Minnesota Ground Water Association

www.mgwa.org

Volume 24, Number 2: June 2005

Dr. Hans-Olaf Pfannkuch Honored

In recognition of Dr. Hans-Olaf Pfannkuch s lifetime of contributions to the study and advancement of ground water science in Minnesota, the MGWA Outstanding Service Award was presented to him at our Spring Conference, May 19, 2005. Olaf has been a supporter of MGWA since before the founding of the organization. He strongly supported the concept of this organization s creation and was instrumental in soliciting participation within the University of Minnesota. Beyond his support of our association, Olaf has taught ground water basics to countless undergraduate and graduate students at the University of Minnesota. And, he has been instrumental in the development of ground water knowledge and understanding throughout this state.

Our Outstanding Service Award was created in 2002 to recognize individuals who have made an outstanding contribution to ground water in Minnesota, particularly those exemplifying MGWA s primary objectives. Dr. Matt Walton was the first recipient. Dr. Pfannkuch is the second.

Dr. Pfannkuch will also be honored with a symposium on his work at the 2005 Geological Society of America Conference in the fall.

MGWA President Laurel Reeves presents the MGWA Outstanding Service Award to Dr. Hans-Olaf Pfannkuch, University of Minnesota. Photo: Sean Hunt.

President s Letter

How time flies! Our Spring Conference on Ground Water Sustainability is nearly a fading memory. Held in conjunction with the North Central Section Geological Society of America's (GSA s) conference, our conference/symposium featured speakers of international, national and local reknown. This conference is reviewed elsewhere in this newsletter; however, I would like to thank the several members who were instrumental through their contribution of ideas and speaker suggestions in preparing for the conference. They are John Wells, Harvey Thorleifson, Sarah Tufford, Chris Elvrum, Jeanette Leete, Jan Falteisek, and Dale Setterholm. Also to be thanked are those who helped the day of the conference. Lanya Ross assisted at the speaker s table. And, thank you to Al Scheer, Terry Lee, Shiela Grow and Mike Convery, all of whom took notes to aide in the conference wrap-up. Speaking of which, I especially would like to thank John Wells not only for his contacts relating to speakers but also for his excellent wrap-up of the conference. If you didn t stay to the end, well, you missed a highlight.

Conference speakers presented many challenges. All these ideas and opportunities can be pretty overwhelming. I left with many, many ideas about things to be accomplished. Only time will tell if any of them are great ideas, the wheat will separate from the chaff. Perhaps this happened to you too. Rather than try to do everything, if each of us selects just one challenge and acts on it, the art and science of ground water sustainability will progress and the conference will not be a faded memory.

Moving on the summer field season is upon us. As you head out into the field, please remember to work safely and take care.

Laurel Reeves, MGWA President

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2005 Newsletter Deadlines

Issue	To Editor
September	08/12/2005
December	11/04/2005

Members in the News

Doug Bergstrom

Doug Bergstrom recently accepted a position to rejoin Braun Intertec, a Minneapolis-based engineering and environmental consulting company with offices in MN, ND, WI, and MI. Doug will manage projects in the areas of brownfield redevelopment, environmental planning, regulatory compliance, environmental review, and environmental management systems. Prior to rejoining Braun Intertec, where he was employed from 1987-1993, he spent five years developing and implementing his firm, Diversified Environmental, performing environmental management system registration audits across the United States (some international), as well as performing environmental consulting services for local clients. Prior to 2000, he worked for seven years at the New Brighton office of Northern Environmental in a variety of capacities performing extensive

NEPA work, as well as a broad range of other consulting services, and spent 11 years with the Minnesota Geological Survey.

Herb Garcia starts Minnesota GeoServices

Last October, my wife Trish and I decided to start a new business. In the past few years my work as a senior geologist at Barr Engineering exposed me to a drilling technology that is well-established in Europe and other parts of the United States, but under-represented in the Midwest. This technology is called either cone penetration testing (CPT), or piezocone penetration testing (CPTU) when combined with an integrated piezometer. Despite our both having rewarding and stable careers, Trish and I were looking for a new challenge, and based on the growth predicted for this service, we decided to purchase a CPT rig and form Minnesota GeoServices.

CPT is similar to geoprobe drilling, although rather than using percussion, the drill string is pushed at a constant rate. The weight of the rig balanced around the drill stem is the reactive force. CPT drilling is very efficient and up to 700 feet can be completed per day. Rugged electronic probes (the cones) transmit data via cabling through the drill stem to a data acquisition system at the surface. This allows in situ soil and water data to be taken continuously throughout the boring without dealing with disturbed samples or soil cuttings. If needed, soil and water samples can be taken to verify the CPT findings.

In addition to the standard cone parameters - pressure on the cone tip, friction on the sleeve of the cone and pore water pressure readings - specialty cones gather additional data, such as conductivity (resistivity), soil gas, laser induced flouresence, pH, redox potential, and numerous other parameters. Video cones are available which show qualitative data such as soil materials, grain size, free-phase contaminants and soil structure. Geophones have been integrated into CPT and CPTU cones, which is a very important development. With an automated energy source at the surface, excellent seismic data can be taken very quickly by advancing the seismic cones through regular depth intervals.

Our CPT truck is a 20-ton tandem axle truck with a heated, air-conditioned drill rig cabin. The cabin houses the equipment, data acquisition systems and work space for the driller and a geologist. The equipment was built by A.P. Van den Berg of Holland, one of the top international manufacturers. Our cones include standard CPTU parameters, seismic and conductivity.

continued on next page

Member News, cont.

To aid determinations of soil materials and facilitate data gathering, we integrate ArcView GIS, the County Well Index and other geologic databases on a laptop in the drill rig. We also have the unique additional ability to rotary drill through thin hard layers such as concrete, gravel or boulders and can take up to approximately 20 feet of rock core samples at up to 80 feet of depth for bedrock characterization. Taken all together, a CPT truck, with rotary drilling and seismic capability is a very powerful tool for in situ site characterization. We are very excited to offer these services to the geologic and engineering community and are willing to donate or discount services for education or research as our schedule permits.

Herb Garcia P.G. is a licensed geologist in Minnesota and has a BA in geology from Macalester College. He has worked in hydrogeology since 1990. Minnesota GeoServices is based in Saint Paul, MN.

Hawaiian Permafrost and Lake Waiau

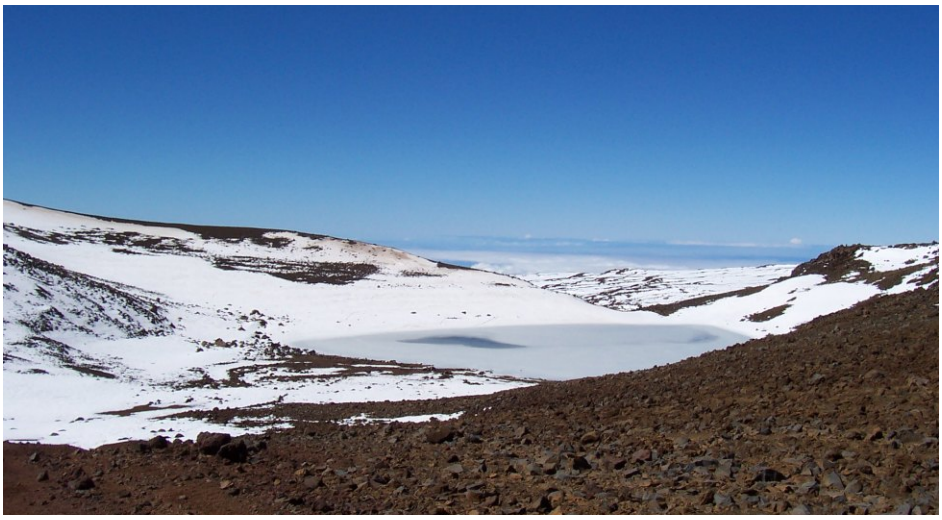
By Ed Schneider, Minnesota Department of Health

Near the top of Mauna Kea, the highest of Hawaii s volcanoes, lies tiny Lake Waiau. The lake, 1.8 acres in area and 10 to 15 feet deep, is rather unremarkable in appearance, but it s very presence has been touted as somewhat of a mystery. The lake exists at an elevation of 13,020 feet, and is one of the world s highest lakes. It exists in spite of relatively low precipitation (less than 15 inches/year) in a land of highly permeable lava and cinder. Why hasn t the lake simply dried up or drained away? I was intrigued by the guidebook claim that this lake is fed by melting permafrost.

In fact, there is permafrost at the highest elevations of this 13,796-foot peak, left over from the end of the last glacial retreat, which in Hawaii was almost 15,000 years ago. However, there appears to be no direct evidence of permafrost at the lake site.

A June 19, 2003 report from the USGS Hawaiian Volcano Observatory suggests other more likely explanations for the existence of the lake have to do with the presence of relatively impermeable ash beds at the base of the Lake Waiau cinder cone, Pu u Waiau. The impermeable ash may have been a product of volcanic eruptions under glacial ice. In addition, precipitation records and geochemical information indicate that the lake is fed entirely by the annual rains and snowfall.

So, perhaps the notion of a permafrost-fed lake in Hawaii is more modern myth than mystery. Whatever the source of the water, the lake and the mountain were sacred to early Hawaiians. Many would make the arduous journey up the mountain to place the piko (umbilical cord) of a newborn baby into the lake, in hopes of bringing strength and good fortune to the child. Aloha.



Lake Waiau, Hawaii. Photograph by Ed Schneider

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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.

MGWA/GSA Ground Water Sustainability Symposium

A Brief Listing of Ground Water Sustainability Speakers on May 19th and 20th

Laurel Reeves (MN DNR Waters), MGWA President, introduced the day s program by using her family history to consider the issue of time. She reminded us that even seven generations is not that long, less than 200 years.

The first three talks by Hans-Olaf Pfannkuch (Univ. of MN), Stephen Ragone (National Water Well Association), and Christopher Lant (Southern Illinois Univ.) focused on systems and the need to consider ground water as part of the larger picture and in relation to the physical, economic, and social systems in which we all live.

Talks by Tom Winter (U.S. Geological Survey), J. Drake Hamilton (Minnesotans for an Energy-Efficient Economy), Maureen Muldoon (Univ. of Wisconsin), and Bruce Brown (Wisconsin Geological and Natural History Survey) considered system workings and details such as the importance of understanding water budgets, and natural and anthropogenic contaminant sources.

Martin Saar (Univ. of MN) challenged us to consider the permeability of very deep basement rocks. The next two talks by Jan Falteisek (MN DNR Waters) and Jean Bahr (Univ. of Wisconsin) showed how chemistry and isotope data could improve understanding of flow systems. Picking up Tom Winter s talk on water balances, the next two talks by Tom Winterstein and Geoff Delin (both with the U.S. Geological Survey) discussed the recharge component by considering recharge in urban areas as well as statewide. Next were two talks on model applications with Ray Wuolo (Barr Engineering) presenting modeling work undertaken to evaluate potential ground-water withdrawal impacts on high-valued surface water and Ken Bradbury (Wisconsin Geological and Natural History Survey) discussing modeling to evaluate regional water-supply options.

Jaroslav Solc (Univ. of North Dakota) and Marios Sophocleous (Kansas Geological Survey) discussed water management challenges and possible solutions in the drier Great Plains states west and southwest of Minnesota.

John Wells (MN Environmental Quality Board) summarized the day s program by noting that with projected climate changes, Minnesota within one hundred years, barely one-half of seven generations, may in some ways be like Kansas is now. (See page 7 for his summary).

The second day of the conference included papers that continued the discussion. Otto Strack (Univ. of MN), Roman Kanivetsky (MN Geological Survey, retired) and Nigel Wattrus (Univ. of MN) presented methods for investigation and analysis of ground water. Madeline Gotkowitz (Univ. of WI - Extension), Heather Adams (Univ. of Akron) and Perry Jones (U.S. Geological Survey) talked on various aspects of grouond water quality study. Ken Harris (MN Geological Survey), Jim Berg (MN DNR Waters) and Tom Reppe (U.S. Geological Survey) addressed the extensive work being conducted in and around the Fargo-Moorhead area. Jow Loughry (Aquifer Science and Technology) closed the second day with a presentation on the response of a regional aquifer system to prolonged over-pumping.

¾ *Jan Falteisek, Newsletter Team*

John Mann Mentor Program in Hydrogeology Proves Popular at MGWA/GSA Meeting

Offer a group of hydrogeology students free pizza and a chance to talk one-on-one to ground water professionals and you get a successful program for all involved. About 20 students and seven professionals representing the public and private sectors met after the technical sessions at the GSA North-Central Section meeting for a couple of hours of socializing and information sharing. Students had a chance to ask questions of the mentors about their careers and the types of work they do. Although the mentors were all from Minnesota, the students represented a diverse geographic spread throughout the north-central states, including graduates and undergraduates from public and private schools.

North-Central GSA By The Numbers

May 19-20, 2005
Minneapolis, MN

Total Registered Attendees:	917
Oral Technical Sessions:	28
Poster Technical Sessions:	17
Field Trips:	9
Oral Presentations:	245
Poster Presentations:	269
Volunteers:	many
Stage change, Mississippi River, St. Paul, May 19-20:	0.5 ft
Discharge change Mississippi River, St. Paul, May 19-20:	4000cfs

North Central GSA Field Trips, May 14 22, 2005

The GSA conference included nine field trips that occurred before and after the conference (photos on page 6). The Sinkhole Anatomy 101 trip involved digging out a sinkhole in southeast Minnesota near Spring Valley. Todd Petersen of Minnesota Department of Natural Resources reported that the Sinkhole Anatomy participants were thoroughly drenched before getting to the bottom of things. It was a wonderful object lesson to walk through Spring Valley Caverns with water dripping profusely through the ceiling.

The two-day field trip focusing on Wisconsinan and Pre-Wisconsinan Glacial Stratigraphy also got a little wet. Yet weather couldn't put a damper on the spirited debate over topics such as glacial ablation, interstadials and landform genesis. Many geomorphic process concepts were expertly presented by Kent Syverson, University of Wisconsin-Eau Claire, Mark Johnson, University of Goteborg, and Steve Kostka, University of Wisconsin-Madison. We explored gravel pits exposing the St. Croix Moraine and the Chippewa Moraine as well as ice-walled lake plains, tunnel channels, eskers and pitted glacial outwash plains.

Back at the hotel, Minnesota Geological Survey Quaternary geologist, Howard Hobbs, gave several rousing renditions of hot tunes and parodies of glacial dimensions. Many Friends of the Pleistocene joined in with the choruses lubricated by malt libations.

A Gallery of Ground Water Sustainability Symposium Speakers

photos by Sean Hunt

Tom Winter, U.S. Geological Survey

Jaroslav Solc, University of North Dakota

Jan Falteisek, Minnesota Department of Natural Resources

Christopher Lant, Southern Illinois University

Maureen Muldoon, University of Wisconsin - Oshkosh

Marios Sophocleous, Kansas Geological Survey

J. Drake Hamilton, Minnesotans for an Energy-Efficient Environment

Geoff Delin, US Geological Survey

Kenneth Bradbury, Wisconsin Geological and Natural History Survey

North Central GSA Field Trip Photographs

Except where noted, photos by Kurt Schroeder, MPCA

Geoscientists discuss the development of tunnel channels in the St. Croix Moraine, Polk County, WI

Howard Hobbs, Quaternary Geologist, Minnesota Geological Survey, in his element

Kent Syverson, University of Wisconsin-Eau Claire, (red helmet) explains a glacial exposure in a gravel pit at the Emerald Phase ice margin, St. Croix Co. WI

During the Sinkhole 101 field trip, an attempt was made to dig out a sinkhole in hopes of finding the entrance to a cave.
Photo by Todd Petersen, MN DNR Waters

Kate Pound, St. Cloud State University, examines coarse material attributed to the Illinoian glaciation in a gravel pit, St. Croix Co. WI

Thoughts on the MGWA Ground Water Sustainability Symposium

John Wells, Minnesota Environmental Quality Board

By all accounts, the spring conference of the Minnesota Ground Water Association was a great success. Held as a symposium within the annual conference of the North Central Section of the Geological Society of America, the Ground Water Symposium attracted in the neighborhood of 350 participants. Even at day's end, well past 5 p.m. and after 16 thought-provoking presentations, as many as 200 people patiently stuck around to hear my closing summation. That is dedication!

MGWA President, Laurel Reeves, opened the symposium with a photo collage of her family's last six generations (with more to come, of course), to make the point that ground water sustainability too should consider the effects of decisions on at least the next seven generations. As her grandfather used to say, look beyond the ornament on the hood, look down the road.

Opening and keynote speaker, Hans-Olaf Pfannkuch, reviewed the various definitions of 'sustainable development', noting that while some are useful, most remain quite vague. The most widely accepted definition, coined by the United Nations Brundtland Commission, defines sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." Dr. Pfannkuch pointed out that the idea has been debated for decades in the ground water profession, beginning with the concept of 'safe yield', which looks at stocks and tries to maintain certain ground water levels. But, as Olaf and others later stated, safe yield fails to consider the levels needed for nature, as well as people.

That thought brings me back to the idea that sustainable development attempts to unify how we address nature, social needs and the economy. People have come up with a number of ways to show these relationships. The Nature Conservancy, for example, has used the three-legged stool to illustrate the inter-connectedness of the three sectors. Pull out one leg and the stool collapses, or more to the point, the person (or, perhaps, humanity?) sitting on it gets unceremoniously dumped. Just ask Dr. Pfannkuch.

Dr. Pfannkuch also cited the need to provide context and adopt quantifiable approaches to defining the concept of sustainable development. Renowned ecological economist, Herman Daly, for example, describes the use of a renewable resource as sustainable if used at a rate less than that at which the resource is renewed. Think about how you might translate that definition to ground water after factoring in its environmental, social and economic elements!

Working with a Governor's Round Table on Sustainable Development in the mid- to late-90s, we at the Environmental Quality Board took a shot at defining 'sustainable development'. We put it simply, because it too easy to throw your arms in the air and call it indefinable. We see it as:

- Thinking & acting as if the long-term future mattered
- Recognizing how things connect
- Living within our means
- Taking creative approaches to issues

At the risk of oversimplification, let's see how the symposium speakers filled in the blanks of this definition.

Thinking & acting as if the long-term future mattered

Taking the first bullet first ¾ thinking and acting as if the long term future mattered, who spoke about the future as if it mattered? Well, at some level, everyone did, of course. But a couple of speakers made points that really hit home for me.

First, Dr Pfannkuch, again. Olaf mentioned the concept of the half-life rate of degradation in the context of use of the earth finite resources. Estimates of the earth's resources' half life range from a mere 20 to over 700 years, depending upon whether one assumes resource use at a rate of 3.5 % annually, or something less. What a wake up call about the future!

J. Drake Hamilton also brought us a wake up call in her review of the science of global climate change and its implications for ground water. She termed climate change "maybe THE most pressing environmental & economic problem facing society today." What's likely in store for Minnesota? Minnesota winters will become more like those of Chicago, with summers something like Kansas or Oklahoma. Such changes will result in increased demands for ground water, increases in the rates of evapotranspiration and lower aquifer recharge rates.

If we really were thinking and acting as if the long term future mattered, wouldn't we be taking a few more steps to address the issue? Hamilton suggests the prudent thing to do would be to buy "insurance" like we do for our cars and houses to mitigate against the risk we know exists. One small beginning step in our field would be to consider the impact of global climate change in every plan we develop for managing ground water.

Recognizing how things connect

Steve Ragone, National Ground Water Association Science & Technology director, was the first of many speakers to make the point that ground water and surface water are one. He also suggested a number of things that decision-makers must know about ground water, including the importance of scale, interbasin transfer, virtual water, water re-use, valuing water properly, and balancing the common good with commodity value. Based on this and other factors, he challenged hydrologists to help people:

- Understand ground water systems and how nature and people affect them
- Understand tradeoffs of ground water extractions, and mitigation needed
- Get informed

Laurel introduced Chris Lant, professor of ecological economics at Southern Illinois University and editor of

Ground Water Symposium, cont.

Water Resources Update, the journal of the Universities Council on Water Resources with a quote from Gaylord Nelson. Nelson, a former U.S. Senator from Wisconsin and founder of Earth Day, once remarked that "The economy is the wholly owned subsidiary of the environment." Chris discussed how a nerdy ecological economist approaches the interconnections of environment, society and community.

First, think of water as natural capital that delivers inputs to the production of ecosystem services, as well as the traditional production of marketable commodities. Then consider how society might invest in this capital. With its way of viewing ecosystems, ecological economics can help reform how we manage water by showing how incentives might be changed to provide better services.

Chris illustrated the concept with a discussion showing how farmer payments under the Conservation Reserve Program brought lasting returns to society by nurturing ecosystems. In contrast, crop support payments encouraged over production of commodities and the environmental damage that typically follows. If Congress were to put the bulk of its subsidies into CRP instead of crop supports, major benefits would follow to water resources and society.

Speakers Maureen Muldoon, Bruce Brown and Jean Bahr described other key water-related interconnections. Muldoon described a barnyard study tracking movement and the effects of best management practices on nitrate contamination in Wisconsin karst terrain. The connection between land use and water quality is clear, except that it can be difficult to track contaminant flows through systems of cracks and fissures (as she found out). Nevertheless, she concludes without hesitation that pollution is the most significant challenge to ground water sustainability in karst regions.

Brown described a land use connection in which the lowering of ground water levels due to pumping led to the oxidation of arsenic-rich minerals and the release of extraordinarily high levels of arsenic. So, water use can seriously affect the quality of ground water. His other lesson for us was that in this case, with a lot of cooperation by well drillers, GIS technicians and state staff, it is possible to bring science and technology to citizens at the local level.

Jean Bahr presented her work on protecting springs during the siting of high capacity wells under the new Wisconsin law. The troubling concern she noted with Wisconsin ground water laws, however, is the continuing allowance of multi-aquifer wells that can bring the contaminants of ground waters closely linked to the land surface down to the deepest, most protected aquifers.

Tom Winterstein described his efforts to show the relationship between impervious surfaces and ground water recharge, but the jury is out on the exact significance given the data he had to work with.

Living within our means

"Living within our means" means a lot more than just living within our economic budget. It also means living within our social and ecological 'budgets'. In this regard, Chris Lant made us stop and think when he told us about a couple of sayings he has posted on his office door:

"Communism collapsed because prices within it didn't reflect economic reality. Will capitalism collapse because prices within it don't reflect ecosystem reality?"

Defining the water budget must be the starting point for water professionals concerned about "living within our means". And it is easier said than done. Tom Winter brought that home with the conclusion that in hydrology, we rarely know the true number of anything.

Winter described the uncertainties in each aspect of the water budget, from precipitation (where gauge density makes a big difference in precipitation estimates) to evapotranspiration (where we're lucky to get within plus or minus 10%) to ground water (where it is tough even to define the physical boundaries of an aquifer, and where hydraulic conductivity may exhibit up to four orders of magnitude of variability). The key, Winter asserts, is to make certain that the water-budget end user understands the uncertainty involved. "A water budget is a progress report that needs continuous updating as new information about the system becomes available".

Several speakers described progress in understanding or estimating various elements of the water budget. Martin Saar presented a method of approximating the depth dependence of permeability across multiple geologic units. Jan Falteisek discussed Minnesota DNR efforts to map regional flow systems using tracers as part of the County Geologic Atlas and Regional Hydrogeologic Assessment series of publications. The work is important to help water managers understand aquifer systems and potential constraints and to develop long-term (i.e., sustainable) management strategies. Geoff Delin discussed his work comparing regional and local-scale estimates of recharge to unconfined sand and gravel aquifers in Minnesota. Recharge rates using four methods were highly variable across the state, ranging from less than 5 cm/yr in the northwest to greater than 20 cm/yr in sand-plain areas. Recharge rates generally seemed to represent 16-35 percent of average annual precipitation.

Ray Wuolo reported on his team's work for the City of Woodbury, which hopes to develop a number of high capacity wells to meet the increasing demands for water as it grows. Ray challenge was to see if this could be done without adversely affecting area trout streams. He found that the rate of recharge was most important in the long-term ability of the aquifer system to supply ground water for water supplies and base flows, but the work continues to determine whether ground water level fluctuations are more due to climatological variations in recharge or the effects of pumping of new wells. One interesting finding was that local recharge affects deep aquifers, as well as surficial ones. His other take home message was that conservative assumptions can actually be wrong.

Taking creative approaches to issues

While Ken Bradbury, Jaroslav Solc and Marios Sophocleous spoke about a number of "living within our

Web Page Volunteer?

We d like our web page to be more attractive, but our current efforts need to be directed more to content than appearance until we can find some additional help. Please contact the editor at newsletter@mgwa.org if you would be willing to assist with this project.

Ground Water Symposium, cont.

means" issues, they also enlightened us with their stories and their passionate, creative perspectives about sustainability issues. Yes, Bradbury pointed out how heavy ground water use along the west coast of Lake Michigan was actually shifting the location of the ground water divide. His blunt conclusion is that current rates of pumping are simply not sustainable (with drawdowns of 800 feet how could they be?). But, he gave many of us a new perspective when he compared the depth of wells (many municipal wells in this area run to depths of 2,200 feet) to the height of urban skyscrapers. The wells usually far surpass their surface counterparts in length. His frustrations? poor water use records and rates of pumping that are increasing faster than population growth.

Jaroslav Solc discussed the Devils Lake, North Dakota dilemma where he found that decisions based only on available modern-day records were insufficient for long-term planning, often resulting in costly errors. His conclusion? Without a profound change in attitude toward water resources, long-term periods of drought will limit socioeconomic development in the region and may threaten even the sustainability of current conditions. In other words, Fargo's days may be limited! His take home was in asking if hydrologists are speaking clearly enough to get the message through to planners. "Are we good ambassadors of our science?"

Marios Sophocleous noted that the Kansas 'safe yield' rules (involving pumping the natural recharge) lead to degradation of streams, wetlands and their water-dependent ecosystems. In other words, safe yield isn't safe. In response, Marios calls for people and society to adopt the precautionary principle even as we strive to make our uses of water more efficient and productive. His advice for us in Minnesota as we face our own 'sustainability challenge' is to adopt the goal of long-term sustainable use, practice adaptive management, seek accurate information on recharge and discharge, and respect ecosystem needs. In other words, be more hydro-ecologic.

Finally, a thought of my own as the guy asked to sum it all up. While it is hard to argue that sustainable development doesn't need better definition, we might look at the task this way. 'Justice' is a concept we all feel is pretty well defined. Yet, try writing down a concrete definition in 21 words or less, as we expect of ourselves with sustainable development. It isn't easy. What's more important is to take a lesson from how society treats the concept of justice. It established and continuously refines a system of laws, enforcement personnel and courts to administer thousands of ground rules and judge their application to specific circumstances. Sustainable development requires something similar. And that's the challenge we face in coming years.

The symposium gave us a robust start at this conversation about the future. Let's find a way to build on it!

Past Issues of Newsletter Available

All the past issues of the MGWA Newsletter going back to the beginning in 1982 have been scanned using Optical Character Recognition (OCR) and indexed. Individual newsletters in PDF format are available anytime on the MGWA web site. A bibliography of article titles and authors is there to facilitate searching for articles of interest.

The text inside each PDF file can be searched. The OCR text of the articles is included in a layer below the image of the newsletter pages.

The complete set of files and a searchable master index of article text for 1982 to 2004 issues is also available on a CD-ROM by mail for $15 for members and $40 for non-members.

Send your order to the MGWA office address or order online.

EQB Water Priorities Report Available On-line

The Biennial Report of the Minnesota Environmental Quality Board, *Protecting Minnesota Waters: Priorities for the 2005-2007 Biennium* is available on-line from the EQB s website at: www.eqb.state.mn.us/pdf/WaterPriorities2005-07.pdf

In addition to describing Pilot Projects and Milestones of the Governor s Clean Water Initiative, the report includes sections on impaired waters, the sustainability of the Twin Cities Metropolitan Area water supply, and recommendations for the 2005-2007 biennium.

Children s Water Festival Website is Updated

The website for the ever-popular Metro Children s Water Festival held each fall has been updated and is available for viewing at:

www.co.carver.mn.us/Divisions/LandWaterServices/EnviroServices/CWF/

The next Festival will be September 28th at the State Fairgrounds in St. Paul.

MGWA Foundation News

The MGWA Foundation has awarded 3 grants in the past few months.

The Metro Children s Water Festival was awarded $1,000. The Festival is a hands-on opportunity for children to receive education on the water cycle, ground water systems, water treatment, water conservation and other water-related issues. The UW River Falls Geology Department was awarded $700 for a field trip to study the geology of Kentucky, Tennessee, Alabama, Georgia, and Florida. They visited Mammoth Cave to study the development of karst features and visited the highly decorated Rickwood Caverns in Alabama. In Florida the students studied the Floridan Aquifer and visited Wakulla Springs (250 to 330 million gallons per day). DNR Waters was awarded $900 for the purchase of color GPS kits for Project Wet to loan out so that teachers and youth leaders can take students earthcaching (see www.earthcache.org)

In the efforts of the Foundation to increase its long-term sustainability, funds in the endowment were transferred to higher interest accounts. In addition, new sources of funds as well as new opportunities to award funds continue to be sought.

Question of the Quarter Answered

The Question of the Quarter is a continuing feature in our newsletter. Each quarter a different question is posed and all members are invited to respond. See below for the anwer to the question we posed last quarter:

When did the last permafrost disappear from Minnesota?

Answer:
A) It's still here
B) 130 - 170 years BP
C) 9,000 - 11,000 years BP
D) 13,000 - 15,000 years BP

Although there is precious little visible geologic evidence of permafrost in Minnesota today, the correct answers would be B or C.

Herb Wright, University of Minnesota-Emeritus Professor of Geology, writes: Frozen peat in July has been reported numerous times from northern Minnesota, but extensive studies in many peatlands in the north have never demonstrated the modern existence of permafrost. Permafrost was confined to a narrow band adjacent to the last ice sheet, and it probably disappeared as the ice sheet retreated with the warming climate about 10-12 thousand years ago. The southern limit of discontinuous permafrost today is well to the north in Canada.

It is generally thought that the glaciers completed their retreat from Minnesota between 9900 and 9500 years BP. A map from US Department of Agriculture s Southern Forest Resource Assessment (2004) shows the extent of the Laurentide Ice Sheet cerca 9500 years BP on page 594, www.srs.fs.usda.gov/sustain/report/pdf/chapter_24e.pdf. The map shows the ice margins at the northeastern border of Minnesota along Lake Superior.

The following link points to an article that includes a thought-provoking model of glacial retreat and the formation and disintegration of permafrost around the ice margins in the upper Midwest. Based on this model, one can readily conclude that continuous permafrost was present in Minnesota until circa 9900 years BP. www.geology.wisc.edu/~davem/abstracts/04-5.pdf

But what about isolated permafrost events in Minnesota?

The following piece from someone at Carleton U-Ottawa discusses criteria for permafrost with -1 deg C as the mean annual temperature required for discontinuous permafrost (see www.carleton.ca/~msmith2/permafrost_zones.htm).

In an article by J. Overpeck et. al. (www.geo.umass.edu/faclty/bradley/ overpeck1997.pdf), the reconstructed temperature record for the station at Churchill, Manitoba, indicates pronounced cold snaps in the early 1840 s and in the 1860 s. These temperature dips apparently coincided with the coldest annual mean temperature for Saint Paul which was recorded in 1843 at 38. 2 deg F!

The current climate record for International Falls shows an 8 deg F mean annual difference from St. Paul with St. Paul at 44.5 deg F annual mean temperature. So it is conceivable that the ground froze for 40 months or more in isolated depressions in the 1840 s. This may have recurred in the period of 1866 - 1868 when the coldest span of three years occurred preceded by seven years of below normal temperatures. The mean annual temperature was only 40.3 deg F in St. Paul during that period which would translate to approximately 32 deg F in International Falls. Some refer to this period as the end of the Little Ice Age.

Let s hope we don t see any extreme years like those in our lifetimes.

¾ *Kurt Schroeder, MGWA Newsteam.*

2005 Environmental Initiative Awards

The new Big Back Yard exhibit at the Science Museum of Minnesota (SMM) was a finalist in this year s Environmental Initiative Awards in the Environmental Education category, organized by the Minnesota Environmental Initiative (www.mn-ei.org). MGWA is partnering with the SMM and others to install a well (see March 2005 newsletter issue) as part of a ground-water display. The ground water display will be part of SMM s recently opened 1.75-acre outdoor science park (www.smm.org/bigbackyard). The 2005 award went to Minnesota: A History of the Land the four-part television series that was shown on public television this spring. The Environmental Initiative Awards recognize partnerships that develop solutions to Minnesota s environmental problems.

Environmental Monitoring at the Minnesota Pollution Control Agency

The MPCA has recently updated information about several of its Environmental Monitoring programs. A general website including references to monitoring summaries, assessments and fact sheets; monitoring reports and requests for data; monitoring guidance and sampling procedures; and quality assurance/quality control can be found at:

www.pca.state.mn.us/monitoring/index.html

In addition, a specific webpage describing the MPCA s new initiative in ground water monitoring and assessment may be accessed at:

www.pca.state.mn.us/water/groundwater/index.html

and clicking on Ambient Ground Water Monitoring and Assessment.

Groundwater Gods: Hydromythology at Camp Coldwater

By Greg A. Brick
Adjunct Instructor in Geology, Normandale College

In my years at environmental consulting firms I occasionally heard beleaguered co-workers make references to the groundwater gods little-understood beings, apparently, who could make or break a groundwater investigation. But do gods really inhabit Minnesota ground water? Other cultures have thought so.

USGS hydrologist William Back (1981) wrote a valuable article, Hydromythology and Ethnohydrology in the New World, in which he described Native American water myths, as in Mesoamerica, where there were whole cultures like the Maya that depended on groundwater resources. Nearer to Minnesota, Back mentioned Hiawatha, the best-known cultural hero north of Mexico, who had some aquatic associations. Ever since Longfellow s famous poem, *The Song of Hiawatha* (1855), Hiawatha has had a strong association with Minnehaha Falls in Minneapolis, but it should be noted that he was actually Iroquois in origin, lived in pre-Columbian times (circa 1450), and belongs more properly to New York State (Howard, 1971). A genuine Minnesota example of hydromythology not discussed by Back, however, involves the Unktehi of the Dakota Indians.

The first I ever heard of Unktehi (there are *many* variant spellings of this word, sometimes singular, sometimes plural) was in the last days of the four-decades-long Highway 55 (Hiawatha Avenue) Re-Route war in Minneapolis, upon which I did a little pro bono consulting in the late 1990s. Many of you in the groundwater consulting community are aware of this episode. The reconstruction of the highway along the west side of Minnehaha Park was opposed by Native Americans, among others, on a number of grounds, such as that it would entail the removal of sacred oaks, and that it would reduce the flow of the historic spring at nearby Camp Coldwater, on the former Bureau of Mines property.

According to White & Lindberg (2001), Camp Coldwater was the first settlement of European-Americans in Minnesota that was not primarily a fur trading post, fort, or mission . The site was the location of many firsts in Minnesota history, a good reason to call it the birthplace of Minnesota. Camp Coldwater was also called Minnesota s Plymouth Rock. The spring, issuing from the Platteville Limestone at 60 gallons per minute, supplied early Fort Snelling with cold drinking water a welcome alternative to the warm, muddy waters of the Mississippi River.

The Reverend Gary Cavender filed an affidavit in the Re-Route case, dated October 13, 1998. Identifying himself as the spiritual leader of the Prior Lake Shakopee Dakota band, he went on to say:

> *The Camp Coldwater spring is a sacred spring. Its flow should not be stopped or disturbed. If the flow is disturbed, it cannot be restored. Also, if its source is disturbed, that disturbs the whole cycle or the flow. The spring is the dwelling place of the undergods and is near the center of the Earth. The spring is part of the cycle of life. The underground stream from the spring to the Mississippi River must remain open to allow the gods to enter the river through the passageway. The spring is the site of our creation myth (or Garden of Eden) and the beginning of Indian existence on Earth. Our underwater god (Unektehs) lives in the spring. The sacredness of the spring is evident by the fact that it never freezes over, and it is always possible to see activity under the surface of the water.*

I began delving into the literature about Unktehi, and eventually accumulated a file an inch thick on this recondite topic, yet I still hadn t exhausted all the references. Included below are brief excerpts regarding Unktehi and his role as a water god.

Eastman (1849) wrote that Unktehi, the god of the waters, is much reverenced by the Dahcotahs. Morgan s bluff [present site of the V.A. Hospital], near Fort Snelling, is called God s house by the Dahcotahs; they say it is the residence of Unktehi, and under the hill is a subterranean passage, through which they say the water-god passes when he enters the St. Peter s [Minnesota River]. He is said to be as large as a white man s house.

Unktehi is credited with creating the Earth and

¾ *continued on next page.*

Ground Water History, cont.

human beings. The prolific Minnesota historian, Neill (1882), recounting what anthropologists would now call an earth-diver myth from Dakota cosmogony, wrote that:

> *The Jupiter Maximus of the Dahkotahs is styled Oanktayhee . He is said to have created the earth. Assembling in grand conclave all of the aquatic tribes, he ordered them to bring up dirt from beneath the water, and proclaimed death to the disobedient . It is the belief of the Dahkotahs that the Rev. R. Hopkins, who was drowned at Traverse des Sioux, on July 4th, 1851, was killed by Oanktayhee, who dwells in the waters, because he had preached against him.*

The Pond brothers, Samuel and Gideon, were early missionaries in the Fort Snelling area, arriving in 1834. Gideon Pond (1889) stated that the bubbling springs of water are called the breathing places of the wakan. (*Wakan*, as a noun, means god.) Pond s statement was much quoted as an allusion to the Camp Coldwater spring during the Re-Route controversy. Pond goes on to say of Unktehi that though destitute of the trident, the horse and the dolphin, yet, because he rules in the watery worlds it may not be out of place to denominate him the Neptune of the Dakotas. He adds One of these gods, it is believed, dwells under the Falls of Saint Anthony, in a den of awful dimensions, and which is constructed of iron.

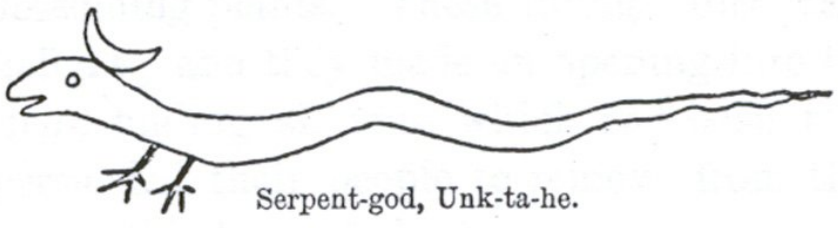
Unktehi was often visualized as a fish or serpent see the depiction of Unktehi included with this column, from Emerson s *Indian Myths* (1884). This imagery was exploited during Major Stephen Long s expedition to the Rocky Mountains in 1820, which was meant to consolidate the gains of Lewis and Clark. Long s Peak is named after him. The steamboat in which Long ascended the Missouri River was officially named the *Western Engineer* but was dubbed Long s Dragon because it was made to look like a huge water snake, belching smoke from its mouth. The goal was to overawe the Indians along the river, a sort of primitive psychological warfare (Dillon, 1967).

But Unktehi had another, very different physical manifestation. In writing of the religion of the Dakota Indians, Samuel Pond (1908) said:

> *Their chief object of worship was Unkteri, the mammoth, though they had many erroneous opinions concerning that extinct species of elephant, and did not know that the race was extinct . They described the species as resembling the buffalo or ox, but of enormous size. As they worshipped many other animals, it was natural that the mammoth, which so much exceeded the others in size, should be adopted as their chief god. To his worship their most solemn religious festivals were dedicated. They supposed that the race was still in existence, and, as they were not seen on land and their bones were found in low and wet places, they concluded that their dwelling was in the water. Their bones were highly prized for magical powers, and were perhaps as valuable to them as relics of a saint are to a devout Catholic. A Dakota told me that he had discovered some of the fossil bones in the lake opposite Shakopee, but was unable to raise them without some boat larger than a canoe.*

Other accounts, it should be noted, state that the god was based on a mastodon, rather than a mammoth the bones of both have been found in Minnesota: The fossil remains of the mastodon, Gideon Pond (1889) wrote, are confidently believed to be the bones of the Onktehi which have been killed by the Wakinyan [thunderbird]. In the United States as a whole, the classic example of low and wet places where such behemoths have been found aplenty is Big Bone Lick in Kentucky, where there are saline springs long used by them as salt licks (Semonin, 2000). It s interesting to note that similar beliefs prevailed in other cultures. The very name mammoth, for example, derives from the Tartar *Mamantu* or ground dweller because the animal occurs in the frozen ground of Siberia, where it was thought to live like a giant mole (Charlesworth, 1957).

Although the Camp Coldwater spring is the most commonly mentioned local haunt of Unktehi nowadays, he is also associated with Carver s Cave, in St. Paul. Cavender, quoted above, was warned by his grandfather never to go deep into Carver s Cave, because Unktehi resides in the lake that fills that cave (The 106 Group Ltd., 2003). Dorsey (1894) presents much additional lore concerning Unktehi.



Serpent-god, Unk-ta-he.

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Perfluorochemicals in Minnesota Ground Water an Emerging Issue?

By Jim Kelly and Ginny Yingling, MDH

Perfluorochemicals (PFCs) have been used for decades to make products that resist heat, oil, stains, grease and water. Common uses include nonstick cookware, stain-resistant carpet and fabric treatments, as components of fire-fighting foam, and other industrial applications. PFCs are used both as an ingredient in the manufacturing process as well as in some finished products.

PFCs are man-made chemicals, and do not occur naturally. Minnesota is one of the few states in the country where these chemicals were made for industrial and consumer use. The 3M Company made PFCs at its Cottage Grove facility from the late 1940 s until 2002.

Two of the chemicals in the PFC group are perfluorooctane sulfonate (PFOS; $C_8F_{17}SO_3$) and perfluorooctanoic acid (PFOA; $C_8F_{15}O_2H$). The chemical structures of PFOS and PFOA (primarily the strength of the carbon-fluorine bond) make them extremely resistant to breakdown in the environment. While PFOS and PFOA are just two chemicals in this large class of compounds, they have been the focus of much of the research due to potential toxicity.

PFCs are very stable chemicals that do not change or break down in the environment. The few studies available regarding the environmental transport and fate of PFCs indicate that they easily enter ground water and move long distances. Some experts suggest that PFCs in air can also travel long distances, deposit on soil and leach into ground water a mechanism that may have caused ground water contamination across the Ohio River from a DuPont plant in West Virginia.

3M s long history of producing PFCs at their Cottage Grove facility resulted in contamination of soil and ground water at the site. Investigations have shown high concentrations of PFCs in ground water in some areas of the facility, primarily near disposal sites. Ground water flow at the facility is controlled by the pumping of multiple production wells, although shallow ground water systems that are contaminated with PFCs likely discharge to the adjacent Mississippi River. Sampling of the nearest private wells to the east and west of the facility has not detected any contamination.

Wastes from the Cottage Grove production process were placed in several disposal sites, primarily in the metro area. The presence of PFCs has been confirmed in ground water extraction systems in place at the 3M-Oakdale Dump Superfund site in Oakdale, the former Washington County Landfill in Lake Elmo, and the 3M-Woodbury disposal site in Woodbury. Staff from the Minnesota Pollution Control Agency (MPCA) and Minnesota Department of Health (MDH) are currently investigating potential releases from these disposal sites, and evaluating nearby public and private wells.

The PFC family of chemicals is relatively new and there are few studies of health effects in people. In animal studies, high concentrations of PFCs harm the liver and other organs. High concentrations of PFOA over a long period of time also cause cancer in animals. Developmental problems have been seen in the offspring of rats exposed to PFCs while pregnant. Studies by 3M of workers exposed to PFOS and PFOA during manufacturing show no apparent impact on their health. There is no similar health study information for the general population.

Because PFCs are known to be in the environment in Minnesota, the MDH developed drinking water criteria, known as Health Based Values (HBVs), for PFOA and PFOS. The HBV for PFOA is 7 parts per billion (ppb) and the HBV for PFOS is 1 ppb. These criteria are the levels that MDH currently considers safe for long-term human consumption.

MDH staff have sampled numerous public and private water supplies in the east Metro area as a part of the investigation of PFC disposal sites. Working with the MPCA, MDH staff have sampled a total of 173 private wells in the City of Lake Elmo as part of this investigation, with 63 wells showing low levels of PFCs. Previous sampling has shown the presence of PFCs in six of seven active Oakdale municipal water supply wells, and in one private well in Oakdale. Public and private wells in Cottage Grove, Hastings, and Woodbury have so far shown no signs of PFC contamination.

The MDH and the MPCA staff are closely examining the Lake Elmo sample results to determine if a pattern exists based on well locations and depth. The full impact of the PFC contamination is not yet clear and additional well sampling in the area was completed in May 2005. Investigations of the various PFC disposal sites are also underway by the MPCA.

Information on PFCs, including the investigation of PFC release sites and contamination in private and public wells can be found on the MDH web site at www.health.state.mn.us/divs/eh/hazardous/index.html.

New Special Well Construction Area Designated

CMC Heartland Lite Yard Site Minneapolis, Hennepin County

By Well Management Section
Minnesota Department of Health

The Minnesota Department of Health (MDH) has designated a SPECIAL WELL CONSTRUCTION AREA that includes a portion of the City of Minneapolis, Hennepin County, as shown on the accompanying map. The Special Well Construction Area became effective on April 1, 2005, and remains in effect until further notice.

The location of the Special Well Construction Area includes the area bounded by East 26th Street on the north, 26th Avenue on the east, Lake Street on the south, and Bloomington Avenue on the west. This area includes the southeast quartile of Section 35 and the southwest quartile of Section 36 of Township 29, Range 24, Hennepin County (see Figure 1).

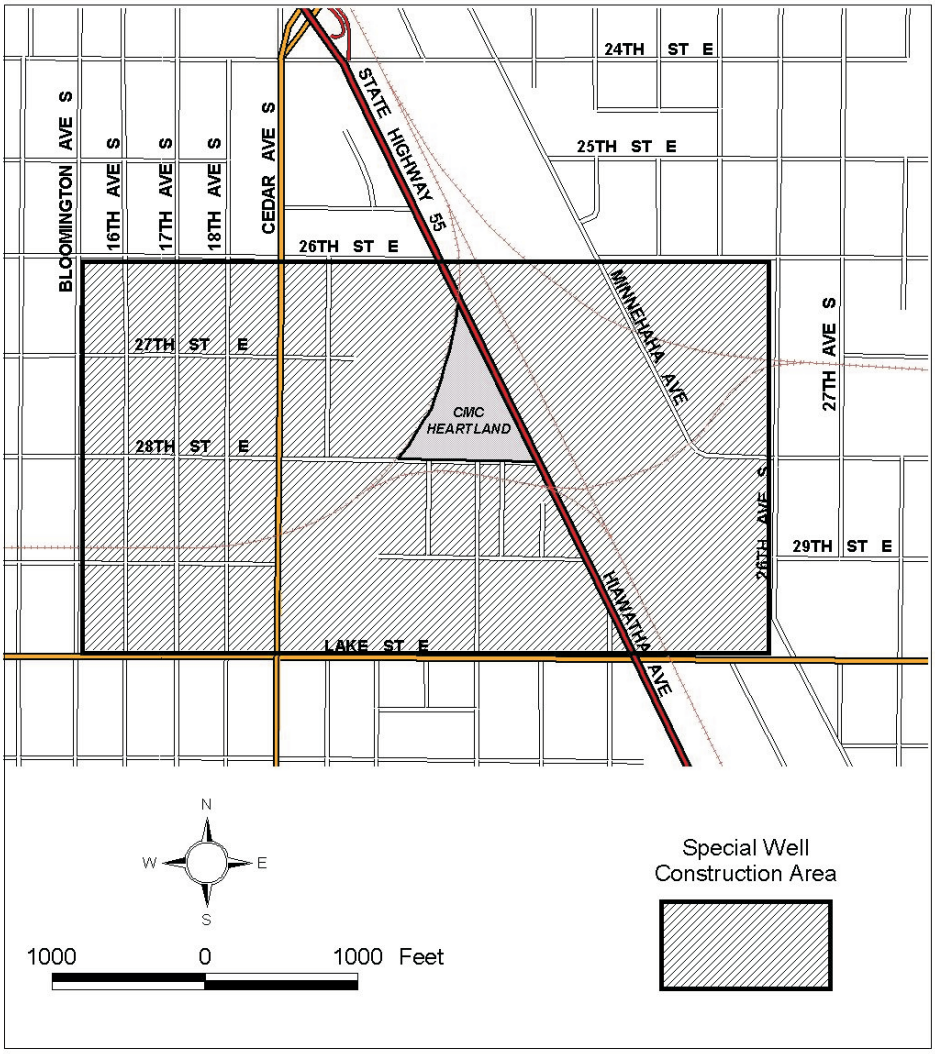
Groundwater in portions of the designated area has been contaminated as a result of historic operations of Reade Manufacturing Company, which manufactured and packaged arsenical pesticides during 1938-63. U.S. Borax also stored sodium arsenate at the site during 1963-68. The site is currently vacant and is owned by CMC Heartland. The site is now officially referred to as the CMC Heartland Lite Yard Site.

Area geology consists of coarse-grained terrace deposits, typically 18-30 feet deep, underlain by 25-30 feet of glacial till. The uppermost bedrock under the site is the Platteville Limestone, although the southwestern corner of the site in underlain by a north-south trending bedrock valley, where the St. Peter Sandstone is present at a depth of 95 feet. Remnants of Decorah Shale may also be present above the Platteville Limestone, but it is not continuous. Groundwater flow in the unconsolidated deposits is to the west-southwest. Flow in the St. Peter Sandstone is to the northeast and appears to be controlled by the Mississippi River.

Contamination has been found in the unconsolidated deposits. Arsenic concentrations in the groundwater at the site have been measured as high as 320,000 micrograms/liter. For comparison, the U.S. Environmental Protection Agency (U.S. EPA) has established a Maximum Contaminant Level of 10 micrograms/liter for public water supplies. A plume of arsenic-contaminated water extends approximately 1500 feet southwest of the site and has dimensions of 1800 feet in length by 600-800 feet in width.

There are concerns for using groundwater in this area for any consumptive uses or other uses involving human contact, including drinking, cooking, bathing, manufacturing, or processing food, drink, or pharmaceuticals or to supply water to plumbing fixtures accessible to humans. Even uses involving incidental contact or consumption by humans or animals, such as garden/lawn irrigation, filling swimming pools, and similar uses must be avoided.

Figure 1. Special Well Construction Area
CMC Heartland Lite Yard Site



The City of Minneapolis, the Minnesota Department of Agriculture (MDA), MDH, and the U.S. EPA have been working to remediate the site and surrounding properties impacted by air-borne deposition of dust from the site. In the fall of 2004, MDA excavated the “hot spot” on the site down to a depth of 27 feet, removing 18,000 cubic yards of heavily-contaminated soil. Additional site excavation and soil replacement is planned during 2005 to ensure that there is four feet of clean soil covering the site. In addition, contaminated soils from 29 properties in the surrounding neighborhood were excavated and replaced with clean soil in 2004. Additional soil sampling and cleanup is anticipated over the next few years.

— continued on next page

CMC Heartland Lite Special Well Construction Area, cont.

The City of Minneapolis regulates water supply wells and monitoring wells, while MDH regulates dewatering wells. Within the designated area, wells cannot be constructed, modified, or sealed until the City of Minneapolis and MDH have reviewed and approved plans for the proposed activity. Plans are required for water supply wells (domestic, public, irrigation, commercial/industrial, heating/cooling, remedial), monitoring wells, and dewatering wells. Permit applications and plans for water supply wells and monitoring wells must be submitted to the City of Minneapolis. Notifications and plans for dewatering wells must be submitted to the MDH. In reviewing plans, the City of Minneapolis and MDH will consider the proposed well construction details, use, pumping rate, and information on groundwater contamination and migration.

Water supply wells will not be approved for completion in the terrace deposits, glacial drift, Platteville Limestone, or St. Peter Sandstone for any consumptive uses or other uses involving human contact. Monitoring wells, dewatering wells, and other water supply wells (such as remedial wells) may be allowed, but the plans must include a sampling schedule to monitor arsenic concentrations. The sampling schedule must be approved before start of work. For any discharge from a well, approval for the discharge must be granted by the local/state agency regulating the discharge.

For additional information regarding this Special Well Construction Area or to request a copy of the Special Well Construction Area, contact either Alison Fong of the City of Minneapolis at 612/673-3179 or Doug Edson of the MDH at 651/643-2109.

Web Availability of Metropolitan Council Environmental Monitoring Data

The Metropolitan Council announces the availability of on-line environmental monitoring data for the Twin Cities area through their Environmental Information Management System (EIMS). The web site for the Metropolitan Council s EIMS is http://es.metc.state.mn.us/eims .

The EIMS is a system for providing timely and reliable information for environmental planning and decision-making for the Twin Cities Metropolitan Area (TCMA) of Minneapolis and St. Paul, Minnesota. Metropolitan Council Environmental Services (MCES), a division of the Metropolitan Council, developed the EIMS to provide access to environmental data, analysis, and documents from various sources through a single, integrated system. The Metropolitan Council is the regional planning agency serving the TCMA and providing essential services to the region.

EIMS includes dynamic reports that allow users to search for water monitoring and other environmental monitoring data by topic in the environmental data warehouse. MCES staff, along with local cooperators and volunteers, monitor thousands of sites, including lakes, rivers, streams, industrial facilities, sewer interceptors, and wastewater treatment plants. Much of this data has been integrated into the EIMS data warehouse. The EIMS data warehouse presently contains over 13 million records, with data that spans more than two decades for some sites. The MCES staff is working to add more data, information, and reports every day. Accessing the dynamic reports requires the installation of a free plug-in for your web browser.

EIMS also provides an interactive map with access to many geographic data layers for the TCMA. Users can pan and zoom, turn data layers on and off, and use the point and click tool to get basic information. This map also allows the user to link to the data in the environmental data warehouse. It also provides links to other maps with related environmental information such as land use, aerial photography, and more.

Questions and comments about EMIS can be directed to Steve Kloiber at 651-602-1056 or steve.kloiber@metc.state.mn.us.

Baytown Special Well Construction Area Update

By Well Management Section, Minnesota Department of Health

On May 6, 1988, the Minnesota Department of Health (MDH) issued a Well Advisory , now known as a Special Well Construction Area (SWCA) for portions of Baytown Township, West Lakeland Township, and the City of Bayport in response to the discovery of volatile organic chemicals (VOCs) in a number of private wells in the area. Since that time, as the contaminant plume has migrated and as drinking water guidelines have become more stringent, the SWCA has been expanded and the requirements have been modified. The last revision was made on March 15, 2004, to reflect the passage of local township ordinances to track water treatment systems and to note the passage of new legislation requiring a seller of property in Washington County to disclose information on the SWCA to a buyer for properties not served by municipal water or having an unsealed well within the SWCA.

Investigations conducted by the Minnesota Pollution Control Agency (MPCA) in 2004 discovered that the groundwater contamination (primarily the solvent trichloroethylene (TCE)) extends further west that previously thought. Significant levels of TCE were noted in the unconsolidated deposits and shallow groundwater at the site of a former metal fabricating facility in the City of Lake Elmo. These findings warrant extending the SWCA further west to now include all of Section 13, Township 29 North, Range 21 West. The SWCA now encompasses approximately 13 square miles, extending from the City of Lake Elmo eastward to the St. Croix River, including portions of Baytown Township, West Lakeland Township, the City of Bayport, and the City of Lake Elmo (see figure on page 16).

The requirements of the SWCA remain unchanged from the March 15, 2004 designation.

Using the glacial deposits for well completion will only be considered in some limited locations along the northern or southern boundaries of the SWCA.

¾ *continued on next page*

Baytown Special Well Construction Area Update, cont.

The Prairie du Chien aquifer will not be allowed for use because cover material is too thin, this formation generally shows the highest private-well TCE contamination, and nitrate levels are elevated. All of these facts demonstrate the vulnerability of the Prairie du Chien aquifer to contamination from land use activities.

Jordan aquifer wells may be considered in some areas outside of the contaminant plume and in areas where the underlying Franconia aquifer is contaminated, provided that the well owners follows an approved monitoring and treatment program regulated under a township ordinance if the well becomes contaminated.

Franconia-Ironton-Galesville wells will be permitted throughout the SWCA. Where contaminant levels in the Franconia aquifer exceed health guidelines, the well owners must follow an approved monitoring and treatment program regulated under a township ordinance.

MDH will consider requests for public water supply wells (wells that serve 15 or more homes or service connections) on any property within the SWCA. Public water supply wells are regulated under the federal Safe Drinking Water Act and state regulations and must comply with management, testing, inspection, and oversight requirements.

MGWA Thanks its Corporate Members

Interpoll, Inc.

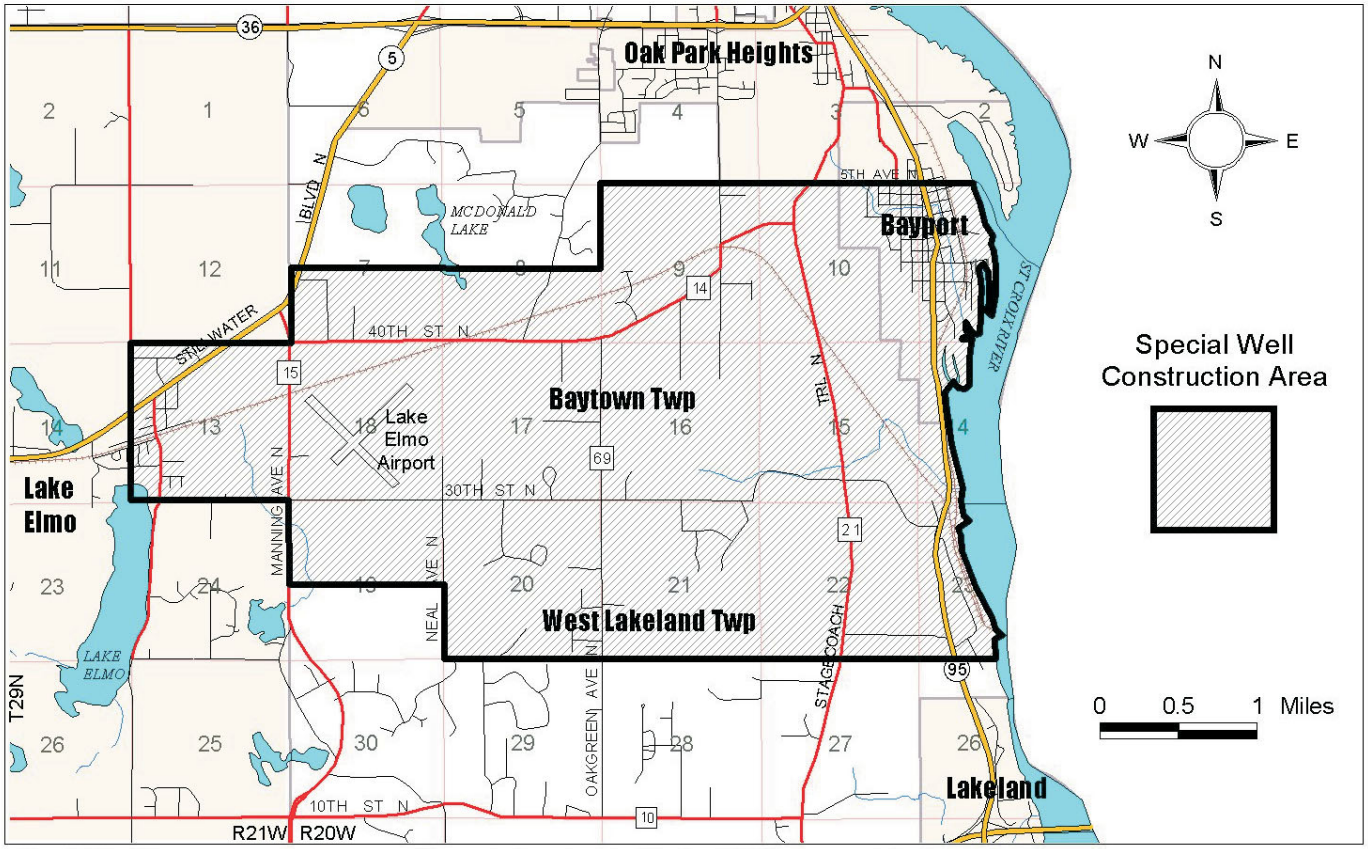
Environmental Strategies Consulting LLC

Liesch Associates, Inc.

Soil Engineering Testing, Inc.

TestAmerica, Inc.

Special Well Construction Area
Covering Portions of Baytown and West Lakeland Townships
and Portions of the Cities of Bayport and Lake Elmo



Rev. 30 Mar 05 Minnesota Department of Health - Well Management Section

MGWA Advertising Opportunities

MGWA can place your ad in several ways: in the newsletter (quarterly), in the directory (annual, with periodic updates) on our web page, and through e-mailing to MGWA members. Two of the less-well-known options are:

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. Direct your orders and questions concerning advertising rates and policy to: Jim Aiken, Advertising Manager, c/o MGWA, 4779 126th Street, White Bear Lake MN 55110-5910; Phone (952)470-0983.

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Standard Level	$505	$583	$78	15%
Industry Leader	$735	$886	$151	20%
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Please make checks payable to Minnesota Ground Water Association or MGWA. Direct your orders and questions concerning corporate memberships and policy to the Advertising Manager: Jim Aiken, MGWA Advertising Manager, c/o MGWA, 4779 126 St N, White Bear Lake MN 55110; Email jaiken@mccainassociates.com.

Join the Minnesota Ground Water Association!

2005 dues are $25 for professional members and $15 for students until 8/1/2005. 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 to it **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. Or you may choose to enroll online at www.mgwa.org

Name________________________ Full-Time Student? ________________________

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Work Address ________________________

City, State, Zip Code________________________

Work Telephone Number ________________________ E-mail ________________________

Fax Number________________________

Home Address ________________________

City, State, Zip Code________________________

Home Telephone Number ________________________

Which Telephone Number should we use for Directory Listing? ________________________

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

Minnesota Ground Water Association - Board Meeting Minutes

February 4, 2005.

Place: Keys Cafe, Lexington and Larpenteur, Roseville, Minnesota.

Attending: Laurel Reeves, President; Dale Setterholm, President Elect; Chris Elvrum, Past President; Craig Kurtz, Treasurer; Norm Mofjeld, Newsletter Editor; Jennie Leete and Sean Hunt, WRI

Past Minutes: Minutes for the Regular Board Meeting held on January 14, 2005, were approved.

Treasurer: Income for the period 1/1/05 to 2/3/05 was $11,058.86. Total cash balance is approximately $31,842. Paperwork has been filed to get Craig Kurtz signatory power on accounts. Quickbooks software was purchased for Craig s use. After the Spring Conference financial results are available it is likely that money will be transferred between accounts, some into short-term certificates of deposit, and some to the Foundation.

Membership: First and second dues notices have been sent. To date, 469 members have paid. It will not be possible to include membership at a reduced rate as part of the Spring Conference registration fee.

Web Page: Office holders and calendar of events have been updated. At least one member volunteered to help with a redesign of the web page.

Foundation: The Foundation received a letter of thanks from the Science Museum of Minnesota for its gift of $20,463 to be applied to the development of ground water education exhibits in the outdoor science park. The Foundation is waiting for distribution of an LCMR grant that will also fund this initiative.

Newsletter: The March issue will be in the present format and the June issue will be a prototype of the new format. Deadline for submissions to the March issue is February 11. Articles in planning include the President s letter, a conference list, pictures of new board members, the completion of drilling the Science Museum well, a notice of the NC GSA abstract deadline, and an announcement of the Spring Conference.

Old Business: The Spring conference will be a session co-convened with the NC GSA meeting on Groundwater Sustainability. It will be held the first day of the meeting. MGWA will cover the $10 abstract fee for invited speakers. A session on lakes and surface water/ ground water interaction will be held as a GSA session on the second day of the conference.

The WRI contract has been signed and delivered.

The CD of scanned documents has been completed. It will contain an index, and searchable versions of all MGWA newsletters. A discussion concerning the availability of past issues in the members-only and non-member accessible areas of the web page was held. Decisions are pending.

The President floated several ideas for the Fall Conference theme including tracers, a training session, aquifer storage and recovery, or an open forum for solicited papers. A half-day combination of themes is also possible.

The board discussed MGWA representation on the Statemap Advisory Committee to the MGS. Jim Piegat has held that position for some time. The President will contact him and discuss the possibility of continued service or replacement.

Chris Elvrum proposed for discussion the idea of MGWA sponsoring a training session for one of the popular ground water modeling software packages. Cost reduction for members is the reason to consider this item. More information was requested for consideration.

March 9, 2005

Place: Keys Cafe, Lexington and Larpenteur, Roseville, Minnesota.

Attending: Laurel Reeves, President; Dale Setterholm, President Elect; Craig Kurtz, Treasurer; Jon Pollock, Secretary; Norm Mofjeld, Newsletter Editor; Jennie Leete and Sean Hunt, WRI

Past Minutes: Minutes for the meeting held 2/4/05 were approved.

Treasurer: Gross profit this year reported as $14156.05. Treasurer has access to the two bank accounts. Treasurer will look into increasing the number of advertisers in the newsletter. Information has been gathered on 3,6, and 12 month CDs. Highest rate found was 2.5% on 12 month CD with 10K. Treasurer will discuss with WRI.

Membership: 510 members similar to numbers from previous years.

Web Page: Spring meeting/conference registration pages up. 2005 directory up. All back issues of newsletter and bibliography added to newsletter page.

Foundation: Two requests for funding: Children s Water Festival and Anoka/Hennepin School District.

Newsletter: Working on June issue and future formatting

Old Business: Spring Conference: Lunch extended conference will go from 0800 to 1720.

Groundwater Modeling Training: On hold.

Fall Conference: Will be working on topic after Spring Conf.

Mugs: Treasurer and WRI working on mugs.

New Business: Awards: President and WRI will look into award categories and forming an awards committee.

April 7, 2005

Place: Keys Cafe, Lexington and Larpenteur, Roseville, Minnesota

Attending: Laurel Reeves, President; Dale Setterholm, President Elect; Chris Elvrum; Past President; Craig Kurtz, Treasurer; Jon Pollock, Secretary; Norm Mofjeld, Newsletter Editor; Jennie Leete and Sean Hunt, WRI

Past Minutes: Minutes for the meeting held March 9, 2005 were approved.

Treasurer: Net income for first quarter: $7,179.97. Total assets: $27,798.73. Approximately a 50/50 split between the Wells Fargo and Affinity Accounts. Considering a certificate of deposit in July after Spring Conference.

Membership: 559 paid members

Web Page: Updated calendar, Foundation web page, and links. Emails sent to members. New edition (April) directory.

Foundation: Approval of $1000.00 to Children s Water Festival pending submittal of proper forms. Foundation pursuing additional funding sources.

Newsletter: Foundation report will be in next newsletter. Working on reformatting newsletter. Discussed

Continued on next page.

Minutes of Board Meetings, cont.

potential articles.

Old Business: Spring Conference: Preparation continuing, display will be updated for Spring Conference.

Groundwater Modeling Training: On hold.

Fall Conference: Will be working on topic after Spring Conference

Mugs: Ordered 108 silver travel mugs with simplified logo.

New Business: Awards: Motion to present outstanding service award to Olaf Pfannkuch at the Spring Conference passed.

May 12, 2005

Place: Keys Café, Lexington and Larpenteur, Roseville, Minnesota. Keys Café

Attending: Laurel Reeves, President; Dale Setterholm, President Elect; Chris Elvrum, Past President; Craig Kurtz, Treasurer; Norm Mofjeld, Newsletter Editor; Jennie Leete and Sean Hunt, WRI; Jim Aiken, Advertising.

Past Minutes: Minutes for the Regular Board Meting held on April 7, 2005 were approved

Treasurer: Craig Kurtz reported that in 2004 the MGWA had approximately $64,000 in revenue and $51,000 in expenses. $9,000 was transferred to the MGWA Foundation. The MGWA has approximately $25,000 for operating expenses. Craig also showed the Board the new mugs to be given out as a thank you to speakers at the conferences.

Membership: The current membership is 569 which is similar to previous years.

Newsletter Advertising: Jim Aiken discussed how companies are generally more discerning with advertising dollars reflected in a reduction in the number of MGWA Newsletter advertisers than in the past. Jim suggested that the Board consider what the goal of advertising is and how much of our resources should go into increasing the advertising. The Board decided to get more information about the costs of the newsletter, website, operations, and income from dues, advertising, and conferences and have a discussion at the next meeting about what to do if anything.

Foundation: Chris Elvrum reported that $1,000 was awarded to the Children's Water Festival and $700 to the UW River Falls geology field trip. A request from DNR Waters for color GPS kits to be made available to teachers and youth leaders is pending. He also reported that Rob Caho has asked to resign from the Board but will stay on until a new President is found.

Education: The well at the Science Museum is going to be sealed up for the summer and the display will be built and ready for Spring 2006.

Newsletter: Norm Mofjeld reported that the Newsletter team is evaluating 3 possible templates for revising the MGWA Newsletter.

Old Business: Spring Conference – Laurel Reeves reported that there were 734 registrants as of May 11th and another 100 are expected. Dale Setterholm said he is working on the display for the MGWA table at the conference.

Ground Water Modeling Training: No Report

Fall Conference: A topic has not yet been chosen.

Awards: The award is set to be handed out at the Conference.

Field Trip Guidebooks Still Available

The 2005 North Central GSA Conference Field Trip Guidebooks are available at the Minnesota Geological Survey. The cost is $25 and it includes all of the field trips (even if cancelled).

Minnesota Ground Water Association Newsletter Advertising Policy

2005 Annual Rate for Display ads:

	Horz x Vert (in.)	Newsletter	Directory
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

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 given on the inside front page. 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.

Please make checks payable to "Minnesota Ground Water Association" or "MGWA." Direct your orders and questions concerning advertising rates and policy to the Advertising Manager: Jim Aiken, Advertising Manager, c/o MGWA, 4779 126th Street, White Bear Lake MN 55110-5910; Phone (952)470-0983; jaiken@mccainassociates.com