

Minnesota Ground Water Association

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Newsletter

June 2010
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MGWA President
Steve Robertson

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President's Letter

By Steve Robertson

Who's concerned about groundwater sustainability?

I suspect most of us are. We all understand the basic concepts involved. But there is much room for discussion on the specifics. What does it mean to you?

I asked this of my college-aged daughter who, fresh from an anthropology class on ancient cultures, waxed prolific on societies like the Sumerians, whose irrigation practices long ago in Mesopotamia allowed the development of city states and written language. However, the specific methodologies used to distribute the water caused salts to accumulate in the soils, rendering them unusable and making the

Mapping a Fragile Geology's Underground Water Routes

By Stephanie Hemphill, Minnesota Public Radio March 29, 2010

Harmony, Minn. — When snow is melting in the woods and fields of southeastern Minnesota, Jeff Green wants to know where it's going.

For Green, a karst hydrologist for the state Department of Natural Resources, the running waters of spring offer a chance to work on maps of underground pathways that water takes in the fragile geology of southeastern Minnesota. His maps will help fire departments, land-use planners, farmers, and people who want to protect trout streams.

Finding underground pathways is important, because Minnesota's driftless area wasn't scraped by the last glacier. The area's honey-combed limestone bedrock, called karst, makes it highly vulnerable to pollution caused by chemical spills, development or poor farming practices.

The first step in making groundwater maps is dye tracing, a process in which scientists pour dye in melting snow and track where it leads.

Near the small town of Harmony, Green and his colleague Jeremy Rivord climbed a fence and splashed through a stream that's overflowing its shallow banks and flooding a pasture.

society vulnerable to other pressures. A similar fate befell the Anasazi of the southwestern United States, who, one theory contends, were unable to adapt to climatic change in a manner that allowed the continued existence of the cliff dwelling culture they had built.

People in these defunct societies likely did not fully understand the changes they were forced to endure. But it is clear that they were either unable or unwilling to adapt to maintain sustainability. Do we really understand all the various dependencies of the physical and biological worlds we occupy to safeguard our future? John Muir once wrote, "When we try to pick out anything by itself, we find it hitched to everything else in the universe."

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Bordering the creek, a natural rock wall riddled with cracks dripped water. The limestone is like a superhighway for water, Rivord said. As melting snow seeps into limestone, it runs

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DNR hydrologist Jeff Green pours fluorescent dye into a sinkhole near Harmony, Minn. on March 12, 2010. Later, he will return to springs a mile away to retrieve the carbon "bugs" that will absorb the dyes. (MPR Photo/Stephanie Hemphill)

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Newsletter Deadlines

| Issue | Due to Editor |
|---------------|---------------|
| September '10 | 08/06/10 |
| December '10 | 11/05/10 |
| March '11 | 02/04/11 |
| June '11 | 05/06/11 |

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MEMBER NEWS

Sherri Kroening Joins Newsletter Team

Sherri Kroening is the newest editor on the MGWA Newsletter Team. She has 15 years experience in the environmental arena. Sherri has been employed as a research scientist at the Minnesota Pollution Control Agency since 2007, where she coordinates the agency's ambient groundwater quality monitoring network.

Prior to her work with the State of Minnesota, she was employed as a hydrologist with the US Geological Survey, both in Florida and Minnesota, where she managed stream, lake, and groundwater quality investigations as part of cooperative studies between federal and state governments and the National Water Quality Assessment.

Sherri earned a Bachelor of Science degree in Chemistry and a Master of Science Degree in Civil Engineering from the University of Minnesota.



Sherri Kroening, MGWA Newsletter Team

Promotions and Appointments

Braun Intertec

Mark Ciampone was recently promoted to Senior Scientist in the St. Paul office's Environmental Consulting Group. Mr. Ciampone manages environmental site assessments, remedial investigations, and feasibility studies for brownfield redevelopment sites as well as underground and above-ground storage tank sites. He is also responsible for evaluating, designing, and implementing soil and groundwater remediation plans.

Daniel R. Holte, PG, was appointed as a Vice President and member of the Braun Intertec Board of Directors. He is a principal scientist in the Environmental Consulting Group where he performs several consulting roles involving company and facility acquisitions, property redevelopment, environmental compliance assessments, and National Environmental Policy Act environmental assessments. His duties also include strategic transactional consulting, technical review of project scopes, and serving as a regulatory agency liaison. Since joining Braun Intertec in 1988, Holte has cultivated an extensive client list that includes urban redevelopers, private equity firms, foundations, and agricultural corporations. Holte received a Master of Business Administration degree from the University of St. Thomas and a Bachelor of Science degree from the University of Minnesota Institute of Technology.

Michael L. Bratrud, PG, was appointed as a Vice President. Bratrud is a principal scientist and the head of the Environmental Consulting Group where he directs environmental due diligence, hydrogeologic evaluations, remedial investigations, and development and redevelopment related activities. He also consults on hazardous waste and Superfund (CERCLA) sites, including soil and groundwater remediation plans, and serves as a regulatory agency liaison. He joined Braun Intertec in 1998. Bratrud received a geology degree from Gustavus Adolphus College and did graduate work in geology at the University of Minnesota - Duluth.

Barr Engineering Company

Jim Aiken, MGWA Advertising Manager and Karma Hughes were voted Vice Presidents of Barr Engineering Company on June 7th.

Westwood Professional Services

Eric Hansen is now employed at Westwood Professional Services. Westwood provides consulting services for wind power projects (among other services). Eric reports that he's enjoying the change.

DNR Waters

Jay Frischman, PG, was appointed project manager for the development of the 11-county Ground Water Level Monitoring Network. Jay was most recently the lead groundwater specialist in the Hydrogeology and Groundwater Unit.

President's Letter, cont.

We'd likely find considerable agreement among ourselves as scientists about the technical aspects of evaluating sustainability. As a civil servant I recognize there are equally thorny political and emotional issues involved. Former Minnesota Pollution Control Agency hydrologist John McDermott used to call scientists working in the public sector 'political' scientists, meaning they had to wear several different hats in doing their work. Without the background or training we have as scientists, it can be challenging to build consensus among parties with divergent interests and ideologies.

Many of the technical and public policy aspects of groundwater sustainability involve encouraging actions that are preventative in nature. Facing these non-technical difficulties, I like to see how others proceed in similar situations. How do epidemiologists motivate people to get a flu shot or have their children vaccinated against pertussis? A key difference between those efforts and ours is that even with the broad societal value, vaccination efforts also confer clear and direct value to the individual participants (and even so public health specialists only exceed a 50% vaccination rate for certain high-risk groups).

I was interested to see an article recently in which an environmental issue, climate change, had been characterized by psychologists as a problem that was designed to be ignored. Why? It's a large scale problem that is global in scale, there are no easy and obvious solutions, no one person or entity is at fault (and can play the role of villain) and the long term fallout seems like it is most likely to affect someone else at some other time. There is a distance between individual behaviors that in the aggregate may do harm and the consequences that result. So it is hard to get people worked up about it, even if, rationally, they believe the science.

I wonder if we are facing similar obstacles as we deal with the groundwater problems of the 21st century. Consider water supply planning on the fringes of the Twin Cities Metropolitan Area. Resource managers are charged with trying to predict which additional well, of the many hundreds used by communities in the metro area will exceed the capacity of the resource. Communities are trying to reduce the number of wells and the amount they pump each of them by encouraging conservation among individual users. Many of the end-users don't understand or appreciate the relationship between their green lawn and a healthy nearby trout stream. So, it's a large scale problem with no single villain, and the harmed resource is removed from most people's daily lives.

The solutions for 20th century problems had clearly identified responsible parties, impacted receptors, and engineered remedies that were

seemingly straightforward, at least from the standpoint that progress could be made by unilateral regulatory controls. But the sustainability issues we face today and in the near future will require new solutions, new partnerships and new sensibilities. How do we do that? I suppose we need to reframe the questions to get people more engaged. And, surely, we'll need to organize collective responses that are multi-lateral in their approach. Perhaps we'll even have psychologists on the team (and, for the proper historical perspective, a few Sumerians).

Many people with wide-ranging backgrounds and perspectives are currently looking at sustainability issues statewide. One key group with substantial state support is the University of Minnesota's Water Resources Center. Follow their work at: wrc.umn.edu/watersustainabilityframework/index.htm

The Department of Natural Resources is proposing ambitious new data collection efforts (files.dnr.state.mn.us/publications/waters/groundwater_level_monitoring_report_october_2009.pdf) so that we can improve our understanding of systems which currently have incomplete knowledge. The objective of these and other similar efforts is to help us understand the manifold uses for our state's water resources. Of course, we'll need to start making decisions about sustainable use now, in many cases without complete comprehension of both the systems themselves and what changes may come our way in the future. That's what's driving some of the new data collection efforts. I think it was Aldo Leopold who once said that "the first rule of intelligent tinkering is to keep all the parts."

P.S. We were happy to welcome a large crowd to the spring MGWA conference on Mining and Water Resources. We are very grateful to the many speakers who gave of their time to prepare and present interesting talks. I know I learned a lot.

Speaking of learning opportunities, keep aware of upcoming educational opportunities by using the calendar feature on the MGWA website. Some of the listed events offer discounts to MGWA members. And don't forget to renew your professional license before the end of June.

Finally, no message from the president would be complete without an appeal to get involved. We are still looking for additional people to help out on the MGWA newsletter team. Having participated with that group for many years, I can attest that it is fun and the burden is relatively light. It's a great way to meet others and to learn more about groundwater in Minnesota. Send an email to tedd.a.ronning@xcelenergy.com to find out more.

Enjoy your summer!

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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.

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Springshed Mapping, cont.

down vertical cracks to horizontal openings. Green called the bigger ones conduits, as the water picks up speed when it reaches them.

"This thing is two or three inches wide, [and] you can imagine a pipe that big, water would move very fast," Green said. "So these conduits are what we're dye tracing. Water is moving through those -- miles per day -- and coming out of these springs."

Green and Rivord traipsed into the wet pasture to put what they call a "bug" in the spring. It's a small mesh bag about the size of a cell phone, packed with charcoal. The charcoal will capture a dye that they'll pour into melting snow in a sinkhole a few miles away.

Their goal is to determine where the water comes from that feeds the spring. That helps Green make what he calls spring-shed maps, that show how the water flows underground.

Farmers are usually happy to let him walk on their fields, and he gets help from other locals too, especially later in the year when snow no longer melts.

"The Harmony Fire Department is fabulous; they bring me water in their fire truck," Green said. "They know that if there's a spill and something nasty gets into a sinkhole, they're part of the response team and they want to know where it's going to come out. And by doing this work, we can tell them that."

After the scientists placed "bugs" in several springs, they drove about a mile away to pour their dyes into sinkholes.

A muddy field was dotted with small groves of trees. The trees were growing around miniature canyons, about 20 feet deep. The sinkholes made it clear how the honeycombed water highway works.

"This is a place where there was a conduit, an opening in the limestone, a fracture that got

dissolved," Green said. "And as water moved through the soil, it carried soil into that opening, and made an air-filled void in the soil at the bedrock surface. Eventually the soil collapsed, and you have a sinkhole."

After finding some running water, Green donned rubber gloves and poured a cup or so of fluorescent dye into the snow.

Rivord jotted down the exact time, and on a GPS unit, pinpointed the spot where surface and groundwater meet -- a sure sign that what happens on the land directly affects the quality of groundwater, the scientists said.

"In this case, it's pretty good, you've got conservation tillage, lots of corn stalks left to keep the soil from eroding, and then you've got grass, permanent cover, around the sinkholes," Green said.

Southeast Minnesota is known for its trout streams. The map Green is making will help protect those streams by pinpointing the source of water that feeds them.

Green will later check the "bugs" he put in the springs to determine where the dye from the sinkhole went.

He usually finds water traveling one to three miles underground before it surfaces in a spring.

When the spring-shed map is finished this spring, Green will share it with local governments, farmers and people who want to protect the region's water.

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You can listen to this news story and view a slide show at: minnesota.publicradio.org/display/web/2010/03/29/karst-hydrology

Management Changes in the Environmental Analysis and Outcomes (EAO) Division at MPCA

The retirement of **Marvin Hora**, longtime manager of the Water Assessment and Environmental Information Section in the EAO Division, has led to two management changes at MPCA. **Shannon Lotthammer**, manager of the Water Monitoring Section, has assumed Marvin's former position. Shannon will now direct programs in water quality standards, effluent limits, and environmental reporting and special studies (including the investigation of emerging contaminants in both surface water and groundwater). **Glenn Skuta**, manager of the Watershed Section in the MPCA's Regional Division, will direct the Water Monitoring Section. The Water Monitoring Section includes

the MPCA's ambient groundwater quality monitoring network and groundwater modeling studies which support Total Maximum Daily Load efforts as well as lake, stream, and wetland monitoring (including MPCA's popular citizen's monitoring programs).

If you would like further details about any of the programs, a good place to start is on the MPCA's newly redesigned web site at:

www.pca.state.mn.us/index.php/water/water-home.html

Save these Dates!

**MGWA's Fall Conference
November 9, 2010**

**MGWA's next Spring
Conference May 4, 2011**

**GSA Annual Meeting
October 9 - 12, 2011**

Development of a CO₂-sequestering Geothermal Power Plant

By Dr. Martin O. Saar and Jimmy B. Randolph, Department of Geology and Geophysics, University of Minnesota

Geologic sequestration of carbon dioxide (CO₂) in deep saline aquifers has been proposed as a means to mitigate greenhouse gas emissions and thus to slow global warming. Saline aquifers make excellent sites for CO₂ sequestration because they are unusable for consumption and irrigation. This proposal would take advantage of the Earth's natural heating of injected CO₂. A portion of the heated CO₂ would then be returned to the surface and used as the working fluid in a geothermal power plant to generate electricity or provide heat. The thermal efficiencies gained would allow for a CO₂-sequestering geothermal power plant with a negative carbon footprint. But let's start at the beginning ...

Who is doing this research?

The Hydrogeology and Geofluids Research Group (the Geofluids Group) of the University of Minnesota Department of Geology and Geophysics conducts quantitative research in fluid dynamics applied to hydrogeology, volcanology, geophysics, and geodynamics. Research interests include groundwater, CO₂, magma, flow through complex porous media, rheology of composite materials (suspensions, magmas), and heat and fluid flow related to geothermal energy, CO₂ sequestration, volcanic eruption dynamics, and hydroseismicity. Currently, five graduate students and three postdoctoral students are working in this group, led by Assistant Professor Dr. Martin Saar, who is the Gibson Chair of Hydrogeology and Geofluids. The group is made possible, to a significant degree, by a generous endowment from George and Orpha Gibson. In addition, the group's research has been supported by grants from the National Science Foundation, the Initiative for Renewable Energy and the Environment (IREE), and the Department of Energy (DOE) – all with Dr. Saar as Principal Investigator. One particular project, which is highlighted hereafter, combines CO₂ sequestration with geothermal energy capture and is partially funded by the above mentioned DOE and IREE grants. The concept was originally developed by Martin Saar and Jimmy Randolph (Ph.D. student).

Geothermal heat

Many of us who have lived here awhile may think that Minnesota would not be a promising place to produce electricity using geothermal energy. After all, the state has no active volcanoes, thermal springs, geysers, or any other features that typically occur at sites with geothermal energy potential. Yet the University of Minnesota's Department of Geology and Geophysics is the center of a large interdisciplinary team of researchers who are developing a method to produce electricity using geothermal energy in regions with low geothermal heat flow rates, such as Minnesota. Geothermal energy is a clean, renewable, and consistent energy source that has the capability to provide much of the nation's electric power and space heating needs. Geothermal power plants are scalable to meet local or large-scale energy requirements.

Three conditions must be met to use geothermal heat for electricity production:

- 1) subsurface temperatures and geothermal heat flow rates must be sufficiently high;
- 2) large amounts of geothermally heated fluid (a liquid or gas, often water) must be present; and
- 3) the subsurface geothermal reservoir must have sufficiently high porosity and permeability to allow easy fluid flow and heating.

Minnesota and most regions worldwide have low geothermal heat flow rates compared to geologically active regions such as the western U.S. (Figure 1). These regions of low heat flow rates have traditionally been excluded during evaluation of geothermal heat potential. However, Minnesota's heat flow rates are likely underestimated. Thus, the Geofluids Group is re-evaluating Minnesota's geothermal heat flow rates by measuring over one hundred temperature-depth profiles throughout the state. Accurate measurements of subsurface temperatures and heat flow rates are critical to evaluate the state's potential for geothermal electricity production.

The new concept

The new concept for geothermal energy utilization proposed by the Geofluids Group would employ geologically sequestered CO₂ in an effort to reduce emissions from power plants and ethanol plants. While most of the CO₂ would be permanently stored deep below ground, a small fraction of the geothermally heated CO₂ is brought back to the surface where it drives an electricity generating turbine. Then the expanded and cooled CO₂ is re-injected into the ground, along with the main CO₂ stream, thereby closing the loop. Using CO₂ rather than water as the geothermal working fluid has several advantages:

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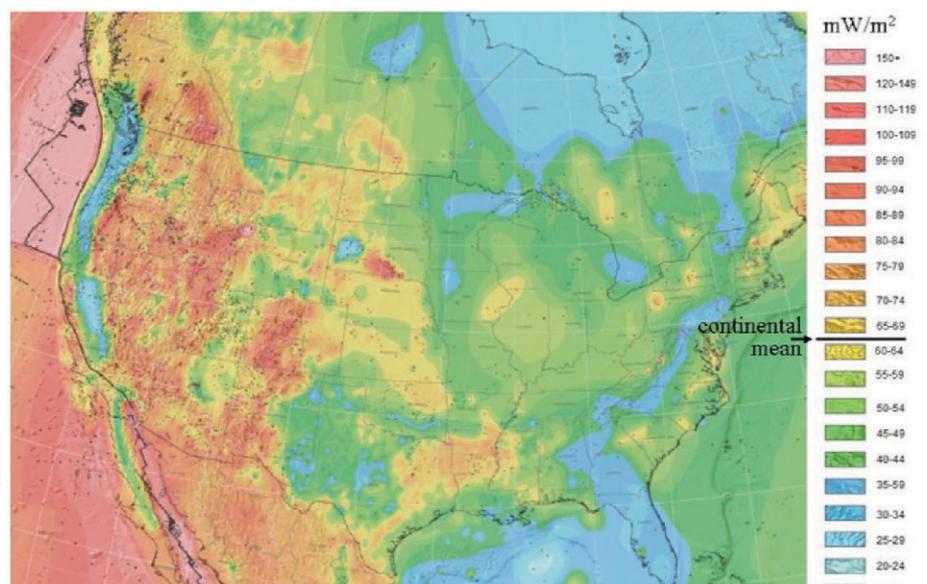


Figure 1: Geothermal heat flux of North America [modified from Blackwell, D. D., and M. Richards. 2004 Geothermal Map of North America, AAPG, scale 1:6500000, 2004.

CO₂-Sequestering Geothermal Power Plant, cont.

- ◆ The thermal properties of CO₂ allow lower temperatures, and thus shallower depths, for geothermal energy capture. This would reduce drilling and power plant operating costs.
- ◆ Aquifers are often needed for water supply and are thus unavailable for geothermal electricity production. Conversely, society needs to dispose of the greenhouse gas, CO₂.
- ◆ Using CO₂ results in geothermal power plant efficiencies approximately twice those of comparable water-based systems.
- ◆ Geothermal heat can provide an electricity source with efficiencies that scale with demand for nightly heating and nightly charging of electric cars. Unlike water, CO₂ does not freeze at 32°F, allowing efficiencies to follow electricity demand even during Minnesota winters.
- ◆ CO₂ geothermal working fluid would reduce power plant-related CO₂ emissions in the US by about 10-20% with large-scale deployment.

The Geofluids Group focuses on numerical modeling of CO₂ injection into deep geologic formations and CO₂ mining of heat energy (Figure 2). In collaboration with Professor Seyfried, the group will also investigate CO₂-brine-rock interactions and resultant fluid flow path modifications that may occur upon CO₂ injection into deep saline aquifers. Research into CO₂ sequestration and geothermal energy production is a new project. Current results are promising, and perhaps in the near future, you could hear about a CO₂-based geothermal power plant under construction.

Information for potential collaborators and investors

Anyone interested in the concept, as a research collaborator and/or investor, should contact Martin Saar (saar@umn.edu, 612-625-7332). We are always interested in ideas and support regarding this and other projects. More information on geofluids research projects can be found at: www.geo.umn.edu/orgs/geofluids.

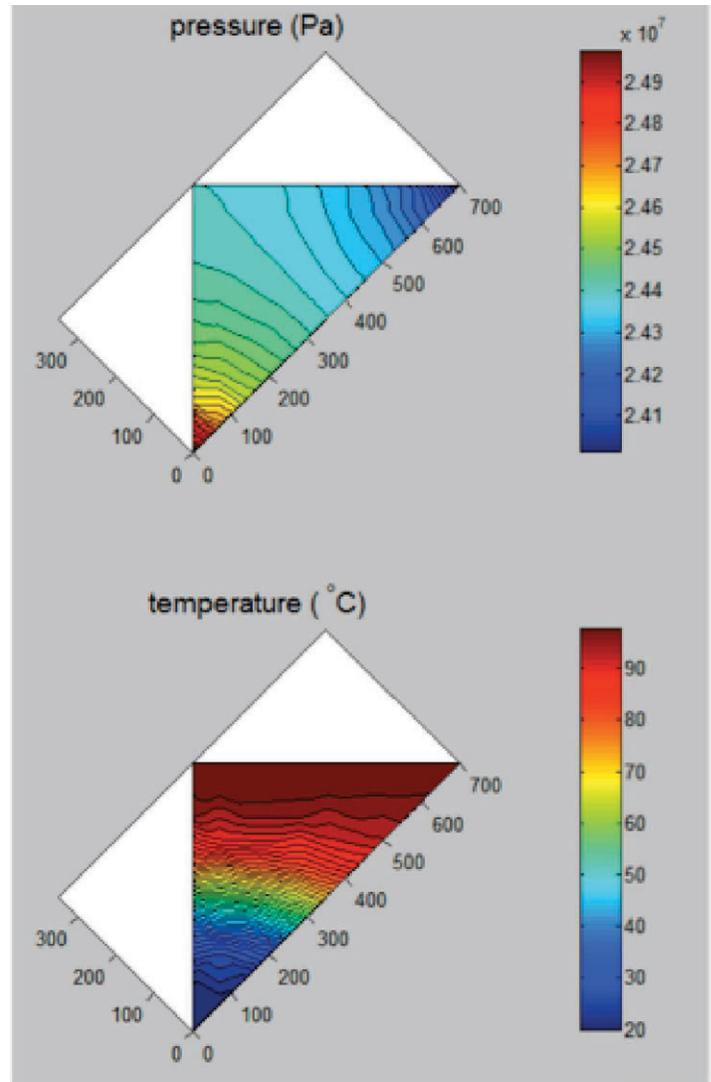


Figure 2: Map-view contour plots of some numerical modeling results, using TOUGH2, of CO₂ injection and production from a deep geologic formation. Cold CO₂ is injected in the bottom left corner of the triangles and produced from the top right corner. Length units are in meters.



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Vadose Zone Discharge of Treated Water by Horizontal Wells

By Brett J. Staeden, P.E., Terracon Consultants, Inc. and Kurt Schroeder, P.G., Minnesota Pollution Control Agency

The Minnesota Pollution Control Agency (MPCA) is overseeing the Baytown Township Groundwater Contamination site, a Superfund site in central Washington County. The primary contaminant of concern is trichloroethene (TCE). The MPCA commissioned Terracon Consultants, Inc. (Terracon) to conduct environmental assessment, contaminant source identification, remedial design and oversight of the source zone for this site. In 2007, the MPCA had Terracon design a remediation system for containing the contaminated groundwater at its source. Terracon also prepared bid documents, oversaw bid solicitation and provided construction oversight and system monitoring. The selected remedy is a hydraulic barrier of pumping wells that serve to contain the source of the TCE at 11325 Stillwater Boulevard in Lake Elmo. Four wells pump water from a buried unconsolidated aquifer to an on-site treatment system that uses an air-stripper, which removes the TCE from the water.

Design of the Discharge System

A challenging part of the design process involved disposing of the high volume of treated water that would be discharged after the air stripper. This involved working with a limited area and with low permeability surface soils that precluded traditional water discharge methods such as sanitary or storm sewers, infiltration ponds, and shallow drain fields. Soil borings were advanced in a baseball field which was the area of the site that was considered for discharging the treated water. (See Figure 1). This area was identified as having low permeability silt and clay soils within eight feet of the surface. However, moderately to highly permeable sand and gravel were identified on the eastern portion of the baseball field at depths of approximately 21 feet to 25 feet below ground surface. These soils were found below the low permeability zone and above the static water table which was approximately 35 feet below ground surface. Based on these constraints, the final design for managing the treated water incorporated a unique infiltration system for vadose zone discharge that

was installed using horizontal directional drilling. Two 6-inch diameter slotted high-density polyethylene (HDPE) pipes were installed at 24 feet below ground surface and at 520-foot lengths to allow the treated water to discharge to the vadose zone and percolate to the shallow unconsolidated aquifer.

Design of a vadose zone discharge system with continuous discharge of water requires a thorough understanding of flow through porous media, construction and system layout options, site-specific soil and groundwater conditions and methods for collecting and analyzing data. For example, an accurate estimate of water mounding was needed to size the vadose zone discharge system properly. This was necessary in order to reduce the potential for day-lighting of the discharged water, which could then lead to flooding at the site. In addition to the assessment and analysis, performance measures were incorporated into the design to evaluate the performance of the infiltration system relative to the design estimates. With respect to mounding criteria, three piezometers were installed along one horizontal well to measure mounding.

Water Quality Considerations

System maintenance is an important consideration for discharging treated water to the vadose zone. One of the most critical factors involved with maintaining a vadose zone discharge system is to manage the quality of the discharge and thereby limit clogging of the infiltration pipes. Depending on the groundwater chemistry and the water treatment system, various chemical, physical and biological changes can occur that could promote clogging such as: excessive suspended solids, precipitation of inorganic species and biogrowth. Furthermore, remedial action may also create changes in the water quality. For example, the application of chemical oxidants to the subsurface to oxidize contaminants will likely alter the groundwater chemistry.

With these issues in mind, treatment options that have been considered for this site include: metal ion sequestrates, recarbonation, pH control, horizontal well cleaning and well televising. Other techniques that could be used include water softening, ion exchange and reverse osmosis. So far with this project, a filter system was installed to remove suspended solids, iron precipitates and manganese precipitates from the water. Water hardness is also an important parameter to consider since calcium carbonate, calcium hydroxides and magnesium hydroxides can form scale on the interior surfaces of pipes and fittings which could lead to clogging of the system. However, removing hardness from water can involve high maintenance and capital costs for the necessary treatment. Alternative methods for preventing scale from clogging the vadose zone discharge system include: cleaning to remove scale from the pipes, adding sequestrates, using pH control and recarbonation. Recarbonation and jetting of the infiltration system pipes are being implemented to maintain system performance. In addition, water level sensors were installed in the infiltration wells that shut down the entire hydraulic barrier system in the event a well becomes clogged or fails to discharge water to the vadose zone.

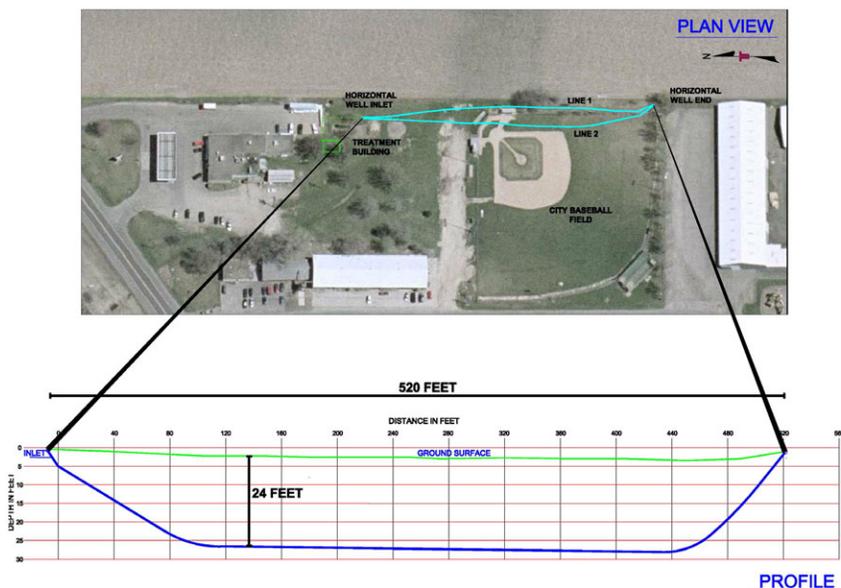


Figure 1 "Plan and profile view of the horizontal infiltration wells"

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Vadose Zone Discharge, cont.

The Constructed Discharge System

The vadose zone discharge system consists of two 520-foot length horizontal wells that discharge water by gravity continuously at a flow rate up to 150 gallons per minute. The contractor that completed the installation of the horizontal wells was Red Pederson Utilities, Inc. working under a subcontract with Stevens Drilling and Environmental. The drill rig is shown in Figure 2. The two horizontal infiltration wells were completed in the winter of 2007-2008. Drilling of each well took approximately three days. To install the slotted six-inch pipes, a pilot borehole was first advanced along the path of the infiltration well followed by pulling a ten-inch diameter solid HDPE pipe with the six-inch pipe inside through the pilot hole. The ten-inch HDPE pipe was then pulled out of the ground leaving the six-inch pipe in place. The length and depth of the horizontal wells are unique when compared to most horizontal drilling. Another aspect worth noting is the use of the adjoining property (a community baseball field) which required the approval of the City of Lake Elmo (City). Because the system was installed by horizontal drilling, it allowed for limited surface impact to the ball field during construction which enabled the City to approve the construction of the system and be a part of the solution to the groundwater contamination problem. Vadose zone discharge promotes sustainability because in effect it returns treated water that is under drinking water standards to the shallow water table aquifer, thereby maintaining a valuable resource. The recharged groundwater is available for future use rather than being wasted by discharge to sewers or alternative aboveground facilities.



Figure 2 "Horizontal drill rig"

Summary

Some significant design elements of the vadose zone discharge system were: constructability – existing equipment and materials were used to construct the system; effectiveness – the system had to accommodate a minimum continuous flow rate of 150 gallons per minute; reliability – the system had to operate continuously without frequent maintenance; and aesthetics – the system had to have minimal visual impact to retain the property's aesthetics. The system also had to be constructed within a reasonable timeframe and budget. Finally, the system had to have a limited impact on the property in order to obtain City approval. This project may not have been implemented if not for productive discussions, meetings and team work between Terracon and the MPCA during the course of the project. In the end, our team developed a successful solution to the problem.

There's no substitute for experience

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MGWA Spring Conference 2010 - Mining and Water Resources

On May 6, 2010, the MGWA Spring Conference drew 240 people to the University of Minnesota campus to hear 11 speakers explore the challenges of mining in Minnesota while protecting water resources.

Dr. Jim Miller of the University of Minnesota started the day off with an excellent summary of the Duluth Complex, the second largest gabbro complex on Earth. He spoke about the historical development of ideas about the complex, and the origin of the complex as part of the 1.1 billion year old midcontinent rift. He gave a detailed tour of the complex, and discussed the copper-nickel deposits along the base of the complex and presented the current understanding of why they accumulated. The historical development of ideas about the Duluth Complex is a window into the history of geology in Minnesota, starting with Newton Horace Winchell in 1872 and continuing to detailed mapping underway today. Dr. Miller described how detailed geophysical work across the rift has greatly expanded the current understanding of the origin of the complex, and discussed the importance of the interaction of felsic and mafic magmas in the process. He concluded his talk with the geochemistry of copper-nickel mineralization, and the essential role of sulfur-bearing rocks of the Virginia Formation. He left the group with this thought: the Duluth Complex bears the largest ore body in the world that has not been mined, and someday it will be mined.

Ernie Lehmann of Franconia Minerals followed with a "Full Circle" talk about the where, why and who of mined materials in

Minnesota. His purpose was to inform the group about the exploration and mining in Minnesota and how this activity has in some ways come "full circle". Exploration began with gold, which led to the discovery of the Vermilion Iron Range, then copper, nickel and platinum group metals, and now it turns back to gold. Lehmann described the Duluth Complex as a "truly complex" complex, formed of at least twelve different intrusions. Now, six mining companies are actively developing the huge copper-nickel resource. Why now? He answered this rhetorical question by explaining the progress in metallurgy and pointing to rising demand.

Permitting and regulatory issues relevant to metallic mining in Minnesota, from the viewpoint of the Minnesota Department of Natural Resources (DNR), was covered by **Jennifer Engstrom**. She gave a thorough account of the environmental review process, the permits involved, financial assurance requirements, and provided a comparison of the requirements for ferrous and non-ferrous mines. Of great interest is the valuable database the DNR has developed from a number of long-running waste characterization tests. The DNR has built up a strong database from lab and field testing over the past few decades on leaching and mitigation techniques.

The MGWA was fortunate to hear **Dr. Rick Wilkin**, who traveled to St. Paul from the US Environmental Protection Agency (EPA) Office of Research and Development (ORD) in Ada, Oklahoma to give his presentation regarding monitored natural attenuation (MNA) of inorganic contaminants in groundwater. He gave a primer on newly published USEPA guidance on the subject, gave

— continued on next page



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2010 MGWA Spring Conference, cont.

the basics regarding the geochemistry involved, and highlighted two case studies in the East Helena, Montana Superfund Site and the Klau-Buena Vista Superfund site, a former mercury mine in California. ORD has issued an interest paper specifically regarding MNA of mining sites, which shows how attenuation processes occur but are not sustainable in most cases. He spoke about the field sites and delivered the message that mobilities depend on biogeochemical interactions, which in the case of inorganics, are reversible, thereby adding to the complexity of using MNA to address environmental effects of mining and emphasizing the importance of site characterization.

The source and fate of sulfate released by mining is an essential topic and was addressed by **Mike Berndt** of the DNR. He covered the findings on sulfate loading in the St. Louis River, emphasizing the importance of hydrology in understanding the geochemistry involved. The DNR conducted a large reconnaissance study, including a great deal of sampling under various seasonal situations. Their main finding was discharge is a major controller of sulfate from the mines, and they measured up to 100 parts per million sulfate in the river. They used sulfur and oxygen isotopes to see if reduction was going on, and their findings suggest reduction followed by re-oxidation is an important process in the region.

Brian Sperazza gave a detailed look at the equipment and methods used to conduct packer tests in drill holes. The main purpose of the packer testing is to measure the conductivity of fracture zones. These studies are needed to characterize hydraulic and chemical conditions of fractured bedrock at potential mine sites in northern Minnesota. The hydrogeologic characterization is used to support the permitting process.

O'Niell Tedrow of Northeast Technical Services described toxicological testing for aquatic species in mine pits. The water flea and the fathead minnow were the prime subjects of the testing. Toxicological tests are sensitive to variable chemical and physical parameters such as pH and dissolved oxygen. Correlations of toxicity test results and sulfate were shown.

Jim Aiken and **Evan Christianson** of Barr Engineering Co. discussed groundwater considerations for proposed sand and gravel mining at UMore Park in Rosemount. Monitoring indicated groundwater flow toward the Mississippi River and away from the potentially sensitive Vermillion River. Groundwater modeling was useful in identifying the effects of drawdown from large-scale mining and future pumping scenarios. A draft environmental impact statement (EIS) is in preparation that includes a detailed geologic and groundwater assessment of UMore Park.

University of Minnesota graduate student **Cale Anger** also spoke on the subject. He described a baseline assessment of the variability of groundwater quality and quantity for the UMore property.

Mike Liljegen of the DNR spoke on borehole mining of manganese near Emily, Minnesota. A friable Emily District Iron Formation may be the largest high-grade deposit of manganese in the northern hemisphere. Plans are to mine the manganese by jetting into boreholes up to 400 feet deep. The ore would be pumped out as slurry. The DNR will be reviewing an EIS for this project.

Heather Arends of the DNR discussed statewide trends affecting aggregate use and mining. Aggregate, either sand and gravel or crushed stone, are produced primarily locally because of transportation costs. Aggregate is nonrenewable, is not equally distributed throughout Minnesota, and some locations preclude mining. She discussed how the public and non-public benefit of aggregate is balanced against the local impact, environmental issues, and

land-use changes.

Scott Alexander ended the day's conference by taking us deep into the Soudan Mine in northeastern Minnesota, a former iron ore mining site, that now is a Minnesota state park, a physics research center, and a window into deep subsurface microbiology. Scott described the unusual chemistry of water seeping into the lowest mine drifts, water often twice as salty as sea water, and some of the effects on the microbiological communities living at the bottom of the mine. Scott closed the conference by offering conjectures on the hydrogeochemistry of Mars and the origin of the microbiological communities living quite successfully half a mile below the land surface.

Breakout Session on Hydrostratigraphic Naming Conventions

The day's program included a special concurrent session, not related to mining, in the afternoon to discuss the need, means, and process for establishing standards for defining and naming hydrostratigraphic units in Minnesota. About 30 people attended the session hosted by **Bruce Olsen**, Minnesota Department of Health (MDH), and **Bob Tipping**, Minnesota Geological Survey (MGS). Bruce began the session by presenting the background that led to holding the session during the conference. He reviewed the history of the County Well Index (CWI), the state database of water well and boring log information that was originally developed to support geologic mapping; aquifer codes were included as an afterthought. Since then the database has been expanded for many other uses, geologic and hydrogeologic understanding has advanced, and gradually the limitations of the database to adequately identify aquifers and aquifer conditions have been identified by database users.

The members of the user community attending the session were asked about the need to tackle an update of CWI aquifer codes and, in general, how to go about it. Those attending were clearly in favor of pursuing an update but at the same time daunted by the work that it would involve. The session included considerable discussion from many perspectives, bringing up some of the issues that would need to be resolved, and ended with general agreement on the need for the update but without complete agreement on the next steps. Bruce Olsen and Bob Tipping invited any member of the CWI database user community to contact them if they were interested in more information on updating the database aquifer codes.

— *Eric Tollefsrud, Kurt Schroeder, and Jan Falteisek, the Newsletter Team*

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Mining Regulatory Programs at the MPCA

By Chris Nelson, Mining Sector Supervisor, and Stephanie Handeland, Staff Hydrologist, Minnesota Pollution Control Agency

All of the taconite facilities on the Mesabi Iron Range have water discharge permits issued by the Minnesota Pollution Control Agency (MPCA). These permits require appropriate water quality monitoring and compliance with applicable water quality standards. The MPCA reviews technical data and modifies the permits as facility operations change.

The MPCA also works with other state and federal agencies on environmental review for mining operations. There are ongoing joint state/federal Environmental Impact Statements under development for projects at US Steel-Keetac, Mesabi Nugget, and Polymet. US Steel-Keetac is a taconite mining operation. Mesabi Nugget makes iron nuggets, which have higher iron content than taconite pellets. Polymet is a proposed mine and processing facility for copper, nickel, and other nonferrous (non-iron) metals. The Minnesota Department of Natural Resources (DNR) and the US Army Corps of Engineers are the lead government agencies for environmental review. Over the past several years, the MPCA also has worked with project proposers looking to extract other minerals or recover iron with novel processes.

Magnetation, Inc. received a water quality permit from MPCA in 2008. Magnetation is excavating magnetic iron units from previously mined natural ore tailings basins using a proprietary separation technology to produce iron ore concentrate. The concentrate can be used in steel-making or other industrial processes. Water at Magnetation's initial site near Keewatin is contained on-site by dikes. No water leaves the site or is pumped to the site for use

in the process. After the facility has recovered the available iron, the site will be reclaimed and developed into various types of wetlands.

Cooperative Mineral Resource (CMR) hopes to extract manganese from a deposit near Emily in Crow Wing County. CMR plans to use a borehole mining method to inject water into the deposit, using water pressure to disaggregate the ore. The company plans to bring the water to the surface for concentration and shipment offsite for further processing. As of May 2010, the CMR bulk sample collection project is under review by several governmental agencies: MPCA (water quality permit), DNR (Environmental Assessment Worksheet), and the US Environmental Protection Agency (injection well permit). These agencies must provide approvals before the project can begin. CMR proposed a small demonstration project at this site to ensure their technology will work and collect data for future environmental studies that must be completed before a full-scale project can begin. The company and their consultants have collected data on aquifer impacts from water pumping and completed studies on water quality and groundwater modeling.



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Health Department's Efforts on Developing Guidelines on Drinking Water Contaminants

By Nitika Moibi, Minnesota Department of Health

"It is the goal of the state that groundwater be maintained in its natural condition, free from any degradation caused by human activities." Minnesota Groundwater Protection Act, 1989, Chapter 103H

The Minnesota Department of Health (MDH) develops human-health guidance for contaminants found in groundwater used for drinking purposes. The guidance specifies health-protective limits for contaminants that likely pose little or no risk to human health. These limits are established based on current scientific knowledge and are periodically reviewed over time. The guidance developed by MDH is used by state environmental protection and remediation programs which address groundwater contamination.

MDH develops three types of human-health guidance for contaminants: Health Risk Limits (HRLs), Health Based Values, and Risk Assessment Advice. The type of guidance developed for each chemical depends on state agency needs and the available scientific data (animal/human toxicity studies, exposure pathways, and duration/time-period exposure data).

MDH is engaged in the following efforts related to amending the existing Health Risk Limit rules on Groundwater Contaminants by:

- ◆ Including guidance for additional contaminants,
- ◆ Periodically reviewing the existing guidance, and
- ◆ Proactively identifying contaminants which may affect our drinking water sources through the Contaminants of Emerging Concern program.

Amending Health Risk Limits

The 1989 Minnesota Groundwater Protection Act (*Minn. Stat.*, Section 103H.201) authorizes MDH to develop and review HRLs for contaminants found in groundwater. HRLs are developed by MDH toxicologists using available scientific data on contaminants and the current risk assessment algorithm. The resulting guidance is formally adopted through the rulemaking process as an HRL. The rulemaking process is initiated by announcing the intent to amend/repeal the existing rules and solicit public input on the derived guidance. This announcement to amend/repeal existing rules includes a justification for the proposed changes. The proposed rules are published in the State Register, and the public is invited to submit written public comments on the proposed rules. Any comments or issues raised during the public comment

period are addressed, which may result in a modification of the proposed rules. The proposed rules and related documents are then reviewed by an administrative law judge before the proposed rules are adopted.

The current HRL rule on groundwater contaminants (*Minn. Stat.* parts 4717.7810-7900) includes the risk algorithm used to derive HRLs as well as current HRL values. This year, MDH is proposing several amendments to these rules. The proposed amendments will add 14 new HRLs for contaminants found in Minnesota groundwater; these contaminants include pesticides and pesticide degradates such as metolachlor, acetochlor ESA, and acetochlor OXA; volatile organic compounds such as xylenes and toluene; and perfluorinated chemicals such as perfluorobutanoic acid and perfluorobutane sulfonate.

For more information on HRL development or to participate in the current HRL rule amendment, please contact Nitika Moibi in the Health Risk Assessment Unit at the MDH. Nitika can be contacted by e-mail at nitika.moibi@state.mn.us or telephone at (651) 201-4907.

Drinking Water Contaminants of Emerging Concern

MDH has a new initiative called the Drinking Water Contaminants of Emerging Concern (CEC) program. This program is funded by the Clean Water Fund from the Clean Water, Land and Legacy Amendment. The CEC program protects drinking water by proactively identifying contaminants of emerging concern that have the potential to occur in Minnesota drinking water sources. The CEC program is tasked to investigate the potential for human exposure to these contaminants and develop human-health guidance, as applicable.

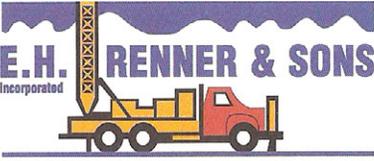
Contaminants evaluated under the CEC effort may include industrial chemicals, pesticides, pharmaceuticals, personal care products, and any other contaminant that may be present in or have the potential to migrate to Minnesota surface water and groundwater. The CEC program intends to provide human-health guidance for ten contaminants during the current biennium; guidance for three contaminants (metribuzin degradates, 1,2,3-trichloropropane, and triclosan) is intended by the developed during the current fiscal year (2010).

MDH staff currently are coordinating outreach efforts regarding the CEC program and have conducted small group meetings with partners from various state and federal agencies and the University of Minnesota. Additional meetings with various non-profit organizations and industry and stakeholder groups also will be conducted. To provide input on the contaminant selection or participate in upcoming meetings, please contact Michele Ross in the Health Risk Assessment Unit of the MDH. Michele may be contacted by e-mail at michele.ross@state.mn.us or telephone at (651)201-4927.

To receive periodic updates on MDH's health-based rules and guidance for groundwater or the CEC program, please sign up for MDH's e-mail subscription service at this link: https://service.govdelivery.com/service/subscribe.html?code=MNMDH_39

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Benton and Chisago County Geologic Atlases, Part A, Completed

Part A of the Benton and Chisago County Geologic Atlases are now available. The reports, recently published by the Minnesota Geological Survey (MGS), include five or six map plates that describe each county's surficial geology; bedrock geology; Quaternary stratigraphy and sand distribution model; bedrock topography; depth to bedrock; and the data sets that support these maps. Faulting and deep buried valleys have affected the distribution of bedrock aquifers in Chisago County. Discontinuous glacial outwash sediments (potential aquifers) are sandwiched between till layers above the bedrock. The MGS created a series of maps that depict the areal extent of these glacial sediments, their tops (by elevation), and their thicknesses (by contours). Glacial outwash sediments are the primary source of water in Benton County, and similar maps have been created to document their distribution.

The Benton and Chisago County Geologic Atlases are a cooperative effort of the MGS, Department of Natural Resources (DNR), Division of Waters, and the counties. Each Part A atlas will be joined in the future by a Part B, to be prepared by DNR Waters, which will include maps of ground water and pollution sensitivity. Funding for these projects was provided primarily by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative and Citizen's Commission on Minnesota Resources, and augmented with federal funds under the STATEMAP program of the National Cooperative Geologic Mapping Program of the U. S. Geological Survey.

County Geologic Atlases, Part A, are underway in Blue Earth, Sibley, Nicollet, Wright, Anoka, Clay, and Renville counties; new projects will be initiated in Sherburne and Morrison counties in July. See Figure 1 for the status of county geologic atlases in Minnesota. Reports in the County Geologic Atlas Series may be purchased at the Minnesota Geological Survey, Publications Sales Office, at 2642 University Avenue, St. Paul, 55114, phone (612) 627-4782.

The Benton and Chisago County Geologic Atlases were prepared using geographic information system (GIS) technology. A DVD was prepared for each report that includes versions of the atlas maps and data in versions accessible both to GIS users and to those who do not use this technology. Data files and portable document format (PDF) images of plates are available for download. Data for Part A of the reports is accessed from the MGS web site at www.geo.umn.edu/mgs/county_atlas/countyatlas.htm. For more information about other reports in the atlas series and access to completed Part B reports please see the DNR Waters web site at www.dnr.state.mn.us/waters/groundwater_section/mapping/status.html.

For more information contact the Minnesota Geological Survey, at (612) 627-4780 or Jan Falteisek, DNR Waters, at (651)259-5665.

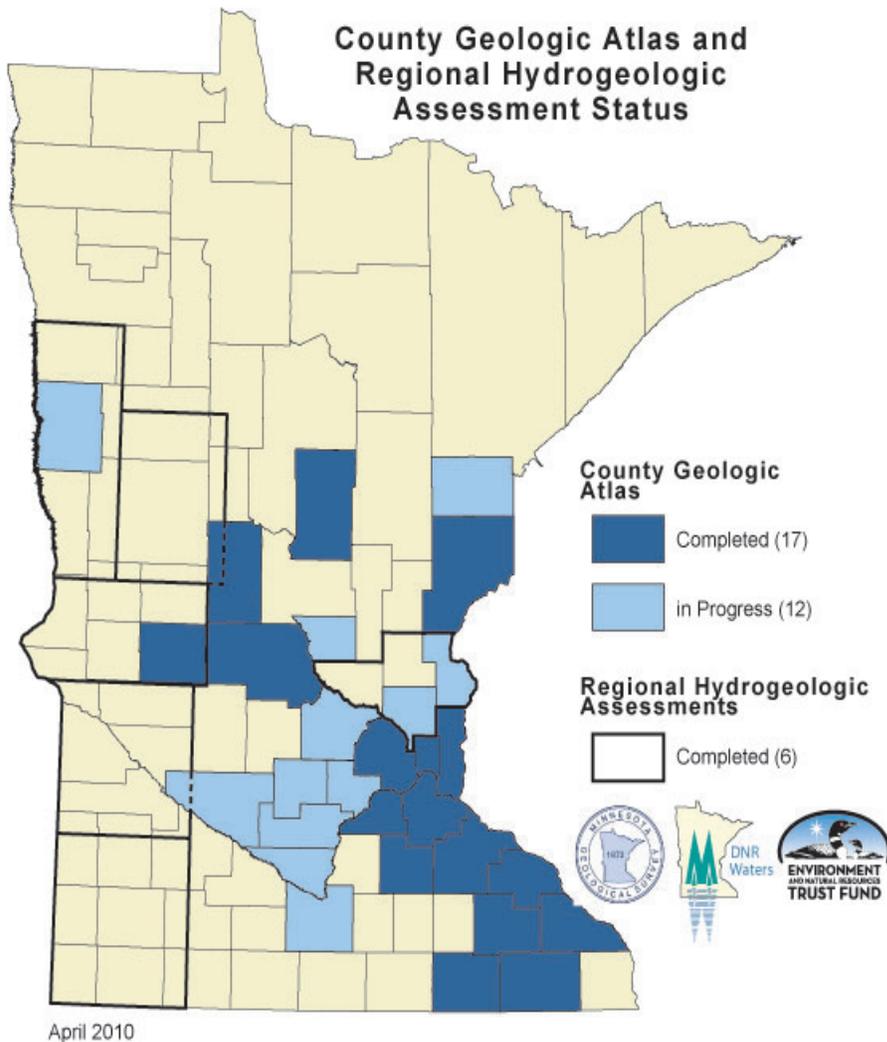


Figure 1. Status of County Geologic Atlases.

Minnesota Department of Health Waterline Newsletter

The MDH has published the summer 2010 issue of their Waterline newsletter. There are many interesting articles including one on the decommissioning of the old St. Paul Regional Water Services reservoir. Waterline can be accessed online at:

www.health.state.mn.us/divs/eh/water/com/waterline/summer2010.html

Remediation Division at MPCA is Reorganized

The Remediation Division at the Minnesota Pollution Control Agency, under director Kathy Sather, has been reorganized in response to changing priorities and the receipt of stimulus funding for some programs from the American Reinvestment and Recovery Act (ARRA) (see organization chart). The new organization consists of three sections: the Closed Landfill and Superfund Section, headed by Jeff Lewis, the Voluntary Investigation and Cleanup (VIC) and Emergency Response Section, headed by Steve Lee, and the Petroleum Remediation Section, headed by Michael Kanner.

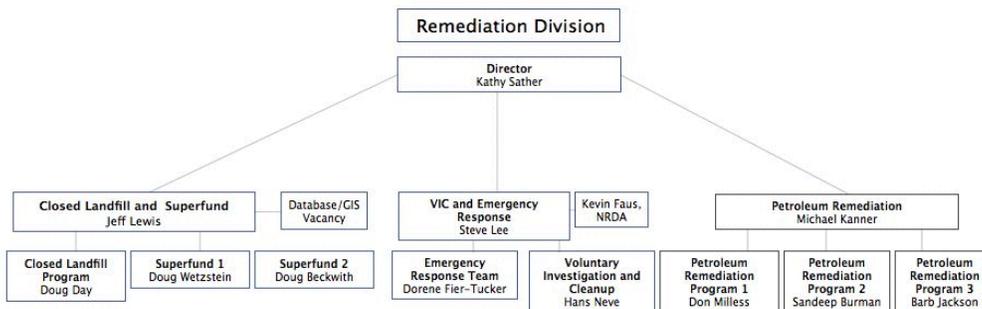
MPCA's Web Site is Redesigned

The Minnesota Pollution Control Agency has redesigned its Web site. You still will access the new "Home" page at www.pca.state.mn.us. If you have bookmarked pages on it, you may need to reset them.

The MPCA is excited about the changes. The site's new design provides more integrated content and simplified navigation. Work continues on improving the searchability of the site.

The MPCA is seeking your feedback and suggestions.

Comments can be sent to: webteam.pca@state.mn.us



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FOUNDATION MINUTES

Minnesota Ground Water Association Foundation Board Meeting Minutes

- Meeting Date:** March 9, 2010
Location: Metro 94 Building, 455 Etna Street, St. Paul
From: Cathy Villas-Horns (Secretary)
Members Present: Gilbert Gabanski, Chris Elvrum, Amanda Strommer, Scott Alexander and Cathy Villas-Horns. MGWA Management Present: Sean Hunt and Jennie Leete
Minutes: The meeting minutes for the December 8, 2009 meeting were unanimously approved on February 8, 2010. The minutes were provided via e-mail to the MGWAF Board and the MGWA Newsletter staff.
There was some discussion of the bullet items that were included in the December 8, 2009 meeting minutes which describe the new Olaf Pfannkuch Scholarship. We need to make sure that the scholarship is handled and administered in a manner that is consistent with MGWAF's tax exempt status with the IRS. In addition, the language describing the hydrogeology field camp may be modified to be less prescriptive. Further discussions need to be conducted with Calvin Alexander and Olaf Pfannkuch, and specific criteria need to be set up for the scholarship.
- Treasurer's Report:** Foundation balance to date is \$96,897.19. Interest in the amount of \$422.49 was accrued since 12-8-09 and was swept into the endowment. Total credits of \$230 from renewing memberships and donations to the MGWA Foundation were received during this period. Total credits of \$3,200 from donations to the Olaf Pfannkuch Scholarship Fund were received during this period. The credits to the Olaf Pfannkuch Scholarship Fund are shown as \$3430 on the Treasurer's Report, which is incorrect. One debit of \$1,000 was paid during this period as a grant to the University of Wisconsin River Falls for a Western Regional Field Trip. Gil proposed and Amanda seconded that a checking account be set up in the amount of \$5,000 out of the unrestricted/non-endowment balance. Motion passed. In February 2010 the 60-month CD matured and the funds were transferred to the Membership Savings account (approximately \$12,000). We discussed different options for investing this money. We will ask Dave to determine if the money could be added to the current Step-Up CD, or if it would be better to put the funds into a 12-month CD. Further communications regarding this money could occur via e-mail.
- New Business:** Grant requests – One grant request received for the Children's Water Festival for \$2,000 received from Carver County Land and Water Services. Chris moved that the grant request be approved for \$1,500. Cathy seconded the motion. Motion passed. Outreach – Renewed outreach to colleges and universities to consider application for MGWAF grants was discussed. Amanda will ask Dave for his list of contacts, update the list and then send it out.
- Old Business:** Pfannkuch Scholarship Fund – we determined that an account separate from the MGWAF account should be set up to manage these funds, and that a Step-Up CD be considered as an investment option. MGWA Board Meeting report – Scott reported that the spring MGWA conference will be focused on Mining in Minnesota. Sean reported that MGWA management has set up a document management space for MGWA and MGWAF personnel on Google Documents. Gil asked that MGWA board meeting minutes be posted on this web service. Sean demonstrated the Google Documents site.
- Next Meeting:** The next meeting will be Tuesday, September 14, 2010 at 11:30 AM at the Metro 94 building. Chris will make the arrangements.

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UPCOMING MEETINGS

Minnesota Ground Water Association Fall Conference

November 9, 2010

University of Minnesota Continuing Education and Conference Center, St. Paul, Minnesota

Call for Abstracts

Poster Presentations

Deadline: October 7, 2010, Submit abstracts by email (see below)

The Minnesota Ground Water Association invites submissions of poster presentations to accompany and supplement its usual program of oral presentations. Space is limited. We'd welcome presentations on a variety of topics, including themes involving groundwater, water resources, and geology, with preference towards Minnesota settings.

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Students -- to submit thesis or work research

Professionals -- to submit work or research on topics that may be preliminary, or that involve ideas or findings about which they would like to engage the professional community.

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For additional information: www.mgwa.org

Geological Society of America Annual Meeting in Minneapolis - October 9-12, 2011

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Jim Miller, Field Trips, UMD, mille066@umn.edu

Curtis M. Hudak, Sponsorship Chair, Foth Infrastructure & Environment, LLC,

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- ◆ Field Trip Proposal Deadline: December 7, 2010
- ◆ Short Course Proposal Deadline: February 1, 2011
- ◆ Technical Session Proposal Deadline: January 11, 2011

AIPG 47th Annual National Conference - September 11-15, 2010

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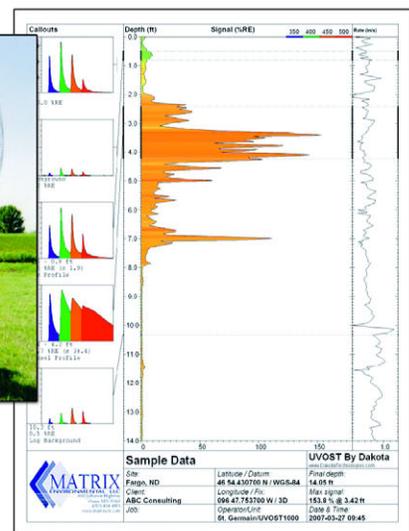
Registration Form:

[www.aipg.org/Meetings/2010 Annual Meeting/Orlando_Registration_Form.pdf](http://www.aipg.org/Meetings/2010%20Annual%20Meeting/Orlando_Registration_Form.pdf)



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MGWA BOARD MINUTES

Minnesota Ground Water Association Board Meeting Minutes

| | |
|----------------------|---|
| Meeting Date: | February 12, 2010 |
| Location: | Fresh Grounds Coffee Shop, 1362 West 7th Street, St. Paul, Minnesota |
| Attending: | Steve Robertson, President; Mindy Erickson, President-Elect; Craig Kurtz, Treasurer; Scott Alexander, Past President; Jill Trescott, Secretary; Tedd Ronning; Jeanette Leete, WRI; Sean Hunt, WRI |
| Past Minutes: | The January 2009 minutes were approved as corrected. |
| Treasury: | Craig reported that WRI has provided the 2009 files for internal audit and he will report back to the board in April. Review of balance sheet reveals cash on hand is approximately \$42,000. Net income for January is about \$14,000 because most of the association's annual dues were received in January and expenses were minimal. |
| Newsletter: | The next issue will include information on the Pfannkuch scholarship and the dates for the 2011 GSA meeting. Scott will include information about the hydrology field camp. |
| Web Page: | Sean gave a presentation on using the Google Docs utility, a collaborative work environment, to share documents for composing the newsletter. He will set up folders for conferences and for each board member. |
| WRI Report: | Report distributed. Highlights include: 1) Second notices for memberships were sent; 2) Worked on trial document sharing platform; 3) Received proposal for Children's Water Festival. |
| Old Business | <u>GSA</u> will hold a joint meeting with MGWA in October 2011. Harvey Thorleifson is coordinating the GSA meeting and his core committee will meet in March. <u>Spring Conference:</u> Steve Robertson presented the proposed topics related to the theme of mining. <u>WRI:</u> Renewal of the contract with WRI was discussed. Trescott moved to approve the contract as proposed. Erickson seconded. All were in favor. |
| New Business | <u>Foundation:</u> MGWA Foundation meeting scheduled for March 9, 2010. <u>MGS Hydrostratigraphic Codes:</u> Bruce Olsen and Bob Tipping are working on hydrostratigraphic, as opposed to lithostratigraphic, codes for Minnesota. <u>MEP membership</u> is due. <u>NGWA Distinguished Lecturers:</u> MGWA should work with the U's student committee that organizes visiting lectures to schedule these, as they get booked up early. MGWA expenses would be about \$500. |

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| Meeting Date: | March 19, 2010 |
| Location: | Fresh Grounds Coffee Shop, 1362 West 7th Street, St. Paul, Minnesota |
| Attending: | Steve Robertson, President; Mindy Erickson, President-Elect; Craig Kurtz, Treasurer; Scott Alexander, Past President; Jill Trescott, Secretary; Jeanette Leete, WRI; Sean Hunt, WRI |
| Past Minutes: | February minutes approved as revised. |
| Treasury: | Craig presented a comparison of the 2009 balance sheet to date with the 2010 balance sheet to date. The Affinity Plus CD is coming due – he will come back to the Board with a recommendation at the next meeting. Review of balance sheet reveals cash on hand is approximately \$43,000. |
| Newsletter: | The next issue should go out next week. Google Docs collaborative software was used to compile the newsletter. |
| Web Page: | Sean is ready to post the March newsletter. After it is posted, he will make the 2009 newsletters public. He is going to update the members-only password. |
| WRI Report: | Report distributed. Ad revenue is significantly down. 511 membership renewals have been received – a few more will come in with conference registrations. |
| Foundation: | Scott reported that the Foundation Board met. The target is \$100,000 for the main endowment, which hasn't quite been reached, before offering scholarships. They are still working on the details of the Pfannkuch scholarship. The Foundation gave \$1,500 to the Children's Water Festival. Craig moved to give the Foundation \$12,600. Steve seconded. Motion passed unanimously. |
| Old Business: | <u>GSA</u> will hold a joint meeting with MGWA in October 2011. Mindy is co-chair for short courses. <u>Spring Conference:</u> Steve gave an update on the Spring Conference speakers. <u>Distinguished speakers:</u> this year's speakers are booked up. We should position ourselves for next year, perhaps in conjunction with the GSA joint meeting. |
| New Business: | <u>MEP sign-on letters:</u> When time is of the essence, Steve will poll the Board members by e-mail for their approval and will support positions if a majority of the Board approves. |

The MGWA Board of Directors meets once a month.

All members are welcome to attend and observe.



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MGWA BOARD MINUTES

Earth Science Week 2010

Exploring Energy

**AGI invites you to take
part in Earth Science
Week 2010!**

www.earthsciweek.org

October 10-16, 2010

Meeting Date: April 16, 2010
Location: Fresh Grounds Coffee Shop, 1362 West 7th Street, St. Paul, Minnesota
Attending: Steve Robertson, President; Mindy Erickson, President-Elect; Craig Kurtz, Treasurer; Jill Trescott, Secretary; Jeanette Leete, WRI; Sean Hunt, WRI
Past Minutes: March minutes approved.
Treasury: The Affinity Plus CD for \$11,000 was renewed through April 6, 2011. The 2009 audit is complete but he has not yet reviewed it with WRI. Review of balance sheet reveals cash on hand is approximately \$42,000.
Newsletter: Work has begun on the next issue.
Web Page: The March newsletter has been posted, as well as the Spring Conference information. Sean distributed Google analytics showing the key word searches that brought people to the website, countries of origin, and most popular pages.
WRI Report: Report distributed. 532 membership renewals have been received; five corporate members have not yet paid. Sean is updating member addresses as mail comes back.
Old Business: GSA will hold a joint meeting with MGWA in October 2011. Mindy passed out sponsorship information.
New Business: Spring Conference (May 6): Website has been updated with information. MEP sign-on letters: Recent requests have been regarding national issues, which Steve felt would not be appropriate for MGWA to weigh in on. Geoscientist licensure: Licensees have to keep track of their own Professional Development Hours and maintain their own licenses. A reminder will be posted in the next conference notice. Midwest Geosciences: offering a short course in September on aquitards. MGWA members are eligible for a discount.

Meeting Date: May 13, 2010
Location: Fresh Grounds Coffee Shop, 1362 West 7th Street, St. Paul, Minnesota
Attending: Steve Robertson, President; Mindy Erickson, President-Elect; Scott Alexander, Past-President; Treasurer; Jill Trescott, Secretary; Jeanette Leete, WRI; Sean Hunt, WRI
Past Minutes: April minutes approved.
Treasury: Craig was not at the meeting, but had e-mailed the monthly financial report. Cash on hand is approximately \$46,000. The Spring Conference was sold out, with 226 pre-registrations and 8 walk-ins. About \$16,000 in conference expenses are still pending.
Newsletter: Tom Clark's work duties leave him less time to work on the newsletter and he is planning to retire in late 2010 or early 2011. New help is needed with the newsletter. The Google Docs site is mainly to facilitate compiling the newsletter.
Web Page: The conference presentations have been loaded onto the website, although the audio has not yet been uploaded. Information will be posted about the Midwest Geosciences seminar coming up in September.
WRI Report: A summary of the conference evaluations, which were generally very positive, was distributed. About 20 membership renewals came in with conference registrations. Barr has renewed its corporate membership but four corporate members have not yet paid. Jim Aiken will contact the other corporate members.
Foundation: No Foundation report. The Foundation's 990 information return is due to the IRS; an extension has been filed.
Old Business: GSA: Mindy gave an update on the GSA's joint meeting with MGWA in October 2011. As an Associated Society, MGWA can hold a ticketed event in conjunction with the meeting. The cost of a booth will be \$150. GSA has a goal of 7,000 attendees for the meeting. Spring Conference (May 6): The summary of comments and some possible themes for future conferences were discussed. New speaker gifts will need to be ordered after this coming Fall meeting.
New Business: Hydrostratigraphy workgroup: This may be a future conference topic. MGS, state and local agencies, drillers, and consultants will be brought together to discuss it. Field trip: A late September field trip, possibly as a joint effort with AIPG, was discussed.
Next Meeting: Friday, June 4, 2010, at 11:30 at Fresh Grounds at 1362 West 7th Street, St. Paul, Minnesota.

Paid Geoscientist Opportunities on National Parks, National Forests, and BLM Lands

GeoCorps America is a program of the Geological Society of America, in partnership with the U.S. Forest Service, the Bureau of Land Management, and the National Park Service.

The program offers paid short-term geoscience positions in some of the most beautiful natural areas in the world. Discrete project areas include geology, hydrology, paleontology, mapping and GIS, minerals, soils, glaciology, geo-hazards, karst, and education. Fall-Winter 2010 positions are now open for you to apply.

The Application period closes July 2, 2010. Apply at: www.geosociety.org/geocorps/apply.htm.

USGS Volcano Resources Online

The United States Geological Survey has made information about volcano hazards easily accessible on their web page:

volcanoes.usgs.gov. Given the recent eruption of Eyjafjallajökull and the disruptions in air travel, this resource might even help you with travel plans!



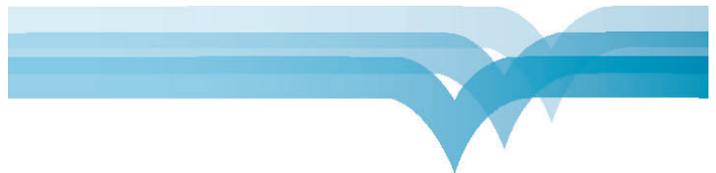
Professional Geologist Renewal Reminder

This is a reminder that all Minnesota Professional Geologist licenses will expire on June 30, 2010. There are two ways to renew your license:

Online at www.aelslagid.state.mn.us. It's fast and easy and your carryover Professional Development Hours are automatically added into your renewal.

There is a surcharge for renewing online. Download a renewal form from the web site and send it in through the mail.

Don't let June 30th slip by without renewing.



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