

Minnesota Ground Water Association

www.mgwa.org

Newsletter

**December 2008
Volume 27, Number 4**

Featured:

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- ◆ Nitrate Increasing in Ground Water, page 12
- ◆ Traverse-Grant Regional Hydrologic Assessment, page 14



— MGWA President
Stu Grubb

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President's Letter

By Stu Grubb, MGWA President

“Change” seems to be what everyone wants lately, so this is a good time to look at changes coming to the ground water community. The Clean Water, Land, and Legacy Amendment was passed by Minnesota voters in November. This will provide unprecedented funding for projects to study, protect, and clean up ground water resources. The recent economic downturn has started to slow ground water work on behalf of private industries, including residential and commercial development, manufacturing, and mining. As a result, I expect to see a shift in ground water-related activities toward state and local governments and the consultants that serve them.

Changes may be coming to regulatory agencies as well. Met Council reached a milestone with the release of its Metropolitan Area Draft Master Water Supply Plan. The Freshwater Society and the University of

Minnesota’s Water Resources Center recently sponsored a conference and other activities to look at ground water sustainability issues. Groups including the Citizens League are focused on changing water governance in Minnesota. The clear message from these efforts is that Minnesota’s complex collection of governmental units must find new processes and embrace changes to address long-term groundwater management issues.

Finally, change is coming to MGWA. We need to select two new Board members, so please take a few minutes to vote on line when you receive an invitation. MGWA candidates promise to run fewer commercials than candidates for Minnesota’s other state-wide offices. The MGWA Board is also working to upgrade our website.

With a successful completion of the Fall Conference and this newsletter, I am now a lame duck waiting for President-elect Scott Alexander to take over my position. Thank you to the MGWA for a great year.



Jack Frost's Beard. Groundwater emerging from partings in the Platteville Formation along the Mississippi River Gorge froze over the weekend of November 8 and 9, 2008. Photo by Steve Robertson, Newsletter Team

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Newsletter Deadlines

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MGWA NEWS

Officer Candidates

Steve Robertson, Candidate for President-Elect

Steve Robertson currently works as a Hydrologist in the Source Water Protection Unit of the Minnesota Department of Health (MDH). His work at MDH for over 10 years has mostly focused on helping public water supply systems safeguard their drinking water supplies through wellhead protection planning. Prior to working at MDH, Steve worked in environmental consulting for 13 years. His educational background includes a B.A. in Geology from Carleton College and a M.A. in Geological Sciences from the University of Texas at Austin. He has volunteered for MGWA since 1996, primarily as part of the newsletter committee.

“I have long appreciated the field trips, conferences, newsletters, personal contacts and other benefits of MGWA membership. My vision for MGWA is to maintain the high quality of its traditional offerings so that its leading roles in groundwater education, technical training, and information distribution are ensured. In addition, I would like to continue MGWA efforts to engage the next generation of groundwater professionals, as well as the many others in society that will benefit from groundwater literacy, because, as we all know, groundwater resources will be subject to increasing demand and continuing threats from contamination in the future.”

Craig Kurtz, Candidate for Treasurer

Craig Kurtz has a B.S. in Geology from the University of Minnesota, and an MBA in Finance from the University of St. Thomas. A professional licensed geologist, he spent 13 years in engineering consulting at SEH Inc. as a project manager and hydrogeologist on water supply, wellhead protection, aquifer characterization, groundwater contamination, and well siting and design projects. Currently, he works for 3M as a Financial Risk Analyst. Craig has been the Treasurer for the MGWA since 2004.

“As Treasurer, my vision for the MGWA is to continue the effective management and good stewardship of the organization’s finances in such a way as to maximize MGWA’s influence in promoting the education, understanding, protection, and careful use of Minnesota’s groundwater resources.”

Bea Hoffman Announces Her Retirement

After almost 18 years as Director of the Southeast Minnesota Water Resources Board, I will be stepping down at year’s end. Our 10-county collaboration was formed against the backdrop of the Ironwood Landfill contamination near Spring Valley in the early 1980’s. Fourteen hundred drums of toxic waste were removed from the site, many crushed and leaking and some sitting directly on bedrock. The site became the first landfill Superfund site in the state and led to a raised public awareness of the vulnerability of our drinking water supplies in a karst area. I have been privileged to work with many fine water resource professionals to improve our understanding of karst aquifers and to advance public understanding of their susceptibility. As part of efforts to protect and improve our region’s water resources, I have worked with our partners at the Minnesota Geological Survey, Science Museum of Minnesota, and Departments of Health, Agriculture, and Natural Resources on ground water monitoring, well head protection research and planning, and karst education. I am thankful for the opportunity to serve in the interest of clean water and to be associated with such energetic and dedicated people.

I’m excited and optimistic about our common future. Since I have always worked, I will need a crash course in retirement, but I do have several personal goals which include being more available to family and friends and serving my community in meaningful ways.



Bea Hoffman and meeting essentials

PROFESSIONAL NEWS

Rebecca Flood is new Assistant Commissioner at PCA

Rebecca Flood has been appointed as the Minnesota Pollution Control Agency's new Assistant Commissioner for Water Policy. She worked previously many years for Metropolitan Council Environmental Services. She started in her new position in October.

EPA Appoints New Head of Science Advisory Board

United States Environmental Protection Agency (EPA) Administrator Stephen L. Johnson recently announced the appointment of Dr. Deborah Swackhamer, an internationally known expert on toxic chemicals in the environment, as chair of the EPA Science Advisory Board (SAB). Dr. Swackhamer, Professor of Environmental Health Sciences and Co-Director of the Water Resources Center at the University of Minnesota, brings to the job extensive experience in applying science to environmental protection. Her research interests focus on chemical and biological processes affecting the behavior and fate of toxic organic contaminants such as PCBs, dioxins and pesticides in water, particularly bioaccumulation of persistent compounds in fish in the Great Lakes.

The SAB is an independently chartered federal advisory committee composed of external scientists and engineers. The SAB's principal mission includes reviewing the quality and relevance of scientific and technical information being used or proposed as the basis for EPA regulations. Every year, EPA solicits nominations for members to serve on the SAB. Dr. Swackhamer's two-year term began October 1. For more information about the SAB, you can check this web site: www.epa.gov/sab

— Material for this article was abstracted from a September 17, 2008 EPA news release.

Clean Water, Wildlife, Cultural Heritage and Natural Areas Amendment Passes

On November 5, Minnesota voters approved an amendment to the state constitution that increases the state sales tax by three-eighths of a percent beginning July 1, 2009, to fund clean water, outdoor recreation and the arts. The cost of a \$100 purchase will increase by 38 cents. About \$275 million a year is expected to be raised through 2034, when the amendment sunsets.

According to the law, 33 percent of the money raised (about \$90 million) is to be allocated to a clean water fund. Money deposited into the fund may be spent only to protect, enhance and restore water quality in lakes, rivers and streams, and to protect ground water from degradation; at least five percent of the fund must be spent only to protect drinking water sources.

The newly appointed Lessard Outdoor Heritage Council consists of the following members: James Cox, Scott Rall, Wayne Enger and Bob Schroeder (appointed by the Governor); David Hartwell, Darby Nelson, Rep. Rick Hansen and Rep. Bob Gunther (appointed by the House); and Lester Bensch, Michael Kilgore, Sen. Ellen Anderson, and Sen. Bill Ingebrigtsen (appointed by the Senate). The Minnesota Department of Natural Resources provides administrative support. The Council is named after former state senator and sportsman Bob Lessard. The council's mission will be to sift through funding proposals and make annual recommendations to the legislature. In addition, the existing Clean Water Council, which consists of 19 citizens appointed by the governor and four state agency representatives, is also likely to play an important role in advising lawmakers about funding for surface water, ground water and drinking water projects.

State Representative Jean Wagenius, chair of the House Environment Finance Committee, said legislators will not be able to use the sales tax increase for other purposes. "This is not money to backfill agency shortfalls," she said. "It's the governor's responsibility to have budgets that cover the basic functions of state agencies."

A web page has been set up for the Lessard Outdoor Heritage Council at www.lohc.state.mn.us

— contributed by Tom Clark, Newsletter Team

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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's Corporate Members for 2008

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Links at www.mgwa.org

MGWA Pumping Test Weekend Workshop

On October 3 to 5 of this year, the MGWA and the University of Minnesota hosted a workshop on aquifer pumping tests. Dr. Martin Saar of the U of M and Scott Alexander of the U of M and MGWA led the workshop. A "hands-on" pumping test was conducted at the UM Hydrogeology Field Site near Akeley, Minnesota with accommodations at the nearby Deep Portage Conservation Reserve. Attendees, shown in Figures 1 & 2, included fourteen people ranging from students to consultants and agency staff. All four students received full or partial scholarships courtesy of the MGWA Foundation.



Figure 1. Group photo of workshop attendees.

The weekend of October 3 to 5, 2008, was selected after consultation with Deep Portage staff to coincide with the expected peak of fall colors. The Friday evening reception was followed by a lecture from Dr. Martin Saar of the U of M Dept. of Geology & Geophysics. Martin covered the basic theory of pump test analysis starting with Theim, Theis and Jacob. Once he had given us a grounding in the assumptions associated with these analytical solutions, he went on to explain how these models can be applied to a range of real world aquifer situations.

The next morning, after a very pleasant breakfast at the Deep Portage Dining Hall, we headed out to the UM Hydrogeology Field Site. The U of M Field Site includes a pumping well with 120 gallons per minute (gpm) capacity and seventeen monitoring wells at radii of seven to 1000 feet from the pumping well. Figure 3 shows the pumping well in operation and several nearby monitoring wells. The unconfined glacial outwash aquifer is about 40 feet thick with a thick basal till aquitard forming the base. The water table is about 60 feet from the land

surface and the bottom of the aquifer is about 100 feet below ground surface. Several of the monitoring wells are nested at the same radius allowing comparison of water table and semi-confined conditions within the aquifer. The U of M Field Site is contained within a much larger USGS study area encompassing Williams Lake and the Shingobee watershed.



Figure 2. Pumping well at U of M Field Site.

After careful calibration of the electronic water level tapes to the "Official Olaf Pfannkuch Steel Tape," we proceeded to measure pre-pumping static water levels. We then re-measured the static water levels to confirm the static readings. Once the readings were found to be reproducible to one-hundredth of a foot we began the pumping test. Power was provided by a USGS diesel generator which is on loan to the U of M.

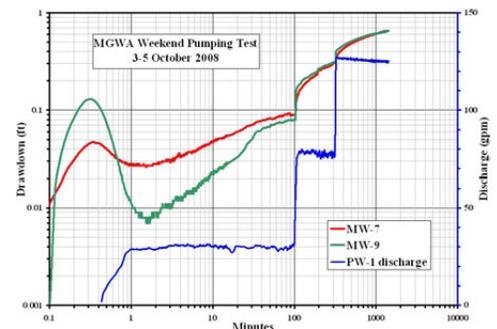


Figure 3. Continuous data logger data from pumping test.

The pumping test was conducted with three steps in the pumping rate. The first step was set at about 30 gpm, followed 100 minutes later with a 77 gpm step. The final step started after 200 minutes at the second step with a 125 gpm discharge. Discharges were monitored continuously with an orifice plate on the discharge pipe and confirmed with periodic filling of a 100 gallon stock tank. The pump was then set up to run overnight for a total of about 24 hours. Figure 3 shows

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MGWA Fall Field Trip, cont.

some of the data logger data from two monitoring wells located 43 feet from the pumping well. Note that the deep well (MW 9) responds much faster than the shallow water table well (MW 7). Discharge data is plotted relative to the right-hand axis and provides a reference for the timing of individual steps. Note that late time data for each step is approaching a classic Theis curve shape. The “wave” seen in the first minute of pumping is associated with an initial dewatering of the pumping well at the start of the test.

Hand water level readings were collected at the whole suite of monitoring wells with electronic water level tapes. These hand readings backed up wells with data loggers and extended the data set to wells with no data logger. Figure 4 is a Jacob plot of the hand data near the end of each of the three steps. Both Figure 3 and 4 can be used to calculate transmissivity (T) and storativity (S) for our outwash aquifer.

The step test allows us to calculate both T and S at increasingly larger radii of influence and provides some comparison aquifer properties with depth. Several limitations of the Jacob analysis can be illustrated with Figure 4. First, at large radii the observed drawdown flattens out as drawdowns approach zero. This is implicit in the small “u” value assumed by the Jacob solution. Second, at wells close to the pumping well, non-horizontal flow is starting to influence the observations creating excess drawdown at the seven and ten foot radii and a shortfall of drawdown at fourteen feet. The seven and ten foot wells are screened in the middle of the aquifer in a very leaky, semi-confining layer while the fourteen foot well is screened right at the water table. Longer pumping times should improve linearity of both the near and far radius drawdowns. The application of a step drawdown test has several advantages over a conventional “full-on” pumping test. In addition to the hydrologic tomography that arises from the varying radii of influence, well efficiency can also be calculated. Even though our weekend pumping test was a relatively short 24 hours it did serve to illustrate a number of the advantages of a step drawdown test while reinforcing the importance of a long time period pumping test, i.e., days to weeks.

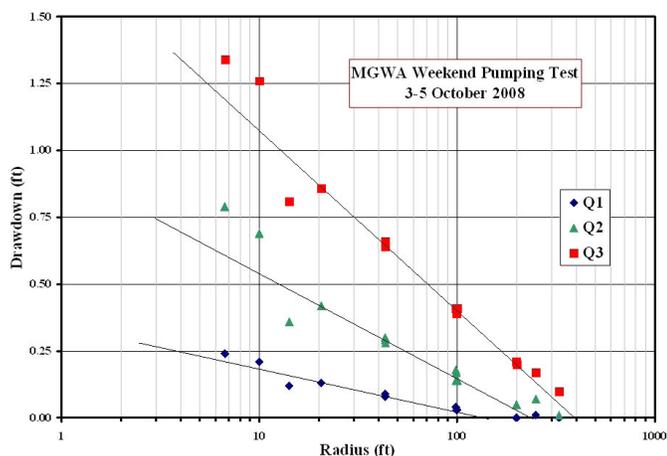


Figure 4. Jacob Plot

After a long, but very pleasant day in the field, we returned to Deep Portage for another wonderful meal and a hike to the Deep Portage observation tower to view the fall colors. Figure 5 shows the view of the Deep Portage Lodge with Big Deep Lake in the background. An evening discussion of pump test analysis was led by Scott Alexander. Important points included the observation that no matter what kind of fancy data analyses are applied to your pumping test, it all relies on quality data. Careful calibration of hand water level tapes and data logger is paramount. Well-calibrated flow measurements are also essential. Once you are certain that your data are reproducible and reliable, you can let the analysis begin.



Figure 5. Deep Portage Conservation Reserve and Big Deep Lake.

Sunday morning dawned a bit gray and threatening to rain after an incredibly sunny Friday and Saturday. We returned to the field site to make a final round of water level measurements. After a second backup round of measurements to confirm the results, we terminated the pumping test. We did, however, manage to shutdown the pumping well and put away all of the discharge pipe and other equipment before the rain began on Sunday afternoon.

— contributed by Scott Alexander, MGWA President-Elect

Twin Cities Forecaster Newsletter Arrives

The National Weather Service Forecast Office in Chanhassen, partnering with the North-Central River Forecast Office, has initiated a new newsletter that will be published seasonally. The Fall 2008 first issue highlights recent flooding in the region, how winter precipitation is observed and measured, and includes a feature on the two EF-3 tornadoes that struck Hugo and Willmar earlier this year. A recurring feature will be an advice column for Coop Observers. In this issue the details of snow measurements are discussed.

The newsletter can be found on line at:

www.crh.noaa.gov/images/mpx/Newsletter/Fall08.pdf

MGWA 2008 Fall Conference

November 13, 2008

MGWA President **Stu Grubb** welcomed the attendees to a conference emphasizing advances in data collection.

Martin Wangenstein, Bay West, Inc., provided a site closure strategy consisting of future first planning, the triad (managing uncertainty and characterizing the site), systematic project planning, dynamic work strategies (decision tree) and real time measurement technologies. Case studies of a former radar tower site and bulk fuel storage area demonstrated the use of this site closure strategy.

Dan Kelleher, Midwest Geosciences Group, stressed the importance of analyzing geologic data in the field. He outlined a geologic framework consisting of knowing what to expect before field activities, defining and differentiating geologic units, correlating geologic units from boring to boring, identifying anticipated conditions, and reducing the number of borings and wells.



Martin Wangenstein, Bay West

Bill Olsen, Dakota County Water Resources, reviewed a water temperature survey conducted by walking through the Vermillion River using a Dallas Thermochron attached to a pole. River temperature was measured as an indication of ground water flux. Temperature changes reflected areas of ground water seepage, tributary contributions, and diurnal variations.

B.J. Bonin, WSB Associates, proposed using vibration monitoring to improve well construction methods. He contrasted pumping test results of another well in Rosemount, which behaved as expected, with a well in Rosemount, which did not. He noted that atypical vibrations indicate atypical conditions.

Jason Kirwin, WCEC, explained the use of laser-induced fluorescence (LIF) for assessing hydrocarbon contaminated sites by effectively and efficiently delineating the source area. The key to LIF is understanding subsurface hydrocarbon contamination phases. LIF equipment consists of an ultraviolet laser light, fiber optic cable in rods, a shock protected optical compartment, and a sapphire window.

Tim Cowdery and Michael Menheer, USGS, promoted the agency's ground water sampling mobile laboratory. Comparable data requires consistent methodology. Mobile labs are an effective sampling tool. Automation can be a substantial aid to efficiency and accuracy.

John Jansen, Aquifer Science and Technology, reviewed past and present geophysical methods. Factors to consider when specifying survey parameters include characteristics of the target and site, desired minimum resolution, optical geophysical method, minimum sampling density and signal to noise ratio.



USGS Water Quality Van

Bob Thein, Thein Well Drilling, compared past and present well drilling technology, including cable tool drilling, mud, air, or dual rotary drilling, sonic drilling, direct push (geoprobe), hollow stem auger drilling, coil tube for geothermal applications, diamond core drilling, reverse circulation, and cone penetration testing rigs.

Brad Oothoudt, Hole Products, noted the depth and site conditions for choosing the appropriate method of drilling. He outlined the steps of clearly defining the purpose of the borehole, reviewing the project requirements, selecting the drilling method(s), bidding, and project completion.

Pat Conrad, Emmons & Olivier Resources, reviewed the stormwater area at the sheep pasture infiltration basin that was visited by the conference attendees in the afternoon. He discussed the development of the site including the pretreatment basin and use of natural landforms and vegetation.

In the afternoon, the sessions moved outside. Here, we got to see first hand the sheep pasture infiltration basin, which was the subject of the last indoor session of the day.

Despite its name, the sheep pasture was full of cows, many of which, by congregating nearby, seemed as curious as the rest of us to see the outdoor demonstrations.



Pat Conrad at the demonstration area

see the outdoor demonstrations.

The fall conference outdoor demonstrations included:

- ◆ RH Renner and Sons - Well drilling equipment.
- ◆ Thein Well drilling - Well drilling equipment and direct push demonstrations.
- ◆ Pat Conrad, Emmons & Olivier Resources - Sheep Pasture stormwater infiltration basin.

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MGWA Fall Conference, cont.

- ◆ Bill Olsen, Dakota County - Stream temperature profiling equipment.
- ◆ Tim Cowdery and Michael Menheer, USGS - Well sampling and mobile laboratory.

MGWA members appreciate the time and effort exhibited by each of the exhibitors to show off their equipment.

— contributed by Norm Mofjeld and Steve Robertson, Newsletter Team; photos by Sean Hunt



Thein's rig was inspected by the regular occupants of the outdoor demonstration area.

2008 Minnesota Water Resources Conference

The Minnesota Water Resources Conference was held in St. Paul on October 27 – 28, 2008. This conference, sponsored by the University of Minnesota's Water Resources Center and College of Continuing Education, presented innovative and practical water resource management techniques and updates regarding ongoing research into Minnesota's water resources. Best practices, water policy, and research into emerging issues were discussed. The conference included concurrent session tracks on subjects such as stormwater best management practices, water quantity and quality issues in the Minnesota River Basin, fresh water sustainability, emerging contaminants, the impact of southeast Minnesota floods, and the 35W bridge, among others.

In the area of fresh water sustainability, Professor John Nieber (University of Minnesota) and John Wells (Minnesota Environmental Quality Board) spoke of work being done toward planning to support fresh water as a quantifiable renewable resource. Julie Ekman (Minnesota Department of Natural Resources) closed out the track by describing the DNR's current permitting program and how it might relate to fresh water sustainability.

In the track regarding Groundwater-Aquifer Characterization and Availability, Jeff Broberg (McGhie & Betts Environmental Services) discussed case studies from Rochester regarding the Decorah edge. Robert Tipping (Minnesota Geological Survey) spoke of recent improvements in the characterization of the hydrostratigraphy of the Twin Cities region by incorporating a hydrochemical approach. Finally, Lanya Ross spoke about water supply planning currently underway at the Metropolitan Council.

Pesticides, Contaminants of Concern and Emerging Contaminants were the topics for an afternoon track, where presentations by Denice Nelson and Mark Lundgren (University of Minnesota) and Bill VanRyswyk (Minnesota Department of Agriculture) described in turn the effect of fermentation processes on recalcitrant compounds in groundwater, the fate of industrial phytoestrogens in the environment and an assessment of pesticides in Minnesota Lakes.

The Plenary Session speaker for the second day of the conference was Dr. Mark Seeley, University of Minnesota

Extension Climatologist. Dr. Seeley described the southeast Minnesota floods of August 18-20, 2007 in their historical and future context. A station in Hokah (Houston County) reported all-time state records for 24-hour rainfall (15.10 inches), storm total rainfall (16.27 inches) and monthly total rainfall (23.86 inches). Upstream from Houston, the town of Rushford was severely damaged (see report in MGWA Newsletter, June 2008) and natural features and infrastructure at Whitewater State Park were wiped out by flood waters. Dr. Seeley reminded the audience that it is important to understand that Minnesota climate is changing, producing amplified variation in precipitation, which impacts the hydrologic cycle, and not always for the better.

The morning Concurrent Sessions had a series of presentations on Wetland Restoration and Mitigation Design Strategies. Lydia Nelson of HDR Engineering described the Minnesota Highway 212 improvement project in the southwest Twin Cities Metro Area. The Design-Build contract required the on-site creation of 33 acres of new wetland credits and 68 acres of public value credits. The final mitigation plan was a combination of on-site new wetland and public value credits, off-site mitigation, and wetland banking credits. Ron Leaf of SEH, Inc. discussed managing stormwater and restoring a natural wetland corridor in an urban setting. The former 50-acre golf course in Maplewood (parts of which were often under water following heavy rains), is undergoing development with a mix of commercial land uses and open space.

The afternoon Concurrent Sessions, which wrapped up the two-day conference, included two presentations by representatives Petra DeWall, Kjersti Anderson and Dave Redig of the Minnesota Department of Transportation (MNDOT) on the rebuilding of the highway infrastructure of southeast Minnesota following the devastating flooding of August 2007. MNDOT spent many hours and thousands of dollars cleaning debris from roads, ditches and culverts, repairing roadway inslopes and backslopes and assisting cities and counties with their cleanup efforts. Some roadway repairs used innovative technology like soil nailing, to repair very steep roadway inslopes which were damaged and compromised during the flooding.

Additional information is available through the website: wrc.umn.edu/waterconf

— contributed by Tom Clark and Eric Tollefsrud

OBITUARY NOTICE

*Georgette Germaine Hélène Lobbé, épouse Pfannkuch
10 Octobre 1929, Paris, 13 Septembre 2008, Saint Paul MN
Chevalier dans l'Ordre des Palmes Académiques*

Georgette Pfannkuch, wife of Olaf Pfannkuch, passed away this last September. Georgette, who had had cancer many years ago and a heart attack four years ago, was 78.

In 1949, she attended theater school in Paris and in the 1950s, she appeared in several films, such as "Les Misérables" by Jean-Paul Le Chanois and "Les Amants" by Louis Malle. She acted on the Paris stage, too. Georgette and Olaf moved to the United States in 1965 after Olaf joined the faculty of the University of Illinois in Urbana. They moved to St. Paul in 1968 when he joined the Department of Geology & Geophysics at the University of Minnesota.

She always missed living in France, said her daughter, Karin VanZyl of St. Paul. "She was so French," said her daughter, adding that she never entirely adapted to the United States. "She would rather convert the English speakers to French speakers, always pushing the food and music," said her daughter. "She was the best cook on Earth," added her daughter. In many ways, "she did not ever leave France," said her daughter.

Georgette aired "Bonjour Minnesota" on KFAI Radio from 1984 until a few months ago. She broadcast in French, while her on-air partner of many years, Caryl Minnetti of Bloomington, provided the English. "She planned the program, using her huge collection

of French pop music from Maurice Chevalier to current rap musicians," said Minnetti. Minnetti said that her voice was so distinctive that strangers on the street would recognize her. She interviewed French personalities ranging from the mime, Marcel Marceau, singer Nana Mouskouri to François Girard, director of the movie "Red Violin."

Pfannkuch entertained friends and international students regularly. "Some of them considered her a second mother, because she knew what it felt like to be away from home," said her husband. Olaf's students learned early on not to turn down an opportunity to dine at the Pfannkuch residence.

In 2002, she was awarded the Chevalier dans l'Ordre des Palmes Académiques, or Knight in the Order of Academic Palms, by the French government for advancing French language and culture in the United States.

In addition to her husband and daughter, she is survived by her other daughter, Barbara Pfannkuch Brown of Duluth; sons, Johannes Pfannkuch of New York City and Georges Lobbé of Paris; sister, Pauline of Antheit, Belgium, and four grandchildren.

A memorial in honor of Georgette has been set up at KFAI Fresh Air Radio. Contributions by check or money order payable to KFAI Fresh Air Radio can be sent by mail to: KFAI-ATTN: Georgette Pfannkuch Memorial, 1808 Riverside Avenue, Minneapolis, MN 55454.



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New Guidance Issued for Evaluating the Vapor Intrusion Pathway

The Minnesota Pollution Control Agency (MPCA) Remediation Division issued new and updated guidance for the vapor intrusion pathway in September 2008. Vapor intrusion is increasingly being recognized nationally as an important exposure pathway whose potential risk to human health must be considered at contaminant release sites. Vapor intrusion is the migration of volatile compounds from the subsurface into buildings. Compounds that are both sufficiently volatile and toxic when released in soil or ground water have the potential to migrate in the subsurface as soil gas and into overlying occupied buildings. These vapors can pose a risk to human health if the concentrations exceed indoor air risk criteria.

The MPCA has two guidance documents for addressing vapor intrusion concerns - "Vapor Intrusion Assessments Performed During Site Investigations, Guidance Document 4-01a," for sites under the regulatory oversight of the MPCA Petroleum Remediation Program (PRP), and the "Risk-Based Guidance for the Vapor Intrusion Pathway," for sites in either the Superfund, RCRA Corrective Action, or Voluntary Investigation and Cleanup (VIC) program.

The PRP guidance document 4-01a is one of several PRP guidance documents developed for the investigation and clean-up of underground storage tank (UST) and aboveground storage tank (AST) release sites. Guidance document 4-01a both updates and replaces the previous guidance of the same name which was released in 2005. The "Risk-Based Guidance for the Vapor Intrusion Pathway" is a new component of the Superfund, RCRA and Voluntary Cleanup Section's Risk-Based Site Evaluation (RBSE) Manual that provides a tiered process for evaluating risks at sites with releases of hazardous substances.

Both guidance documents present a fundamentally consistent decision framework for conducting a vapor intrusion investigation. This decision framework and guidance is based on the collection of empirical field information obtained from site specific receptor surveys, subsurface soil gas investigations, and building- or receptor-specific investigations. Site information collected and risk evaluation conducted should be interpreted within the framework of a well-developed site conceptual model. The use of a conceptual model in risk-based site evaluation is not new, but, for the vapor intrusion pathway it is an especially important tool for using multiple lines of evidence to

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Case Studies

The September 2008 edition of the LUSTline Bulletin described two recent case histories where underground storage tank systems leaked causing significant vapor intrusion requiring expensive remediation. The following summaries describe what happened in Utah and Alabama, and underscore the need for vapor intrusion guidance from state regulatory agencies.

21,000 Gallons of Gasoline Escape in Utah

During the summer of 2007, the weld-seam of a single-walled steel tank installed in 1981 failed, releasing about 21,000 gallons of gasoline in Gunnison, Utah. Statistical Inventory Reconciliation (SIR), an approved method of leak detection, was being used. The monthly data had been collected and submitted to the SIR contractor, but because the leak started the first day of the month and records were submitted after the last day of the month, the leak went undetected and unreported for 40 days. The 12,000-gallon tank leaked throughout the month of July, during which it was refilled several times. There were no drinking water impacts in this case, but because the plume followed a depression in a hardpan layer lying 10-13 feet below the surface, there was serious vapor intrusion in a three-block city area. Fifteen businesses and 15 homes were impacted and are still undergoing continuous air monitoring. One million dollars in state remediation fund coverage and about the same amount from the responsible party has been spent on the cleanup.

— continued on page 10



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Case Studies, cont.

56,000 Gallons of Gasoline Escape in Alabama

It was holiday season in 2007, when 56,000 gallons of unleaded gasoline leaked from an underground storage tank system in Alex City, Alabama and flowed toward the drainage area of a nearby recreational lake. The station owner had taken some time off, and personnel working there were not trained to recognize abnormalities, like the frequent need for fuel deliveries, for one thing. The facility had a leak detection system and the sump sensor had been recording normal readings. However, the sump sensor wasn't working properly and a frayed flex connector at the piping sump was continually leaking product under pressure. Finally, the fuel delivery company brought the need for frequent deliveries to the owner's attention. A customer had also complained about a strong odor of gasoline behind the facility. The Alabama Department of Environmental Management undertook a massive and expensive emergency response effort to prevent gasoline from entering the lake. At this writing, cleanup is ongoing.



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Vapor Intrusion Guidance, cont.

better understand the origin and distribution of vapor sources, the migration of subsurface vapors, and as a framework to assess risks to receptors. The successive and increasingly site-specific steps outlined in the guidance include: 1) conducting a preliminary vapor risk screening assessment; 2) conducting or completing a subsurface soil gas investigation; 3) conducting building-specific investigations; and, if necessary, 4) implementing response actions as necessary to eliminate identified or potential risks.

MPCA staff are developing a more comprehensive Technical Support Document that will supplement these two existing programmatic guidance documents. The Technical Support Document will include additional details on sampling methodologies and strategies, the use of multiple lines of evidence for interpreting site information,

Drinking Water Resources and Agricultural Field Day

By Mark Wettlaufer, Minnesota Rural Water Association, reprinted from an article in the Minnesota Rural Water Association newsletter "MRWA Today" -- Fall 2008 edition.

On July 29th, 2008, the Red Rock Rural Water System and City of Windom hosted a "Drinking Water Resources & Agriculture Field Day" south of Jeffers, Minnesota. The event was held to raise awareness about drinking water protection efforts and how agricultural practices and programs can protect groundwater. Area crop consultants, farm operators, rural landowners, Federal, State and local resource staff and the public were invited to attend. A variety of people attended, all sharing an interest and desire to work proactively to protect the area's drinking water resources.

A tour of the new Red Rock Rural Water Treatment Plant and overview of the Jeffers – Red Rock Rural Water Lake Augusta Well field was provided as part of the event. Dominic Jones, Red Rock Rural Water Manager, explained some of the operation and maintenance associated with running the new treatment plant. Marcus Vind, Water Operator assisted with the tour of the treatment plant.

Another session focused on helping people better understand local geology and soil conditions. The photo on page 11 shows Terry Bovee, Minnesota Department of Health, and Tom Jackson, USDA Natural Resources

and on evaluating and choosing appropriate remedial alternatives to address risks associated with this exposure pathway. The release of the Technical Support Document is anticipated near or subsequent to the 2009 Minnesota Air, Water and Waste Environmental Conference to be held on February 11-12, 2009. Links to the two September 2008 guidance documents are provided below:

Vapor Intrusion Assessments Performed During Site Investigations, Guidance Document 4-01a, Petroleum Remediation Program www.pca.state.mn.us/cleanup/pubs/lustpubs.html

MPCA Contact: Tom Higgins 651.757.2436
Risk-Based Guidance for the Vapor Intrusion Pathway, Superfund RCRA and Voluntary Cleanup Section www.pca.state.mn.us/cleanup/riskbasedoc.html

MPCA Contact: Rick Jolley, 651.757.2475

Conservation Service (NRCS), describing the soils and geology in the area and how land management decisions can impact the shallow groundwater aquifers in Southwest Minnesota.

Dave Neiman, Minnesota Rural Water Association, provided background information on the State Wellhead Protection Program and how public water systems are working to protect local drinking water resources through the development and implementation of Wellhead Protection Plans. In follow-up to Dave's presentation, I spoke on how wellhead protection boils down to individual choices and commitments on the part of what a landowner, farmer, business person, etc. does that will protect local drinking water supplies.

Over lunch, Gerald Woodley, congressional staff to U.S. Senator Norm Coleman, and Rod Hamilton, Minnesota State Representative, both spoke on the importance of clean drinking water and holding events such as this. In the afternoon, a combination of topics and information was presented highlighting agriculture best management practices.

Brian Williams, Minnesota Department of Agriculture (MDA), and Nick Muller, an area farmer, presented information on the MN NRCS funded Nutrient Management Initiative Program which allows farmers to conduct nutrient field trials on their own property to fine tune nutrient management rates and receive some financial incentive to

— continued on page 11

New DNR Geothermal Heating and Cooling System Fact Sheet

In response to the increased interest in geothermal heating and cooling systems as a way to save energy, the Department of Natural Resources (DNR) has published a new fact sheet on how these systems work and what some of the permit requirements are for the involved water agencies (DNR, Minnesota Department of Health, and Minnesota Pollution Control Agency). The fact sheet can be accessed on-line at http://files.dnr.state.mn.us/publications/waters/geothermal_systems.pdf

Geothermal Heating and Cooling Systems

What should I know about installing a geothermal system?

Do I need a DNR Waters permit for my geothermal system?

Public Waters Permit¹. A permit is required if the cool assembly (facility) is located on the bed of a public water. The requirements for permitting this facility in a lake or body of water include the following conditions:

- A government agency accepts responsibility for future maintenance of the facility or its removal if the owner fails to maintain or abandon the facility.
- No alternative sites exist that would have less environmental impact.
- A closed-loop system is used.
- The facility is not located in a designated trout stream or lake or a designated wild and scenic river.
- The facility's design and location will not cause a navigation hazard.
- The facility will not exceed more than a minimum encroachment, change, or damage to the environment, particularly the ecology of the water.
- The facility will not contain substances, if released into public waters, that would be detrimental to water quality or plant or animal life.

Water Appropriations Permit². A water use permit is required for all users, including an open-loop system, with drawing more than 10,000 gallons of ground water or surface water per day or 1 million gallons per year.

Questions? If you have questions, contact your DNR Area Hydrologist. See contact information on reverse side.

¹Minnesota Rules Chapter 6113.0212, Subp. 06.
²Minnesota Rules 6113.0620

Geothermal Heating and Cooling Systems, August 2008 Page 1 of 2

New USGS Publications

For more information or ordering assistance, call 1-888-ASK-USGS (1-888-275-8747), visit <http://ask.usgs.gov>, contact any USGS Earth Science Information Center (ESIC). To obtain a publication: Send email to: usgsstore@ff.gov.

Occurrence of Endocrine Active Compounds and Biological Responses in the Mississippi River - Study Design and Data, June through August 2006; USGS Data Series Report Number 368; Kathy E. Lee, Christine S. Yaeger, Nathan D. Jahns, Heiko L. Schoenfuss; 2008.

ABSTRACT: Concern that selected chemicals in the environment may act as endocrine active compounds in aquatic ecosystems is widespread; however, few studies have examined the occurrence of endocrine active compounds and identified biological markers of endocrine disruption such as intersex occurrence in fish longitudinally in a river system. This report presents environmental data collected and analyzed by the U.S. Geological Survey, Minnesota Pollution Control Agency and St. Cloud State University as part of an integrated biological and chemical study of endocrine disruption in fish in the Mississippi River.

Data were collected from water, bed sediment, and fish at 43 sites along the river from the headwaters at Lake Itasca to 14 miles downstream from Brownsville, Minnesota during June through August 2006. Twenty-four individual compounds were detected in water samples, with cholesterol, atrazine, N,N-diethyl-meta-toluamide, metolachlor, and

— continued on page 12

Ag Field Day, cont.

complete the trials. Next, Russ Derickson, MDA, highlighted programs and technical assistance available to both growers and public water suppliers to protect drinking water resources through their agency. Annalie Plaetz, Cottonwood Soil and Water Conservation District, and April Sullivan, Cottonwood Co. NRCS, described some of the Federal Farm Bill and state programs available to assist growers on nutrient and farm management programs.

Liz Stahl, University of Minnesota—Extension, spoke about the changes in the University's nitrogen rate recommendations for corn. Jeff Vetsch, University of Minnesota Soil Scientist, explained some of the results of Economic Optimum Nitrogen Rate (EONR) field trial test plot results for corn.

One of the thoughts I'm left with after the workshop is the number of people from various disciplines and walks of life that are involved in protecting our groundwater and drinking water resources. It really takes a team effort to provide long term protection, from those of us who work at it as a profession, water customers, landowners, agronomists, soils experts and Federal, State and local conservation professionals, etc. With increasing demands for energy, food and water supplies one can truly

appreciate the complexities of balancing these growing needs and Source Water Protection.

I would like to acknowledge the Red Rock Rural Water System, City of Windom and Cottonwood County Resource Staff for their time and contribution towards this event. Way to go!



Terry Bovee (second from right) and Tom Jackson (right) talk soils at the Drinking Water Resources and Agriculture Field Day.

USGS Publications, cont.

hexahydrohexamethylcyclopentabenzopyran detected most frequently (in at least 10 percent of the samples). The number of compounds detected in water per site ranged from 0 to 8. Forty individual compounds were detected in bed-sediment samples. The most commonly detected compounds (in at least 50 percent of the samples) were indole, beta-sitosterol, cholesterol, beta-stigmastanol, 3-methyl-1H-indole, p-cresol, pyrene, phenol, fluoranthene, 3-beta coprostanol, benzo[a]pyrene, acetophenone, and 2,6-dimethylnaphthalene. The total number of detections in bed sediment (at a site) ranged from 3 to 31. The compounds NP1EO, NP2EO, and 4-nonylphenol were detected in greater than 10 percent of the samples. Most (80 percent) female fish collected had measurable concentrations of vitellogenin. Vitellogenin also was detected in 62, 63, and 33 percent of male carp, smallmouth bass, and redhorse, respectively. The one male walleye sample plasma sample analyzed had a vitellogenin detection. Vitellogenin concentrations were lower in male fish (not detected to 10.80 micrograms per milliliter) than female fish (0.04 to 248,079 micrograms per milliliter). Gonadosomatic Index values ranged from 0.02 to 7.49 percent among all male fish and were greater for male carp than for the other three species. No intersex (oocytes present in testes tissue) was found in any male fish sampled.

Field Techniques for Estimating Water Fluxes Between Surface Water and Ground Water, USGS Series Techniques and Methods Report Number 4-D2, Edited by Donald O. Rosenberry and James W. LaBaugh, 2008, 135 p.

ABSTRACT: This report focuses on measuring the flow of water across the interface between surface water and ground water, rather than the hydrogeological or geochemical processes that

occur at or near this interface. The methods, however, that use hydrogeological and geochemical evidence to quantify water fluxes are described herein. This material is presented as a guide for those who have to examine the interaction of surface water and ground water. The intent here is that both the overview of the many available methods and the in-depth presentation of specific methods will enable the reader to choose those study approaches that will best meet the requirements of the environments and processes they are investigating, as well as to recognize the merits of using more than one approach.

This report is designed to make the reader aware of the breadth of approaches available for the study of the exchange between surface and ground water. To accomplish this, the report is divided into four chapters. Chapter 1 describes many well-documented approaches for defining the flow between surface and ground waters. Subsequent chapters provide an in-depth presentation of particular methods. Chapter 2 focuses on three of the most commonly used methods to either calculate or directly measure flow of water between surface-water bodies and the ground-water domain: (1) measurement of water levels in well networks in combination with measurement of water level in nearby surface water to determine water-level gradients and flow; (2) use of portable piezometers (wells) or hydraulic potentiometers to measure hydraulic gradients; and (3) use of seepage meters to measure flow directly. Chapter 3 describes the techniques involved in conducting water-tracer tests using fluorescent dyes, a method commonly used in the hydrogeologic investigation and characterization of karst aquifers, and in the study of water fluxes in karst terranes. Chapter 4 focuses on heat as a tracer in hydrological investigations of the near-surface environment.

Nitrate in Ground Water on the Rise

Decadal-Scale Changes of Nitrate in Ground Water of the United States, 1988–2004, Michael G. Rupert, Journal of Environmental Quality, 37:S-240-248.

This paper may be viewed on-line by subscribers at: jeq.scijournals.org/cgi/content/abstract/37/5_Supplement/S-240. Non-subscribers can purchase it.

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ABSTRACT: This study evaluated decadal-scale changes of nitrate concentrations in ground water samples collected by the USGS National Water-Quality Assessment Program from 495 wells in 24 well networks across the USA in predominantly agricultural areas. Each well network was sampled once during 1988–1995 and resampled once during 2000–2004. Statistical tests of decadal-scale changes of nitrate concentrations in water from all 495 wells combined indicate there is a significant increase in nitrate concentrations in the data set as a whole. Eight out of the 24 well networks, or about 33%, had significant changes of nitrate concentrations. Of the eight well networks with significant decadal-scale changes of nitrate, all except one, the Willamette Valley of Oregon, had increasing nitrate concentrations. Median nitrate concentrations of three of those

eight well networks increased above the USEPA maximum contaminant level of 10 milligrams per liter. Nitrate in water from wells with reduced conditions had significantly smaller decadal-scale changes in nitrate concentrations than oxidized and mixed waters. A subset of wells had data on ground water recharge date; nitrate concentrations increased in response to the increase of N fertilizer use since about 1950. Determining ground water recharge dates is an important component of a ground water trends investigation because recharge dates provide a link between changes in ground water quality and changes in land-use practices.



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Air, Water and Waste Conference, February 10-12, 2009

The Minnesota Pollution Control Agency will host its annual Air, Water and Waste Conference at the St. Paul River Centre on February 10-12, 2009. The conference is designed to appeal to a broad audience and will address media-specific topics and emerging environmental concerns. Breakout sessions for the 2009 conference are organized into seven areas:

- ◆ Energy and Climate Change
- ◆ Technical and Regulatory Programs
- ◆ Implications of Regulations, Policies and Reports
- ◆ Leading Environmental Practices
- ◆ Business and Regulatory Partnerships
- ◆ Economic and Social Value Issues
- ◆ Emerging MPCA Issues and Hot Topics

In addition to the technical presentations, over 100 exhibitors from the public and private sectors will showcase their environmental products and services in one of the largest such exhibits in Minnesota. The conference is designed to meet continuing education requirements of various professional certification and licensing programs. For further details, visit:

www.pca.state.mn.us/news/training/mawweconference/index.html

USGS Sponsors Research Program Lecture by Rick Healy

Each year, the U.S. Geological Survey's National Research Program offers lectures sponsored by local offices. On October 22, 2008, the USGS Minnesota Water Science Center offered a well-attended lecture by Rick Healy, entitled, "Recent Trends in Quantifying Recharge Rates". Mr. Healy's talk was particularly relevant to Minnesota's ground water professionals in light of ongoing efforts to improve characterization of regional recharge rates and a desire to improve our understanding of water availability and sustainability in our state.

A powerpoint of Mr. Healy's talk can be found at:

mn.water.usgs.gov/index.html

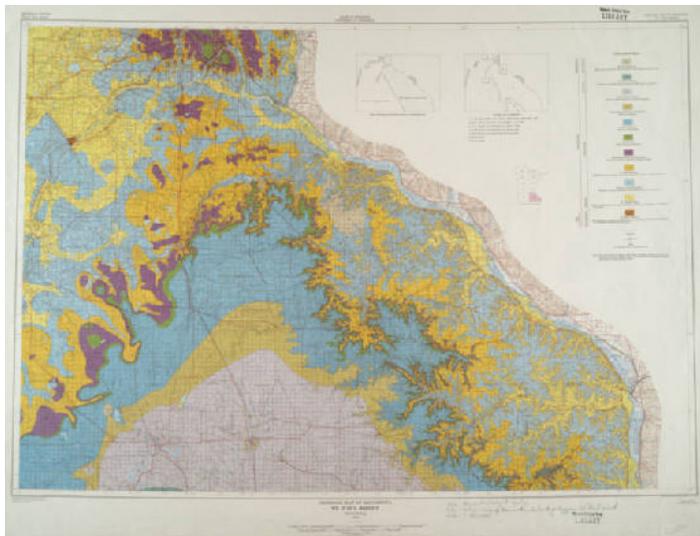
The powerpoint file is found under the Current Issues heading, and you can download the powerpoint by clicking the picture.

For further reading related to his presentation, Rick Healy suggested the following publications:

- Healy, R. W. and P. G. Cook (2002). "Using groundwater levels to estimate recharge." *Hydrogeology Journal* 10(1): 91-109.
- Scanlon, B. R., R. W. Healy, et al. (2002). "Choosing appropriate techniques for quantifying groundwater recharge." *Hydrogeology Journal* 10: 18-39.
- Scanlon, B. R., R. W. Healy, et al. (2002). "Choosing appropriate techniques for quantifying groundwater recharge." *Hydrogeology Journal* 10.

Minnesota Geological Survey Maps and Reports are now available online

During its history, since 1872, the Minnesota Geological Survey (MGS) has published over 40,000 pages of reports and more than 600 maps. These documents remain a crucial source of information that the people of Minnesota need to ensure wise stewardship of their water, land, and mineral resources. The documents also facilitate societal benefits related to economic prosperity, public health, natural hazards, aesthetic appreciation and preservation of our natural heritage. In the current era, people access much of the information that they need, or wish



Example of a scanned map. This image is a 1966 map of the bedrock of Southeastern Minnesota.

to view, through the Internet and the web. In 2007, therefore, at the instigation of the MGS Director, Dr. Harvey Thorleifson, the MGS launched a project to scan and web-enable every document formally published in the history of the organization. This has been completed, with the generous support of the Minnesota Digital Library, and the University of Minnesota Libraries Digital Collections Unit (DCU).

The link to Minnesota Reflections reflections.mndigital.org, which is acting as the host site for the map images is now active. MGS maps can be found by searching for Minnesota Geological Survey or by browsing the collection in a drop-down box, where listings are in alphabetical order of contributor. The map images web page is searchable by title, author, county and description; maps can be viewed at a variety of zoom levels.

The pages from the reports are still being processed within the DCU and will be linked as they become available.

The collection of scanned maps is available via the Minnesota Digital Library at reflections.mndigital.org/cdm4/browse.php?CISOROOT=/mgs. Page-sized images of commonly requested maps are available on the MGS website at [http://160.94.61.144/mgs/Minnesota Geology Images/image_index.htm](http://160.94.61.144/mgs/Minnesota%20Geology%20Images/image_index.htm).

Traverse Grant Area Regional Hydrogeologic Assessment, Part B

By Jim Berg, DNR Waters

In November 2008 DNR Waters published the Traverse Grant Area Regional Hydrogeologic Assessment, Part B. This report is the sixth in a series of regional hydrogeologic assessments (RHA-6) completed as a joint effort by the Division of Waters from the Minnesota Department of Natural Resource (DNR Waters) and the Minnesota Geological Survey (MGS). This report describes the geology and hydrogeology of all or parts of six counties in western Minnesota to create a regional inventory of aquifers and aquifer conditions (Figure 1). While similar in geographic scope to previous RHAs, this report contains a more extensive treatment of the regional buried aquifer characteristics such as thickness and depth; hydrogeology as illustrated by cross sections; and ground-water flow directions, hydrochemistry, and pollution sensitivity. These features make it similar to, but less detailed than, the companion county geologic atlas series. The southeastern part of the study area was described in the Pope County Geologic Atlas, Part A (2003) and Part B (2006). This RHA is designed for units of government and citizens to use in planning for land use, water supply, and pollution prevention.

Surficial sand and gravel aquifers

Buried sand and gravel aquifers are an important ground-water resource throughout the study area for domestic, municipal, and industrial use. The surficial sand aquifer is commonly used for agricultural irrigation especially in the southeastern portion of the study area (eastern Pope County) and along the Chippewa and Pomme de Terre rivers in the central portion of the study area. Figure 2 shows the thickness and distribution of surficial sand and gravel deposits in the study area. The largest

and thickest deposit from glacial meltwater is the Belgrade-Glenwood sand plain in the eastern portion of the study area. The thickest portions of this sand plain, where thicknesses from 50 feet to 70 feet are common, occur in the Alexandria area of central Douglas County, the Glenwood area of northeastern Pope County, and the Lake Johanna area of southeastern Pope County.

The two major rivers of the central portion of the study area, the Chippewa and the Pomme de Terre, are associated with thick, linear glacial outwash deposits. This sand and gravel was deposited along the eastern edge of major ice lobes that existed to the west. Thicknesses of 20–70 feet are common in these deposits. West of the Pomme de Terre River in Traverse, northern Big Stone, and western Grant and Stevens counties, occurrences of surficial sand are limited and thin. The dendritic pattern of surficial sand shown on the western portion of Figure 2 occurs in small creek valleys; was deposited during the postglacial period (Holocene); and consists of silty, clayey sand. Pleistocene (ice age) glacial lake beach ridges occur as a curved pattern of surficial sand in Grant, northwest Stevens, and Traverse counties. These beach ridges are roughly perpendicular to the creek and river alluvial deposits. Thicknesses commonly range from 10 feet to 15 feet.

Regional stratigraphy and buried aquifers

In addition to the surficial sand and gravel thickness map, maps of five buried sand and gravel aquifers are included in RHA-6, part B. The following geologic sequence of events summarizes the late glacial history of west-central Minnesota, as described in the Minnesota Geological Survey Part A assessment, and focuses on the deposition of four of the five buried aquifers in this study area. Other aquifers are present beneath these mapped

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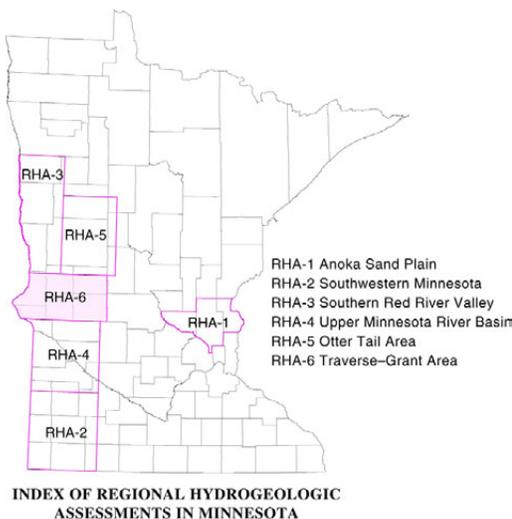


Figure 1. Location of RHA-6 and previous RHAs

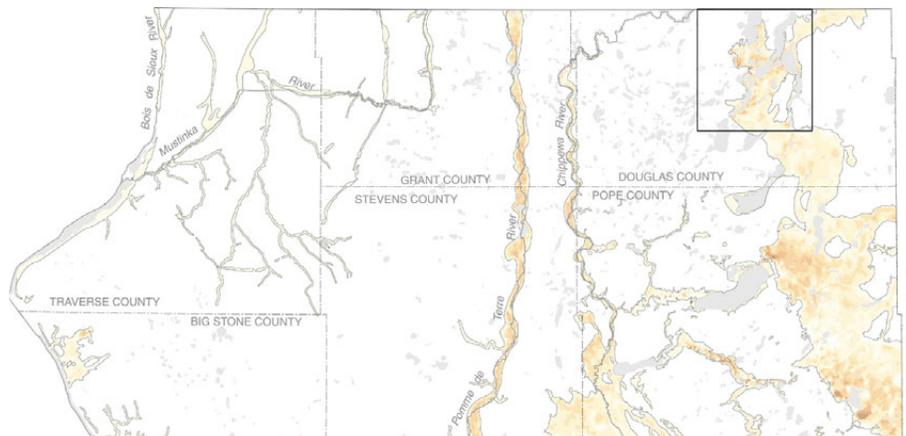


Figure 2. Surficial sand and gravel aquifers in study area. The map shows the thickness and distribution of the surficial sand and gravel deposits. The thickness key is shown on Figure 6. Darker shades correspond to greater thicknesses. The box on the upper right of the map identifies the detail area for Figure 6.

Traverse-Grant RHA, cont.

aquifers but could not be delineated across the study area because of a lack of data.

The late glacial history of west-central Minnesota is generally a story of sediment deposition from ice lobes that repeatedly moved into and retreated from the region. The two sources of the ice lobes were in Canada: the Keewatin dome, from which ice lobes flowed into Minnesota from the northwest, and the Labradoran dome, from which ice lobes entered from the northeast. Ice lobes from the northwest are referred to as Des Moines ice lobes. The depositional model for the LG and OT aquifers (aquifers above the Lower Goose River group and Otter Tail River group, respectively, Figure 4) is based on the assumption of sediment transport to the southwest and south. The ice lobes that created the LG and OT aquifers receded to the northwest and possibly acted as western barriers during sediment transport and deposition in some areas. In the eastern and central portions of the study area, the model for the CW aquifer (aquifer above the Crow Wing River group) is based on the assumption of southwestern movement of sand and gravel from ice lobes that were receding to the northeast. The depositional model for the earlier aquifer 1 assumes sediment transport to the southwest and south similar to the later LG and OT aquifers. The stratigraphic associations of the western

aquifer in the western portion of the study area are mostly unknown.

Buried sand and gravel aquifers are often difficult to map. Our knowledge of these aquifers primarily depends on drill hole information, and the reliability of the aquifer maps depends on the spatial density of that information. A mapping method using closely spaced cross sections was successfully used for some previously published geologic atlases (Berg, 2006; Tipping, 2006; Petersen, 2007) and was also used to produce the maps in RHA-6, Part B.

Hydrogeology of the surficial and buried aquifers – Alexandria example

The city of Alexandria sits on the crest of the Alexandria moraine, which is the largest geomorphic feature of western Minnesota and extends south to the Spicer-New London area and north to the Upper and Lower Red Lakes. A major surface-water divide passes through this area splitting surface-water flow between the Minnesota River to the west and the Mississippi River to the east. Regional ground-water flow of the shallow buried aquifers mapped in this report is similarly split

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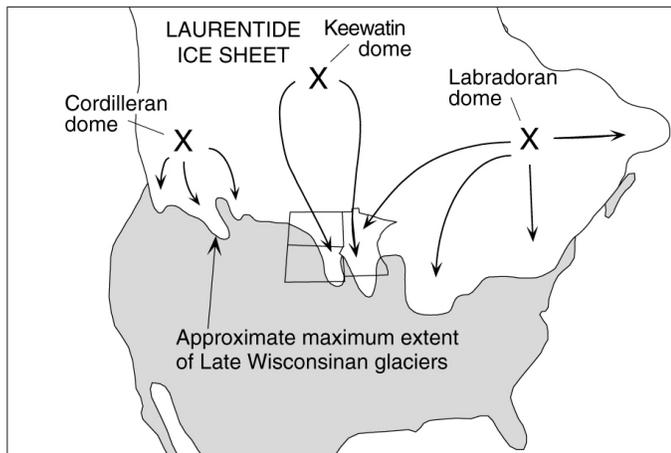
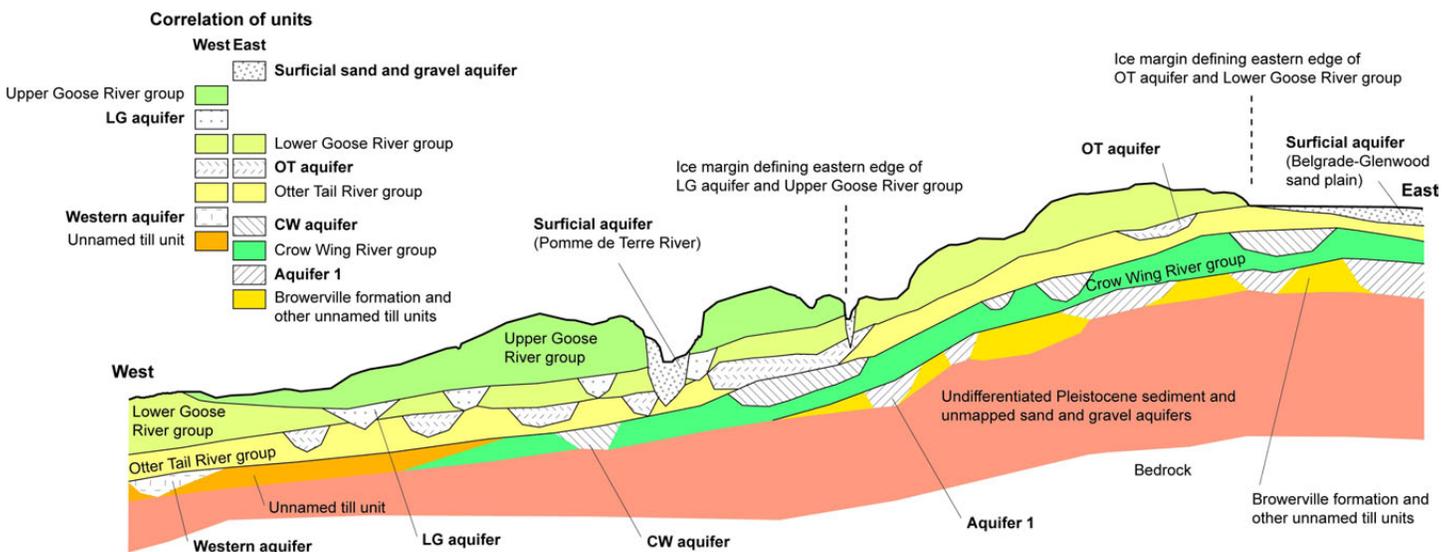


Figure 3. Glacial ice sources. Approximate extent of a portion of the Laurentide ice sheet about 15,000 years ago. Arrows indicate possible ice flow paths (modified from Plate 1, Part A)

Figure 4. Simplified cross section showing stratigraphy and distribution of aquifers and fine-grained glacial deposits in the study area.



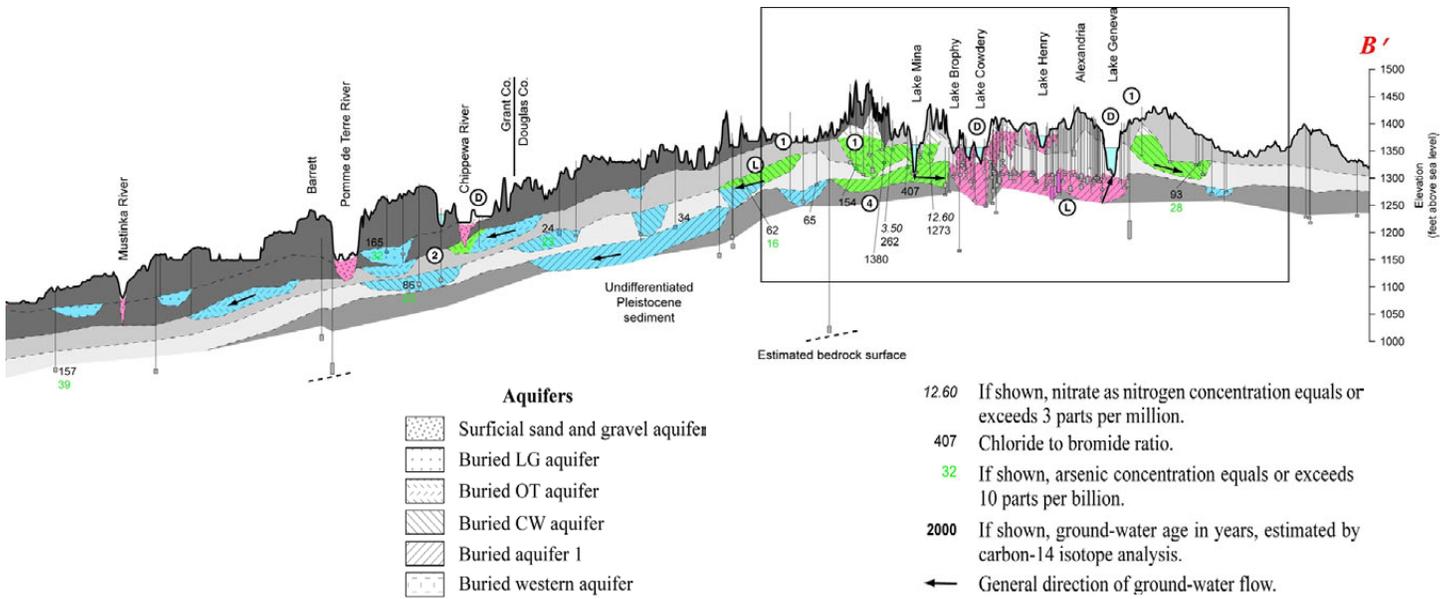


Figure 5. Portion of east-west regional cross section through Alexandria in the northern part of the study area. Box indicates the location of the detail cross section shown in Figure 6. Colors indicate measured or inferred groundwater tritium conditions: Pink – recent, green – mixed, and blue – vintage. The circled numbers and letters represent recharge and discharge conditions at selected locations that are described in the report.

(Figure 5). Superimposed on this regional flow pattern is a complex local ground-water system in which ground water passes through the surficial sand aquifer or shallow buried occurrences of the OT or CW aquifers into aquifer 1 (Figure 6, cross section). Some ground water within aquifer 1 appears to discharge into the cluster of lakes in the area that ultimately flows into Lake Carlos and the Long Prairie River (Figure 6, map).

Figure 6 also shows the ground-water residence times of samples from selected wells. Geochemical data collected by DNR Waters for this project were supplemented by additional data from the Minnesota Department of Health collected during two previous investigations of water-quality issues of western Minnesota (Walsh, 2000; MDH, 2001). The pink, green, and blue symbols on the map represent tritium values that indicate ground-water residence time. This is the approximate time that has elapsed from when the water infiltrated the land surface to when it was pumped from the aquifer for this investigation. In general, short residence time suggests high pollution sensitivity, whereas long residence time suggests low sensitivity.

Tritium (³H) is a naturally occurring isotope of hydrogen. Concentrations of this isotope in the atmosphere were greatly increased from 1953 through 1963 by aboveground detonation of hydrogen bombs (Alexander and Alexander, 1989). This isotope decays at a known rate, with a half-life of 12.43 years. Ground-water samples with concentrations of tritium equal to or greater than 10 tritium units (TU) are considered recent water (mostly recharged in the past 50 years, shown in pink). Concentrations equal to or less than 1 TU are considered vintage water

(recharged prior to 1953, shown in blue). Concentrations between these two limits are considered a mixture of recent and vintage and are referred to as mixed water (shown in green).

Aquifer symbols with a yellow dot indicate elevated values of chloride (chloride to bromide ratio greater than 175) originating from human activities (anthropogenic). Chloride concentrations and ratios of chloride to bromide (Cl/Br) from water samples have been used in previous ground-water studies (Berg, 2004 and 2006) as an indicator of chloride contamination from human activities.

Figure 6 features ground-water flow into, through, and out of aquifer 1 in the northeastern part of the study area. The groundwater residence data and ground water flow directions indicate two major recharge zones in the Alexandria area that include the south-central portion of the Figure 6 map within the surficial sand area surrounded by Andrew, Union, Burgan, Mud, and Latoka lakes. The thick surficial sand and connected buried aquifers allow recharge to aquifer 1 in this area. The other major recharge zone is in the western portion of the Figure 6 map, south of the city of Garfield and north of Lobster Lake and Lake Mina and shown on the left portion of the Figure 6 cross section. Surface water can infiltrate the thin cover of glacial till that covers the OT aquifer in the area, pass through the CW aquifer into aquifer 1, and ultimately discharge to the lakes.

— continued on page 17

Traverse-Grant RHA, cont.

Aquifer depth, thickness, and pollution sensitivity map examples

Since RHA-6 is a regional assessment most of the maps and cross sections are large and difficult to show in a newsletter in their entirety. The following detail area examples were chosen to illustrate some of the important characteristics and purposes of the maps.

Depth and thickness of buried aquifers

In Figure 7, an area west of Alexandria shows a portion of one of the five buried aquifer maps included in RHA-6, Part B. The solid colors indicate the depth to the top of this aquifer from land surface. The aquifer thickness is indicated by the colored contour lines. Notice the general trend of vintage tritium values in the deeper areas and mixed tritium values in the shallower areas. The X well symbols represent the wells that were used to map this particular aquifer so the user can judge the certainty of any particular portion of the map.

Sensitivity to pollution of the buried aquifers

Figure 8 shows the relative pollution sensitivity of the CW aquifer west of Alexandria as an example of one of the five buried sand and gravel aquifer sensitivity maps included in RHA-6, Part B. Sensitivity to pollution is defined as the ease

with which a surface contaminant moving with water might travel to and enter a subsurface water source. This evaluation was based on the assumption of vertical ground-water transport, although horizontal flow dominates in many settings. Also, the sensitivity ratings are based on vertical travel time of water, not the behavior of specific contaminants.

The goals of the pollution sensitivity modeling and mapping process were to calculate the thickness of protective material overlying each aquifer and interpret protective thickness as different levels of pollution sensitivity (Berg, 2006). The pollution sensitivity modeling and mapping process has three steps. The first step is mapping and defining the aquifers and low-permeability geologic units (protective layers) as three-dimensional geographic information system (GIS) surfaces. The second step is representing aquifer recharge as a series of related elevation surfaces that can be used along with the protective layer thickness calculations (Figure 9). The third step is interpreting the protective thickness calculations as pollution sensitivity.

The calculated elevation surfaces for all the aquifers, till layers, and recharge surfaces are used in the third step to generate pollution sensitivity maps for each buried aquifer. In the final

— continued on page 19

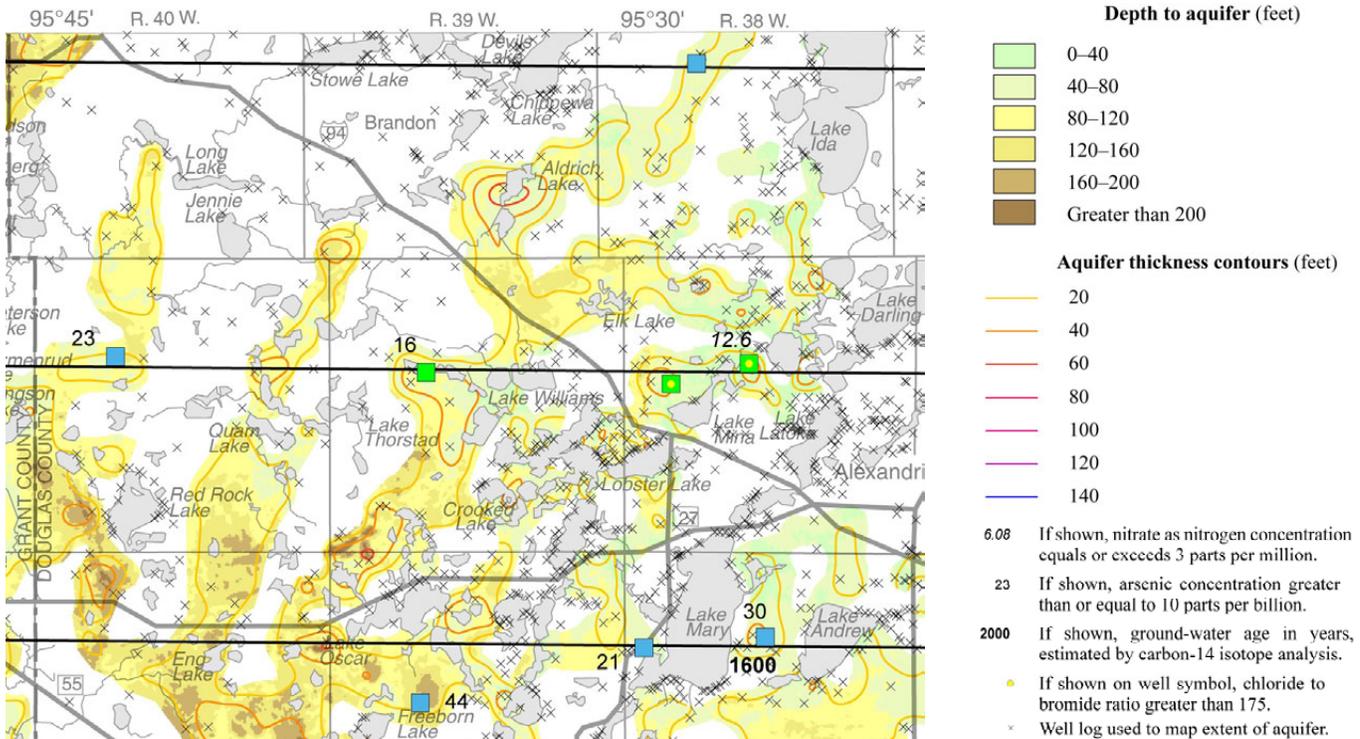


Figure 7. Thickness and depth of sand and gravel deposits on top of the Crow Wing River group (CW aquifer), west of the Alexandria area. The thin gray lines represent township boundaries. The black horizontal lines show cross section locations included in the report. Colored symbols indicate tritium conditions and/or elevated Cl/Br ratios

Traverse-Grant RHA, cont.

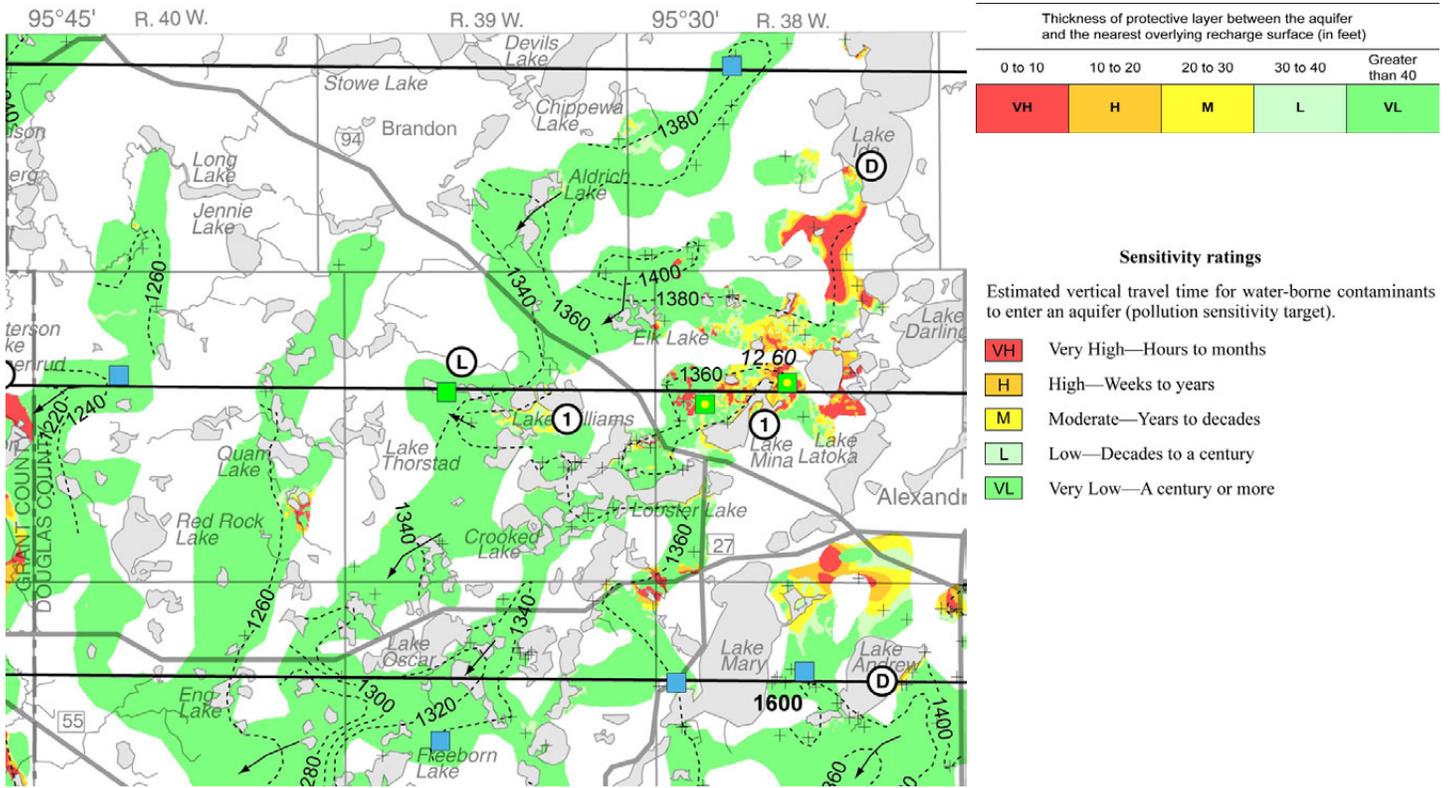


Figure 8. Pollution sensitivity and potentiometric surface of the CW aquifer west of the Alexandria area. The thin gray lines represent township boundaries. The black horizontal lines show cross section locations included in the report. The circled numbers and letters represent recharge and discharge conditions at selected locations that are described in the Part B report.

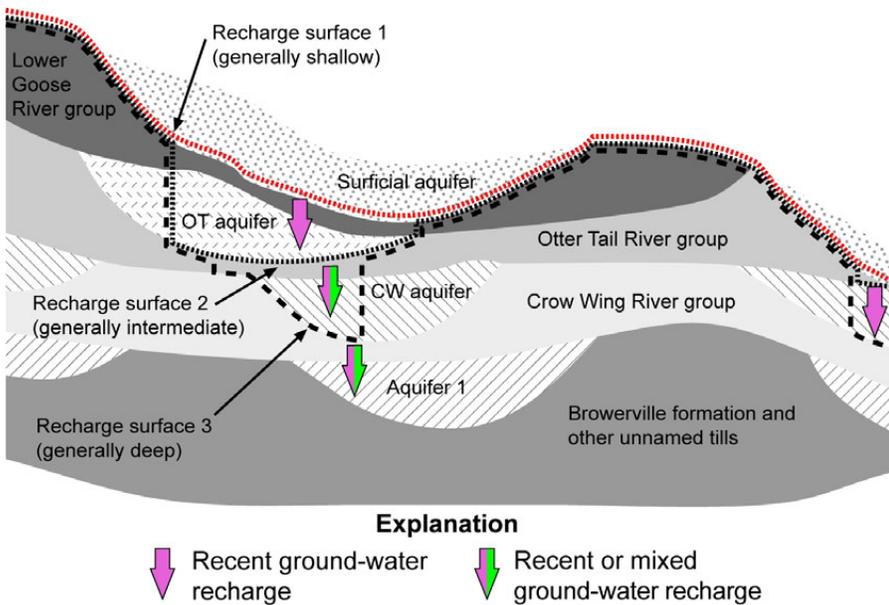


Figure 9. Generalized cross section showing recharge concepts for buried aquifers considered in the sensitivity evaluations. In this conceptual model of the eastern part of the study area, all recent recharge enters the buried aquifer system at recharge surface 1 (red dotted line). Recharge surface 1 is considered to be at the land surface where till is present, at the bottom of surficial sand deposits and at the bottom of surface water bodies where surficial sand is not present. If less than 10 feet of fine-grained sediment (clay or till) exists between recharge surface 1 and the shallowest underlying buried aquifer, then recent recharge is assumed to move to the bottom of that aquifer to form recharge surface 2. The process and criteria are repeated stepwise for deeper aquifers (recharge surface 3).

Traverse-Grant RHA, cont.

step of the sensitivity evaluation, the thickness of the protective till that covers each aquifer is calculated and a sensitivity rating is applied. The sensitivity of the aquifer is inversely proportional to the thickness of that protective layer. The protective layer thickness is calculated by subtracting the elevation of the top of the aquifer from the elevation of the adjacent overlying recharge surface. Figure 9 shows the model for interpreting the pollution sensitivity of the buried aquifers according to the calculated protective layer thickness.

The results of a valid pollution sensitivity model should generally correspond to the distribution of ground-water residence time indicators. The most important indicators for the buried aquifers were the values and spatial characteristics of tritium in collected ground-water samples. In general, the recent and mixed tritium values should correspond to areas of very high to low sensitivity, whereas, the vintage values should correspond to areas of low to very low sensitivity. The carbon-14 residence time values from collected ground-water samples were also useful for corroborating sensitivity for portions of the buried aquifers that have a predicted very low sensitivity. The chlorides to bromide ratios, as an anthropogenic indicator of recent industrial age activity, were useful evidence of recent water infiltration and an evaluation tool for areas with very high to low pollution sensitivity classifications.

Figure 8 shows good agreement between ground-water residence time indicators and pollution sensitivity classifications for the CW aquifer with one exception. In the center of the map a mixed tritium value is in an area that was classified with a very low sensitivity. Some of these mixed values and some of the elevated Cl/Br values throughout the study area that seem inconsistent with the sensitivity model are near or possibly downgradient of high-sensitivity areas, which may be the source of mixed water that moved laterally through the CW aquifer to the sample locations.

Finally, the potentiometric surface contours for this aquifer in addition to the distribution of moderate to very high pollution sensitivity illustrates the general pattern of recharge in the eastern portion of this study area and regional groundwater flow to the southwest.

For more information

The Traverse–Grant area regional hydrogeologic assessment, Parts A and B can be purchased at the Minnesota Geological Survey, Publications Office, 2642 University Avenue, St. Paul, Minnesota 55114, (612) 627-4782. Portable document file (.pdf) images of the plates are available for download. Please see the DNR Waters web site at: www.dnr.state.mn.us/waters/groundwater_section/mapping/status.html for Part B access and download instructions. Data files for Part B will be posted soon. PDF images and data files for Part A of the report can be downloaded from the MGS ftp site at: <ftp://mgssun6.mnngs.umn.edu/pub2/rha-6/>. For additional information contact Jim Berg (651) 259-5680, Jan Falteisek (651) 259-5665 or Dale Setterholm (612) 627-4780.

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Photo courtesy of the Yucca Mountain Project

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An exciting benefit to this course is the field trip to Yucca Mountain, an unequaled opportunity to visit a site where the fracture system has been mapped to precise detail and the hydrogeologic testing has been put to the most thorough analysis.

Lake Mead Fresh Water Intake No. 3

Lake Mead water levels have declined so low that it threatens to dip below the water intake pipes located near the shoreline. Looking forward, the South Nevada Water Authority has initiated a historic tunneling project where a third water intake can extract water from greater depths in Lake Mead. The new (No. 3) fresh water intake will be constructed using a tunnel boring machine that advances from offshore to underneath the lake targeting the deepest portion. This year, the course includes a fifth day (Saturday, March 28) where participants will gain exclusive access to this historic project site including non-public areas inside Hoover Dam. Details about the Lake Mead Intake No. 3 Project Tour are forthcoming.

Register Now at: www.midwestgeo.com

“The Oldest Well in U.S.A.”: The Perils of Postcard Hydrology

By Greg Brick

One of my hobbies is collecting old postcards of caves, springs, water wells, strange rock formations, and so forth. I have made much use of these images in my PowerPoint geology lectures at local colleges, to the extent that I gained a reputation as a “postcard geologist.” In previous columns for this newsletter, I have used postcards as a source of valuable information about ground water features. But this time I present an entertaining case where postcards were very misleading. Here’s what it says on the back of one such postcard (Figure 1), in choppy, ungrammatical English:

“THE OLDEST WELL IN U.S.A. This old well was first visited by Coronado, the Spanish Explorer, when in search for the Grand Quivera in 1541, and was then being used by Indians. Being taken from the Indians by Spanish about 250 years ago; then 85 years ago taken from Spanish by the Americans and rebuilt as it is now by American Government and for 40 years after and until 1879 used to water the stage and cavalry horses. Then one of the most important stops on Santa Fe trail. Since the Railroad came thru in 1879 the Santa Fe trail has been abandoned, likewise the Old Well and Old Trading Post, until last few years. Since the highways have again been opened over old trail, the Old Well has again been opened to the Public. One of the oldest and most historical landmarks, not only in the West but in the U.S.A., at Glorieta Pass, N. Mex. The Battle of Glorieta Pass was one of the really important Battles in civil war and decided the future of everything west of Denver and Salt Lake City. The ‘Gettysburg of the Southwest.’”

While attending biannual shows of the Twin City Postcard Club, I came across more postcards of the Old Well, showing visitors hobnobbing with the resident pet bears (Figure 2). One postcard unblushingly pushed the origin of the Old Well back a full 1,000 years, dating it to the great droughts of the Southwest in pre-Columbian times.

Intrigued by these images, I attempted to collect additional information about “the oldest well in U.S.A.” But I was somewhat puzzled. The well was not mentioned in voluminous bibliographies and histories of New Mexico, the Santa Fe Trail, geological reports, and the like. Alas, there was good reason. I

Interior View of the Oldest and Most Historical Indian-Spanish-American Well in the United States



Visited by Coronado—Spanish Explorer—1541. Glorieta Pass, N. Mex.

2757-29

Figure 1. Postcard showing interior of “The Oldest Well in U.S.A.” at Glorieta Pass, New Mexico. Author’s collection.



Thos. L. Greer, Mgr.

Glorieta Pass, N. Mex.

Figure 2. Postcard showing “Most Historic and Wonderful Old Indian Spanish American Well” (upper left) set amidst other tourist attractions. Author’s collection.

finally came across an official museum publication (Oakes et al, 1995). These linen postcards date from about 1935, according to the report, while the USA’s oldest well began looking more youthful: “We note a strong tendency by Greer [the well’s promoter] to use the word ‘Old.’... Where Greer got the notion that the well directly across the road from the ranch building was of great antiquity is a mystery.... The well was actually 100 years old, not 250.”

— continued on page 23

Ground Water History, cont.

So if Greer's well is not the oldest in the US, what is? I have another postcard, this one showing the Fountain of Youth tourist well in St. Augustine, Florida, dating to 1513 according to the sign (Fig. 3). But the Spanish discoverer of Florida, Ponce de Leon, never got this far north along the Florida coast in 1513 and the city of St. Augustine was not founded until 1565 (Olschki, 1941; Scisco, 1913). I think you get the picture.

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Figure 3. Postcard showing "Fountain of Youth" at St. Augustine, Florida. Author's collection.



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Looking for a New Newsletter Editor

After over six years as your newsletter editor, it's time for me to step down and give someone else the chance to fill this position. The December issue will be my last issue as your newsletter editor. Over the past six years, we have seen the publication move to an electronic format; a change in its look, including color; the 25th Anniversary edition; and the posting of all past issues on the MGWA web site. It has been a rewarding experience and I have enjoyed working on every issue.

I would like to thank the members of the newsletter team, Jan Falteisek, Tom Clark, Kurt Schroeder, Steve Robertson, and Eric Tollefsrud, for their involvement in the publication. It is the team concept that really makes the newsletter editor position an enjoyable one. The issue editor coordinates the selected articles and is rotated among the members of the newsletter team. The layout is handled by our publisher, the Watershed Research, Inc. with Jennie Leete and Sean Hunt providing a great service to our organization through their involvement with this publication. Jim Aiken, our advertising manager, does a great job of contacting companies to advertise in the newsletter.

With so many people involved in the publication, the newsletter editor is not a position that gets over-worked or burnt-out. It's an opportunity to work with people from different state agencies and private companies to make a difference in communicating to our members about important ground water issues. The newsletter editor chairs the monthly newsletter team meetings and attends the MGWA Board meetings as an appointed official. If you would be interested in this position, please contact one of the MGWA Board members or a member of the newsletter team.

— Norm Mofjeld, MGWA Newsletter Editor

Guidelines for Submission of Newsletter Articles

The newsletter team appreciates the efforts of article contributors, without whom our newsletter would not be possible. To make the process easier on the author, the newsletter team and production staff, we have established some guidelines we would like authors to follow. For a complete list of guidelines, please see the MGWA web site:

- ◆ Submittals should be complete and ready for publication.
- ◆ The text of the article should be submitted as a Microsoft Word document in an attachment to an e-mail or on disk.
- ◆ Tables, captions, figures and graphics should be submitted as separate high quality files.
- ◆ A version of the article with embedded tables, figures, and graphics may be submitted as an additional file to indicate the preferred layout of the tables, figures and graphics within the article.
- ◆ The contributor should include the contributor's name and affiliation following "By" below the title of the article.
- ◆ The contributor should secure permission to print or reprint if applicable and provide the required text to be included with the article.
- ◆ Materials should be submitted before the deadline.
- ◆ If there is any question about the suitability of a proposed article's content for the MGWA newsletter, it is advisable for the contributor to call the editor before investing significant time in article preparation.

**Have an idea for an article?
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New Version of Minnesota Ground Water Directory

The “Minnesota Ground Water Directory” (Directory) has just been revised and updated. The Directory is essentially an annotated telephone book for Minnesota ground-water programs. But it also clarifies Minnesota ground-water responsibilities to help users decide who to contact. The last version was dated 2003 so much of the contact information, especially telephone numbers for several State agencies, needed updating.

The Directory is one of four components that make up the Minnesota Ground Water Information Guide (Guide). To take full advantage of the new Directory, minor updates were also made to the Guide’s home page and to the Information Resources component. Users can now link directly from the “Contacts” section of the Information Resources component to the Directory so they can easily take advantage of the Directory’s advanced features and updated listings.

The Directory can be accessed from the MGWA home page www.mgwa.org by clicking on the Minnesota Ground Water Information Guide (Guide) link www.mgwa.org/gwig/. Once you have arrived at the “Guide” web site, click on the “Directory” icon in the left margin.

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MGWA FOUNDATION NEWS

2008 Children's Water Festival a Big Success

As in recent years, the Foundation contributed \$1,000 to the operation and success of the 2008 CWF. The 2009 CWF will be held on September, 30, 2009.



Above: Gil Gabanski, MGWA Foundation President, demonstrates a ground water flow model.



Right: Fifth graders take advantage of a perfect fall day to explore how precipitation moves through a model watershed.

— Pictures provided courtesy of April Rust, MNDNR Project Wet Coordinator

Excerpts from letters from the Children at the 2008 Children's Water Festival

"It was fun and interesting. It taught us a lot of cool things. My class had a blast...We learned a lot. Most of it was about pollution and conserving water. Also that a small % of water is drinking water." Gabby.

"It would be fun to go back...I learned a lot about water and how to save it. It was educational and exciting. We learned how old water is." Michael.

"It was a very generous thing for you to do and take your time to teach us how to conserve water. I would also like to thank you for buying those T-shirts your sponsor gave to us. It was the best first field trip I have ever been to...My favorite thing was touching the snail, and the baby shark." Anna.

"Rice Lakes Fifth Grade Class thanks you full heartedly for sponsoring the 2008 Children's Water Festival. Your dedication and effort to help us all learn more about the importance of water and how to save it. Your hard work has helped us learn lots of interesting things, such as the importance of conserving water, stopping pollution, and saving the fish. You also made it fun. Thank you for teaching us all these useful things." William.

"It was cool to see lots of things I didn't even think could happen to our water. I thought it was interesting to see lots of different ways we use and help water. I think it's very thoughtful of you to let kids learn about water for free...I learned about how we use, help, and hurt our water supplies. It was amazing to see how much pollution can get into our water just by littering. Also it was cool to see how much water one person can use in a day. The water festival gave me ideas of how to save our water supplies. Thank you for all your support and kindness!" Erin.

Also received was a huge card showing water thanking us for the water festival and signed by a teacher and 13 students.

FOUNDATION MINUTES

Minnesota Ground Water Association Foundation Board Meeting Minutes

Meeting Date: Tuesday, September 9, 2008
Location: DNR Offices, 500 Lafayette Road, St. Paul
From: Cathy Villas-Horns (Secretary)
Members Present: Gilbert Gabanski, Amanda Strommer, Jeff Stoner, Chris Elvrum, David Liverseed and Cathy Villas-Horns, Board Members; Sean Hunt and Jeanette Leete, MGWA Management

Minutes: The meeting minutes for the June 10, 2008 meeting were unanimously approved on July 2, 2008 and provided via e-mail to the MGWAF Board and the MGWA Newsletter staff.

Treasurer's Report: Foundation balance to date is \$81,457.38. Total credits of \$3813.70 were added to the accounts; \$3500 from the MGWA and \$313.70 in donations from membership renewals. Interest in the amount of \$954.38 was accrued in this period and was swept into the endowment, which now totals over \$71,443.38. Debits were \$1,900 for this period.
The 4.25%, 29-month Odyssey CD will be maturing in November. Dave recommended that the 4.25% Odyssey CD be deposited into the 5.271% Odyssey CD when the 4.25% CD matures in November. Amanda moved that this transfer be completed. Jeff seconded the motion. Motion passed.

Old Business: Science Museum of Minnesota (SMM) Big Backyard (BBY) – Gil passed out the results of a survey of ten adult visitors to the Ground Water Plaza that was completed by SMM personnel. Labels on the sand tank model may help visitors better understand and utilize this part of the exhibit. Gil, Chris and Cathy may meet with SMM staff this fall to discuss other improvements. Cathy is still working on a draft article on the Ground Water Display for possible inclusion in a National Ground Water Association publication.
Children's Water Festival – More volunteers still needed. Sean will send a message to MGWA membership requesting help.
MGWA Board Meeting report – Jeff stated that the fall 2008 MGWA conference will have a field focus and will be held on November 13. The MGWA website is being updated. The MGWA Fall Field trip will be Oct. 3-5 in Deep Portage. Three students funded by MGWAF so far.
LCCMR member tour – Dave reported that the LCCMR wants to include ground water in their field trip. Scott Alexander, Stu Grubb, Gretchen Sabel and Dave met with LCCMR staff to discuss the field trip. They will add a ground water stop to the tour in SE MN. Draft field trip itineraries were handed out by Dave.

New Business: Grant requests – No requests were received during this quarter.
Sun Current advertising opportunity – We discussed this and decided that the MGWAF would not pursue any advertising in the Sun Current newspapers.
EQB Water Issues task force – May/June 2008 meeting which included discussion on unfunded legislative mandate on sustainability for ground water and surface water. There was an interesting exchange of ideas. There is a formal request from the MPCA Board to the EQB to produce a report, which is underway.

Next Meeting: The next meeting is scheduled for December 9, 2008 at 11:30 AM at the Opus office building in Minnetonka.

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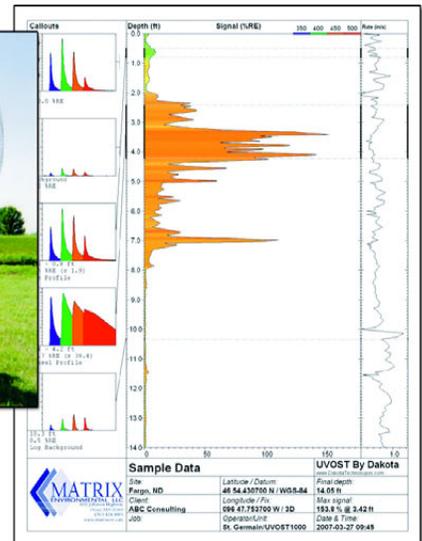
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MGWA BOARD MINUTES

Minnesota Ground Water Association Board Meeting Minutes

Meeting Date: August 21, 2008
Meeting Location: Fresh Grounds Restaurant, St. Paul, MN
Attendance: Stu Grubb, President; Jeff Stoner, Past President; Scott Alexander, President-Elect; Craig Kurtz, Treasurer; Norm Mofjeld, Newsletter Editor
Past Minutes: July 22, 2008 minutes approved as corrected
Treasury: Savings and checking account balance: approximately \$28,800
Through August 20: Gross income \$51,657; Total expenses \$29,142; Net Income is \$22,514 (compared to \$19,300 at this time last year). Dues are down approximately \$500 and advertising revenue up \$3,200 from last year.
Newsletter: The September MGWA newsletter is approximately one week behind schedule due to articles being submitted late. CD with the newsletter to be sent to WRI for formatting on Monday, the 25th of August.
Webpage: MGWA website needs updating in style and appearance. Volunteers have not come forward to assist. Board to consider hiring a web designer to perform a one-time upgrade, but the site should continue to be maintained by MGWA. Stu to write a request for proposals for the next Newsletter. Proposals should be received by October 15. Stu to talk to WRI to obtain a cost estimate to bring to the Board at the next meeting. The Shopping Cart on the website needs to be functioning before registration for the Fall Conference begins.
Old Business
LCCMR Fieldtrip: Set for Sept. 16-17. There is a full agenda and travels through southeast Minnesota. Shelly Schreffler of LCCMR is coordinating with S. Alexander and other MGWA members.
MGWA Fieldtrip: A flyer/notice to go into the next Newsletter with a follow-up email for detailed registration. A brief notice went to the members via email. Funding to be managed by U of MN. Cost is \$300/person. 10-12 people needed to breakeven. Will be cancelled with 6-7 or fewer attendees; upper limit is 30-50+ people. Three scholarships available through the Foundation.
Fall Conference: Still looking for a couple more presenters. Demo area (sheep pasture) appears farther away from Conference Center than originally planned. S. Grubb and S. Alexander to evaluate if a closer location is viable. Demo with stations to begin after 2 p.m. S. Grubb to check with WRI regarding continuing ed credits for MDH certification.
New Business
Minnesota Environmental Partnership Membership: Motion: "MGWA will continue its Associate Membership with MEP for \$100." (S. Grubb moved; C. Kurtz second) Motion approved.
MPCA Landfill Siting Committee Appointment: Committee looking for someone to represent ground water resources. Gil Gabanski was asked and agreed to participate; he will be representing his employer.
MPCA State Fair Eco Experience Water Display: Looking for volunteers to be at the State Fair
Next Meeting: September 19, 2008, 11:30 a.m., Fresh Grounds

Meeting Date: September 19, 2008
Meeting Location: Fresh Grounds Restaurant, St. Paul, MN
Attendance: Stu Grubb, President; Jeff Stoner, Past President; Scott Alexander, President-Elect; Craig Kurtz, Treasurer; Sean Hunt, WRI (via phone); Jennie Leete, WRI (via phone)
Past Minutes: August 21 meeting minutes approved as written.
Treasury: Savings and checking account balance: \$28,646. Through Sept 17: Gross income \$51,687; Total expenses \$29,320; Net Income \$22,366 (compared to \$15,321 at this time last year). Dues down approximately \$500 and advertising revenue up \$1,160 from last year. Administrative costs down nearly \$3,800 from last year. Report to include 2007 Balance Sheet for comparison. CD at Affinity Plus comes due on Oct.9. MGWA will renew the CD.
Newsletter: WRI has completed the edits. Newsletter to be sent out to members by the end of the month. The deadline for articles for the next newsletter is Nov.7.
Webpage: An RFP was sent out to MGWA asking for proposals to update the MGWA website. Eight (8) proposals were received; none directly from MGWA members. Each proposal appears different from the others; some had maintenance agreements included. Proposed costs range from approximately \$2,000 to \$3,000, up to \$10,000 to \$12,000. S. Hunt and C. Kurtz to review the proposals and make recommendations to the Board. The Shopping Cart on the website is now functioning for the Fall Conference registration.
WRI Mgmt: The state and federal tax filings are complete for MGWA and MGWAF and are on the website. The financial books have been updated and sent to the Treasurer.
MGWAF Report: Foundation would like a report on how the fieldtrip scholarships were used. Their finances are okay.
Old Business
LCCMR Fieldtrip: The fieldtrip went very well and was a success. 25-30 people

The MGWA Board of Directors meets once a month.

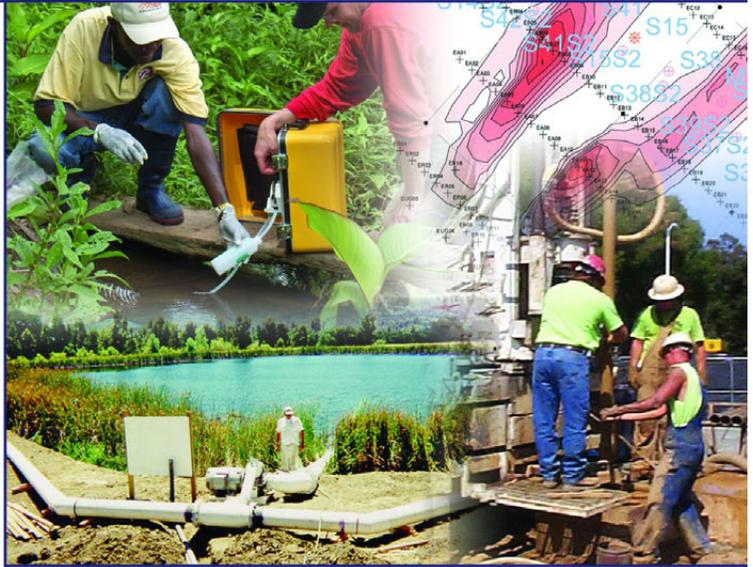
All members are welcome to attend and observe

— continued on page 31

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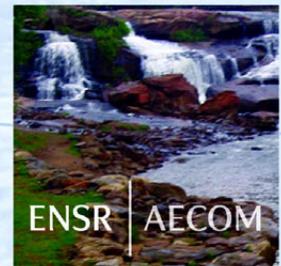
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MGWA BOARD MINUTES

Minnesota Ground Water Association Board Meeting Minutes, cont.

- attended. MGWA to acknowledge those who helped organize the trip.
- MGWA Fieldtrip:** Nine people have registered; three or four more have said they are sending in payment. Three students have accepted scholarships; \$150 remains for ½ of another student scholarship. Another email notice will be coming out with a deadline for registration. The trip is planned for Oct 3-5. Handouts will be provided through the U of MN
- Fall Conference:** No changes to the speakers; 8 presentations scheduled. Still trying to secure 1-2 drilling companies for the demo area. Field labs and high-resolution geophysics equipment will be set up for the demo area. Announcements for the Conference should be sent out mid-October. Conference to take place Nov. 13.
- New Business: Motion to send \$100 donation to the Georgette Pfannkuch memorial fund at KFAI radio station. (S. Grubb moved; J. Stoner second). Motion approved. S. Alexander to send sympathy card to Olaf Pfannkuch on behalf of all; C. Kurtz to mail check.
- Next Meeting: October 10, 2008, 12:00 p.m., C. Kurtz to determine location.
- Meeting Date:** **October 10, 2008**
- Meeting Location: Fresh Grounds Restaurant, St. Paul, MN
- Attendance: Stu Grubb, President; Scott Alexander, President-Elect; Norm Mofjeld, Newsletter Editor, Sean Hunt, WRI; Jennie Leete, WRI
- Past Minutes: Not a sufficient quorum to approve minutes
- Treasury: Savings and checking account balance: approximately \$27,370
- Newsletter: The September MGWA newsletter is out. Steve Robertson is the December issue editor. The issue submittal deadline is November 7, 2008. Need officer candidate info and ballot in next issue. Production software to be updated to InDesign. A new Newsletter Editor needed. Position is appointed by the Board.
- Webpage: September newsletter is online. Sean Hunt is working with Craig Kurtz to narrow down web redesign proposals. Shopping cart is done and ready to process conference registrations and membership renewals.
- WRI Mgmt: Finished September newsletter layout and printing of paper copies to mail. Updated advertising records. Will start advertising renewals and membership renewals.
- Old Business: **MGWA Fieldtrip:** 14 people participated. Scott had positive feedback from the participants. He will write up the results from the pumping test for a newsletter article.
- Fall Conference:** Presentations mostly finalized. Plan on lunch at 11:30. Outdoor afternoon portion to be at Sheep Pasture infiltration area. 3 to 4 demonstration areas to be setup and conference goes to gather at different stations for 30 minutes each. Need to develop site safety plan. Need site map for handouts. Need to notify campus police of our schedule. Brochure draft finalized at the meeting. Will be mailed out shortly.
- New Business: **2009 Officers:** Officers needed are President-Elect and Treasurer.
- Next Meeting: November 21, 2008, 11:30 a.m., Fresh Grounds

Members can access the current year's newsletters in the 'Members Only' area of the web page.

The username is mgwa and the password is emailed to members with each announcement of newsletter availability



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The International Year of Planet Earth aims to ensure greater and more effective use by society of the knowledge accumulated by the world's 400,000 Earth scientists. The Year's ultimate goal of helping to build safer, healthier and wealthier societies around the globe is expressed in the Year's subtitle 'Earth Sciences for Society'.

The International Year runs from January 2007 to December 2009, the central year of the triennium (2008) having been proclaimed by the UN General Assembly as the UN Year. The UN sees the Year as a contribution to their



sustainable development targets as it promotes wise (sustainable) use of Earth materials and encourages better planning and management to reduce risks for the world's inhabitants.