

Minnesota Ground Water Association

www.mgwa.org

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MGWA Spring Conference on Interaction of Groundwater and Surface Water

MGWA members filled the main meeting room at the Earle Brown Continuing Education Center on the St. Paul Campus of the University on April 17, 2003, to learn about the interaction of surface water and groundwater. The conference was dedicated to David R. Ford, a former DNR-Waters employee, who died in January. Dave had worked for over 25 years in the water resources field and will be long remembered by all those who worked with him, even those who only met him incidentally. Twelve speakers covered 13 different topics starting with the keynote address by **Don Rosenberry** concerning why groundwater and surface water interactions are important to professionals and the lay public alike.



Don Rosenberry is a hydrogeologist working with the U.S. Geological Survey (USGS) in Denver and has been studying groundwater and surface water interactions since the mid

1980s. In his presentation he identified issues that are relevant to the public. These include drought-deluge cycles, water supply issues, water quality issues, and infrastructure impacts. Drought-deluge cycles are particularly important to the public because of their affect on surface water elevations. Don cited experiences from Long Lake near Kalamazoo, MI, and Lake Belle Taine, near Bemidji, as examples. Landowners suffer from changing water levels and in-depth studies in these areas show how important the role of the groundwater system can be in affecting system dynamics. Likewise, water supply issues often are of interest to the general public because people have a high regard for the public health value of protecting the drinking water supply. Groundwater and surface water interactions are integral to many situations such as where wells are placed in close proximity to a river or lake (and may incidentally collect surface water) or are designed to appropriate surface waters (Ranney wells).

Don went on to explore issues of interest to the scientific community on the topic of groundwater and surface water interactions. These include hyporheic processes, ecological impacts (anybody see the editorial in the May-June issue of *Ground Water*?), scaling issues, and quantification methods. He cited situations where the chemical constituents of groundwater help to support the nutrient balance of surface waters and discussed ongoing research into the significance of hydrologic inflows in supporting spawning grounds of certain species of fish.

Kelton Barr, who now works with Exponent, followed with a presentation on groundwater and surface water interactions in which he

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President's Column

I would first like to express my enthusiasm over the success of the 2003 Spring Conference. I am pleased to report that the attendance numbered over 220. The depth of the speakers was noted by all attendees, making the conference truly an educational experience. I know that I will be able to put some of the information from the conference into use. Thank you to all the speakers. This was a great conference to dedicate to the life and works of David Ford, who for over 24 years worked for DNR Waters. Much of Dave's work helped all of us better understand the importance of the interaction between ground water and surface water. I would personally like to thank the conference planning committee for their hard work. Each of these volunteers contributed greatly to the conference's success; the planning committee included President-Elect Chris Elvrum, Treasurer Eric Hansen, Secretary/Membership Director Jon Pollock, Past President Rob Caho, Past Board Member Jim Stark, Audrey Van Cleve from DPRA Incorporated, and Jennie Leete and Sean Hunt from WRI.

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President's Letter, cont.

I would like to also thank Jim Stark for everything that he has given to MGWA over the years. As President of MGWA, I presented Jim MGWA's Award for Distinguished Service. Jim has been an asset to this organization and we appreciate all he has done, including volunteering to help during the spring conference.



The MGWA fall conference planning is underway. The theme is Water Conservation. The conference will tie into the Question of the Quarter in this newsletter, and help you answer more amazing trivia questions about water waste. Conference speakers, exhibitors, and volunteers are still needed for this event. Please contact me at DPRA Incorporated (651)227-6500 x3140 or email me at mbonnell@dpra.com to volunteer or offer suggestions.

See you at the fall conference!

— Marty Bonnell, MGWA President

Spring Conference, cont.

reviewed some of the basic principles and presented selected case studies. (Kelton did an admirable job despite having little sleep due to having had to do battle for most of the previous night with a failing computer on which he was developing his presentation.) Kelton started by reviewing some of the classical work by Hubbard, by Toth, by Freeze and Witherspoon, and by Tom Winter. He cited examples from Lino Lakes, Minnehaha Creek, Grey Cloud Island, Washington County, and Lake Belle Taine. The talks by Kelton Barr and Don Rosenberry served to set the stage for the reminder of the talks of the day.

The next presentation was made by **Jim Ruhl** of the USGS. He talked about his research into the climatic and hydrologic factors related to the rise of Long Lost Lake in Clearwater County. The stage of this lake has risen 13 feet during the interval from 1993 to 2002. The lake is part of a closed hydrologic basin, in an area of the Itasca Moraine characterized by high hills with steep slopes. The glacial sediments are 300 – 400 feet thick. The USGS is in the early part of the study, which is going to focus on geologic and hydrogeologic characterization, examination of historical aerial photos, analysis of precipitation data, and collection of site-specific data including water level measurements.

Jim Berg of Minnesota Department of Natural Resources – Waters Division (DNR-Waters) spoke next on his work, carried out in conjunction with Todd Petersen, also of DNR-Waters, looking at the relationship of groundwater flow to critical topeka shiner habitat, which is estimated to be only 10% of its former range. Resistivity surveys were used to characterize the subsurface conditions because of the lack of wells in the area. In addition, they conducted temperature surveys through the sediment at the base of surface water bodies within the known range of the species. The findings show that fish were found in the 14 out of 20 off-channel habitats with moderate or strong temperature profiles (taken as a sign of groundwater exchange) in the sediment.

John Adams, also of DNR-Waters, gave the next presentation in which he discussed hydrologic issues and modeling challenges on the Mesabi Iron Range. He discussed Dave Ford's development of the WATBUD Water Balance Model and John's use of it to characterize groundwater flow in the tailing basins of the Biwabik Iron Formation. This information along with other models will be used to help determine how fast the basins are filling up with water and to predict the future water levels in wells.

Bob Tipping, Minnesota Geological Survey (MGS), and **Scott Alexander**, University of Minnesota, gave a joint

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Membership News and Information Update:

Now ground water information can flow two ways! Our Newsletter can be a forum for every member to share information they encounter. Are you working on an interesting project? Have you come across an interesting fact? Describe something you experienced or witnessed. What progress or developments is your organization making? Let us know if you've changed job positions recently. Let's keep our membership in touch with one another! Selected comments will appear in the next issue (See "Flowing Both Ways" on page 5 for current comments). Email your comments to: newsletter@mgwa.org

presentation on groundwater/lake interaction in northeastern Washington County. Bob first discussed MGS efforts to characterize glacial materials that control system dynamics and to map bedrock valleys that influence groundwater movement. Scott Alexander presented results of his research in and around several northeastern Washington County lakes (Square, Big Marine, Big Carnelian, and Little Carnelian Lakes) at which he measured rates of groundwater influx and/or surface water outflow. His findings indicate that groundwater influx can be higher than traditional measurements indicate and the measurement techniques used can help to characterize lake susceptibility to certain nutrient and contaminant loading. Susceptibility can vary with some systems more dependent on groundwater and other systems more dependent on precipitation and surface water inflow.



— Scott Alexander and Bob Tipping show off samples they collected during their work in Washington County

Lunch was tacos. It wasn't the best taco I've ever had, but it was a bit better than other meals I've had at Earle Brown (food didn't run out!).

Skip Wright, DNR-Waters, kicked off the afternoon sessions by discussing the ways in which the ordinary high water (OHW) level is determined. The OHW level, Skip pointed out, is a catchy, oft-used acronym, and is referred to by several important state rules/statutes. It is also the jurisdictional boundary of public waters in Minnesota, as well as a useful tool in shoreland management and hydrology studies. It is not an average, normal or high water level for a water body. He then cited several examples of OHW for different types of water bodies, and if I tried to repeat them here I'd get it wrong. Best instead to check out the DNR web site for the complete guidelines on OHW determination (or call Skip at 320-796-6272).

Don Rosenberry's second talk of the day summarized his knowledge of various automated seepage meters for measuring groundwater inflow into surface water bodies. Scientists have been using the Lee-type seepage meter since the mid 1970s. Makoto Taniguchi developed a heat pulse seepage meter in 1993. Steve Krupa developed the Krupaseep (also heat pulse) in the mid 1990s. Ron Paulsen developed an ultrasonic seepage meter in 2000. Rosenberry and Morin now have an electromagnetic seepage meter. While the devices are getting better, and the results they produce are fascinating, more work is needed to make them easier to use and less expensive.

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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.

Spring Conference, cont.

Following Rosenberry was **Eric Hedbloom**, from Service Engineering Group, who discussed his use of flux meters to evaluate surface water and groundwater interaction in a seiche-influenced river bay. The information from the flux meters was used to establish hydrogeologic conditions and remediation options.

Doug Hansen, of the Minnesota Pollution Control Agency (MPCA), talked next about his efforts to use stream flow data to validate the MPCA's metro model. Flow measurements of major rivers in the model domain, such as the Minnesota River, are in greater error than the actual groundwater contribution to the river between gauging stations, so these data are not useful beyond defining an upper limit that we know is too high for groundwater discharge. The Metro Model team focused its efforts on analyzing the discharge of tributaries to these major rivers. Flow measurements in the lower reaches

of the tributary streams lying within the riparian zones of the large rivers essentially represent groundwater discharge to the large river valleys. As such, the Metro Model team interpreted these measurements to represent discharge to the major rivers. Modeled groundwater discharge rates to the major rivers compared favorably to these measurements derived from the tributary streams.

Jim Lundy, of the MPCA, spoke of his research of direct measurement of groundwater contaminant discharge to surface water. He indicated that he first looks for strong groundwater discharge zones. Then he measures the seepage, temperature differences and vertical gradient pressure differences of surface water and groundwater. Using the Type I Divergence from Conceptual Plume Model, he incorporates factors such as heterogeneity, infiltration and natural attenuation. As an example of non-point source applications, he cited his use of the St. Peter Ground Water Model to track changes in

chemistry of groundwater as a result of manure spreading.

Vanessa Demuth, of Dakota County, Environmental Services, ended the conference with her amusing historical account of attempts in the past to drill for oil in Dakota County. She discussed the construction of these extremely deep wells which never did encounter oil and the successful efforts by her agency to locate and seal them.

The conference served 220 people, nearly half of whom turned in evaluations. The evaluations were overwhelmingly positive (thanks to the speakers and to the conference organizers), and contained good suggestions for future conference topics. Also included in the conference materials was a CD that contained several of the speakers' powerpoint presentations, as well as other items of interest to MGWA members.

Contributed by Steve Robertson and Norm Moffeld, MGWA Newsletter Team; Photos by Sean Hunt

Newsletter Team Changes

May 27, 2003, Aaron Fredrikson wrote: I have decided to resign from the MGWA newsletter team. I've determined that I need more time for other pursuits. I have enjoyed working with everyone over this past year. Working on the newsletter has given me an opportunity to evolve skills and be creative. Thank you for the insight into how the newsletter is produced and the opportunity to contribute to it. It has been a good experience.

Newsletter Team: Thanks, Aaron. You've brought a new dimension to the newsletter team and your skills will be missed! Good luck in your future endeavors.

The MGWA newsletter team is always looking for new members to put the quarterly newsletter together. We usually meet the first Tuesday of the month at 7:45 am in the PCA-DNR Cafeteria, 520 Lafayette Rd. Meetings generally conclude by 9:00 am. If interested, contact any of the newsletter team members listed in the sidebar.



—Vanessa Demuth answers questions with her MGWA-provided "protection" (MGWA President Marty Bonnell) close at hand



— Over 200 people showed up for the MGWA Spring Conference 2003

Ground Water or Groundwater?

The March 2003 Question of the Quarter was: Ground Water or Groundwater? Is it one word or two? There were six responses and the tally is: two for one word, two for two words, and two "don't care":

Oneworders:

Dave A. wrote: groundwater (one word).

Charlie T. wrote: Are you sure you really want answers to this question? I can see the butter-side-up and butter-side-down war commencing already.

At the risk of alienating my fellow readers, my opinion is "groundwater" is one word. The most basic rationale is simply that this has become the convention, like it or not. I do understand that water is everywhere, with no qualitative difference whether it's underground or on top. I grant that consistency would suggest two words as in "surface water", "pond water", "well water", or "city water". However, in this instance, I prefer incorporating the modifier as a compound (adjective-noun) rather than a separate noun strung onto the beginning. "Ground" draws too much focus from "water" when separated; you almost overlook that we're really talking about water. Perhaps if the opening word "ground" were recast in a form less substantial than a noun, we could have a phrase like "grounded water" or "groundly water". In some sense, this would be more appropriate, though perhaps less lilting to the ear than either "ground water" or "groundwater".

In the end, I'll be happy so long as we don't have to start calling it "water that is underground now but probably wasn't always there and won't be forever and will probably be ice or vapor someday too or be broken down to liberate its component elements". When that day comes, I think I'll stop talking about it all together.

Two worders:

Laurel R. wrote a short message in the subject header: question answer = 2 words.

?

Question of the Quarter! ?

The Question of the Quarter is a new section in our newsletter. Each quarter a different question will be posed and all members are invited to offer their "two cents worth".

Bottled water bought from vending machines can commonly cost up to how much more than the average cost for water supplied to a home in the United States?

- A) 13 times
- B) 32 times
- C) 320 times
- D) 3200 times

Email your answer and your "two cents worth" to:

newsletter@mgwa.org

Tom C. wrote: As a former editor of this august publication, I can't help but chime in with a few words regarding the spelling of the resource we are all trying to protect. In the December 1995 MGWA Newsletter, I wrote a short editorial on this same issue, including the following words: "Since this is a debate that has raged for decades and probably will continue into the next century, I've chosen to take a "soft" editorial approach to the issue and follow the author's wishes". Well, here we are in the next century, the issue is no closer to any kind of resolution that I'm aware of, and your faithful newsletter staff still follows the author's preference in the spelling of ground water (there, I've tipped my hand). One thing we do look for, however, is consistency of spelling within the same article.

Don't care:

Mike T. wrote: The answer to the question is, "Yes."

Paul S. wrote: My first take is, "Who cares?" I certainly don't, since either expression clearly conveys the meaning. In other words, in either form, the terms mean exactly the same thing to a reader, just as speaking the term "ground water" or "groundwater" does. Function over form is a cliché that comes to mind in this case.

Flowing Both Ways

Barb H. from Rochester wrote:

Now that you have an on-line newsletter, a simple way to accomplish some educational outreach would be to provide the newsletter (free of charge) to Minnesota Science educators. The MGWA newsletter is a very high quality resource of current and interesting information. Teachers who could find applications for the information within their curricula would certainly extract it and apply it. I would suggest contacting the Minnesota Science Teachers Association to learn more about what information science teachers (K-12) need and how best to help them share current and locally relevant information with their students.

Newsletter Team writes:

Thank you for your comments. We will follow up on your suggestion. One of MGWA's primary objectives is education of the public regarding ground water resources. We agree that one of the many benefits of an on-line newsletter should be increased availability to the public and educators. Although the current year's issues are always password protected and can only be viewed by MGWA members, past issues can be viewed by non-members free of charge. Presently, all issues from 2000, 2001, and 2002 can be downloaded at www.mgwa.org by

Flowing Both Ways, cont.

everyone with access to the Internet. We are preserving the member benefit of the current year's issues under one password because we need to maintain a membership base, or there won't be a newsletter to share!

Let us also take this opportunity to publicize two other educational possibilities—the MGWA's Environmental Education Committee and Project WET.

The MGWA's Environmental Education Committee promotes partnerships with those that provide education about ground water, provide educators with tools for teaching students about ground water, and provide information to citizens, legislators, and resource managers to help them understand how they can protect ground water. If an instructor is interested in having a hydrologist speak to their class about a ground water topic, please visit the MGWA website at www.mgwa.org for more information. The Education Committee is also considering the development of a freely available on-line newsletter specifically for items relating to ground water education. The Education Committee continues to make public presentations and to date have presented to more than 1500 school children, adults, and ground water professionals.

The Project WET (Water Education for Teachers) is an international, interdisciplinary, water science and education program for formal and non-formal educators of K-12 students. The goal of Project WET is to facilitate and promote awareness, appreciation, knowledge, and stewardship of water resources through the development and dissemination of classroom-ready teaching aids through state sponsored Project WET programs. For more information, visit Project WET's website at www.dnr.state.mn.us/projectwet/. If you are interested in having the Minnesota Ground Water Association facilitate a Project WET workshop, please visit the MGWA website at www.mgwa.org for more information. Workshops are six hours in length and include exposure to a wide range of activities and lessons that can be applied in the classroom. These

activities and lessons align with Minnesota Graduation Standards. The cost is \$15 for the reference guide (which you get to keep) that includes dozens of activities, lessons, and extensions for K-12 students.

Barbara H. wrote:

I applaud your transition to an on-line newsletter. I hope it saves paper, postage and time.

Newsletter Team writes:

Thank you for your compliment. The on-line distribution option is definitely saving money and resources. The additional production costs are less than MGWA's previous costs of printing and postage. Of course, we still print and send newsletters to those who prefer that format and those subscribers now bear that cost.

Gilbert G. wrote:

The March newsletter looked great. The newsletter is still one of the best benefits of a MGWA membership and continues to be a major source of information regarding ground water and related topics. I especially thought the color photos were an added advantage from downloading via the internet. Several concerns I have with using the internet. I have a standard modem connection and it took about 40 minutes to download the entire document, this is not a huge problem, more of an annoyance, particularly because it ties up my system. Initially, it appeared that the download time would exceed an hour and 10 minutes, but the connection speed picked up (to a dizzy rate between 1.6 to 1.7 kbps). In the future, regardless of this problem, I would continue to download via the internet, but I wonder how many others would do so; and, if the interest might lessen over time. Do all members have access to the internet? I would think most, but I still know people who do not have home internet service and others who cannot access the internet at work because of company policies. I even know one environmental consulting company where the owner does not have internet service at work! In addition, I prefer a paper copy of the newsletter because I would rather read a document like this in print and not on a screen. I also take the newsletter

with me so I can read it when I have those "idle" time slots. I have an inkjet printer and, although I didn't time how long it took to print, it took a long time. In the future I likely would not print out the last four or so pages that have ads, simply to save on the ink cartridge and to save time. This can be changed by requesting several of the advertisers to reduce the amount of "black" space in their ads (see pages 22 and 23). Thank you for the time each of you spend on the newsletter, each issue shows that your efforts are substantial.

Newsletter Team writes:

Thank you for your compliments and comments.

We agree that one of the many benefits of the on-line newsletter is the color images. You have voiced the concern of many members who have standard modem connections or "dial-up" connections and experience slow downloading of the newsletter. We have now developed two options for downloading the newsletter. Both will provide high quality images on the computer screen.

The print quality option has higher resolution (and is a larger size file) and therefore the images will print as clear as they appear on the screen. This version is not interactive and does not include the bookmarks and links to other web pages.

The interactive screen quality option includes smaller versions of the photos and figures and will download much more quickly. It has all the bookmarks and links to other web sites. This file is printable, but the low-resolution graphics won't look "hot" on the printed page.

As mentioned above, the MGWA newsletter team is aware that some members wish to continue receiving a paper newsletter in the mail — this option is available. At the time of membership renewal, members are asked whether or not they wish to receive the newsletter via the Internet or receive the newsletter in paper form. Our current estimate of the additional cost is \$10/year (having never before printed color newsletters), which is paid in addition to 2003 dues by members who choose the mailed paper newsletters.

Ground Water and Urban Growth—Running on Empty?

NOTE from the author: This piece was originally written as a Minnesota Pollution Control Agency “Indicator of the Month” and it will appear on MPCA’s web site sometime this summer at <http://www.pca.state.mn.us> (check under “In the Spotlight”).

MPCA directs environmental indicators primarily toward the lay public as a learning tool to highlight important or emerging environmental issues to its web site visitors. As such, this article is written in a popularized format and your newsletter team hopes it is interesting and useful not only for our more technical members, but also for students, science educators and others being targeted by the MGWA Education Committee.

Minnesotans tend to take an adequate supply of good quality water for granted. Much of our water supply (serving about three-quarters of the state’s population) comes from ground water. This brief article takes a look at some issues that have recently emerged concerning water quality and quantity as the state’s population inches past five million and our **aquifers** face increasing demand from businesses and homeowners alike.

Until very recently, most communities haven’t considered that the availability of a good quality water supply would limit their growth. Water supply was not generally considered a big concern during the abnormally wet 1990’s:

<http://climate.umn.edu/doc/journal/wet1990s.htm>

The last major drought in Minnesota was in 1988. Although severe in parts of the state, this was a relatively short drought that was followed by above average precipitation. One factor that made the 1988 drought more severe than it otherwise might have been was the hot summer conditions that accompanied it:

<http://climate.umn.edu/pdf/drought88.pdf>

One outcome of the 1988 drought was passage of the 1989 Ground

Water Protection Act that put in place numerous safeguards to help protect quality and quantity of the state’s ground water resources:

<http://www.revisor.leg.state.mn.us/sta/103A>

Managing Water for Growth

The I-94 corridor between the Twin Cities Metro Area and St. Cloud is one of the fastest growing areas of the state. Every county in the Metro Area and along this growth corridor, with the exception of Ramsey, is projected by the State Demographic Office to have at least a five percent growth rate through 2010, and in some places in this area, the growth rate will likely exceed 30 percent.

The rich ground water resources of the Twin Cities **artesian** basin give way to a single, limited and vulnerable aquifer in the St. Cloud area (Figure 1).

In some cases, the issue is not so much the total amount of water available, but its distribution, quality and the expense of getting it out of the ground. For example, about one-third of the Metro Area does not have easy access to the high-yielding Prairie du Chien-Jordan aquifer. Other water

supply limitations include competition for water among ground water users and the need to protect sensitive surface features, like springs and **calcareous fens** that may lose water when an aquifer is pumped nearby.

At the northwest end of the corridor near St. Cloud, water quality is an issue. As subdivisions spread over former agricultural land, the shallow sand and gravel aquifer relied on in these areas may contain contaminants like nitrates and pesticides. Over-application of lawn fertilizers and improperly-maintained septic systems may add further nitrates to the mix.

Balancing the “Bank Account”

“They hang the man and flog the woman that steal the goose from off the common; but let the greater villain loose that steal the common from the goose.”

—English Folk Poem

An aquifer can be viewed as one of nature’s bank accounts, with “deposits” such as rain and snowmelt helping to offset “withdrawals” like pumping ground water or discharging water to streams, lakes and wetlands. A large withdrawal like that

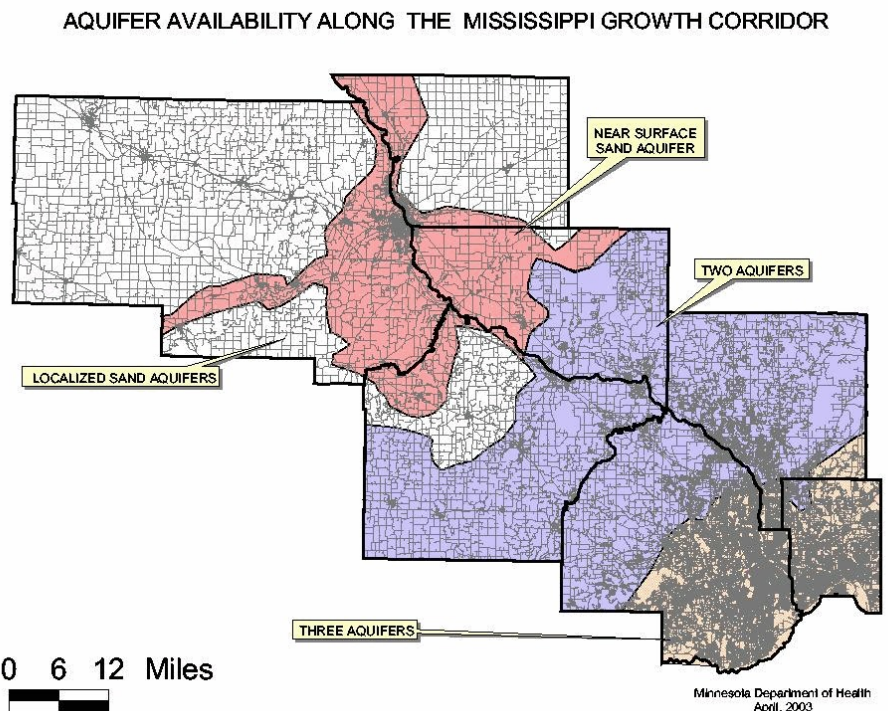


Figure 1: Aquifers Limited in Minnesota’s Growth Corridor

Running on Empty, cont.

from a high-capacity municipal well can create a “**cone of depression**” around the intake screen that can lower water levels in nearby smaller capacity residential wells, sometimes leaving them dry. Likewise, too many residential wells tapping a low-yielding aquifer simultaneously can result in water supply problems for multiple homeowners. Examples of both situations have occurred at either end of the growth corridor in recent years.

During a hot, dry spell in July 2001 in the south metro city of Lakeville, demand for watering lawns and other uses resulted in city wells sucking up 414 million gallons of water, nearly doubling the previous record for July of 239 million gallons. According to a Minnesota Department of Natural Resources (DNR) investigation, the average ground water level near Lakeville’s wells dropped 40 feet, leaving over 50 private well pumps in the area high and dry. DNR determined that the city pumpage was

responsible for the drop in water levels. The city has since compensated many residential well owners whose wells were interfered with by the city’s pumping (St. Paul Pioneer-Press, 7/14/02).

At the other end of the growth corridor in the Sherburne County subdivision of Prairie Woods Estates southeast of St. Cloud, the problem is both water quality and quantity. Here, a relatively thin, low-yielding sand and gravel aquifer interspersed with impermeable **till** overlies weathered granite (Figure 2).

About 75 homes tapping the aquifer have experienced a range of problems with water quantity and quality since 1980 when the subdivision was built on former agricultural land (Minnesota Conservation Volunteer Magazine, May-June 2001). Well problems have ranged from decreasing yields over time, to nitrate levels above the drinking water standard of 10 parts per million.

The DNR has a water level observation well within the same aquifer

system that supplies Prairie Woods Estates (Figure 3). The effect of increased pumping of the shallow, low-yielding aquifer as more houses were built and wells installed, is shown by a drop in the **water table** over time. Note also the decline and recovery of the water level in this well in response to the 1988 drought:

Having enough water to supply residential wells is not the only ground water issue in the area. The MPCA, in a multi-year study of impacts of land-use changes in the St. Cloud area, found that shallow aquifers were subject to water quality problems like elevated nitrate levels when agricultural land is converted to subdivisions that rely on wells:

<http://www.pca.state.mn.us/water/groundwater/gwmap/rpt-landuse-sc-short.pdf>

Planning for the Future

The above examples show how increased demands for ground water

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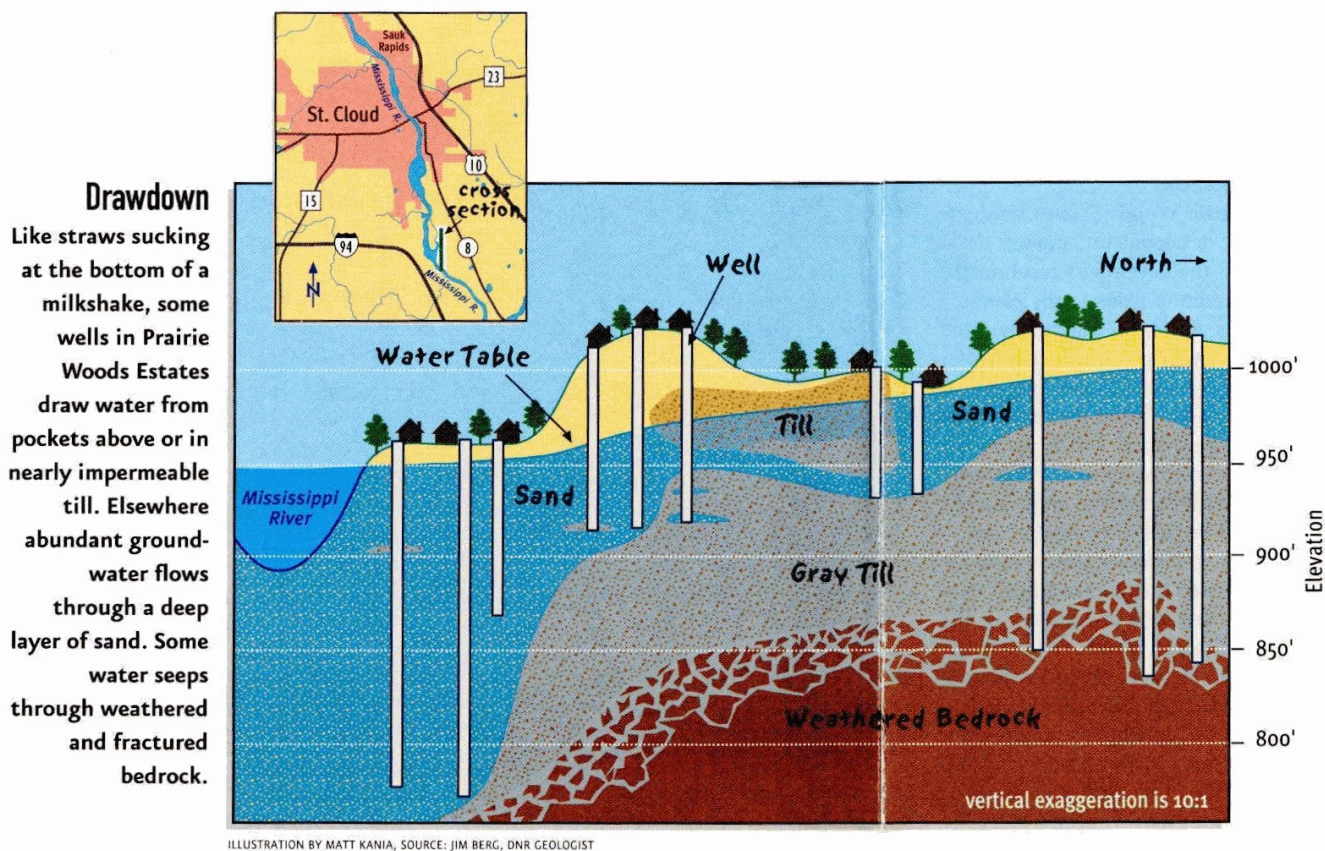


Figure 2: Cross-Section of Shallow Wells in Prairie Woods Estates

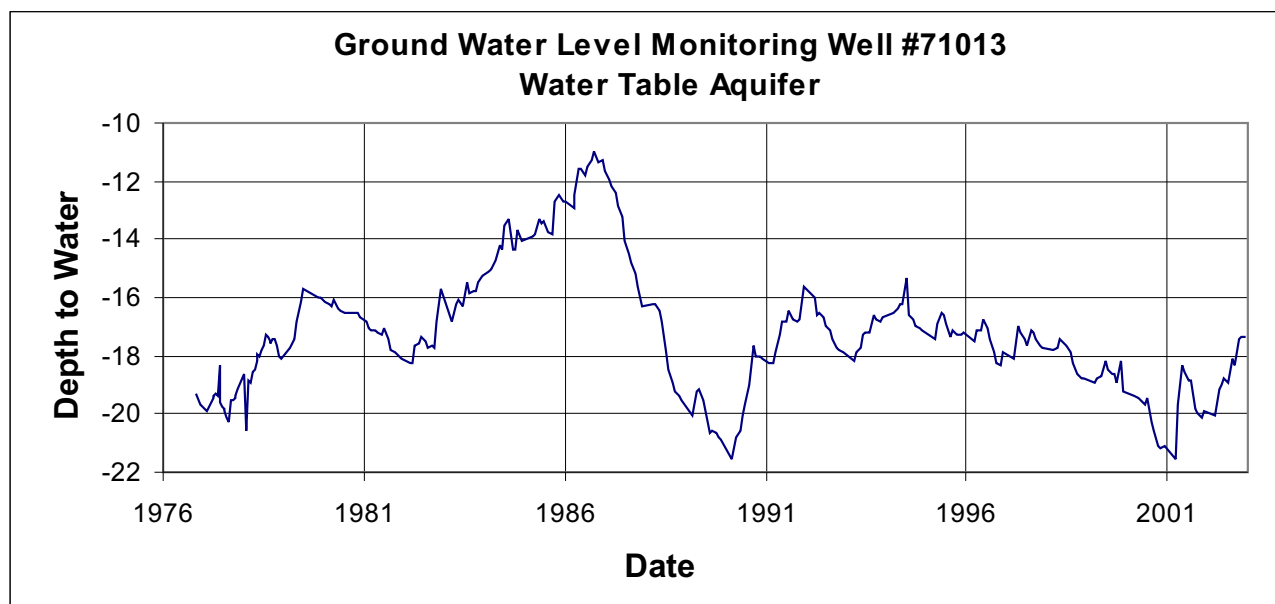


Figure 3: Water Table Elevation Plot, DNR Observation Well 71013

in a rapidly-developing area can lead to problems with both water quality and quantity. But there are a number of measures that can be taken to help assure that these key growth areas can have reliable ground water supplies to respond to the needs of increased population and economic activity into the future:

- Educate community planners and developers about the limited availability of ground water resources to meet water supply needs;
- Define local hydrogeologic conditions that impact ground water availability and natural water quality, including use of ground water modeling where appropriate;
- Determine areas where existing land uses have impacted water quality and may limit the use of ground water as a source of drinking water;
- Educate homeowners and businesses of the importance of implementing best management practices (BMPs) in their approach to land use;
- Identify areas where ground water does not meet drinking water standards so that construction of additional water supply wells is prohibited in these areas;

- Determine areas where ground water and surface water are directly connected and where use of one may affect the availability and quality of the other;
- Establish sustainable development goals for aquifers so that pumping does not divert water needed to supply surface water bodies;
- Develop a regional database of existing contamination sites so that communities and private individuals will not construct water supply wells in contaminated areas.

Some Helpful Web Site References

The MPCA is introducing a new resource for people who want to know, "What's in My Neighborhood?" When completed, users will be able to view a list of sites in a given county, city or zip code with known or suspected sources of ground-water contamination. The web site is currently under development, but some services are available now at: <http://www.pca.state.mn.us/backyard/neighborhood.html>

Minnesota has a Drought Response Plan developed by the Department of Natural Resources, Division of Waters. The establishment of a

drought plan was mandated by the 1989 Ground Water Protection Act. The current Drought Response Plan (now being revised and updated) is available at:

<http://files.dnr.state.mn.us/publications/waters/droughtp.pdf>

The Twin Cities Ground Water Model, a computer simulation of regional ground-water flow for the seven-county metropolitan area, was developed by the MPCA as a cooperative venture among ground-water scientists in both the private and public sectors. To learn how the model can be useful in planning for future ground water supply needs, see the model web site at:

<http://www.pca.state.mn.us/water/grounderwater/mm-overview.html>

Glossary of Ground Water Terms

NOTE: The terms defined below appear in **bold** when first used, above:

Aquifer: Rock or sediment below the surface of the earth capable of producing water as from a well.

Artesian: Ground water under sufficient pressure to rise above the top of the aquifer containing it.

— continued on page 10

Gary Englund Retires from MDH

The year is 1969. Richard M. Nixon is inaugurated as the 37th president of the U.S... the first "online" data exchange over what would become the internet takes place... thousands of young Americans flood a small New York town to celebrate peace and music at the Woodstock Festival... and Gary Englund embarks on a long and rewarding career in drinking water.

Our story begins in Houghton, Michigan at Michigan Technological University, where Gary earned a Bachelors of Science in Civil Engineering. With his future in front of him, Gary decides it is time for a change of scenery and moves off to Minnesota to put his education into practice with the Minnesota Department of Health. The transfer was swift, as Gary recalls, having "graduated on Friday and beginning work on Monday." Back then, a staff of five ran the drinking water program. Over time, the office grew and expanded in its responsibilities and, in December of 1976, Gary was promoted to Program Manager of the Section for Drinking Water Protection.

This new position brought with it new and exciting challenges for Gary, but with a highly competent staff and a unique "direct services" approach to the program's administration, he was more easily able to face the many trials of public health protection. That unique approach included the in-house collection of a majority of samples from the state's utilities; the preparation of a consumer



Gary circa 1970s

confidence report template for each system, which they may elect to use with minor edits or create their own; and the initiation of "water use" fees that, when coupled with Federal dollars, completely fund Minnesota's drinking water program today.

Among his many professional affiliations, Gary has enjoyed a long-standing relationship with the Association of State Drinking Water Administrators (ASDWA). He has served as the ASDWA Board member for Region V states for two terms from 1989-1992 and again from 1999-2001. Gary has served as the ASDWA participating member on the Underwriters Laboratories, Inc. Environmental and Public Health Council as well as on the NSF Joint Committee on Drinking Water Additives.

We could fill the pages of this newsletter with the list of Gary's contributions to public health protection in Minnesota and beyond; for the groundwater community he administered a program to ensure safe drinking water in Minnesota where many public water systems come from groundwater. As part of this effort he helped establish the Wellhead Protection Program. He also contributed by lending department support to Children's Water Festivals.

May 2, 2003, was the day Gary retired after over 33 years of public service. The drinking water community will lose a great asset, a fact that was hammered home when over 150 people came to wish him well at his retirement party. Gary's response to getting roasted was characteristically low-key. He related his father's view that the hole he'll leave will simply be



Gary 2003

Running on Empty?, cont.

Cone of Depression: A conical lowering of the water table or pressure surface in an aquifer resulting from water withdrawal, such as pumping.

Calcareous Fen: An area of upwelling of calcium-rich ground water that often harbors unique or rare vegetation.

Till: Unstratified sediment deposited by a glacier; generally does not yield a good supply of water to a well.

Water Table: The water surface in an unconfined aquifer at which the pore water pressure is at equilibrium with atmospheric pressure.

Figure Credits (all figures used with permission)

Figure 1: Bruce Olsen; Minnesota Department of Health, Well-head/Source Water Protection

Figure 2: Jim Berg; Minnesota Department of Natural Resources, Division of Waters and Matt Kania, Illustrator

Figure 3: Laurel Reeves; Minnesota Department of Natural Resources, Division of Waters, Ground-Water Level Monitoring

Prepared by Tom Clark with peer review and editorial assistance of staff from the MPCA, DNR and MDH.

the same as is left when you remove your finger from a bucket of water (this view overlooks the fact that water is a solid for five months out of the year here in Minnesota).

Retirement is sure to be a positive change for Gary, who might finally have enough time for hunting, fishing, boating and travel. In addition, he intends to spend more time back in Michigan, where his father lives, and where he owns a Christmas tree farm. On behalf of the MGWA, we all wish Gary well on his new adventure.

— Submitted by Steve Robertson, MGWA Newsletter Team. Modified from an article in the February 2003 issue of ASDWA Update, the newsletter of the Association of State Drinking Water Administrators.

Local Water Management Funding Reduced

With the end of the 2003 Legislative session, many people in Minnesota's environmental community are wondering happened to the state's funding of local water management.

Among Governor Pawlenty's proposed budget reductions in FY 2004-05 for the Board of Water and Soil Resources was elimination of all funding for the Local Water Resources Protection and Management Program, -commonly known as county water planning base grants.

Under the Pawlenty administration's proposal, BWSR would have lost the \$2.7 million in grants for that program. Additionally, feedlot cost-share grants would have been reduced by \$615,000 to the FY 01 level of \$1.5 million. The Nonpoint Engineering Assistance (NPEA) program would have been reduced by \$66,000. The Reinvest in Minnesota Services Grants would have been reduced to \$345,000, about half the level appropriated in FY 03.

In the end, the House and Senate restored \$1.5 million per fiscal year to BWSR's local water management grants. This is about half the amount appropriated for FY03. In other legislation, the Legislative Commission on Minnesota Resources approved \$500,000 for the biennium for local water management challenge grants. The Feedlot Cost-Share Program saw an additional reduction (\$35,000 per fiscal year) in the final bill, for a total of a \$650,000 reduction overall. Funding for the NPEA program and Reinvest in Minnesota Service Grants was reduced as recommended in the Governor's proposal.

Overall, BWSR will see a 10 percent reduction in its budget. The agency's administrative budget will be reduced by 20 percent or by \$3.4 million per year. Recommendations forwarded to the Governor in January by BWSR placed a priority on maintaining funding for mandatory programs and water and soil conservation practice implementation programs delivered through local government, rather than a funding reduction across all programs.

Over the years, BWSR, state review agency staff, and local governments have been working on ways to emphasize local water management as a platform upon which to build local activities and elements of state agency programs. Since the program's beginning in 1987, support for local water management has grown and the program has flourished as an important niche in the overall management of water in Minnesota.

County local water funding from BWSR has been used to promote a number of local activities throughout the state that pertain to surface water and groundwater. Examples of groundwater protection activities include developing and implementing cost-share programs for well sealing, developing wellhead protection plans, conducting well testing clinics, determining groundwater volume and aquifer boundaries, locating wells and septic systems, updating a groundwater model, conducting groundwater arsenic studies, assessing groundwater supplies, developing groundwater children's programs, monitoring groundwater quality, promoting empty pesticide jug collection, and promoting best management practices for agricultural chemical fertilizer management, manure management and lawn fertilizer management.

The Legislature approved a number of changes to the Local Water Management Statute (103B) and repealed the county local water planning rule (Chapter 9300). BWSR sought these changes to shift the focus of local water plans to implementing projects and programs that solve priority local water resource concerns, and streamline and shorten the process to update local water plans. Because the rule for the program was repealed, BWSR staff will work with counties and SWCDs to develop guidance materials that will reflect changes in requirements for local water plans and reduced state funding.

The cuts come on top of earlier cuts to BWSR's fiscal year 2003 budget. When the House and Senate failed to reach an agreement to balance the budget for fiscal year 2003, the Governor cut funding in February to state agency programs through the

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unallotment of available funds. Unallotment is authority vested in the Governor to balance the state budget as required by the constitution.

BWSR's unallotment initially resulted in the loss of all funding that remained for FY 03 Natural Resources Block Grant (NRBG) programs, which include Local Water Management, Wetland Conservation Act (WCA), Individual Sewage Treatment Systems (ISTS), Feedlot Regulation, and Shoreland Management. BWSR was later notified that \$1 million of the unallotted funds was returned to its budget, which restored some funding to the NRBG program, while the MPCA shifted some funding to make up for the Feedlot program shortfall. That funding is available for local governments to use for the first 6 months of program administration for 2003, with FY 04 funding to be distributed this July to take some strain off of local governments.

This article was prepared using the [Board of Water and Soil Resources Q & A: FY 03 Unallotment & FY 2004-05 Budget Impacts](#) and other information regarding the budget that can be found on the BWSR web site at www.bwsr.state.mn.us.

*Submitted by Norm Mofjeld,
Minnesota Department of Health.*

The Impact of the State Budget Deficit on the Minnesota Geological Survey

The Minnesota Geological Survey (MGS) is funded in two ways. A State Special Appropriation from the State to the University provides base funding. Both the Legislature and the University affect the size of that appropriation. Over the last 12 years it has grown at an annual rate of 2.4%. Because the cost of doing business has increased at a greater rate, our base funding has effectively shrunk. That appropriation was recently cut by 2.5% to address the deficit for 2003, and we are told to expect additional cuts in 2004 and 2005 on the order of 10 to 15%.

Over the years, MGS has bolstered its income with contracts and grants. Our largest and most consistent contract has been with the DNR Division of Waters to fund the County Geologic Atlas Program. The Groundwater Protection Act of 1989 partnered the MGS with DNR Waters in this program. Over the last 8 years the funding was level, at \$400,000 per year. That amount was reduced to \$200,000 for 2003 when the state needed to reduce spending on technical and professional contracts. That cut was appealed, with support from many MGWA members, however the appeal was unsuccessful. DNR has indicated that it intends to fund the MGS portion of the Atlas program at that 50% level over the next two years.

Another consistent and important source of income is the Minnesota Minerals Diversification Fund administered by the DNR Division of Lands and Minerals. This fund allocates approximately \$750,000 per biennium through a competitive grant process. MGS was allocated nearly \$300,000 for the 2004-2005 biennium, but the Governor's budget reduced the original \$750,000 to only \$126,000. Negotiations at the legislature partially restored the grant fund and MGS will receive approximately \$228,000 over the biennium.

MGS was successful in competing for an LCMR grant for 2004-2005 to produce basic geologic mapping (bed-

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- Industry Leader: Half page ad in newsletter and directory, "Lobby Copy" of membership directory, web page sidebar, Certificate of Membership, and up to 14 employee memberships
- Corporate Sponsor: Full sponsor acknowledgement in MGWA conference publications, full page ad in newsletter and directory, "Lobby Copy" of membership directory, Certificate of Membership, web page sidebar and up to 20 employee memberships

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.

rock topography, drift thickness) and a subsurface database (County Well Index) for the eastern half of the Mesabi Range to facilitate modeling of post-mining groundwater conditions. The final state budget diverted approximately one-third of the LCMR funds to the general fund to help make up the deficit, which required an additional round of project reductions. However, the MGS proposal made the final roster of funded projects.

MGS produces geologic mapping under the National Cooperative Geologic Mapping Program of the USGS. In the coming biennium we will receive about \$126,000 of the \$147,000 we proposed. This program requires matching funds from our State Special budget and cuts to that budget are affecting our ability to obtain larger federal grants.

The cuts discussed here have required MGS to reduce its roster by five employees, or 18% of our workforce. The loss of employees

would have been greater if not for financial assistance provided by the Dept. of Geology and Geophysics and the Dean of the Institute of Technology. They provided funds to cover severance costs, and bridging funds to carry employees through the biennium.

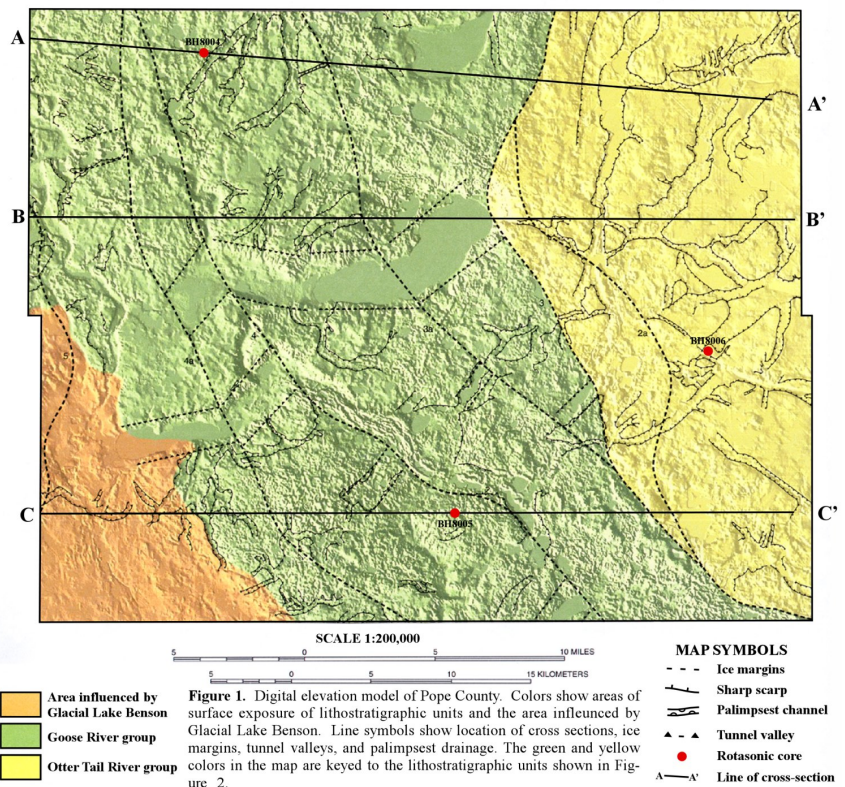
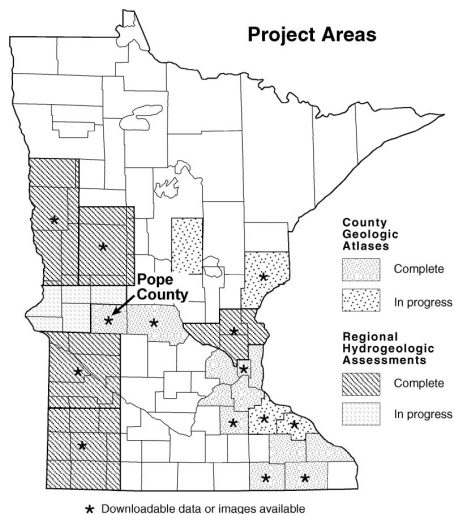
This outcome will likely cause many to question the basic funding mechanism for MGS. The staff at MGS remains convinced that we are doing the right things, and doing them well. However, the current trends must be reversed if we are to continue. We appreciate very much the support and encouragement we receive from MGWA and its members.

— submitted by Dale Setterholm,
Minnesota Geological Survey

Lithostratigraphy and Hydrostratigraphy of Pope County, West-Central Minnesota

Kenneth L Harris, Minnesota Geological Survey, 2642 University Avenue, St. Paul, Minnesota, 55114-1057, harri015@umn.edu, and James A. Berg, Minnesota Department of Natural Resources, 500 Lafayette Road, St. Paul, Minnesota 55155 4032, jim.berg@dnr.state.mn.us.

The Minnesota Geological Survey (MGS) and Minnesota Department of Natural Resources, Division of Waters (DNR Waters) are jointly producing the Pope County Geological Atlas (Pope CGA), supported, in part, by Pope County. Part A, the geology, has been completed by the MGS (see below for purchase and download information). Part B, the hydrogeology, will be prepared by the DNR Waters. Pope County is situated on the Alexandria moraine, which trends from northwest to southeast across the county. It is cored by Rainy lobe deposits that are buried by sediment deposited by multiple advances of the Red River ice stream. Geologic mapping has expanded our understanding of the sequence of surge-like ice advances, their depositional extent, and the hydrostratigraphy of the Alexandria moraine.



Surficial mapping, test drilling, and outcrop examination provided information necessary to interpret the near-surface lithostratigraphic setting (Figs. 1 and 2). This information included samples derived from Rotasonic cores (3 test holes; ~600 ft of core), soil probe borings (~124 test holes), and outcrop descriptions. Computer assisted interpretation of nearly 650 textural and lithologic sample sets were used to characterize tills. Pope CGA interpretations were combined with the results of the

Southern Red River Valley Regional Hydrogeologic Assessment (SRRV RHA) and other regional studies to develop the near-surface lithostratigraphic model.

Lithostratigraphic units were identified and placed in seven groups based on textural and lithologic attributes and stratigraphic position. Two of the groups are present on the surface of Pope County, and three

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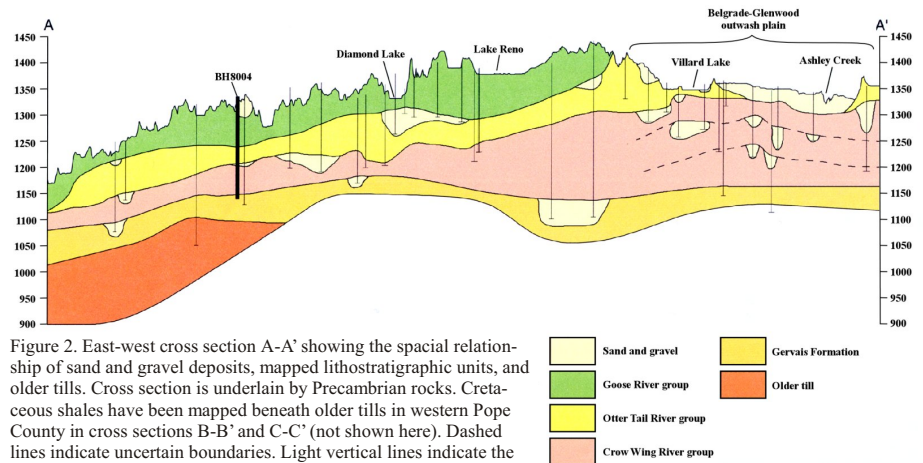


Figure 2. East-west cross section A-A' showing the spatial relationship of sand and gravel deposits, mapped lithostratigraphic units, and older tills. Cross section is underlain by Precambrian rocks. Cretaceous shales have been mapped beneath older tills in western Pope County in cross sections B-B' and C-C' (not shown here). Dashed lines indicate uncertain boundaries. Light vertical lines indicate the location of water wells used to construct the cross section. Colors in the cross-section panels are keyed to the lithologic units shown in Figure 1.

Pope Atlas, cont.

are confined to the subsurface (see key in Fig. 2).

Depositional Model of Buried Sand and Gravel Aquifers

Buried sand and gravel layers are potential sources of water for domestic, industrial, and municipal use. Much of this sediment was deposited by meltwater released by receding glaciers. Subsequent readvances of glacial ice eroded the sand and gravel deposits in some places and buried them in others. The maps in Figure 3 show the approximate distribution of areas where sand and gravel associated with the Crow Wing River and Otter Tail River groups are present or thin or absent. The first step in producing these maps was to create a network of 15 cross sections within the county that included the three Rotasonic cores. Stratigraphic information from the cores along with lithologic information from water-well logs, were used to estimate the elevation of the top of the Crow Wing River and Otter Tail River groups within the county. These data were gridded and contoured to produce maps of the buried surfaces as they exist today. These surfaces have undergone collapse during deglaciation and erosion during reglaciation; they do not represent the topography at the time of glacial recession, but probably approximate that surface.

The ice advance that deposited the Crow Wing River group came from the northeast. As it receded back to the northeast, meltwater transported coarse-grained sediment to the west and southwest (Fig. 3a). In some areas the surface expression of palimpsest channels were used to help define the paleodrainage patterns for the Crow Wing River group.

The ice advance that deposited the overlying Otter Tail River group advanced from the west onto the pre-existing Alexandria moraine and covered Pope County. As this ice receded, meltwater, confined by the elevated landscape to the east and the glacial ice to the west,

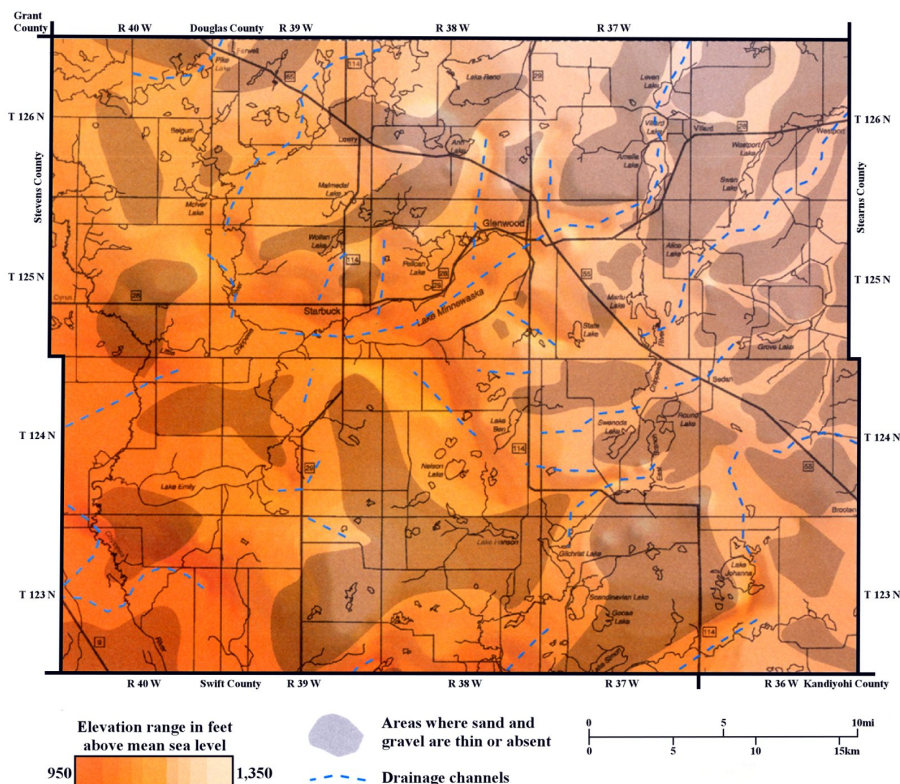


Figure 3a. Shaded-relief map of the Crow Wing group surface.

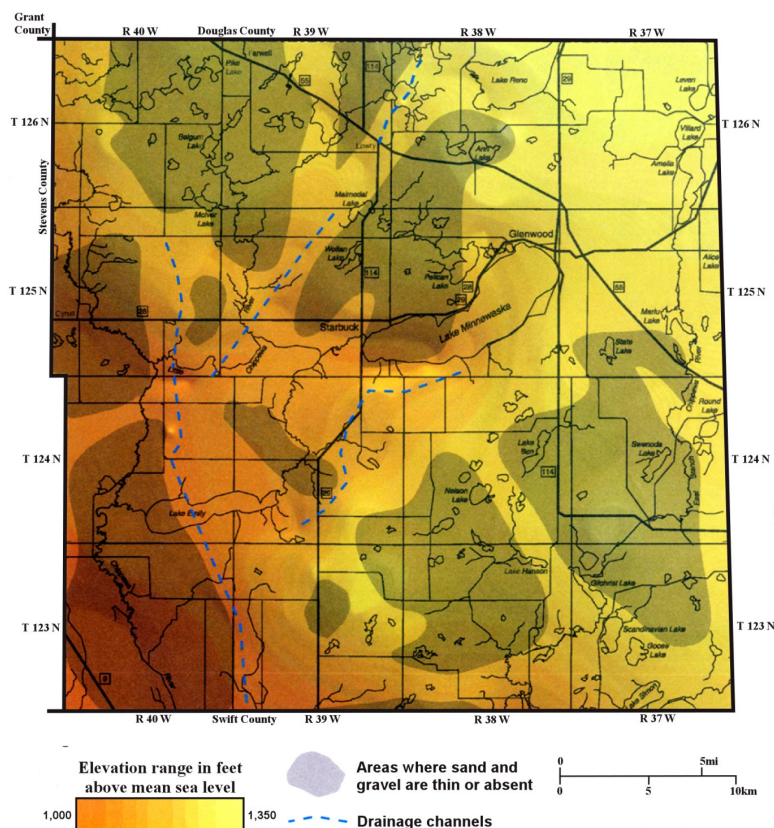


Figure 3b. Shaded-relief map of the Otter Tail River group surface.

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Pope Atlas, cont.

transported coarse-grained sediment generally to the south (Fig. 3b). Later, the Otter Tail River group sediments in the western two-thirds of the county were buried by Goose River group sediments.

The gray shaded areas on these maps indicate areas where sand and gravel deposits are thin or absent. Sand and gravel deposits (greater than 20 feet thick) are interpreted to be present in the unshaded areas. The total thickness of the sand and gravel in these areas is difficult to evaluate, because water-well drillers will typically drill through only enough sand and gravel to produce the required water yield. Consequently, the total thickness of sand and gravel may not be penetrated. Therefore, much of the data between the shaded areas provide minimum values and a greater thickness of sand and gravel may be present. The dashed lines on these maps represent the locus of sand and gravel deposits that are greater than 20 feet thick. They are interpreted to represent the general

paths followed by meltwater streams that were active on these surfaces. Other more deeply buried sand and gravel units exist within the county but not enough data were available to map their distribution.

Part A Report and Data Available

The five plates in the Part A report include: data-base map; bedrock geology, bedrock topography, and depth to bedrock; surficial geology; quaternary stratigraphy; and mineral endowment. The report is available in both print and online versions. The print version may be purchased at the Minnesota Geological Survey, Map and Publication Sales, 2642 University Ave. W., St. Paul, MN 55114, phone (612) 627-4782. The plates may be viewed online by downloading images in PDF format from the MGS FTP site at <ftp://156.98.153.1/pub3/c-15/>.

The atlas was prepared using geographic information systems (GIS) technology. GIS data files and related information are available for download from the ftp site listed above.

To comment on this article, send email to newsletter@mgwa.org or click on this link.

Minnesota Ground Water Directory - 2003 version

The April 2003, version of "A Minnesota Ground Water Directory" is now available. Please note that this is a completely different document than the Minnesota Ground Water Information Resources Guide that was distributed on or about April 22 (see article on page 17). It can be viewed at the following web site addresses:

<http://www.moea.state.mn.us/sc/resources.cfm> (Access from the Office of Environmental Assistance [OEA] Web Site)

http://www.moea.state.mn.us/sc/resources/GroundWater_Directory.pdf (Direct Access to the PDF document)

The directory is published by the Minnesota Pollution Control Agency (MPCA) but includes information about numerous organizations with Minnesota ground-water responsibilities or services. The last version was published in 1995. If you provided updates or suggestions on earlier

— continued on next page

Join the Minnesota Ground Water Association!

Annual dues are \$25 for professional members and \$15 for students. Members are entitled to subscribe to the paper version of the newsletter for \$10/yr, the electronic version is available on the website for members at no additional charge. Members are also entitled to purchase a paper copy of the annual membership directory for \$7; an electronic version is available on the website for paid members at no additional charge. Additional donations to the MGWA Foundation will be gratefully accepted. Dues paid to MGWA are **not** deductible as charitable contributions for federal income tax purposes. However, dues payments are deductible as ordinary and necessary business expenses to the extent allowed by law. The MGWA Foundation is a 501(c)3 non-profit and donations to it **are** deductible as charitable contributions.

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Ground Water Directory, cont.

drafts of this directory, thank you very much for your help.

The Adobe Portable Document Format (PDF) file is formatted as a 7" x 8.5" booklet in color. If you print your copy on 8.5" x 11" paper, there will be a lot of white space along the margins.

I hope this directory will be a useful reference for many of you. If you have any questions about the directory, please do not hesitate to call me.

*Submitted by Tim Thurnblad,
Minnesota Pollution Control Agency,
(651)296-8582,
tim.thurnblad@pca.state.mn.us*

MDA 2003 Monitoring Report

The Minnesota Department of Agriculture has recently released its annual monitoring report for pesticides in groundwater and surface water. The report covers a one and a half year period ending in the summer of 2002. It is available on the MDA website at:

<http://www.mda.state.mn.us/appd/ace/03datareport.pdf>

Please let me, or Monitoring Unit Supervisor John Hines, (651)297-3994, know if you have any questions.

*Submitted by Daniel Stoddard,
Manager, Agchemical Environmental
Section, Agronomy and Plant
Protection Division, Minnesota
Department of Agriculture,
(651)297-8293*

Karst maps and database

A valuable resource for the ground water community is the "Karst Features of Minnesota" web site at the UM Geology Dept. It has been updated with current links to downloadable location and attribute data and metadata. It's found at

<http://156.98.153.12/karst/>

Bob Tipping at the Minnesota Geological Survey is the current custodian of the database. Dr. Calvin Alexander, University of Minnesota Department of Geology and Geophysics, has been the driving force behind it.

The UM Geology karst page includes a link to the PCA karst pages that provide additional information on this geologically and hydrologically sensitive landscape.

*Submitted by Jan Falteisek, DNR
Waters, (651)297-3877.*

Minnesota Ground-Water Information Resources Guide Available

Why is a Guide to Minnesota Ground-Water Information Needed?

Many local, regional, state and federal organizations have valuable Minnesota ground-water information available. An impressive percentage of this information can be accessed on the internet. Nonetheless, many people become frustrated when seeking Minnesota ground-water information because it is distributed (some might say 'scattered') among so many organizations. The purpose of this guide is to provide an organized, central ('one-stop shopping') access point to make the search for Minnesota ground-water information easier and more efficient.

What is this Guide?

The 'heart' of this guide was created by modernizing the concept of a traditional subject bibliography to take advantage of internet technology. The 'bibliography' was molded into a hierarchical structure with internal and external hypertext links throughout the entire 74-page list of topics to empower it with multiple-search capability and the immediacy of internet-based information resources. This enables a user to focus on a specific topic or geographic region and expeditiously access data sets, maps, reports, library catalog searches, contact information and more. As explained on the home page, the guide has enough flexibility to allow users to choose from a list of at least six different ways to search for desired information.

Get the Guide!

For more information or to use the guide, you can access it at the following web site addresses:

<http://www.mgwa.org/gwguide.html> or
<http://www.geo.umn.edu/mgs/gwig/gwguide.html>

Contact Tim Thurnblad, Minnesota Pollution Control Agency,
(651)296-8582,
tim.thurnblad@pca.state.mn.us

Confirmed Waterborne Illness Outbreaks in Minnesota Caused by High Metals Concentrations in Drinking Water

In 2001, the Acute Disease Investigation and Control Section of the Minnesota Department of Health (MDH) investigated and confirmed two waterborne illness outbreaks that occurred in Minnesota involving high levels of metals in drinking water.

The first waterborne illness outbreak occurred on September 16, 2001, and involved four children who drank a soft drink made from a powder mix and well water at a church in west central Minnesota. All four children became ill with gastrointestinal symptoms and vomited within minutes of consuming the soft drink mix. All four recovered within minutes of vomiting. There were no cases of illness reported among children who did not consume the soft drink mix.

The investigation revealed that a well contractor had installed a new pump and pressure tank for the church well, and disinfected the well with calcium hypochlorite (chlorine) on September 7, 2001. It is believed that all water lines, except the one used to make the soft drink mix, were flushed prior to placing the well back in service. The leftover soft drink mix was tested and found to have 69,300 micrograms per liter ($\mu\text{g/l}$) of copper, 1,800 $\mu\text{g/l}$ lead, and 9,650 $\mu\text{g/l}$ of iron.

The clinical picture was consistent with copper poisoning. The outbreak was due to consumption of a soft drink made from tap water that contained high levels of copper and other metals. Disinfection with chlorine, following the repair work, without subsequent complete flushing of all the water distribution lines, likely resulted in corrosion of copper water distribution piping and most likely was a contributing factor to the high level of metals in the water.

This case exemplifies the importance of flushing residual chlorine disinfectant solution from a well and distribution system before placing the well back into service. (Minnesota Rules,

part 4725.5550 requires the person disinfecting a well to flush the residual chlorine solution from the well and distribution system before placing the well back into service.)

The second waterborne illness outbreak in Minnesota, due to high levels of metals in drinking water, occurred on November 19, 2001, at an elementary school in southwestern Minnesota. The outbreak involved 28 school children who became ill after drinking "blue" water from a drinking water fountain. Of the 960 children at the school, 28 became ill with nausea, and 8 of the children who became ill reported vomiting also. Symptoms started within 5-15 minutes of consuming the water and lasted less than 24 hours.

School and public health officials suspected that the cause of the blue water might have been a recently installed device designed to prevent scale build up in the plumbing system. Water from the drinking fountain used by the children was tested and found to have 43,000 $\mu\text{g/l}$ of copper. Water from the treatment device was tested and found to have 270,000 $\mu\text{g/l}$ of copper. The treatment device was taken off line. The fountain was then flushed and the water was retested and found to contain 1,600 $\mu\text{g/l}$ copper.

The cause was an incorrectly installed scaling prevention device. The treatment device was designed to prevent scale build up in a nonpotable portion of the plumbing system, and should not have been installed on the potable portion of the water system. The chemicals from the treatment device caused high levels of copper to leach from the copper tubing in the drinking fountain into the drinking water, thus causing the children to become ill.

If you would like to read the entire write up for these outbreaks, they can be obtained at
<http://www.health.state.mn.us/divs/dpc/ades/fvzd/outbreaks2001.pdf>.

This article appeared in Minnesota Well Management News, Volume 23, No. 1, Spring 2003. The author was Milt Bellin, Minnesota Department of Health. The information was taken from the MDH Summary cited above.

Oil-Lubricated Vertical Turbine Pumps

In a typical Minnesota irrigation season, an oil-lubricated vertical turbine well pump will leak 7 to 10 gallons of petroleum based oil into an irrigation well. The oil is used to lubricate bearings on the turbine pump shaft. The Minnesota Department of Health's Well Management Section currently estimates that there are approximately 3,000 oil-lubricated turbine pumps installed in irrigation wells in Minnesota. This adds up to 20,000 to 30,000 gallons of oil leaking into Minnesota irrigation wells each year.

Vertical turbine pumps are the most common type of water pump used in large diameter, deep, or high-capacity wells. A vertical turbine pump consists of a motor that drives a lineshaft with impellers, often referred to as pump bowls. Lubrication of the lineshaft and bearings is done either with water, or with oil. Oil-lubricated pumps have traditionally been used in irrigation wells, wells producing sand, and wells with deep pump settings. The oil in an oil-lubricated pump flows by gravity from a surface reservoir mounted at the pump-head, down an oil tube which surrounds the lineshaft. The oil lubricates the bearings, and is discharged outside the pump into the well through an oil port. Oil-lubricated turbine pumps are designed to leak oil into the well. Some irrigation wells have been found to have in excess of 20 feet of oil floating on the water surface.

Oil-lubricated turbine pumps have never been approved for use in municipal "drinking" water-supply wells in Minnesota. Historically, oil-lubricated turbine pumps were not prohibited for use in irrigation and commercial wells. In 1993, new Minnesota rules prohibited installation of an oil-lubricated turbine pump in any well, including irrigation wells. The rules do allow repair and reinstallation of an existing oil-lubricated pump, as long as the repair does not include replacement of the oil tube, or involve replacement of more than 50 percent of the pump.

Replacement or retrofitting of an oil-lubricated pump with a water-lubricated pump is expensive, but is the

only way to eliminate oil leakage into wells and groundwater. Leakage may be reduced in some cases by adjustment of the oiler. Installation of an auto shutoff oiler will prevent oil loss when the pump is not operating. Soy or other vegetable oils have been used as an alternative to petroleum-based oils; however, vegetable oils are often expensive, may not provide adequate lubricating properties, and can provide a nutrient source for bacteria.

Cleanup of wells contaminated with oil should be done by a professional. Bailers or skimmer pumps are often used to remove floating oil. Absorbent bats or wick systems may be employed for lesser quantities. Surfactants (detergents) may be used to remove residues from the pump and casing. Pumping and treatment of the water may be needed.

For more information on the regulation of oil-lubricated turbine pumps, contact the Well Management Section of the Minnesota Department of Health at 651/215-0811. For information on disposal of used oil, contact the Minnesota Pollution Control Agency, Customer Assistance Center at 651/ 297-2274, or 800/646-6247. To report a spill, contact the Minnesota State Duty Officer at 651/649-5451, or 800/422-0798.

This article appeared in Minnesota Well Management News, Volume 23, No. 1, Spring 2003. The author was Ron Thompson, Minnesota Department of Health.

MGWAF Endowment Grows

Funding Awarded

With the great success of the recent Spring Conference, the MGWA Board has approved the contribution of additional funds to the Foundation, raising the endowed funds to more than \$36,000. Combined with personal and corporate contributions, funds continue to be available for qualifying groups and activities that

fulfill the objectives and purpose of the Foundation.

Recent funding requests received and approved include:

- MGWA Education Group – Funding for a display table and attendance at the Minnesota Science Teachers Association Spring Conference in St. Cloud, Minnesota.
- University of Wisconsin River Falls Department of Plant and Earth Science – Funding to support student investigations in hydrology and hydrogeology.
- 2003 6th Annual Metro Children's Water Festival – Financial support for this educational outreach program offered to Metro Area schools for fifth grade students and teachers at no cost to schools.
- Project WET - Project WET is a national organization designed to provide educators with tools for teaching about water. Funding provided support for up to seven attendees at the Project WET workshop.

Other funding requests are currently under evaluation and consideration for Foundation support. Nevertheless, funds remain available and the Foundation would like to see applications for funding from programs and activities targeting education of the public and students on water issues.

If you are a member of a group or organization that operates to fulfill these actions and you are looking for financial support, you are urged to apply to the Foundation for possible funding. We are actively seeking applicants for funding.

Donors and Funding Candidates can find additional information on the Foundation and electronic application forms on the MGWA web page <http://www.mgwa.org/foundation.html>

It is possible to donate to the Foundation through the web page by "buying" donations in our "store".

Please do not hesitate to contact Foundation Board Members (Gordie Hess, Rob Caho, Dave Kill, Jeanette Leete) with any questions or for additional information.

Highlights of March 2003 Pharmaceuticals Conference in Minneapolis

New findings showing widespread detection of pharmaceuticals and endocrine disrupting chemicals (EDCs) in surface and ground water and advances in treatment technology were highlights of the National Ground Water Association's third conference on emerging contaminants, held in April in Minneapolis. The conference featured a strong international presence both on the speaker's platform and in the audience, with representation from Austria, Australia, Canada, Denmark, Finland, France and Germany. Representatives from eight major drug manufacturers also attended.

"The fact that estrogen was recently deemed a human carcinogen and the growing evidence of reproductive disorders in wildlife from EDCs promise to keep these compounds interesting," said Bob Masters, conference coordinator. The next pharmaceuticals conference is scheduled for September 2004.

Full proceedings of this year's conference are available on CD ROM through the NGWA bookstore. In addition, a special 2004 issue of Ground Water Monitoring and Remediation will be dedicated to the occurrence and fate of EDCs and pharmaceuticals during ground water recharge, with guest editor Dr. Thomas Heberer from the Technical University of Berlin.

Reprinted from the NGWA On-Line Newszine, April 2003.

MGWA Board Meetings

February 6, 2003

Place: Black Bear Crossing in St. Paul, Minnesota

Attending: Marty Bonnell, President; Chris Elvrum, President Elect; Eric Hansen, Treasurer; Jennie Leete, WRI; Jon Pollock, Secretary; Norm Mofjeld; Mike Trojan, Education

Approval of Minutes: Minutes for the Regular Board Meeting held on January 8, 2003 were approved by the Board.

Treasurer's Report: No Report from Eric as no changes have occurred since the last Board Meeting.

Membership: Jennie indicated that membership is ahead of normal for this time of year. 44 members have elected to receive paper copy of the newsletter and eleven people have ordered paper directories.

Web Page: Jennie indicated that Sean has posted info from Education Committee on the web site. The Groundwater Information Guide from Tim Thurnblad is ready to go to MGS in PDF. Not quite sure on status of HTML. Board approved motion to: Create a link on the MGWA web page to the Minnesota Groundwater Information Guide on the Minnesota Geological Survey's web site.

Foundation: \$295.00 dollars added to Foundation from contributions from membership renewal. \$105.00 dispersed to Project WET.

Education: Mike Trojan indicated that the Education Committee met last week. Project WET will be first week in April. Jim will submit article on where and when. Committee working on Ground Water CD. Proposing legislative process will look for Board approval at next Board Meeting. Concerning membership: would like to see conferences include business meetings. Jennie indicated that the conference rooms are expensive and that perhaps this type of meeting should be held elsewhere. Education Committee will discuss ways of increasing membership and will present to the Board. Jon indicated that the Board would be interested in hearing the Education Committee's ideas and exploring a funded membership drive.

Newsletter: March issue is coming together. Need a picture of Chris, Foundation Report, list of field trip guidebooks. Jennie has previous year's financial report.

Old Business:

Spring Conference: Motion approved: MGWA 2003 Spring Conference will be dedicated to David Ford. Someone from DNR will speak about Dave

Ford at the Conference. Flyer and Agenda will indicate that the conference is being dedicated to Dave.

Outstanding Service Award: Award recipients do not need to be members, if given this year, it will be at the Fall Meeting. There will be no membership award this year.

New Business

Future Conference Location: Earle Brown Center is inexpensive; however we do receive complaints about amount of food, the size of the room, and the air. Alternatives discussed included the History Center and the Thunderbird. Motion approved: MGWA Board authorizes WRI to solicit bids for fall conference locations.

Fall Field Trip: St. Croix field trip with AIPG lead and possibly WGWA and WIAIPG. Jon will get copy of the Memorandum of Agreement between AIPG and MGWA to Chris.

March 6, 2003

Place: Black Bear Crossing in St. Paul, Minnesota

Attending: Marty Bonnell, President; Chris Elvrum, President Elect; Rob Caho, Past President; Eric Hansen, Treasurer; Jon Pollock, Secretary; Jennie Leete, WRI; Sean Hunt, WRI; Norm Mofjeld, Newsletter; Mark Ferrey, Education; Gordy Hess, Foundation

Approval of Minutes: Minutes for the Regular Board Meeting held on February 6, 2003, were approved by the Board with the following corrections: The meeting location name was changed from Black Bear Crossing Como Pavilion to Black Bear Crossings. The typographical error in the spelling of the word field under the Fall Field Trip heading as filed was changed to field.

Treasurer's Report: WRI completed the 2002 taxes and the forms will be signed and sent this week.

Membership: Sean passed out membership renewal update. Approximately 45 renewals in the last month. Second notices (paper copies) will be sent this week. Renewals indicate that we are on target for usual amount of members.

— continued on next page

Board Minutes, cont.

Web Page: Spring Conference information was recently added to web page. Brochure has been finalized and is going out this week.

Foundation: One request for funding was received for \$200.00 for attendance at the Minnesota Science Teachers Conference in April and is being reviewed. Gordy is looking into alternatives for investments.

Education: Mark Ferrey reported that the Education Committee is looking for comments from the Board on their proposed legislative process. Not all Board members acknowledged the receipt of the process so discussion was tabled until next meeting. Mark will send the proposed legislative process to the Board members. Mike Trojan has received grant (\$2,500.00) to look at surface water/ground water interaction from the Minnehaha Watershed District. Mike is looking to minimize the amount of money spent on equipment. The Education Committee continues to work with the Science Museum on a ground water exhibit.

Newsletter: Norm reported on the March issue.

Old Business:

Spring Conference: Flyers have been prepared and are going out this week.

New Business:

Future Conference Location: WRI will solicit future conference venues.

Fall Field Trip: Chris is the MGWA representative and is working with the AIPG to set up the fall conference. The Wisconsin Ground Water Association has been contacted. Jon will get copy of the Memorandum of Agreement between AIPG and MGWA to Chris.

Meeting Date: April 3, 2003

Place: Black Bear Crossing in St. Paul, Minnesota

Attending: Marty Bonnell, President; Chris Elvrum, President Elect; Rob Caho, Past President; Eric Hansen, Treasurer; Jon Pollock, Secretary; Jennie Leete, WRI; Sean Hunt, WRI; Norm Mofjeld, Newsletter; Mike Trojan, Education.

Approval of Minutes: Minutes for the Regular Board Meeting held on March 6, 2003, were approved by the Board.

Membership: Down by about 50 members at this time last year. Sean handed out a table and graph of the membership. A motion that non-members paying full conference fees will automatically become members unless specifically requested otherwise. Motion was passed.

Web Page: Setup newsletter area. Sent email to members telling them newsletter was available. Updated calendar. Updated education web page.

Foundation: No report.

Education: Mike Trojan requested use of display board. Mike will set up display table at Spring Conference. Education will run loop on screen during breaks at the Spring conference. Legislative process still not seen by all members. Chris will forward to Board and this issue will be on the next agenda. Web page for teachers changed to education web page. Committee would also like to put power point presentation on web page. Mike is looking into this issue.

Newsletter: Complaints about downloading time. Sean looking into a printable copy with no links that would not take so long. Norm had four paper copy options. Option chosen is 8.5x 11 with a staple in corner.

Old Business:

Spring Conference: Kent Lokkesmoe of DNR Waters will speak to dedicate conference to Dave Ford.

Future Conference Location: Cost will double for another location like Mystic Lake or History Center. Jennie will contact Thunderbird.

New Business:

Performance Alloys wants to sign up as corporate member. Jim Aiken will ask if they want to actually advertise with us instead of become a member, since they are a well driller supply company. Motion was made and passed to accept Performance Alloys Corporation as corporate advertiser and, if they choose that option, to provide them with no more than one set of mailing labels of our membership per year.

Fall Field Trip

Keep September 26-27th open for this year's Fall Field Trip.

The Minnesota Chapter of the American Institute of Professional Geologists (AIPG) has the lead this year for the annual fall field trip, co-hosted by MGWA. The Field Trip is scheduled for September 26th – 27th, 2003. It will depart from Hudson, Wisconsin and travel North along the St. Croix River Valley exploring the geology and hydrogeology along the way.

The following stops are planned:

- Birkmose Park, Hudson, WI - Overview of St. Croix Valley; Indian burial grounds; research in the valley
- Boomsite, Stillwater, MN Hydrostratigraphy - Franconia Fm outcrop (Mazomanie member) + springs
- Pine Needles Cabin, Marine on St. Croix - Groundwater-dependent natural resources
- Dresser Trap Rock, Dresser, WI - Mineralogy
- Crex Meadow, Grantsburg, WI - Glacial Lake Grantsburg
- SandRock Cliffs Park, Rural Grantsburg, WI - Paleozoic stratigraphy
- Rock Creek quarry, Rock Creek, MN - Grantsburg sublobe & Glacial Lake Lind sediments
- Beroun Moraine, Beroun, MN - Thrust fault in glacial sediments
- Robinson Park Sandstone, MN Fractured Hinckley sandstone\stratigraphy
- Hinckley flowing spring, Sandstone, MN - Spring in Hinckley\dyke trace
- Beaver Sinks Askov, MN Sinkhole development in Hinckley SS
- Basalt Traprock Quarry, Rural Askov, MN - Quarry on margin of Douglas Fault
- Kroon Farms, Rural Askov, MN - Sinkhole development and pollution abatement at Rocky Kroon farm
- Audubon Center, Grindstone Lake, MN

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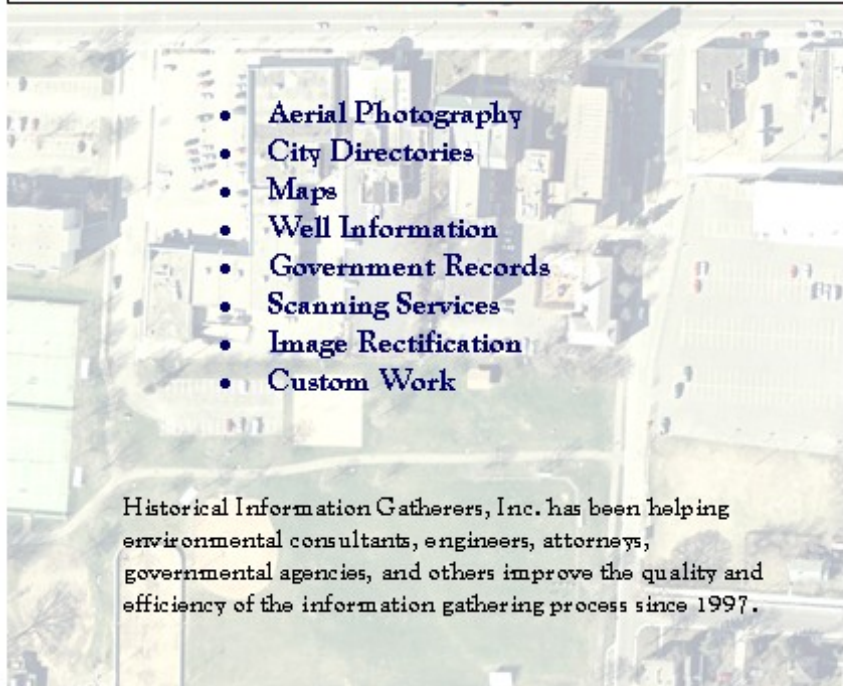
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MGWA Membership/New Members

MGWA membership has been in the lower 500s the past 4 years. A core group seems to maintain their membership from year to year. MGWA gains new members primarily from contact with nonmembers from our conference and field trips.

New Members 2003

- Scott Alexander, U of MN
- Valene Anderson, URS Corporation
- Ann Banitt, US Army Corps of Engineers
- Karl F. Beaster, American Engineering Testing
- Kim Benson-Johnson, MN Dept of Health
- Judy Boudreau, MN DNR Waters
- Ross A. Brian, Widseth Smith Nolting
- Douglas Bruner, US Army Corps of Engineers
- Mac Cafferty, City of Lakeville
- Camilla Correll, Emmons and Olivier Resources LLP
- Jeremy Coughlin, Braun Intertec Corp
- Michele DiGirolamo Ross, Emmons and Olivier Resources LLP
- Dana Dostert, MN DNR Waters
- Doug Edson, MN Dept of Health
- Brett Emmons, Emmons and Olivier Resources LLP
- Bernie Esselman, TestAmerica Inc.
- Richard Foster, Bonestroo, Rosene, Anderlik & Assoc
- Robert Frykman, AMEC Earth and Environmental
- Beverly A. Gudbrandson
- Roy Hill, Pinnacle Engineering
- Pat Hoggarth, Nicollet County
- Dennis Holme, US Army Corps of Engineers
- Mike Howe, MN Department of Health St Cloud
- Mark Iverson, Cedar Corp
- David Jenkin, AllPhase Companies Inc
- Beth L. Johnson, Geomatrix Consultants
- Kelly Jorgenson, MN Dept of Health
- Eric Kovatch, Natural Resource Technology
- Heather Krauel, MSA Professional Services
- John Landwehr, Pinnacle Engineering
- Michael A. Lee, Ceres Environmental
- Scott Longanecker, MN Dept of Health St Cloud

- Scott Maclean, Nicollet County
- Eric Merten, MN DNR Fisheries
- Kathy Metzker, MN DNR Waters
- Jennifer Olson, Emmons and Olivier Resources LLP
- Todd Osweiler, Rochester Public Utilities
- Kristina Kay, Rehling Cooper Engineering
- Thomas Reppe, Epoch Environmental
- Brian Ross, Widseth Smith Nolting
- Chris Rydell, Summit Envirosolutions, Inc
- Marvin Schumacher
- Dale Seppa, SW Mississippi Comm College
- Mel Sinn, MN DNR Waters
- Jim Solstad, MN DNR Waters
- Dave Strand, Leggette, Brashears & Graham
- Judy Sventek, Metropolitan Council
- Dr. John B. Swenson, University of Minnesota - Duluth
- Warren Topel, TestAmerica Inc.
- Paul Turner, Wenck Associates Inc
- Ronald G Urick
- Eric Wallin, Widseth Smith Nolting
- John R. Wells, MN Environmental Quality Board
- John Whelan, Soil Engineering Testing Inc
- Mary A. Williams
- Marianne Winberg, TestAmerica Inc

