst. Jim and Barb will try to get more information, but the impetus for this effort should come from concerned parties in SE MN, such as Bea Hoffmann.

11.Classroom CD – The group agreed that we should look into developing an educational CD designed for use in the classroom. This CD would not be interactive because of financial and time constraints. The CD would be a tool designed for teachers to use in the classroom. It would therefore include a list of activities, general and technical information about the particular ground water subject, and maybe some other things such as reference lists and photos. The CD could have a format attractive to the target group, which will be Middle School. It will be important to get input from teachers who have an interest in writing curricula that incorporate environmental science. There was some concern that teachers might not use the CD, but Barb indicated that teachers are overwhelmingly interested in these types of resources, if we make them accessible. The CD would therefore be free and distributed to teachers. Don Berger of the MPCA has some information on funding sources. Mike will work a little on the general structure of the CD, talk to Don, and begin trying to identify teachers who will work with us in development of the CD.

12.Mike will attend the next MGWA Board meeting on August 1.

MGWA Board Meeting Minutes

June 6, 2002

Place: USGS WRD Office in Mounds View, Minnesota

Attending: Rob Caho, President; Jim Stark, Past President; Eric Hansen, Treasurer & acting Secretary for the meeting in the absence of Jon Pollock; Norm Mofjeld, Newsletter Editor; Jennie Leete, WRI; Mike Trojan, Education Committee; Gordie Hess, MGWA Foundation

Approval of Minutes: Rob called the meeting to order at 7:40 a.m. Minutes for the Regular Board Meeting held on May 2, 2002, were approved.

Treasurer's Report: Eric transferred \$13,000.00 to the MGWA Foundation endowment in May, in accordance with approval at last meeting.

Membership: Eric reported on a Membership meeting June 4, 2002. Total membership goal set at 700. Target demographics were determined, including specific benefits for each group. An initial effort to contact all the former members in our database was established as the first action item for the committee. The group will also lobby for changes in the newsletter to enhance its value to the membership.

Web Page: A group in Pennsylvania asked if they could to place a link to

— continued on next page

Board Meetings, cont.

our web page on their page. This was determined to be acceptable, and no approval was necessary as the use of web site links is not regulated or routinely recorded.

Foundation: Gordie is keeping track of general issues. The MGWA Foundation's endowment is approaching \$25,000. Once that goal is reached, the interest will be available to fund programs. The MGWA Foundation has some unrestricted funds that can fund programs now.

Education: Committee activities reported elsewhere in this newsletter

Newsletter: Norm reported that the June issue is available in draft and ready for his editing. Electronic distribution will be further discussed and the cost to of printing individual paper copies will be determined. Newsletter content review by the board was discussed. The Board resolved that the MGWA President should review the newsletter prior to printing to ensure consistent policy presentation. All edits will continue to be routed through the editor.

Old Business: Outstanding Service Award: We received a thank you letter from Matt Walton.

Advertising Corporate Membership: Liesch has signed up as a key sponsor. LBG is also a new sponsor.

New Business: Fall Field Trip: Jennie was in Rochester and met with Jeff Green and Jeremy Pavlish of DNR. They continue to be interested in helping by suggesting stops and talks.

Fall Conference: November 12 at the Earle Brown Center on the St. Paul Campus. We will offer vendor booths.

Summer Picnic: August 3rd at Jennie's House. WRI will formally sponsor the event to ensure insurance coverage. The brewing dates of July 11 and 25 were confirmed. A subcommittee is needed for the hog roasting.

Committee Guidelines: Brief discussion of guidelines for committee activities. Committees should be given specific charges in writing so that the Board authority over and approval of committee actions is assured.

Emails: The board hopes to make

expanded use of emails to the membership. The goal is to better interact with the general membership. It appears that the current software used by WRI is adequate for such efforts as it preserves the anonymity of the addressees.

Membership costs: A general discussion included the increase of annual dues to help defray base operating expenses. We need to increase dues to \$35 to cover increased newsletter printing and mailing costs. But a general dues increase might result in membership numbers below 500, which would result in the loss of our pre-sort mailing status.

No action was taken. (Note: this issue was resolved at the next Board meeting and the resolution is discussed in the capillary fringe article on page 1.

July 11, 2002

Place: Vine Park Brewery, St. Paul, Minnesota

Attending: Rob Caho, President; Eric Hanson, Treasurer; Sean Hunt, WRI; Jennie Leete, WRI; Jon Pollock, Secretary; Jim Lundy, Education Committee; Gordie Hess, Foundation.

Approval of Minutes: Rob called the meeting to order at 4:22 p.m. Minutes for the Regular Board Meeting held on June 6, 2002, were approved.

Treasurer's Report: The board decided to move the MGWA Money Market Account from Wells Fargo to Affinity Plus Credit Union to avoid new charges being imposed by Wells Fargo. Jon will write up and sign the necessary paperwork for Eric to make the transfer. Prior to the meeting Jennie e-mailed the annual financial status of the newsletter for 1997-2001 along with the status from January 2002 through June of 2002. The annual reports indicate a steady increase in newsletter expenses and a decrease in income. Advertising revenue may yet cover production costs, but not printing and mailing costs.

Newsletter Costs and 2003 Dues: Instead of raising dues to \$35 for everyone, the board decided to keep dues at \$25 and distribute the newsletter as a PDF via the web page. Members can print the newsletter out with their own paper and ink. This eliminates the printing and mailing costs that would have caused a dues

increase. Members who still want a paper newsletter mailed to them can choose to pay an extra \$10. The newsletter will be in color in 2003, via the web page and via the mail.

Membership: Jon has received a list of inactive MGWA members and the current membership breakdown from Sean. Jon will be setting up a meeting of the Membership Committee.

Web Page: Sean will put the Fall Field Trip on the web page.

Foundation: Gordie is working on soliciting items or donations for a silent auction at the Fall Conference.

Education: Committee activities reported elsewhere in this newsletter

Old Business: Advertising Corporate Membership: Rob will check with Jim Aiken on the status of companies that have advertised in the newsletter in the past and what can be done to increase the number of organizations advertising in the newsletter.

Summer Picnic: August 3, 2002.

Jennie indicated that she could use help the day of the picnic and that probably about 50 people would be attending.

New Business: Fall Field Trip and Fall Conference: Planning meetings continue. Assistance is needed in all aspects.

Foundation Seeks Silent Auction Donations

The MGWA Foundation is planning a silent auction. To make it a success we need items to auction off. Suggestions about what you might give:

A week or weekend at your cabin or lake home

Your tickets to a sporting event or theatre production

Babysitting service (four hours one Saturday before Christmas?)

Holiday baking (pies or cookies to help out those who would otherwise attend family gatherings empty-handed)

Frequent flyer miles for a round trip of the buyer's choice, etc.

To donate, call Gordie Hess or send details about yourself and your item to office@mgwa.org.

From Small Springs, Great Rivers Grow

An integrated approach to ground water and surface water management in the Lower St. Croix Valley

by Marcey L. Westrick

On a cold, snowy November day in 2000, Dr. Len Ferrington of the University of Minnesota's Department of Entomology worked with a group of researchers to identify and sample spring creeks along the Lower St. Croix River Valley in northern Washington County. The group included members of the National Park Service, Emmons and Olivier Resources, Washington County, Minnesota Geological Survey, the Science Museum of Minnesota, and the Mill Stream Association. The field trip marked the beginning of an extensive two-year study of ground water/surface water interactions in the Lower St. Croix Valley.

The study includes two separate but complementary projects, *Integrating Ground Water and Surface Water Management (IGSWM) – Northern Washington County*, and *The St. Croix Springs Stewardship Plan (SCSP)*.

IGSWM investigates regional ground water issues, with particular emphasis on ground water recharge and regional ground water/surface water interactions. The SCSP focuses on the unique ground-water-dependent resources associated with the St. Croix River Valley.

The St. Croix Moraine dominates the landscape of northern Washington County. Steeply rolling hills, depressions, and poorly developed surface water drainage systems characterize this geomorphic feature. Due to the nature and geology of the landscape, ground water recharge to quaternary and bedrock aquifers and ground water discharge to seeps and spring creeks are common. The spring creeks and associated ecosystems harbor a large share of the rare and unique floral and faunal communities found near the Twin Cities Metro Area.

Currently, little is known about the hydrologic systems that feed ground

water to these resources or how landscape changes will impact the ecology of the seeps, spring creeks, and the St. Croix itself. As urban areas in the Lower St. Croix Valley expand, associated land cover changes and increases in ground water consumption pose a threat to water quality. Local governments are faced with the challenge of managing and protecting their water resources and the resources dependent on them, but lack key information. The two projects are designed to provide some of this missing information. Specifically, the projects will (1) define the interconnected ground water and surface water systems in



— Dr. Len Ferrington collects chironomids

Washington County, (2) inventory and assess the ecosystems dependent on these waters, and (3) integrate ground and surface water management with strategies to protect ground-water dependent resources in Washington County and the Lower St. Croix River Basin.

As a project collaborator for the study, Ferrington collects pupa of emerging chironomids and other aquatic species to generate information for ongoing biological monitoring. Prior to moving to Minnesota in July of 2000, Ferrington spent 20 years working on water quality issues at the University of Kansas. Ferrington is pleased with the integrated nature of the project and with citizen awareness: "Being relatively new to



— A spring creek of the Lower St. Croix River

Minnesota, I am impressed by the general concern about biodiversity and water quality issues and also the spirit of collaboration shown by the local residents and those agencies responsible for managing the Saint Croix River Basin."

Partial funding for the project is provided by the Minnesota Board of Water and Soil Resources, Washington County, the Marine on St. Croix Water Management Organization, the Carnelian Marine Watershed District, and New Scandia Township.

— reprinted from the University of Minnesota Water Resources Center "Minnegram", December, 2001

MGWA Welcomes New Corporate Members

MGWA's new corporate membership program has two new members, Soil Engineering Testing and TestAmerica, Inc. Look for their new ads in this issue of the newsletter. Our list of corporate members:

**Howard R. Green
Interpoll, Inc.
Environmental Strategies Corp.
Liesch Associates, Inc.
Leggette Brashears and
Graham
Soil Engineering Testing
TestAmerica, Inc.**

Wisconsin Proposes New Regulations To Control Runoff Pollution

Wisconsin state officials have proposed new rules for keeping polluted runoff out of lakes and streams, calling the initiative the largest single piece of environmental legislation ever considered in Wisconsin.

The rules, which need state Natural Resources Board approval and review by state legislators to take effect, set mandatory goals for farmers, cities, developers, and others to meet to keep pollutants from state waters.

Environmental groups were generally supportive of the legislation's thrust but lamented what they said was a weakening of some rules. They were surprised and irked that the Department of Natural Resources dropped a plan requiring farmers to leave at least a 10-foot buffer between a stream or lake and a field. Without the buffer mandate, the runoff standards are "not adequate" to protect drinking water sources and fisheries, said both Trout Unlimited and the state Sierra Club.

Buffers protect water quality by trapping soil, animal wastes, and fertilizers. Wisconsin's Environmental Decade called the elimination of buffer strips a "major weakening" of the rules. The 33 member groups of the Clean Water Coalition want buffers of 20-35 feet.

The DNR said it wants to focus limited state dollars on measures more effective than buffers, and it said the state would lose some of its deferral conservation funding if it required them – a claim met with skepticism by environmentalists.

The proposed rules, years in the making, change Wisconsin's approach to controlling polluted runoff from one that's largely voluntary and targets specific watersheds to one that's mandatory and applies statewide said Al Shea, director of the DNR's Bureau of Watershed Management.

"These are landmark rules," he said. "This would be the first comprehensive set of nonpoint source pollution regulations in the nation."

Corporate Membership Rates for 2002

Membership Levels	Annual Package Cost	Annual per Item Cost	Annual Savings	Percent Savings
Basic Level	\$350	\$369	\$19	5%
Standard Level	\$505	\$583	\$78	15%
Industry Leader	\$735	\$886	\$151	20%
Corporate Sponsor	\$1530	\$1986	\$456	30%

Corporate Membership Features:

Basic Level: Business Card ad in newsletter and membership directory, "Lobby Copy" of membership directory, web page sidebar, Certificate of Membership, and up to 4 employee memberships

Standard Level: Quarter page ad in newsletter and directory, "Lobby Copy" of membership directory, web page sidebar, Certificate of Membership, and up to 9 employee memberships

Industry Leader: Half page ad in newsletter and directory, "Lobby Copy" of membership directory, web page sidebar, Certificate of Membership, and up to 14 employee memberships

Corporate Sponsor: Full sponsor acknowledgement in MGWA conference publications, full page ad in newsletter and directory, "Lobby Copy" of membership directory, Certificate of Membership, web page sidebar and up to 20 employee memberships

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DNR Secretary Darrell Bazzell called the proposed rules "groundbreaking" and said they are the critical missing piece in the state's quest to make all water safe for fishing and swimming.

Caryl Terrell, spokeswoman for the state Sierra Club, said while her organization is upset about the buffer issue, "the good news is that these new rules will limit polluted runoff from construction sites and urban streets."

Keith Reopelle of Wisconsin's Environmental Decade said the rules are far from ideal but still important. "We've had a voluntary program for many, many years, and it just hasn't done the job," he said. "We need standards. The big question is whether there will be enough money and enough political will to enforce these standards."

For the first time, farmers with small operations would be required to control soil erosion and manure runoff.

As long as the state helps farmers financially, the proposed rules are consistent with regulations the

agricultural community has signaled it can support, said Paul Zimmerman, a lobbyist with the Wisconsin Farm Bureau Federation.

- U.S. Water News

MGWA Ground Water Education Committee Launches New Web Page

The MGWA ground water education committee has prepared and launched a web page at the MGWA web site (www.mgwa.org/education.index.html). The page is designed for easy use by educators interested in bringing ground water topics to the classroom, and includes "Water Facts", "Lesson Plans", "Activities/Stunts", and many links to related education web sites. We are also offering to supply hydrologists to inquiring classrooms (please contact Mike Trojan, (651)297-5219 or Jim Lundy, (651)296-7822 if you are willing to try this fun and rewarding activity).

New USGS Publication on Recharge

Estimates of recharge to unconfined aquifers and leakage to confined aquifers in the seven-county metropolitan area of Minneapolis-St. Paul, Minnesota. James F. Ruhl, U.S. Geological Survey, Roman Kanivetsky, Minnesota Geological Survey, and Boris Shmagin, Minnesota Geological Survey. 2002. U. S. Geological Survey Water-Resources Investigations Report 02-4092.

Abstract. Recharge to unconfined aquifers in the seven-county Twin Cities metropolitan area of Minnesota was estimated by five methods. Mean recharge estimated as a percentage (27 percent) of precipitation ranged from 7.7 to 8.3 in./yr across the study area. The median recharge estimated from automated analyses of streamflow-recession displacements for seven basins ranged from 1.2 to 12.2 in./yr. Median recharge estimated from graphical analyses of ground-water level fluctuations for 11 wells ranged from 4.5 to 13.6 in./yr. Recharge estimated by age dating of shallow ground water at a nested well site was 8.8 in./yr. Minimal ground-water recharge estimated by statistical analyses of watershed characteristics (geologic data and streamflow records) ranged from less than 0.1 to 5.6 in./yr.

Leakage, considered recharge to confined aquifers, in the seven-county Twin Cities metropolitan area was estimated by two methods. Leakage estimated by analyses of ground-water level fluctuations for 11 wells ranged from 3.2×10^{-3} to 1.1×10^{-2} ins./yr. Leakage estimated by analyses of vertical-hydraulic gradients based on application of the Darcy flow equation for seven nested well sites ranged from 4.6×10^{-5} to 1.1×10^{-1} in./yr.

Recharge estimates, which generally varied within 10 in./yr for each of the methods, generally were largest based on the precipitation, ground-water level fluctuation, and age dating of shallow ground water methods, slightly smaller based on the streamflow-recession displacement method, and smallest based on the watershed characteristics method. Leakage, which was less than 1 in./yr varied within 1 order of magnitude based on the ground-water level fluctuation method and as much as 4 orders of magnitude based on analyses of vertical-hydraulic gradients.

National Reconnaissance of Pharmaceuticals, Hormones, and Other Organic Wastewater Contaminants in Streams of the U.S

This field reconnaissance is using newly developed laboratory methods to provide baseline information

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on the environmental occurrence of a wide range of organic wastewater contaminants in the Nation's streams.

By design, most streams sampled were known, or suspected to be, susceptible to sources of human, animal or industrial wastewater. During 1999 and 2000, a network of 139 streams were sampled across 30 states.

New results are available:

Pharmaceuticals, Hormones, and Other Organic Wastewater Contaminants in U.S. Streams, 1999-2000: A National Reconnaissance; Environmental Science & Technology, v. 36, no. 6, pages 1202-1211

http://pubs.acs.org/hotartcl/est/es011055j_rev.html

The companion USGS Data report, *Water-quality data for pharmaceuticals, hormones, and other organic wastewater contaminants in U.S. streams, 1999-2000* (USGS Open-File Report 02-94).

<http://toxics.usgs.gov/pubs/OFR-02-94/index.html>

A Fact Sheet, *Pharmaceuticals, Hormones, and Other Organic Wastewater Contaminants in U.S. Streams*, (FS-027-02)

<http://toxics.usgs.gov/pubs/OFR-02-94/FS-027-02.pdf>

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If you are reading this newsletter second-hand, we'd like to take this opportunity to invite you to become a member of MGWA for 2003. Annual dues are \$25 for professional members and \$15 for students. Members are entitled to subscribe to the paper version of the newsletter for \$10/yr, the electronic version is available on the website for members at no additional charge. Members are also entitled to purchase a paper copy of the annual membership directory for \$7; an electronic version is available on the website for paid members at no additional charge. Additional donations to the MGWA Foundation will be gratefully accepted.

*Dues paid to MGWA are **not** deductible as charitable contributions for federal income tax purposes. However, dues payments are deductible as ordinary and necessary business expenses to the extent allowed by law. The MGWA Foundation is a 501(c)3 non-profit and donations paid to MGWAF **are** deductible as charitable contributions.*

Just complete the form below and mail to: MGWA, c/o WRI, 4779 126th St. N, White Bear Lake, MN 55110-5910.

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Please indicate if you want to have the Directory (\$7) _____ or Newsletter (\$10) mailed to you _____

Note that both can be downloaded from mgwa.org at no additional charge (you pay for your own paper and ink!).

2002 Minnesota Ground Water Association Newsletter Advertising Policy

Display ads:

Size	Inches Hor. x Vert.	Quarterly	2002 Membership
		Newsletter	Directory
		Annual Rate; 4 issues	Annual Rate; 1 issue
Business Card	3.5 x 2.3	\$66	\$50
Quarter Page	3.5 x 4.8	\$121	\$99
Half Page	7.5 x 4.8	\$225	\$190
Full Page	7.5 x 9.75	\$425	\$360
Inside Cover	7.5 x 9.75	not available	\$395

Classified ads: Classified ads in the newsletter are charged at the rate of \$3 per 45 characters (including spaces and punctuation) per newsletter issue.

E-mail notices: A one-time e-mailing to the membership costs \$10 for an individual (e.g., seeking a job), and \$50 for an organization (e.g., announcing a new product, job opening etc.). A 200 word limit is imposed. The advantage of e-mail is the speed of dissemination.

The Advertising Manager has final determination on the acceptance of materials submitted. There are no commissions on ads. Copy must be received by the publication deadlines: 1 February, 1 May, 1 August, or 1 November. Advertisers should submit their material as a digital file in TIFF, JPEG or PCX format at 300 to 600 dpi. A set-up charge will be applied to non-digital ad material.

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