

# Minnesota Ground Water Association

Volume 17, Number 4: December, 1998

## President's Column

*Paula Berger, Environmental Strategies Corp.*

Well, 1998 is drawing to a close and its time to welcome in the New Year and a new MGWA President. I've really enjoyed serving as the President this year and I wish Jim good luck in the upcoming year. Watch your mailbox for a ballot as we vote for a President-Elect and Treasurer for 1999.

The fall field trip was a great success and we enjoyed (mostly) beautiful weather as well as learned a lot about the glacial geology of Wisconsin and north central Minnesota, thanks to Mark Johnson and Lee Trotta. Special thanks to Lee for coordinating the trip and materials in the guidebook. Several photographs of the weekend are included in this issue and hopefully this will entice you to consider joining us next year.

These last two years have been my first MGWA field trips and I know that I'll make it a priority in years to come. Its easy to get caught up in the stress and time crunches of the profession and forget about what interested me about this field in the first place. The MGWA field trips are an easy way to remind myself and just enjoy learning without having to produce something.

Speaking of time crunches, we were not successful in completing the Environmental Referral Directory for the 1998 MGWA Directory this year. As described elsewhere in this issue, production of the directory was delayed as we tried to obtain updated information after the changes at the Minnesota Pollution Control Agency. As it turns out, publication of the agency referral guide didn't occur as quickly as anticipated. Therefore, members that paid for a 1998 Directory will receive an abbreviated membership directory and credit for a 1999 Directory that

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## Variety the Key to MGWA's 1998 Fall Conference

The 60 or so attendees at our fall conference held November 13 at the Minnesota Pollution Control Agency were treated to a packed schedule of seven talks highlighting new and emerging technologies in the study and remediation of ground water. **MGWA President, Paula Berger** began the morning by outlining some proposed changes to the MGWA bylaws and circulated a petition seeking the required 10 percent membership approval so the changes can be put to a vote. If you weren't at the meeting and would like to review the changes and the petition, consult your September 1998 newsletter.

The technical talks started with a presentation by **William Pedler, Principal with RAS, Inc., Golden Colorado**. Bill described a hydrophysical well logging technique he and several colleagues have developed to describe the contaminant hydrogeology of aquifers. HydroPhysical (TM) logging is based on measuring induced electrical conductivity changes in the fluid column of a wellbore by employing advanced downhole water quality instrumentation. The technique contemporaneously identifies locations of water bearing intervals, specific inflow rates of those intervals during pumping, and the in-situ hydrochemistry of the formation waters associated with each producing interval. By deploying a downhole fluid sampler during logging, it is possible to evaluate contaminant concentrations and migration of contaminants vertically within a borehole.

Next, **Fred Paillet, Geologist with the USGS in Denver**, described how to characterize hydraulically active zones in bedrock aquifers using heat-pulse flow meters. Fred emphasized that well logging techniques should be used in tandem, combining continuous profiles

with in-situ measurements. Heat-pulse flow meters have been used in a wide variety of applications from locating a water supply for the visitor center at the rim of the Grand Canyon at a depth of 3000 feet (great slides, Fred!), to hydrogeologic studies in the Everglades where core recovery couldn't always be relied on, so geophysical logging using flow meters was indispensable.

**Gordon Girtz, Program Director of the Institute of Environmental Affairs at the University of Minnesota**, and **Steve Jansen, Vice President of Peer Environmental Engineering and Resources, Inc.** then cooperated on a presentation of environmental issues and solutions associated with construction of the Minnesota Library Access Center (MLAC), a unique underground facility designed for long term storage of paper-based library and archival materials on the University's West Bank, adjoining the Mississippi River. Ground water at the site occurs in horizontal bedding planes and vertical fractures within the Plattville Limestone. To complicate matters, the ground water is contaminated with polynuclear aromatic hydrocarbons (PAHs) and petroleum constituents that originated from upgradient, off-site sources. Special modifications

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## The primary objectives of the MGWA are:

- Promote and encourage scientific and public policy aspects of ground water;
- 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.

### Fall Conference Report, cont.

and additions to the initial site design have been necessary to control contaminated ground water encountered during construction and to ensure its proper management as a part of facility operation.

After a break, **Mark Olsen, GIS Coordinator for the Minnesota Pollution Control Agency**, shifted gears to discuss development of the National Surface Water Hydrography database set. The database is currently in prototype and will soon have web access via the U. S. Geological Survey EROS data center in Sioux Falls, SD. Mark demonstrated how the database will work on a prototype basin in Iowa. A major use of this new tool will likely be in spill contingency planning/emergency response scenarios to enable planners to predict impacts of possible discharges of contaminants to a basin or sub-basin to downstream water interests.

**Lee Trotta, Applications Engineer, U. S. Filter/Johnson Screens**, then demonstrated a sampling device for passive sampling in low-flow aquifers which works via diffusion. The unit has a variety of applications, not strictly limited to low-flow situations, although this is where it is ideally suited. It allows vertical resolution to within 3 inches, so it is useful where detailed sampling of a water column is required.

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**Fred Campbell, Hydrogeologist, Minnesota Pollution Control Agency**, continued in the vein of demonstrations by showing use of a bubbly gas membrane system (the Membran Module) in aquifer restoration projects. The fiber bundle nodules are installed in-line in injection wells where oxygenated water is injected into contaminated ground water as a part of a treatment system. The technology has been used with success at the Andersen Corporation site in Bayport, MN.

The program concluded with an interesting presentation on bioluminescent sensors for the detection of contamination in the environment, given by **Lisa Strong of the University of Minnesota Biology Processing Technology Institute**. The technology is definitely in the formative stages, but bench-scale testing has proved promising and lists of chemicals that cause bioluminescent reactions in certain bacteria are being developed.

— Contributed by Tom Clark

## Correction

In the September issue of the newsletter, the lead-article author's name was misspelled. Mark Ferrey, a soil scientist with the MPCA, was the author of the article, "Natural Attenuation of Ground Water Contaminants". We apologize for any inconvenience this may have caused.

### President's Column, cont.

will be published midyear. We apologize for any inconvenience that this caused.

Thanks again to all of the MGWA Board members and volunteers for their help this year, especially outgoing Past-President, Ray Wuolo, and Treasurer, Paul Bulger. In case either of you feels yourself going through withdrawals during the first week of the month, feel free to come back and help out at Board meetings.

## Soundings — Progress in Minnesota Water Management

Minnesota's water benefited in the 1990s from new efforts aimed at promoting conservation, protecting wetlands, preventing pollution from on-site wastewater treatment systems and correcting problems from leaking tanks and unsealed wells. *Soundings: A Minnesota Water Plan Assessment*, just released by the Environmental Quality Board, reports progress in carrying out the 14 objectives relating to integrating water management, protecting and conserving water resources and focusing on lakes, wetlands, rivers and ground water contained in the 1991 *Minnesota Water Plan*. *Soundings* also identifies state water needs and recommends directions.

Progress is focused in key areas.

- New approaches that use sustainable development principles, ecosystem management and basin management are unifying management efforts.
- Local water planning is progressing and is an integral part of most water efforts.
- Coordination is increasing and reflects a growing expertise at the local level.
- Computers are changing methods of educating, information sharing and accessing data with almost instant access through web sites and listservers.
- New or refocused monitoring is providing better information.
- Added legislation, enforcement and funding are enhancing pollution prevention and correction actions.

*Soundings* will be used by the EQB Water Resources Committee and those interested in water management in Minnesota as a tool to shape the next water plan due in September 2000. To assist in developing Minnesota Water Plan 2000, a questionnaire accompanies the report both available on the Internet at [www.mnplan.state.mn.us](http://www.mnplan.state.mn.us). For more information contact Marilyn Lundberg, Minnesota Planning, (651)296-0676.

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## MGWA Helps Sponsor Children's Water Festival

The Minnesota Ground Water Association was one of more than 30 sponsors providing bus transportation, lunch, t-shirts, educational souvenirs, teacher's resource materials, and lots of exciting educational activities for 600 Twin City Metro Area fifth-grade students at the 1998 Children's Water Festival on October 14th.

The Festival was a hands-on, educational event. The goals were to educate, inspire, motivate, and challenge these young students to understand, conserve, and protect our water resources. Learning stations were set up under the fall foliage and colorful tents along the river at Fort Snelling State Park. The sun was shining as classrooms of students raced from station to station learning about the importance of groundwater and surface water systems, the hydrologic cycle, the importance of water to all of life, and how human activities affect water quality and water quantity. Activities included the Science Museum's assembly program, "Water!"; Charlie McGuire as the "Singing Ranger"; Metropolitan Council's stream model; Watershed Partners' watershed model; groundwater models; climatology; fish identification; fresh water bugs under a microscope; frogs; and other environ-

mental and water-related games and activities. Classrooms attending the festival were selected randomly from each of the seven Metro Area counties from applications received in response to an informational flyer sent out last spring. The Festival was coordinated by the Metro Area Ground Water Alliance (MAGWA), which is an affiliation of state and local government units.

The broad base and diversity of sponsors underscores the importance of ground water education. The list includes, among others: Culligan, Bongard's Creameries, Target, CAMAS Minnesota, Tonka Equipment, Andersen Window, North Star Steel, Montgomery Watson, SEH, CDM, Afton Apple Orchard, Old Dutch Foods, Famous Dave's, North Star Ice, Vessco, Graffic Traffic, Lake Elmo Repair, Rick's 36 Automotive, Fred's Tire, Schroeder's Dairy, Waste Management and several watershed districts. MAGWA plans to make the Children's Water Festival an annual event, thanks to the response of the sponsors, volunteers, and enthusiastic students and teachers.

Many of the volunteers at the various stations were members of MGWA and MGWA's involvement in the financial support of this festival was made possible by MGWA members' scholarship donations. Thank you.



Science Museum staff teaching about how society uses water.  
Photo by Sheila Grow.

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## SEPM Research Conference: Fluid Flow in Carbonates

*Jim Lundy and Cathy O'Dell*

A contingent of Minnesotans crossed Wisconsin to participate in the SEPM (Society for Sedimentary Geology) Research Conference: "Fluid Flow in Carbonates: Interdisciplinary Approaches," held in Egg Harbor (Door County), Wisconsin on September 20-24, 1998. The conference was convened by Maureen Muldoon (University of Wisconsin-Oshkosh), Ken Bradbury (Wisconsin Geological and Natural History Survey, WGNHS), Toni Simo (University of Wisconsin-Madison), and Mark Harris (University of Wisconsin-Milwaukee), with the goal of "gathering those interested in fluid flow in carbonates ... in an informal setting to discuss methods for integrating diverse data types (lithostratigraphy, sedimentology, diagenesis, sequence stratigraphy, mechanical stratigraphy, and hydraulic properties) into conceptual models of fluid flow in carbonate aquifers and reservoirs." The conference attracted fifty participants from several states and eight countries in North America and Europe. A full-day field trip examined the Silurian dolomite in three quarries, and was followed by two

and one-half days of presentations and discussion.

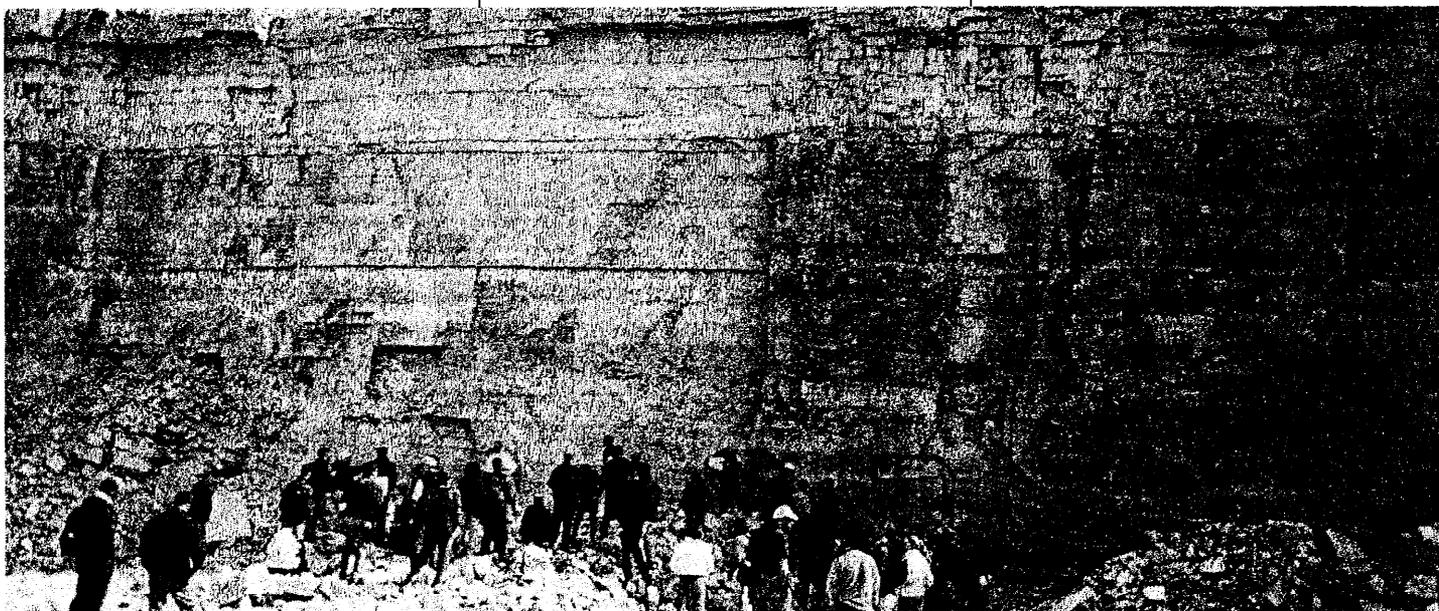
The Silurian dolomite of Door County was the inspiration for the conference. This fractured, highly-permeable dolomite is covered by thin soils with little attenuation capacity, and contaminants near the land surface can move rapidly through fractures to the water table, and then are transported at very high rates through near-horizontal, dissolution-enlarged bedding plane fractures. The Silurian dolomite aquifer supplies 99% of the water used in largely agricultural Door County. Elevated nitrate, coliform bacteria, turbidity, and other constituents are frequently reported in water samples from drinking-water supply wells. Recent work by the conference convenors suggests that detailed stratigraphic analysis coupled with geophysical and hydrogeologic data may enable improved prediction of fluid flow in this carbonate aquifer.

Keynote speaker Paul LaPointe (Golder Associates) posed three questions: 1) where did something go (or come from)? 2) how fast did it move? and 3) how much of it made it there? Extensive investigation may provide answers, but an alternative approach commonly used in the petroleum and exploration industries involves constructing 3D stochastic realizations to numerically model fracture flow. During the field trip we ex-

amined fracture patterns in the walls and floors of Bissen Quarry, while discussing how they relate to hydraulic conductivity, facies, depositional cycles, and flow units. A recurring discussion concerned the effect of scale on hydraulic conductivity determination. We examined instrumentation Maureen Muldoon used to intensively monitor hydraulic conductivity, head distribution, and fracture flow in a small quarry volume. Data suggest that vertical and horizontal fractures are important pathways for groundwater movement, and that groundwater flow in the matrix is less significant than the fracture pathways. Nevertheless, modeling based on the field data did not yield an accurate prediction of ground water flow at the selected scale.

Space limitations prevent a description of the presented conference papers, but they are available in the conference volumes (SEPM Research Conference—Fluid Flow in Carbonates: Interdisciplinary Approaches, September 20-24, 1998, Door County, Wisconsin. Program with Abstracts and Field Trip Guidebook). In the final open discussion, which assimilated the field trip and all the presented papers, there was assent that an interdisciplinary approach to fluid flow in carbonates is important.

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SEPM Conference Fluid Flow in Carbonates: September 20-24, 1998. Photo by Kelton Barr

## Playing "Glacial Roulette" on the Fall Field Trip

This year's Fall Field Trip, held September 19-20 and co-sponsored by the Minnesota Ground Water Association, American Institute of Professional Geologists, and Association for Women Geologists, focused on glacial processes and the evidences, sediments, and landforms left behind. In addition to the sites in east-central Minnesota in the vicinity of Mille Lacs Lake and in Pine County, the tour also included west-central Wisconsin sites in Polk and Burnett counties.

This year's trip was planned and organized by Field Trip Coordinator, Lee Trotta, U.S. Filter, Paula Berger, MGWA President and Environmental Strategies Corp., Chris Tillema, AWG representative and American Companies, Andrew Nichols, MPCA, and Sean Hunt, DNR. I also participated in the committee and assisted in developing the guidebook.

Starting out bright and early with perfect weather, our coach bus headed north out of the Twin Cities toward the Walleye Mecca, Lake Mille Lacs. The glacial geology stops south and west of Lake Mille Lacs, and on and near the Mille Lacs Band of Ojibwe Reservation, generated a good deal of critical discussion. The recently published U.S. Geological Survey report, Ground Water Resources of the Mille Lacs Lake Area by Lee Trotta and Tim Cowdery (USGS WRI Report 97-4116), was our "text" for this area. Thin glacial sand and gravel aquifers in the area are both unconfined and confined. The extent of these aquifers and connections between them can be difficult to interpret from the available data, although at least some are local and isolated. At the stop at the Mille Lacs Tribe Public Works we learned that the Tribe is very concerned about development in the area and being able to provide adequate water and at the same time protect those water resources.

The afternoon's two stops in Pine County generated a good deal of lively discussion. At Robinson's Quarry Park in Sandstone in the Kettle River gorge, Terry Boerboom, Min-

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## The Capillary Fringe

Bergerson-Caswell drillers display special equipment from recent field work done in Faribault for the Minnesota Pollution Control Agency (MPCA)—the cork-screw or "rotini" screen. It augers through the tightest formations, allowing for easy well completions, and, at the end of the day, it cooks up "al dente" in just 12 minutes. However, sample bailing is still problematic.

Actually, at the beginning of the project the screen was straight. The driller advanced hollow stem augers with a plastic centerplug to the intended screened interval, then attempted to set the screen/casing assembly. This usually involves knocking the centerplug out of the augers by driving the screen/casing assembly downwards and simultaneously withdrawing the augers 1 to 3 feet. The formation collapses around the screen and the temporary well is complete. However, in this case, even after hammering the screen/casing assembly, the plug did not budge. After several attempts, the driller withdrew the screen only to find it had buckled to a spiral shape, confined by the inside diameter of the hollow stem augers.

Bon appetit!

— Contributed by Jim Lundy, MPCA



## Boron in Ground Water Fact Sheet Available

A one-page (two-sided) fact sheet, Boron in Minnesota's Ground Water, is now available from the MPCA. The fact sheet discusses sources of boron in ground water, what is considered a safe level in ground water, how boron is distributed (using data generated from sampling over 900 wells in the Ground Water Monitoring and Assessment Program [GWMAP] network), which aquifers are most sensitive to boron contamination, and some management strategies for reducing risks from boron. The fact sheet is the second in a series of chemical fact sheets being prepared by the Environmental Outcomes Division using GWMAP statewide baseline network data, and complements the sheet on nitrates that was published in August. Copies of both fact sheets may be obtained by contacting the GWMAP staff in the Environmental Monitoring and Analysis Section, or Tom Clark in the Environmental Research and Reporting Section of the Environmental Outcomes Division at (651) 296-8580. A third sheet on arsenic is currently in peer review and should be available later this month.

Contributed by Tom Clark, MPCA

nesota Geological Survey, showed the group subvertical open fractures in the Hinckley Sandstone as much as five meters wide; similar fractures of varying widths may be underlying parts of Pine County, perhaps largely controlling ground water movement and acting as a rapid subsurface drain in areas of thin glacial drift. Calvin Alexander, University of Minnesota, introduced the group to the sad tale of a family of beavers trying to make a living in an area that, for all it's non-carbonate geology, appears to have some properties similar to carbonate rock areas in southeastern Minnesota. It seems that several attempts by the beavers to pond water failed due to development of subsurface drainage and loss of ponded water down features that looked remarkably like carbonate-ter-

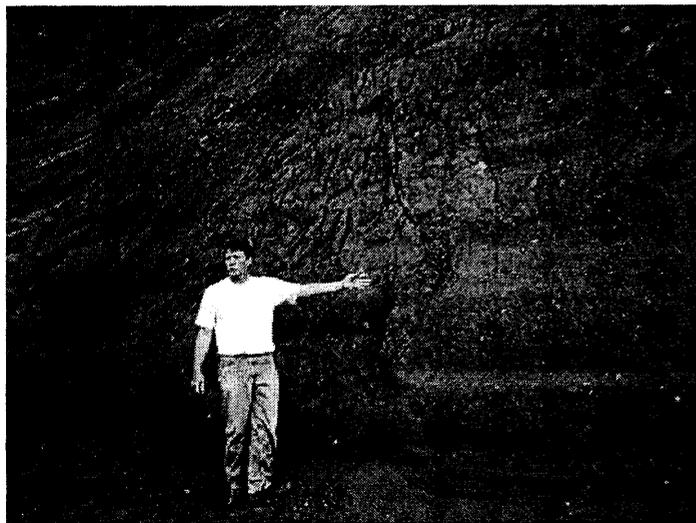
Calvin Alexander (on beaver lodge), Jim Piegat, Ray and Lee Schreurs and others. Calvin is explaining the hard luck story of beavers and karst-like terraine. Photo by Lee Trotta



rain swallet holes. Also at the stop, Tom Rosga of Rosga Well Drilling discussed problems he has encountered and attempted to solve when drilling the Pine County area. His experience in the area indicates fracture-type groundwater movement, not porous-media flow; anyone working in the area should recognize the potential and not insist on a porous-media flow model.

The day finished just as the skies opened with a thorough rain shower. At the evening dinner, held at the Askov Community Center, Tom Riewe, Wisconsin Department of Natural Resources, provided a review of ground water issues in Wisconsin's glacial outwash areas and set the stage for the following day.

By all accounts, the entire second day, with leader Mark Johnson, Gustavus Adolphus College, was a favorite of those on the trip. The weather was picture



Mark Johnson making a varved point.

Photo by Lee Trotta

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## SEPM Conference, cont.

Hydrology is central; stratigraphy is critical, but structural geology is important too. And geochemical and geophysical data can shed important light on fluid flow in fractures.

One attendee summed up the importance of interdisciplinary approaches with the new moniker "hydrogeochemical stratigraphy".

New scientists must be trained in the interdisciplinary approach. The important fields will probably include porosity, permeability, lithology, stratigraphy, sedimentology, diagenesis, hydrology, rock mechanics, reservoir geology, geochemistry, tectonic history, structural geology, paleoclimate, burial history, geologic history. Hydrogeologic tools are improving (software, hardware). We are relatively early in the process of applying statistical tools; these will be important in guiding future investigations. Flow modeling of fractured carbonate aquifers is likely to become more important as model codes appropriate to the scale of observation are developed.

Communication skills among scientists from different disciplines will become a key element to success. We must be crystal clear about what "elephant part" we describe for other scientists. For example, hydrologists like the pores in the rock; sedimentologists like the matrix. During the field trip, a sedimentologist and hydrogeologist were holding a day-long conversation about the Door County aquifers we looked at. The sedimentologist could not remember seeing any of the horizontal fractures the hydrogeologist was talking about. Near the end of the day, standing in front of a quarry face, the hydrogeologist pointed to a bedding plane fracture and said "here is a horizontal fracture". The sedimentologist said, "Oh! That's what you mean by horizontal fracture. To me, those are just bedding planes. I thought there was some other feature you were talking about."

## 1998 Directory Delay

The MGWA Board apologizes for the delay in publication of the 1998 Membership Directory. It had been our intention to publish an updated information referral index showing changes in contact names and phone numbers as a result of the Minnesota Pollution Control Agency's reorganization. However, MPCA has not yet published a new referral index. Rather than delay publication of a directory further, the Board voted, at its November meeting, to immediately publish a 1998 directory member listings only. This directory was recently sent to all who ordered a directory with their 1998 membership renewal. The 1999 directory, including an updated referral index, will be published about midyear on the normal schedule. Anyone who ordered in 1998 will not need to order in 1999. Again, we are sorry for the delay and hope this approach will be satisfactory to our members.

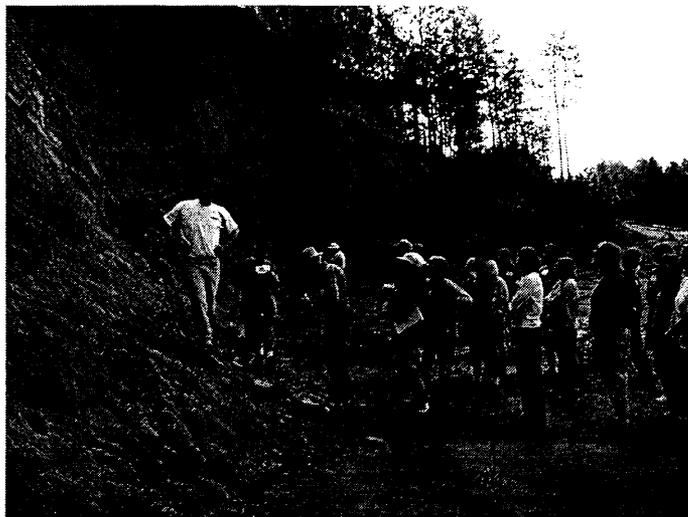
## Goodhue Atlas Part A

The Minnesota Geological Survey (MGS) recently published Part A of the Goodhue County geologic atlas. The atlas contains maps of the bedrock geology, surficial geology, thickness of Quaternary sediments, bedrock topography, and geologic resources. An explanation of the Quaternary stratigraphy and a subsurface data base are also included. This account of the geology of the county is intended to support planning, research, education, and environmental-protection efforts. Digital files of the geologic information are available for use in geographic information systems. The Minnesota Department of Natural Resources, Division of Waters, will follow up with Part B, a study of the ground-water system and karst fractures of the county.

County Atlas C-12, Part A, Geologic atlas of Goodhue County, Minnesota. Dale R. Setterholm, project manager. Color. Scale 1:100,000. 6 plates. \$17.00 (sales tax and shipping charges extra), Minnesota Geological Survey, Publications, 2642 University Ave. W., St. Paul, MN, 55114-1057, ph. 612-627-4780, extension 238.

## Fall Field Trip Report, cont.

perfect, and Mark had selected some highly instructive stops in Polk and Burnett counties. The morning's stops included a sandpit with wonderfully exposed coarse varves and ice-collapse features, one of the largest ice-walled lake plains in western Wisconsin and exhibiting multiple rims, and the Eskedahl tunnel channel with prominent center esker.



*Mark Johnson discusses the geological implications of the varves seen in this gravel pit.*

*Photo by Sean Hunt*

We stopped in Luck, Wisconsin for lunch, enjoying the view of Big Butternut Lake from the local park. Traveler's tip: the Stop a Sec gas/convenience store in Luck makes a pretty good sub.

Continuing with the rest of the day's stops, we first attempted to decipher the sequence of glacial advances by examining glacial striations in basalt outcrops. Next, we were introduced to the type section of the Trade River Formation, composed of till, lake sediment, outwash from the Grantsburg sublobe, and at this stop deposited over Superior Lobe outwash. At our final stop, varves were again the focus, this time of Glacial Lake Lind. In contrast to our first stop of the

*These specialized striations, known as crag-and-tail structures, were observed on outcrops of amygdaloidal basalt in Northwest Wisconsin. As glacial ice moved across the rock surface, it plucked the hard mineral fillings from the amygdules. These minerals then abraded the basalt as they were dragged by the ice, leaving structures that allow us to infer the direction of ice flow.*

*Photo by John Seaberg*



day, a very short-lived lake, this sequence of varves indicated a long-lived lake of more than 1000 years, and older than Glacial Lake Grantsburg.

Many thanks to those committee members and field stop leaders, without whom no Fall Field Trip is possible. Next year the AIPG will be the lead for the trip. If you have suggestions for a theme, area, or specific stops for next year's trip contact any committee member or AIPG or MGWA Board members.

— Contributed by Jan Falteisek, DNR

## MGWA Field Trip Scholarships

### Bemidji State University

I would like to thank MGWA for their scholarship support of our geohydrology and waste management spring field trip to Akeley, Minnesota. Our field trip visited sites associated with the U.S. Geological Survey's Interdisciplinary Research initiative near Shingobee and Williams Lakes. Two USGS personnel, Don Rosenberry (MGWA member) and Dallas Hudson, were on hand to demonstrate hydrogeologic field techniques. We visited Akeley's wastewater treatment site where the sampling protocols used to collect water samples from monitoring wells were demonstrated. The photo below shows students installing a shallow piezometer adjacent to a wetland near Williams Lake.

— submitted by Timothy Kroeger



### Carleton College



Student group on Carleton College's Geology Field Trip to Missouri. This photo was taken at Elephant Rocks State Park. They say they had a great trip. Photo by Tim Vick

## DNR Water Level Observation Well Program Update

This has been a busy year for the Obwell Program. Over the last year we have added three Mt. Simon obwells to the network. All of these are wells which would have been sealed under the well sealing (state owned property) program. The new obwells are at the Cambridge Regional Treatment Center, the Anoka Regional Treatment Center and at the North Star WMA between Mankato and New Ulm. Unfortunately, it appears certain that we will lose the Mt. Simon obwell in downtown Minneapolis due to the Target store project. We have been working with the City's Environmental Inspections Division to find an alternate well or a location to drill a new well (expensive) preferably as part of an educational exhibit. We have a few prospects, but, so far, nothing concrete.

Recently, the South Dakota Geological Survey drilled two test holes with us and for us near Canby as part of a cooperative effort surrounding the Lincoln-Pipestone Rural Water project. Neither hole resulted in a well in the aquifer of interest. Additional drilling related to this project may occur later this fiscal year.

Observation wells were added in northeastern Minnesota also. Three obwells were installed near Kinney related to a continuing mine pit study. In a cooperative project with the Department of Agriculture, we installed (with Pollution Control Agency's rig) a few wells near Duluth. They are being used for monitoring a particular site, but when that work is completed some of the wells will be added to our obwell network.

Four obwells were installed in Savage. Two are located on top of the bluff and the other two on the north side of Savage Fen. Each nest consists of a Prairie du Chien well and a Jordan well. During the period October through December, tests of each of these aquifers were conducted. The City of Savage cooperated with the pumping schedule of their wells so that they pumped from the Prairie du Chien well for a period, turned it

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## 47th Annual Geotechnical Engineering Conference

The 47th Annual Geotechnical Engineering Conference will be held at the University of Minnesota on February 19, 1999. Approximately 150 engineering professionals will convene to hear practitioners and researchers discuss significant projects and current theories. The keynote address, the so-called Kersten Lecture named in honor of Prof. Miles Kersten, will feature Dr. J.P. Giroud of GeoSyntec Consultants. Other speakers will include Prof. Tuncer Edil from the University of Wisconsin, Prof. Paul Mayne of the Georgia Institute of Technology, Prof. Andrew Drescher of the University of Minnesota, and Dr. Ethan Dawson of Dames & Moore. Topics at the conference will cover advances in geosynthetics, recent developments regarding construction over soft ground, enhanced in-situ testing techniques, retro-specification of limit analysis, and finite element modeling of slope stability. The winner of the Young Engineer Paper competition will also give a presentation. The conference will conclude with recent case histories. Inquiries should be directed to Prof. Joseph F. Labuz at [jlubuz@tc.umn.edu](mailto:jlubuz@tc.umn.edu) or (612) 625-9060. The 47th Annual Geotechnical Engineering Conference is co-sponsored by the Minnesota Geotechnical Society, the Geo-Institute of ASCE, the Minnesota Section of ASCE, and the Consulting Engineers Council of Minnesota.

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## UM Geology Seminar Series

January 21, 1999, Michael McDonald, McDonald and Harbaugh, will be speaking on the topic of modeling ground water recharge in the western U.S. 3:30 p.m., 110 Pillsbury

January 22, 1999. Michael McDonald will speak on the history of MODFLOW, 10-11 a.m. in 121 Pillsbury.

February 3, 1999, GSA Birdsall-Driess Lecture, Professor Stuart Rojstaczer, Duke University. Further details will be forthcoming.

— Provided by HO Pfannkuch.

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## New USGS publications

Stoner, J.D., Lorenz, D.L., Goldstein, R.M., Brigham, M.E., and Cowdery, T.K., 1998, Water Quality in the Red River of the North Basin, Minnesota, North Dakota, and South Dakota, 1992-95: U.S. Geological Survey Circular 1169, on line at <http://water.usgs.gov/pubs/circ1169>.

Winter, T.C., Harvey, J.W., Franke, O.L., and Alley, W.M., 1998, Ground Water and Surface Water – A Single Resource: U.S. Geological Survey Circular 1139.

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## Minnesota Association of Professional Soil Scientists

Our fellow scientists at Minnesota Association of Professional Soil Scientists (MAPSS) have established a web site at:

<http://www.soils.umn.edu/in-foserv/orgs/mapss2/mapss2.htm>

Among other activities, they publish a quarterly newsletter and sponsor a summer field trip, usually in late July or early August. Dues are currently \$25 for full members and \$15 for student members.

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## MGWA Names New Representative to Mapping Advisory Panel

At its October meeting, the MGWA Board appointed Jim Piegat as its representative to the Minnesota Geologic Mapping Advisory Panel, replacing Rita O'Connell whose three-year term had expired.

The purpose of the panel is to assist the Minnesota Geological Survey with prioritizing its geologic mapping activities. Panel membership is selected to represent principal groups of geologic users in the state. MGWA Members with input or ideas to pass along to the panel can contact Jim. The Board would like to thank Rita for her service and to congratulate Jim, also the MGWA president-elect, on his appointment.

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## Newsletter Team Looks Forward to 1999

Looking back on 1998, your MGWA newsletter editorial team is pleased to have reviewed and published a wide variety of articles describing Minnesota's hydrogeology and emerging ground water issues in our state. This is an all volunteer organization which relies heavily on contributions from **you**, our readers. Why not take advantage of this captive audience and write an article on your ground water research or area(s) of interest for an upcoming issue of the MGWA newsletter?

With John LaFave's return to Montana, the editorial team is looking for another member (or two or three!) If you're interested in any aspect of putting together **your** quarterly newsletter, contact any member of the newsletter team for more information.

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## DNR Obwell Network Update

off to obtain recovery data, then pumped the Jordan well for awhile, and turned it off. The purposes of these tests were to provide data on the connectivity of these two aquifers, to provide data on the characteristics of these two aquifers, to provide information on possible effects of pumping on the Savage fen, and to provide information on possible interactions with surface water. Five residential Prairie du Chien wells plus our obwells and the two pumping wells, a total of 17 wells, were monitored before and during the testing. In addition, surface water measurements were taken before, during and after the pumping. A climate station was also in place. Data from these tests are available from DNR Waters.

A test hole is planned near Worthington. This test hole will provide additional data for correlation of test drilling and geophysical testing conducted over the last two to three years.

We plan to install several other obwells yet this fiscal year. Possible locations include near Granite Falls, Camden State Park/Marshall, Renville and Wood Lake/Hanley Falls.

— Laurel Reeves, Minnesota DNR Waters

## MGWA Calendar

Contact information for the major event-holders is listed at the end of the column.

**January 11-15, 1999** PC applications in risk assessment, remediation, modeling and GIS, Orlando, FL. Contact: NGWA.

**January 11, 1999** Abstracts due for the North-Central Section Geological Society of America meeting April 22-23, 1999 at Champaign-Urbana, Illinois. C. Pius Weibel, Illinois State Geological Survey, 615 E. Peabody Dr., Champaign, IL 61820-6964, phone 9217) 333-5108, e-mail [weibel@isgs.uiuc.edu](mailto:weibel@isgs.uiuc.edu). Check the GSA web site at [www.geosociety.org](http://www.geosociety.org) for abstract forms and additional information.

**January 12-13, 1999** Assessment and management of MTBE impacted sites, Orlando, FL. Contact: NGWA.

**January 19-20, 1999** Assessment and management of MTBE impacted site, San Francisco, CA. Contact: NGWA.

**January 20-22, 1999** Understanding migration, assessment, and remediation of non-aqueous phase liquids (LNAPLs and DNAPLs), San Francisco, CA. Contact: NGWA.

**January 27-29, 1999** Natural attenuation of fuel hydrocarbons and chlorinated solvents: processes, monitoring and modeling with BIOSCREEN and BIOPLUME III, Atlanta, GA. Contact: NGWA.

**January 27-29, 1999** Ground water and environmental data management, Atlanta, GA. Contact: NGWA.

**January 31-February 3, 1999** Minnesota Water Well Association (MWWA) Annual Convention, St. Cloud, MN. Contact Doug Ohlson, (612)290-6270.

**February 15-16, 1999** Natural attenuation for remediation of contaminated sites, Albuquerque, NM. Contact: NGWA.

**February 22-23, 1999** Assessment and management of MTBE impacted sites, Denver, CO. Contact: NGWA.

**February 24-25, 1999** Environmental aspects of surface and ground water interactions, Denver, CO. Contact: NGWA.

## This Newsletter brought to you by:

Tom Clark, Editor-In-Chief

Steve Robertson

Jan Falteisek

Jim Lundy

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[jim.lundy@pca.state.mn.us](mailto:jim.lundy@pca.state.mn.us)

## MGWA Newsletter Deadlines for 1999

Issue	Copy to Editor	Final Copy to Publisher
March (v. 18, no. 1)	2/5/99	2/12/99
June (v.18, no. 2)	5/7/99	5/14/99
September (v. 18, no. 3)	8/6/99	8/13/99
December (v.18, no. 4)	11/5/99	11/12/99

**February 24-26, 1999** Visual MODFLOW. Contact: NGWA.

**March 2-4, 1999** Minnesota Rural Water Association (MRWA) Technical Conference, St. Cloud, Minnesota. Contact: MRWA at 1-800-367-6792.

**March 16, 1999** Southern Minnesota Children's Water Festival and Workshop for Minnesota Basin Teachers, North Mankato, Minnesota. Contact: Bonnie Holz, (507)931-4140.

**March 24, 1999** Minnesota Department of Health (MDH) Annual Well Conference, Thunderbird Hotel, Bloomington, Minnesota. Contact: Ed Schneider, (651)215-0827.

**March 22-25, 1999** Analysis and design of aquifer tests including slug tests and fracture flow, San Diego, CA. Contact: NGWA.

**March 25-26, 1999** Risk assessment for the environmental professional: contaminant fate and transport modeling using API decision software, San Diego, CA. Contact: NGWA.

**April, 1999** Fracture trace and lineament analysis: applications to ground water resources characterization and protection, Penn State. Contact: NGWA.

**April 12-14, 1999** Desktop GIS and remote sensing techniques and technologies for environmental hydrology, Chicago, IL. Contact: NGWA.

**April 19-20, 1999** Fundamentals of ground water geochemistry, Dallas, TX. Contact: NGWA.

**April 21-22, 1999** Assessment and management of MTBE impacted sites, Dallas, TX. Contact: NGWA.

**April 21-23, 1999** Applications of ground water geochemistry, Dallas, TX. Contact: NGWA.

**April 22-23, 1999** North-Central Section, Geological Society America at Champaign-Urbana, Illinois. Check the GSA web site at [www.geosociety.org](http://www.geosociety.org) for additional information.

**April 26-27, 1999** Low cost remediation strategies for contaminated soil and ground water, Philadelphia, PA. Contact: NGWA.

**April 28-30, 1999** Principles and practice of forced air remediation systems, Philadelphia, PA. Contact: NGWA.

**April 28-30, 1999** Assessment and management of MTBE impacted sites, Philadelphia, PA. Contact: NGWA.

**May 10-12, 1999** Natural attenuation of fuel hydrocarbons and chlorinated solvents: processes, monitoring and modeling with BIOSCREEN and BIOPLUME III, Phoenix, AZ. Contact: NGWA.

**May 12-14, 1999** Ground water and environmental data management, Phoenix, AZ. Contact: NGWA.

**May 18-19, 1999** Natural attenuation for remediation of contaminated sites, Raleigh, NC. Contact: NGWA.

**May 16-17, 1999** Groundwater in Tomorrow's Europe, Castle Donnington, UK. Organized by the IAH British

— continued on next page

## MGWA Calendar, cont.

National Chapter in association with the Hydrogeology Group of the Geological Society, the UK Groundwater Forum, Environment Agency and EuroGeoSurveys. Contact Justine Huddart, Conference Nottingham, +44 115 985 6533, E-mail: [info@confnottingham.co.uk](mailto:info@confnottingham.co.uk)

**June 8-9, 1999** Natural attenuation for remediation of contaminated sites, Seattle, WA. Contact: NGWA.

**June 14-16, 1999** Principles of ground water – flow, transport and remediation, Portland, OR. Contact: NGWA.

**June 17-18, 1999** Assessment and management of MTBE impacted sites, Portland, OR. Contact: NGWA.

**June 22-23, 1999** Water Quality: Don't Let It Slip Through the Cracks, 1999 State Water Planners Conference, Rochester, MN. Contact: Bea Hoffman, SE MN Water Resources Board, 507-457-5223, [hoffman@vax2.winona.msus.edu](mailto:hoffman@vax2.winona.msus.edu)

**June 22-25, 1999** Computer modeling of natural attenuation and bioremediation systems, Atlanta, GA. Contact: NGWA.

**September 1999** Natural Attenuation. Contact: NGWA.

**October 15-18, 1999** Midwest Ground Water Conference, St. Paul, MN. Contact Sarah Tufford, Minnesota Department of Natural Resources, 651-297-2431, or e-mail [sarah.tufford@dnr.state.mn.us](mailto:sarah.tufford@dnr.state.mn.us).

**November 1999** Natural Attenuation. Contact: NGWA.

**November 7-10, 1999** Fourth USA/CIS joint conference on environmental hydrology and hydrogeology: hydrologic issues for the 21st century: ecology, environment and human health. American Institute of Hydrology (AIH), Cathedral Hill Hotel San Francisco, CA. Contact: AIH, 2499 Rice Street, Suite 135, St. Paul, MN 55113. 651-484-8169 E-mail: [AI-Hydro@aol.com](mailto:AI-Hydro@aol.com)

### Contacts:

#### for NGWA events:

1-800-551-7379 or <http://www.h2o-ngwa.org>

#### for Nielsen Environmental Field School events:

4686 State Route 605 S.  
Galena, OH 43021  
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614-965-5027 (fax)  
email: [nielsenfieldschool@juno.com](mailto:nielsenfieldschool@juno.com)

#### for GSA events:

<http://www.geosociety.org>

#### for Princeton's events:

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813-964-0800, 813-964-0900 (fax)  
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#### for AIH events:

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email: [aihydro@aol.com](mailto:aihydro@aol.com)

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## MGWA Board Meeting Minutes

### September 10, 1998, Egg & I, University and 280, 7:30 a.m.

**Attending:** Ray Wuolo, Past President; Paula Berger, President; Jim Piegat, President Elect; Jan Falteisek, Secretary; Paul Bulger, Treasurer; Jeanette Leete, Sean Hunt, WRI; Leigh Harrod, Advertising Manager; Tom Clark, Newsletter Coordinator; Lee Trotta, 1998 Field Trip Coordinator; Charlie Tiller, guest.

**Approval of Minutes** – Paula Berger called the meeting to order at 7:40 a.m. Minutes for the regular Board meeting held August 6, 1998 were approved with three changes noted.

**Fall Field Trip** – Lee Trotta reported on status, noting that there are about 30 current registrations. Sean Hunt reported that the guidebook is being assembled. Sean also noted that some article reprints may not be received in time, so that copies may need to be inserted. Fifty copies will be made. Lee reported that he has all equipment lined up and miscellaneous supplies organized. Paula and Chris will purchase snacks and pop. Paula noted that next year's field trip could possibly be done in combination with the Midwest Groundwater

Conference, to be held in the Twin Cities. Paula had talked with Sarah Tufford, DNR, who was receptive to the idea.

**Fall Conference** – Conference topic discussion focused on "Emerging Technologies in Ground Water Investigations". Paula checked with Roman Kanivetsky regarding availability of a speaker. Conference location was discussed; WRI is to contact the MN History Center about room availability. Topics proposed for a half-day conference (4-5 speakers) included passive sampling devices, environmental forensics, UM tunneling project, GIS, database, and National Hydrography Dataset. First choice of date is Friday, Nov. 13th.

**By-Laws Revisions** – Proposed changes were printed in the newsletter. The next step is a petition of ten percent of the membership to bring the changes to a vote by the membership. Petition deadline will be Nov. 13th. Petitions will also be e-mailed to the membership. Tom will get the petition text to Jennie for the newsletter.

**Newsletter/Directory** – Tom Clark provided an update on the newsletter, noting that the draft was done. Jim Piegat is working on the Directory update. Leigh Harrod noted that many ads expire with the September issue. The newsletter team will meet next Tuesday, Sept. 15th.

**Midwest Groundwater Conference** – Tom said that he could provide conference notes on the 1998 conference.

**Next meeting** – October 8, 1998, 7:30 a.m. at Egg & I.

Meeting adjourned 8:50 a.m.

### October 7, 1998, Egg & I, University and 280, 7:30 a.m.

**Attending:** Ray Wuolo, Past President; Paula Berger, President; Jim Piegat, President Elect; Jan Falteisek, Secretary; Paul Bulger, Treasurer; Sean Hunt, WRI; Tom Clark, Newsletter Coordinator.

**Approval of Minutes** – Paula Berger called the meeting to order at 7:45 a.m. Minutes for the regular Board meeting held September 10, 1998 were approved.

**Fall Field Trip Follow-up** – Observations from field trip attendees were

## MGWA Minutes, cont.

shared. It was noted that the weather cooperated and logistics worked well. Attendees seemed to especially enjoy the Wisconsin part of the trip lead by Mark Johnson of Gustavus Adolphus. A final financial report is needed and will be shared with co-sponsors.

**Fall Conference** – Paula reported on preparation. She noted that she has had difficulty contacting potential speakers. Other potential speakers were not available. In addition to the three currently committed speakers (National Hydrography database, low-flow sampling, remediation using O<sub>2</sub> injection), additional speakers are needed to fill the program. Paul will follow up on idea of environmental forensics. Ray said he will follow up on the O<sub>2</sub> injection speaker. Paul said he would check on the UM Archives project. The program is scheduled for the PCA boardroom. Paula will work with Sean on a flyer. Program cost was estimated to be \$35-\$40, depending on costs as the program is finalized. It was noted that the PCA cafeteria could provide coffee, and that MGWA could provide rolls for break.

**MGS Geologic Mapping Advisory Panel** – Paula noted a letter from Dave Southwick, director of the Minnesota Geological Survey,

regarding appointing an MGWA representative to the Advisory Panel for the years 1998-2000. President-Elect Jim Piegat volunteered to be appointed to the panel. Ray moved and Jan seconded that Jim be appointed to the panel. Motion passed. Paula will send a letter to Dave Southwick regarding the appointment. Tom Clark said that he would ask Rita O'Connell, previously appointed to the panel, if she had any records or files from the appointment.

**Children's Water Festival** – It was noted that sponsorship, per last month's minutes, was provided to the organizers of the festival.

**Newsletter/Directory** – Tom Clark noted the September issue had been completed. Sean will check with the bulk mailer regarding what seems to be a delay in mailing. Jennie Leete requested delivery of directory updates by Oct. 15th. The newsletter team will meet next Tuesday, Oct. 13th.

**Scholarship** – Deferred to next board meeting.

**Officer Elections** – Paula will mention at the Fall Conference that board positions President-Elect and Treasurer are open for election and candidates are needed.

**Mesabi Range Geologic Society** – Sean noted the MRGS had

announced their next meeting will be held on Oct. 21, 1998 with an accompanying talk on the geochemical characteristics of iron ore.

**Web Site** – Sean will update the web site information, including such items as fall conference, newsletter, and membership renewals.

**Next meeting** – The next meeting will be November 5th, 1998, 7:30 a.m. at Egg & I.

Meeting adjourned 8:55 a.m.

**November 5, 1998, Egg & I, University and 280, 7:30 a.m.**

**Attending:** Paula Berger, President; Jan Falteisek, Secretary; Paul Bulger, Treasurer; Jennie Leete, Sean Hunt, WRI; Tom Clark, Newsletter Coordinator; Leigh Harrod, Advertising Coordinator; Jeremy Pavlish, guest.

**Approval of Minutes** – Paula Berger called the meeting to order at 7:55 a.m. Minutes for the regular Board meeting held October 7, 1998 were approved.

**Fall Field Trip Follow-up** – A preliminary financial report was distributed (attached).

**Fall Conference** – Paula reviewed the program, including the schedule of speakers. Sean said he would check the with the PCA/DNR

— continued on next page

## Join the Minnesota Ground Water Association!

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 1999. Annual dues are \$20 for professional members and \$15 for students. Members are entitled to purchase the annual membership directory for \$7. Additional donations toward our scholarships and/or the use of recycled paper 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.*

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## MGWA Board Meetings, cont.

cafeteria regarding coffee. Sean will also arrange to bring bagels and muffins. Tom Clark said he would help with the AV setup. Jennie will send a follow up email reminder. Paula will do a final check-call to speakers. Preparation of handouts, including by-laws, were discussed and arranged.

**By-Laws** – Paula noted that one petition and one comment had been received so far. The comment was discussed and minor rewording of one section was suggested.

**Officer Elections** – Potential candidates were discussed. Additional recruiting of candidates is needed.

**Newsletter/Directory** – Tom Clark noted the December issue would be ready for WRI to work on Dec. 9th. For review, a .pdf file will be sent for markup. Jim Piegat sent word the referral section of the directory would be ready Nov. 20th. Tom suggested applying a credit to next year's dues. Other options were also discussed. It was finally agreed to send out the membership part of the directory right away, with the referral part to be sent right after the first of the year. This arrangement will be coor-

inated with the membership renewal letters. Tom will write a short explanation for the newsletter. Leigh provided an advertising status update. She suggested that the MGWA place an ad in AIPG newsletter and the AIPG reciprocate with an AIPG ad in the MGWA newsletter. She said she would check with the AIPG on this arrangement. She also said ad renewal letters were sent out.

**1999 Scholarships** – Paula said she would send out the letters before the end of the year.

**Next meeting** – December 4th, 1998, 7:30 a.m. at Egg & I.

Meeting adjourned 9:10 a.m.

## Well Record Information Gets Geographically Located

The Mississippi Headwaters Board (MHB) and its eight member counties are developing a comprehensive well record database for the Mississippi Headwaters area. The project will establish a database containing well records submitted by water well contractors to the Minnesota Department of Health (MDH).

Public well water supplies will be prioritized. The MHB counties will have the well data, including accurate geographic locations, entered into an automated database. Well water quality data will also be entered.

This database will be used to:

- identify areas where ground water may be at risk to contamination, and;
- identify hydrogeologic conditions throughout the counties that will be used to prepare a ground water flow model. Funding for this 18-month project is being provided by the MHB through a grant from MDH. Beltrami, Crow Wing and Morrison Counties have begun working on the well records; Aitkin, Itasca, Cass, Clearwater, and Hubbard counties will be starting soon.

— reprinted from *Tidings of the Mississippi Headwaters*, 10/16/98

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## Newsletter Advertising Policy for 1999

### Display ads:

Size	inches H x V	Quarterly Newsletter Annual Rate 4 issues	1999 Membership Directory Annual Rate 1 issue
Business Card	3.5 x 2.3	\$60	\$45
Quarter Page	3.5 x 4.8	\$110	\$90
Half Page	7.5 x 4.8	\$205	\$170
Full Page	7.5 x 9.75	\$385	\$325
Inside Cover	7.5 x 9.75	Not Available	\$360

### 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 job opening). The advantage of e-mail is the speed of dissemination.

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Please make checks payable to the "MGWA." Direct your orders and questions to Leigh Harrod, Advertising Manager: 220 Bell St. Excelsior MN 55331-1812, Phone: 651-602-8085; email: mn\_homebase@worldnet.att.net

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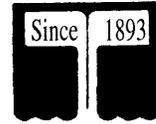
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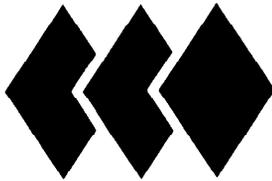
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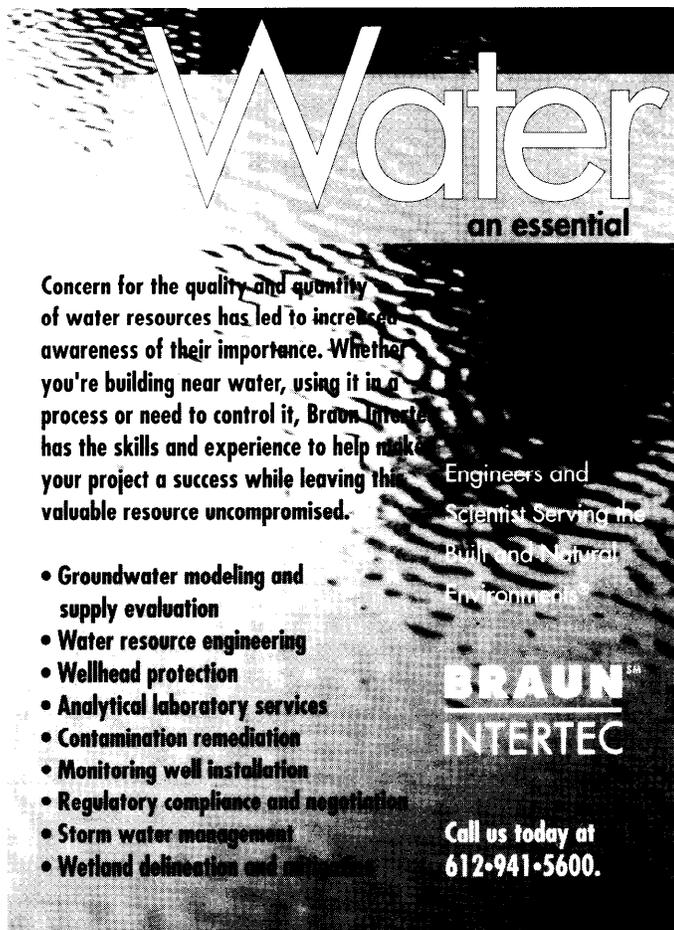
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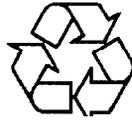
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