Minnesota Ground Water Association
www.mgwa.org
Newsletter

June 2006
Volume 25, Number 2

Featured:

MGWA President Dale Setterholm

Inside:

Better Ground Water by Design

The MGWA 2006 Spring Conference was held April 12th. The topic was Better Ground Water by Design: A Review of Practices and Systems That Impact Ground Water.

The morning session of the day's program was introduced by MGWA President Dale Setterholm, with a look at "the long view" to encourage all those attending to think beyond ground water. To help us, Dale employed a handy diagram of "landscapes" (see Figure 1 on page 3). Dale pointed out the many relationships of ground water with the landscapes within which we live. The landscapes include technological, natural, institutional, economic, social, political, and demographic although the day's program could only include components of the technological, social, and political landscapes.

John Barten, Three Rivers Park District, led off the morning's talks with a very interesting talk on turf management. John described the work of the district, which includes 27,000 acres in the southern and western Twin Cities metropolitan area, to improve infiltration and reduce runoff. He said that current construction practices in residential developments result in compacted subsoil with insufficient topsoil that reduces infiltration, increases runoff, and requires excessive watering. He provided a long list of common-sense practices and many examples, including replacing turf area with other plants, avoiding use of curbs, installing rain gardens, and using grassed areas instead of paving new areas for seasonal temporary parking.

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President's Letter

The Spring Conference was a great opportunity to hear from the experts about the impact of some of our waste management and land use practices on the ground water resource. If you came away from that session with the feeling that some changes need to be made, let's consider what might make that happen.

First, didn't hearing solid, factual information on the ground water impact of these processes make an impression on you? It seems to me that it would likely have a similar effect on the rest of the population. Recognizing a problem is an essential step toward solving it. The ground water quality problems that are occurring in public supplies around the state are almost entirely found in hydrologic systems we would describe as sensitive, meaning that they would most quickly show the effects of activity at the land surface. If our sensitive systems are showing problems, logically we can expect that, given more time, the less sensitive systems will likely also have problems. This time delay between recognizing the effects and paying for the costs of ground water degradation seriously weakens efforts to bring about change.

One segment of the population that especially needs to hear this news is our legislators and congressional delegation. There are many opportunities to communicate with these people in both public and private forums. Some of the businesses that impact ground water are significantly influenced by public policy in the form of subsidies and tax breaks. It would be great to see ground water protection become an important part of those policies. Be sure to take advantage of any opportunities to share what you know.

Second, changes in this world, and in this country in particular, are often reward-driven. We need to create a market for ground water-friendly practices, the products that support them, and the goods they produce. You have ultimate control here in that you determine how to spend your money. It might

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Newsletter Deadlines

Issue	Due to Editor
September '06	08/11/2006
December '06	11/09/2006
March '07	02/15/2007
June '07	05/14/2007

MGWA NEWS

Member News

Pat Bloomgren has been appointed as division director for the Infectious Disease Epidemiology, Prevention and Control Division (IDEPC) of the Minnesota Department of Health. She has been serving as the acting director for the past several months. Before serving in that capacity, she was the director of the Environmental Health Division since 1992. John Linc Stine has been appointed division director of the Environmental Health Division.

John Gleason passed the Association of State Boards of Geology (ASBOG) Fundamentals of Geology exam in March 2006, earning certification as a Geologist-in-Training in the state of Minnesota. In May 2005, he earned his Master of Science degree in environmental studies, with an emphasis in hydrogeology, from Bemidji State University. In October 2005, John accepted a position as a hydrologist with the Minnesota Department of Natural Resources, Lands and Minerals Division in Hibbing, where he is evaluating the potential impacts of proposed mining projects on water resources.

He may be reached at (218)262-7340 or john.gleason@dnr.state.mn.us.

Lifeng Guo, after over ten years as a senior hydrologist with the Minnesota Pollution Control Agency, has accepted a position as a hydrogeologist with the Kentucky Geological Survey of the University of Kentucky in Lexington. He may be reached at (859)257-5500, ext. 156 or lifeng.guo@uky.edu.

Jim Seaberg has recently taken a position as a hydrogeologist for the Minnesota Department of Agriculture in the Pesticide and Fertilizer Management Division. He formerly worked as a hydrologist at the Minnesota Pollution Control Agency. Jim's new phone number is (651)201-6139.

Lee Trotta has accepted a position as a hydrologist with Crispell-Snyder, Incorporated, a consulting firm with several offices in southeast Wisconsin. The firm provides a variety of services, including municipal engineering, wastewater collection and treatment, water supply, storm water management and geographic information systems. Lee worked for the U. S. Geological Survey in St. Paul during the 1980's and was editor of the MGWA newsletter, 1987-1990. Lee may be reached at (262)255-8000.

MGWA Joins the Minnesota Environmental Partnership

In order to expand Minnesota citizens' understanding of ground water science, MGWA's Board recently sought membership in the Minnesota Environmental Partnership (MEP). The MEP Board approved our application this spring. With that, MGWA joins this coalition of over 90 Minnesota environmental and conservation organizations working together to protect and preserve Minnesota's natural environment. Together, the MEP's member organizations are supported by more than 500,000 Minnesotans. MEP provides a way for environmental organizations to collaborate in their efforts to make sure that Minnesota's natural resources are well cared for.

Membership in MEP does not necessarily mean that MGWA supports the all views of the other member organizations; however, it does give our members additional opportunities to inform other members about ground water and to influence those views.

In addition MGWA will now also be able to publicize our events through the MEP webpage www.mepartnership.org and through their weekly electronic updates. You may sign up for these weekly electronic updates, which are sent on Friday, on the webpage.

If you are involved with ground water related events that you would like to have publicized to other MEP members, please contact an MGWA Board member at least two weeks before the event. At this time only MGWA Board members have access to the "members only" section of the MEP web page through which events can be posted.

MGWA Welcomes New Corporate Member ARCADIS

ARCADIS
Infrastructure, environment, buildings

Spring Conference 2006: Better Ground Water by Design, cont.

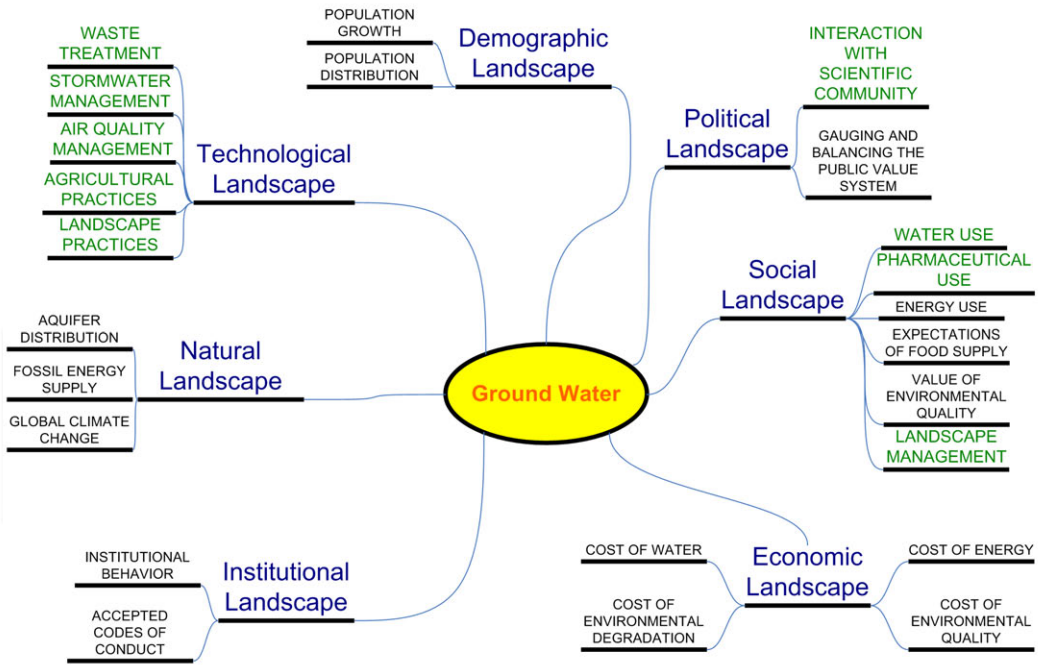

Figure 1 – Diagram of "Landscapes" related to ground water discussed by Dale Setterholm.

Dr. Jim Anderson, University of Minnesota, Department of Soil, Water, and Climate, provided a brief review of the design and functioning of individual sewage treatment systems (ISTS). Households generate 35-70 gallons per capita per day of sewage, which is a complex mixture of water, solids, solutes, bacteria, nutrients, and pathogens. Jim described the typical design of a septic system noting the importance of biomat development, aerobic conditions, and soil properties. He also described some ideas for improved treatment that are being tested, such as pre-treatment of wastewater.

Shifting from wastewater and the land management of rainfall, Dr. Matt Simcik, University of Minnesota, Environmental Health Sciences, took a look at another part of the hydrologic cycle, the atmosphere. Matt provided a good overview of the complex chemical and particulate properties and interactions that affect contaminant transport in the atmosphere and subsequent terrestrial deposition. He discussed several potential contaminants that could enter ground water via atmospheric deposition, including ammonia/nitrate, some metals, and pesticides.

To finish out the morning session Dr. Bill Arnold, University of Minnesota Department of Civil Engineering, and Holly Dolliver, University of Minnesota, Department of Soil, Water, and Climate, gave a joint presentation on pharmaceuticals in ground water, which is an emerging area of concern. Pharmaceuticals administered to humans and livestock have a wide range of response to waste treatment with some more persistent that others. Bill noted detections are usually at the parts per billion or parts per trillion levels and multiple contaminants are often detected together. Antibiotics, analgesics, caffeine, and estrogens are among those that have been detected. Holly then continued with a closer look at antibiotics in Minnesota waters. In Minnesota, 11 antibiotics have been found in water samples and about 47 percent of water supplies sampled had at least one detection. Holly described her 2004 research data on leaching of antibiotics from applied manure. The results suggested that less than a few percent of the initial concentration of antibiotics in manure was detected in runoff or subsurface leaching.

The afternoon session began with Camilla Correll, an engineer, and Jennifer Olson, a hydrogeologist, with Emmons and Olivier Resources, Inc., speaking about the topic Stormwater Management and Ground Water: Are They Compatible? The amount of recharge decreases from 50 percent for natural ground cover to 35 percent for highly developed areas. A number of practices to increase infiltration were discussed including infiltration basins, trenches and tubes; raingardens; underground infiltration systems; and permeable surfaces. Site features that must be considered

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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.

MDH Guidance on the Infiltration of Storm Water in Vulnerable Wellhead Protection Areas

Many storm water management protocols lean heavily on infiltration as a means of attenuating peak flows and distributing runoff to regulate flow volumes. Infiltration practices redirect storm water into the subsurface, where it becomes ground water. Care should be exercised in planning storm water infiltration projects, especially in wellhead protection areas, because most people in Minnesota use ground water as a source of drinking water. The Minnesota Department of Health has developed guidance to help local officials and others decide if storm water infiltration is appropriate in wellhead settings.

Storm water runoff often carries with it contaminants that can lead to adverse health effects. Contaminant types vary widely depending on land use and commonly include nitrates, pathogens, metals, and hydrocarbons. When present, these contaminants can pollute ground water supplies if infiltrated into the ground.

Most of the public water supply systems in Minnesota rely on ground water as their source. Drinking water protection activities are the responsibility in Minnesota of the MDH. As part of these efforts, MDH regulates wellhead protection planning activities carried out by public water suppliers in the state. One of the goals of wellhead protection planning is to determine the recharge area (i.e., the wellhead protection area) for a well and to manage that area in a manner consistent with safeguarding the drinking water supply. Wellhead protection planning is largely a local activity in Minnesota. Each public water supply system decides how to manage land use within wellhead protection areas. Wellhead protection planning and storm water management both involve a substantial amount of local government involvement and leadership, thus good opportunities exist for adopting a consistent approach in the application of each.

The focus of the guidance is on identifying vulnerable wellhead protection area settings that may not be appropriate for encouraging infiltration, especially those that pose acute health hazards. An example is where the infiltration is proposed for a site within a one-year time of travel to the public water supply well. Pathogens common in surface waters are known to die off within one year when introduced to the ground water environment. If introduced to a drinking water aquifer, the possibility exists for such contamination to cause a disease outbreak should it be entrained by a public water supply well. Avoiding such outcomes is one of the primary goals of wellhead protection planning.

This guidance should be available from the MDH Source Water Protection Unit (651-201-4700) in June 2006.

submitted by Steve Robertson, MGWA Newsletter Team.

President's Letter, cont.

seem far-fetched that we will be bragging to our neighbors about the high-performance septic system we installed, but I can envision people paying a premium to live in a development that is designed and operated to specifically minimize environmental impact, including ground water. In our industrial and agricultural businesses might there be opportunities to compete on product quality and environmental impact rather than just price? Minnesota has long been a destination of choice because of its natural beauty. Wouldn't it be great to have Minnesota be the food source of choice because of the high quality of the environment in which that food was grown? Take the time to inform yourself and understand the impact of your lifestyle. As ground water experts we need to lead by example.

I'm considering a Fall Conference that would focus on the structure and the tools of ground water management in Minnesota. I'd like to better understand how the coordinated efforts of our members and others are intended to protect or improve ground water quality and quantity. I think this would be useful to most of us, and especially to those in local government that carry out much of the hands-on activity associated with ground water management. I welcome your thoughts on this idea.

— Dale Setterholm, MGWA President.

Spring Conference 2006, cont.

when choosing an infiltration practice include soils and geology; drainage area; minimum setbacks; topography and land use.

Dr. Gyles Randall from the University of Minnesota, Southern Research and Outreach Center at Waseca, Minnesota, followed with a presentation on the Impact of Agricultural Practices on Minnesota's Ground Water. He stated that the primary contaminants impairing water quality in agricultural areas are sediments; nutrients, primarily nitrogen and phosphorus; pathogens; and excess water. Best management practices in a corn/soybean rotation cropping system were discussed to reduce these contaminants and included soil conservation practices and timing of fertilizer and manure applications.

Minnesota State Senator Michael J. Jungbauer spoke on the topic of How Legislators Receive Scientific Information to Support Decision-Making. He noted that few legislators have a scientific background. He said before banning the use of a product, such as phosphorus in detergents, a detailed and careful review of alternative products is needed to make sure that the alternatives are not worse for the environment. Organizations, such as the Minnesota Ground Water Association, can play a significant role in the process by providing balanced and scientifically based information about environmental issues to state legislators.

Tim Crocker and Julie Ekman, area hydrologists with the Minnesota Department of Natural Resources, Division of Waters, rounded out the conference with a discussion about Management of Ground Water Use and Supply. They discussed the need and process for approving water appropriation permits. Urban sprawl and intensive water use industries, such as ethanol plants, are increasing the competition among users for ground water. They noted that the metropolitan area is expanding north and west into regions with less available ground water resources. New ethanol plants are proposed for areas with corn, power, and transportation, but water is often overlooked, with plant proposers still operating under the paradigm that an abundant water supply can be found anywhere in Minnesota.

— submitted by Jan Falteisek and Norm Mofjeld, MGWA Newsletter Team.

Dakota County Ambient Groundwater Quality Study

by Vanessa Demuth and Jill V. Trescott, Dakota County Water Resources Office.

Introduction

Dakota County is committed to having safe, healthy citizens and a quality physical environment. In support of that commitment, Dakota County Water Resources (referred to as "the County") has been conducting a long-term study of groundwater and private wells, its Ambient Groundwater Quality Study (AGQS). The results raise concerns about contamination found in some residential wells.

Dakota County, south of St. Paul, is the third most populous county in the state, after Hennepin and Ramsey counties (Figure 1). Despite the county's large and growing population of approximately 360,000 people, about two-thirds of its land area is still rural.

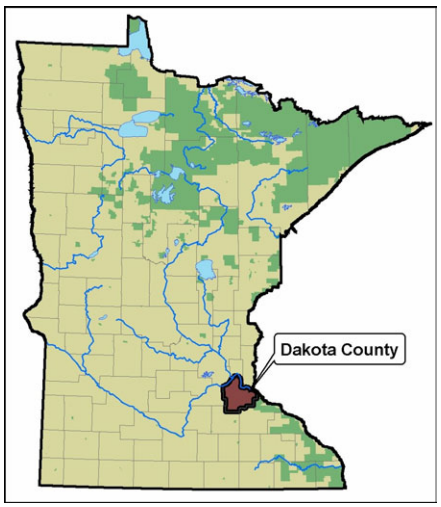

Figure 1 – Location of Dakota County, Minnesota

Ninety-one percent of Dakota County residents obtain their drinking water supply from groundwater. The two most heavily used aquifers in the county are the Shakopee dolomite formation of the Prairie du Chien Group (OPDC) and the Jordan Sandstone (CJDN) for both private and municipal supplies. While many of the state's hydrogeologists consider these formations as a single aquifer system, County staff has found that they behave as separate aquifers in most of the county; the Oneota formation of the OPDC acts as a confining unit between the Shakopee and the CJDN. The OPDC underlies most of the county, as can be seen on the first bedrock map from the Dakota County Geologic Atlas, Figure 2. (The black line on Figure 2 shows the location of the cross-section illustrated in Figure 5.)

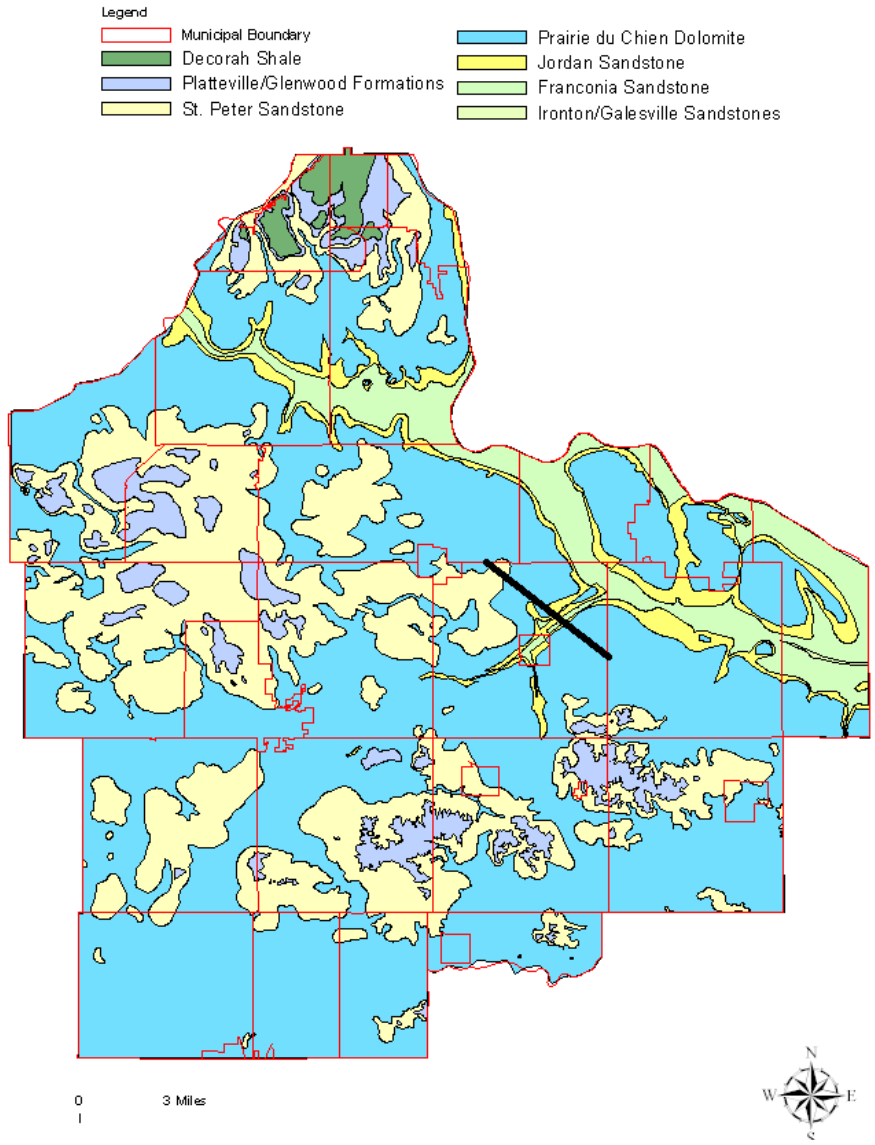

Figure 2 – Dakota County Bedrock Geology Map, John Mossler, Minnesota Geological Survey, 1990.

In 1998, the Dakota County Environmental Management Department was seeking a tool to measure the effectiveness of its well management, solid waste, and hazardous waste programs; this, coupled with concern for increasing nitrate levels in domestic wells and the City of Hastings' municipal wells, spurred the creation of the AGQS. Dakota County conducted its first AGQS sampling event in 1999. The planned duration of the study is 20 years.

The study has established a baseline of groundwater quality data to which future data can be compared. This has enabled the County to identify issues of concern, track changes in groundwater, and protect the future of this valuable resource.

Well Selection

The study concept is to sample the same set of privately-owned drinking water wells, located throughout the county, once each year in order to study changes in the groundwater over time and space. For the first five years of the AGQS (1999-2003) the same 23 wells completed in the OPDC and 19 wells completed in the CJDN were sampled once each year. The parameters for which the water samples are analyzed and the time of year has varied with each sampling event.

The wells selected for sampling represent the county's geologic and geographic

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Dakota County AGQS, cont.

conditions (Figure 3). First, a well completed in the OPDC was selected based on geology and geographic distribution. Next, a nearby CJDN well was identified, usually within 1500 feet of the OPDC well. In some areas of the county a nearby CJDN well could not be located. Once wells were selected, the owners were invited to participate; participation is voluntary and uncompensated.

In 2004, 24 screened wells completed in the Quaternary sands and gravels (Q) plus one completed in the OPDC were added to the study. The Q wells selected are located near the paired OPDC and CJDN where possible. Only a few private domestic wells were sampled within the Metropolitan Urban Services Area where municipal water and sewer exists. In 2005, the five City of Hastings municipal wells completed in the CJDN and one additional Q well were added. In 2005, 68 private wells and 5 municipal wells were sampled.

Analytical Parameters

Minnesota Valley Testing Laboratories, Inc. (MVTL) collects the untreated samples from faucets. The water samples are analyzed for field parameters: temperature, specific conductance, pH, dissolved oxygen, turbidity and appearance. In the lab, MVTL analyzes the water samples for general chemistry: total alkalinity, sulfate, total chloride, bromide, nitrate, nitrite, ammonia nitrogen, total kjeldahl nitrogen, calcium, magnesium, sodium, potassium, iron, manganese, fluoride, and total organic carbon.

Water from each well was analyzed once for volatile organic compounds and caffeine; neither was found and the analysis has not been repeated. In addition, each well in the study was sampled one time for arsenic; only low levels were found. Each year the water samples are analyzed for pesticides associated with corn and soybean farming, which are the most widely used agricultural pesticides in Minnesota and the nation.

In 2001, Dakota County began a partnership with the United States Geological Survey (USGS) to investigate pesticides and pesticide breakdown chemicals as part of the AGQS. In its research, the USGS Organic Geochemistry Research Group in Kansas has the capacity to analyze water for a wider variety of pesticide and pesticide breakdown chemicals, at lower detection levels, than is available through commercial laboratories.

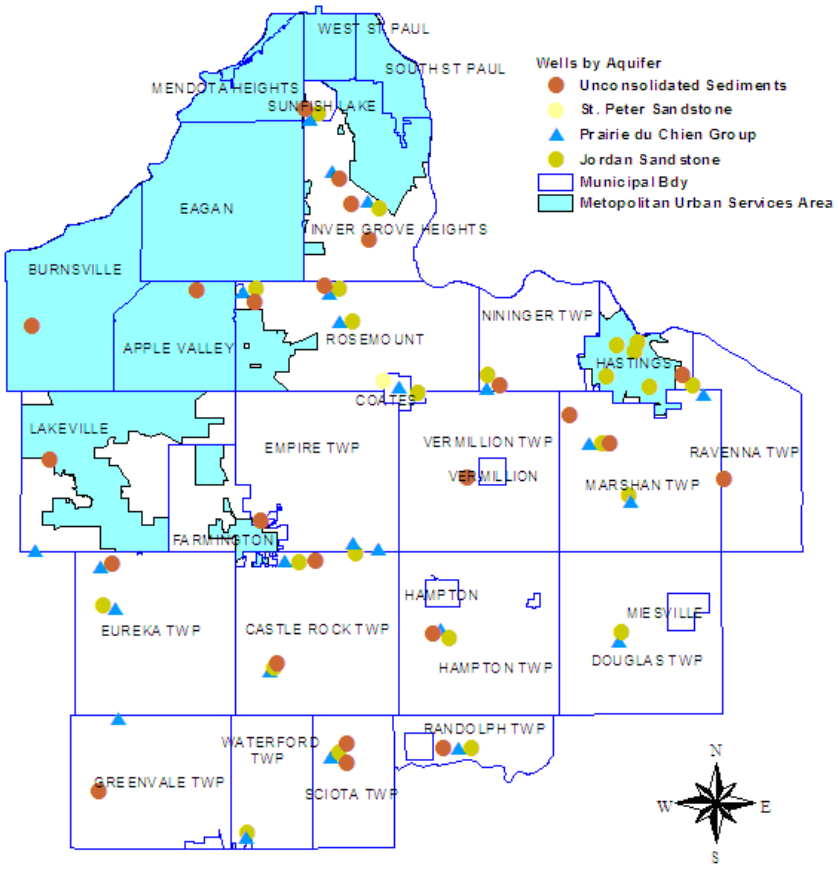

Figure 3 – Location of AGQS sampled wells.

AGQS Results

The contaminants of concern in the AGQS have been nitrate, pesticides, and pesticide breakdown chemicals. Nitrate, pesticides, or their breakdown chemicals were detected in 56 of the 68 private drinking water wells sampled in 2005 (82%).

Nitrate

Nitrate is the most common source of groundwater contamination in Minnesota and the rest of the United States. In general, nitrate results in the AGQS have not changed since the study began in 1999, so the 2005 results shown in Figure 4 are typical. The study's results for 2005 found that 36 of the 68 wells sampled (53%) had detectable levels of nitrate; 12 of the 68 (18%) exceeded the drinking water standard for nitrate of 10 mg/L (milligrams per liter). Nitrate contamination can derive from a variety of sources, but in Dakota County's Hastings Area Nitrate Study (HANS, available at http://www.co.dakota.mn.us/environ/Hans/hans.pdf), it was found to be strongly associated with corn and soybean farming. In particular, the HANS wells' nitrate results were highly correlated with the total mass of agricultural pesticides

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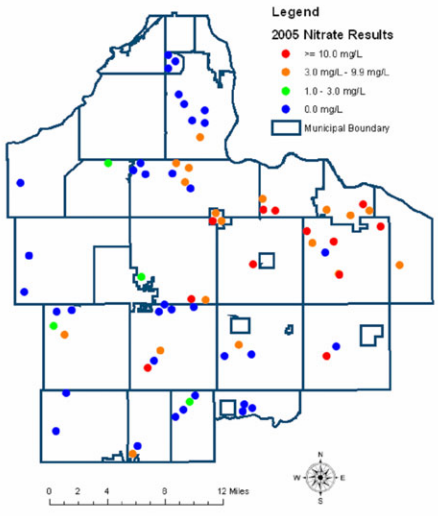

Figure 4 – 2005 Nitrate Results, Dakota County AGQS.

Dakota County AGQS, cont.

and pesticide breakdown chemicals (Spearman's rho = 0.793, p = 0.0000).

As can be seen in Figure 4, high nitrate in the AGQS appears most often in eastern Dakota County, which is particularly vulnerable to groundwater contamination. The predominant land use in this part of the county is row-crop agriculture, and a number of factors contribute to the vulnerability of the drinking water aquifers:

- Permeable, coarse-textured soils over glacial deposits of sand and gravel;
- A buried bedrock valley (Figure 2) that can be as deep as 500 feet, as well as a lesser (400 foot deep) bedrock valley under the Vermillion River;
- Karst;
- The Empire Fault; and
- The Vermillion River, which contributes contamination from its upper reaches downstream to the groundwater underlying its lower reaches.

As can be seen in Figure 5, the buried bedrock valleys cut into the OPDC and CJDN, replacing any confining layers with permeable glacial deposits. The lesser bedrock valley under the Vermillion River lies along the geologic formations offset by the Empire Fault.

Pesticides and Pesticide Breakdown Chemicals

Adjustments have been made to the list of AGQS analytes each year. From 2001 through 2003, samples from the bedrock wells in the AGQS were analyzed for pesticides and pesticide breakdown chemicals by the USGS Organic Geochemistry Research Group. The pesticides for which analysis was conducted were predominantly herbicides associated with corn and soybean farming, since these have been the most widely detected pesticides in the USGS's National Ambient Water Quality Assessment program. Those analyses detected numerous compounds, but at levels well below the applicable Health Risk Limits (HRLs) or Health Based Values (HBVs).

In 2004, 24 wells screened in Quaternary sands and gravels were added to the AGQS and they were analyzed for pesticides by the USGS using a different set of analytical methods than in previous years. The 2004 results found five Q wells that had cyanazine breakdown chemicals that

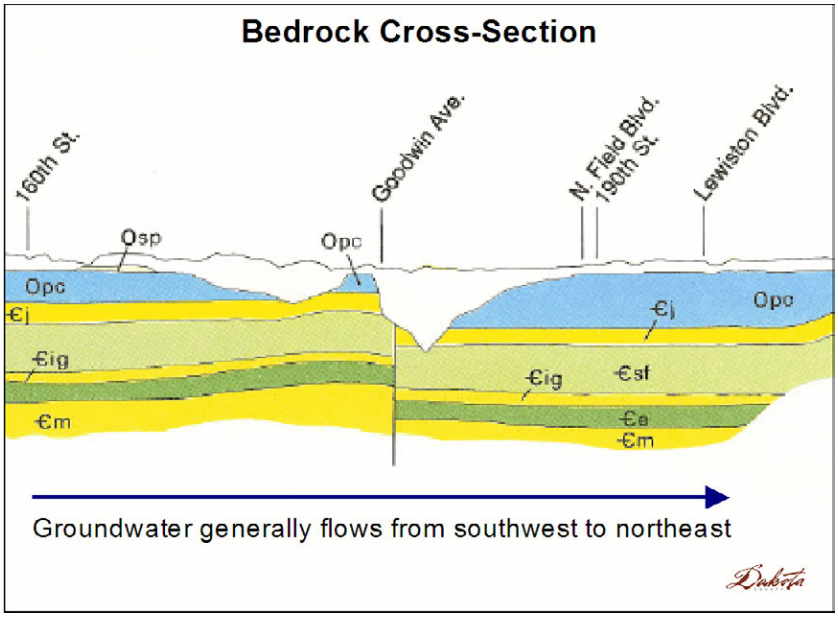

Figure 5 – Cross-section of Bedrock Showing Empire Fault and Minor Buried Bedrock Valley.

Table 1: 2005 USGS LC/MS Pesticide Analytes

2005 USGS LC/MS Pesticide Analysis	2005 Reporting Limit (ug/L)	2005 USGS LC/MS Pesticide Analysis	2005 Reporting Limit (ug/L)
Detections in Red			
Analyzed for, but not detected, in italics			
Exceeds applicable draft Health Risk Limit or Health Based Value in bold and red.			
Acetochlor	0.02	Atrazine (Aatrex)	0.025
Acetochlor deschloro	0.02	Bromacil	0.025
Acetochlor ESA	0.02	*Cyanazine (Bladex)*	0.025
Acetochlor hydroxy	0.02	Cyanazine amide (CAM)	0.025
Acetochlor OXA	0.02	Cyanazine acid (CAC)	0.025
Acetochlor SAA	0.02	Deethylatrazine (DEA)	0.025
Acetochlor/ Metolachlor ESA - 2nd Amide	0.02	Deethylcyanazine (DEC)	0.025
Acetochlor/ Metolachlor - 2nd Amide	0.02	**Deethylcyanazine acid (DCAC)**	0.025
Alachlor (Lasso)	0.02	Deethylcyanazine amide (DCAM)	0.025
Alachlor -- 2nd amide	0.02	Deethylhydroxyatrazine (DEHA) (2004)	0.025
Alachlor deschloro	0.02	Deisopropylatrazine (DIA)	0.025
Alachlor ESA	0.02	Deisopropylhydroxyatrazine (DIHA)	0.025
Alachlor ESA -- 2nd Amide	0.02	Didealkylatrazine (DDA)	0.025
Alachlor hydroxy	0.02	Hydroxyatrazine (HA)	0.025
Alachlor OXA	0.02	Hydroxysimazine	0.025
Alachlor SAA	0.02	Prometon (Pramitol)	0.025
Dimethenamid (Frontier)	0.02	Propazine (Milogard)	0.025
Dimethenamid deschloro	0.02	Simazine (Princep)	0.025
Dimethenamid ESA	0.02	*Diuron*	0.2
Dimethenamid hydroxy	0.02	*Fluometuron*	0.2
Dimethenamid OXA	0.02	*Linuron*	0.2
Flufenacet	0.02	*Demethylfluometron (DMFM)*	0.2
Flufenacet ESA	0.02		
Flufenacet OXA	0.02		
Metolachlor (Dual)	0.02		
Metolachlor deschloro	0.02		
Metolachlor ESA	0.02		
Metolachlor hydroxy	0.02		
Metolachlor OXA	0.02		
Propachlor (Ramrod)	0.02		
Propachlor ESA	0.05		
Propachlor OXA	0.05		

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Dakota County AGQS, cont.

exceeded the HBV for cyanazine and one well that exceeded the draft HRL for alachlor.

In 2005, all the AGQS wells were analyzed using the "new" analytical methods. Table 1 lists the analytes and shows which were detected and which chemicals had exceedances. The study's results for 2005 found that 53 of the 68 private wells tested (78%) had detectable levels of pesticides or their breakdown chemicals. Combined concentrations of cyanazine breakdown chemicals that exceeded the HBV for cyanazine were found in 7 of the 68 wells and concentrations of alachlor that exceeded the draft HRL for alachlor were found in one well.

Most of the pesticide detections were breakdown chemicals, which are generally less toxic than the parent pesticide but which persist longer in the environment. Cyanazine itself (sold as Bladex) has not been legal for use since 2002, and the parent compound was not detected in the AGQS.

Figure 6 shows the location of the cyanazine breakdown chemical detections and the alachlor exceedance. As with nitrate, the worst pesticide results were found in the geologically sensitive eastern portion of the county.

In Table 2, the chemicals are grouped by the parent pesticide and listed in order of the frequency of detection. (Alachlor ESA, the most frequently detected chemical, is listed separately because it has a higher HBV than the HRL for alachlor.) Fifty-three of the 68 wells (62%) had multiple pesticides detected in them, with as many as seven different pesticides detected per well. As in Dakota County's early HAN Study, nitrate results were highly correlated to the total mass of pesticides and pesticide breakdown chemicals in a well (Spearman's rho = 0.7735, p = 0.0000).

As mentioned above, in Dakota County the OPDC and CJDN are regulated as separate aquifers, although this is not the case in other parts of Minnesota. The AGQS results have supported the separate treatment of the two aquifers. The wells screened in the Quaternary and the OPDC wells have had very similar results in terms of nitrate and pesticide detections, as shown in Figure 7, whereas the detections in the CJDN have been significantly lower. The CJDN wells are deeper than the Q and OPDC wells; in addition, the CJDN has denitrifying conditions: high iron and low oxygen.

Response to Ambient Contamination of Groundwater

Dakota County is working with the Minnesota Department of Agriculture (MDA), the Minnesota Department of Health (MDH), and other agencies in addressing the groundwater contamination identified in the AGQS. This response combines communicating with private well owners about the concerns identified in the AGQS with efforts to prevent future contamination.

Each year, the County sends an individualized report to the well owners who par-

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Table 2: Frequency of Detection in Private Drinking Water Wells, by Parent Pesticide

Pesticides and/or their degradates detected in 2005 Ambient Groundwater Study private wells (n = 68)	% Detections	% Over Standard
Alachlor ESA	65%	
Alachlor (Draft HRL = 0.7 ug/L)	38%	1%
Metolachlor	54%	
Atrazine	50%	
Cyanazine (Draft HRL = 1.0 ug/L)	41%	11%
Acetochlor	34%	
Simazine	21%	
Dimethenamid	6%	
Prometon	3%	
Propazine	1%	
Bromacil	1%	

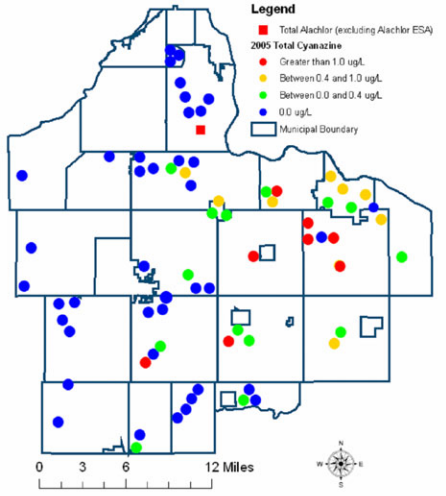

Figure 6 – 2005 Cyanazine Detections and Alachlor Exceedance, Dakota County AGQS.

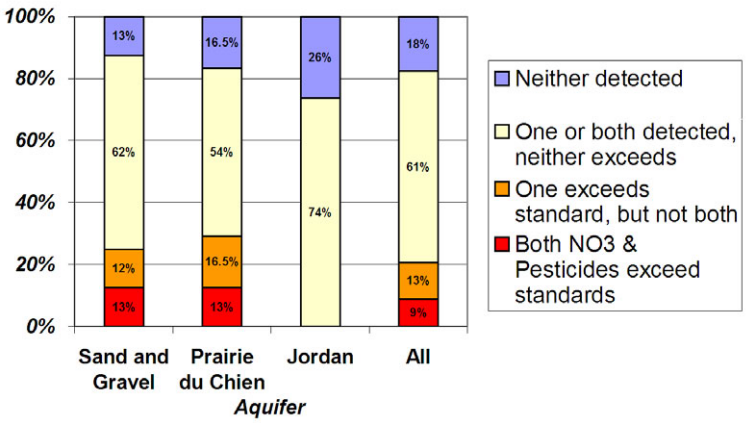

Figure 7 – Nitrate and Pesticide Summary, by Aquifer, Dakota County AGQS.

Dakota County AGQS, cont.

ticipate in the study, informing them of that year's results and explaining any related health concerns and potential point-of-use treatment systems. The Environmental Protection Agency has found that a reverse-osmosis treatment system with a thin-film composite membrane and activated carbon filters can effectively remove most types of contamination found in private wells in Dakota County; these treatment systems are readily available from commercial water treatment companies.

The County will continue to sample the private wells in its study once each year; the 2006 sampling event is planned for June. The USGS pesticide and pesticide breakdown chemical analysis will be included in the AGQS suite of analytes until any significant trends in the data can be identified.

Based on the 2005 results, the County is developing a broader communications campaign to inform its estimated 8,000 households that rely on private drinking water wells about the AGQS results. The goal of this effort to inform these households about the contamination that has been found, reassure them about the availability of effective treatment, encourage them to have their own wells tested for nitrate, and educate them about ways to protect their wells.

In terms of prevention, research by the MDA has found that farmers in eastern Dakota County generally follow the University of Minnesota's recommendations for the application of fertilizer and pesticides; however, the area's sensitive geological conditions make it very susceptible to groundwater contamination. Since that research, the University and MDA have revamped their recommendations for fertilizer applications in sensitive areas like Dakota County. In addition, in 2005 MDA issued a revised Pesticide Management Plan for the state. Dakota County, MDA, MDH, and a number of other agencies are working together to promote adoption of farming practices that will protect the county's future water resources.

The first five-year report for the AGQS (1999-2003) has been published. It is available on-line at www.co.dakota.mn.us/environ/water.htm. For additional information, contact the authors at vanessa.demuth@co.dakota.mn.us or jill.trescott@co.dakota.mn.us.

Parking Lot Sealcoat as a Major Source of PAHs in Urban Environments

Dr. Barbara Mahler of the U. S. Geological Survey office in Austin, Texas was a guest lecturer at the local USGS office in Mounds View on May 2, 2006. Dr. Mahler, a graduate of the University of Texas at Austin, described the research that she and several colleagues are conducting on parking lot sealcoat as a source of polycyclic aromatic hydrocarbons (PAHs) in urban and suburban environments (Van Metre et al, 2006)

PAHs are a ubiquitous contaminant in urban environments. They are toxic to aquatic life and several are probable or possible human carcinogens. The consensus-based probable effect concentration (PEC) for PAH is 23 ppm. Previous cases of PAH contamination of surface and ground water in Minnesota have been well-documented, including perhaps the most notorious case, the Reilly Tar Site in St. Louis Park, MN which made news headlines back in the 1970s after a number of water supply wells were contaminated.

Dr. Mahler's research focuses on a little-studied source of urban PAHs to water resources, parking lot sealcoating. The research involves studying concentrations of PAHs removed from various types of sealcoated surfaces in the Austin area, as well as a nationwide study of soil cores from urban lakes and rivers that are recipients of urban runoff. In general, the urban lakes being studied show an upward trend in PAHs in bottom sediments since 1970 (Van Metre and Mahler, 2005).

"Sealcoat" is a generic term for a variety of emulsions applied to paved (generally asphalt) surfaces, from commercial parking lots to private driveways. The two major types of sealcoat include oil-based asphalt emulsions and coal tar emulsions (including creosote) derived from the coking of coal. In general, coal tar sealcoat contains a much higher percentage of PAHs than does asphalt sealcoat, often over 50 percent by weight.

Over 300,000 metric tons of sealcoat are applied annually nationwide. Suburban watersheds typically contain five percent parking lots and this percentage may be considerably higher in urban areas. Mahler et al (2005) sampled runoff from 13 parking lots in the Austin area and found the following concentrations of total PAH in the runoff water: unsealed asphalt parking lot (54 ppm); asphalt sealed parking lot (620 ppm); coal tar sealed parking lot (3500 ppm). By contrast, sediment cores from the Charles River in Boston, MA showed a concentration of 66 ppm and the Black River near Cleveland, OH showed 1100 ppm. An average value for typical urban lake sediment is 12 ppm.

In Minnesota, the Department of Transportation (MNDOT) specifies only oil-based asphalt sealants be used in its bidding documents, because of the concern of high PAH levels in coal tar sealants. However, some sealants sold for household use are coal tar emulsions. Consumers should read labels carefully before purchasing sealants for use around the home and check with contractors before having a driveway professionally sealcoated.

References:

Mahler, B. J., Van Metre, P. C., Bashara, T. J., Wilson, J. T., and Johns, D. A., 2005. Parking lot sealcoat: an unrecognized source of urban PAHs. Environmental Science and Technology, vol. 39, no. 15, p. 5560-5566.

Van Metre, P. C. and Mahler, B. J.,. 2005. Trends in hydrophobic organic contaminants in urban and reference lake sediments across the United States, 1970-2001. Environmental Science and Technology, vol. 39, no. 15, p. 5567-5574.

Van Metre, P. C., Mahler, B. J., Scoggins, M. and Hamilton, P. A., 2006, Parking lot sealcoat: a major source of polycyclic aromatic hydrocarbons (PAHs) in urban and suburban environments. U. S. Geological Survey Fact Sheet 2005-3147. 4 p.

— Submitted by Tom Clark, MGWA

The Metropolitan Council has Moved

Effective May 15, 2006, the Metropolitan Council has moved to 390 Robert St. N, Saint Paul, Minnesota 55101-1805. For a map and directions, please go to www.metrocouncil.org/about/MearsLocationDirectionsMap.htm.

The telephone numbers and e-mail addresses have not changed.

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BUSINESS NEWS

Braun Opens Mankato Office

In order to accommodate the overall construction growth in southern Minnesota, Braun Intertec Corporation has opened a regional office in Mankato. Headquartered in Minneapolis, Braun Intertec, an engineering and environmental consulting and testing firm, was founded in 1957.

Braun Intertec's Mankato office, located at 153 Chestnut Street, will cover a geographic region that extends from the southern end of the Twin Cities metro area throughout southwestern Minnesota. The office will focus on geotechnical and construction materials testing in the commercial, residential and industrial sectors.

Dan Messner has been named branch office manager. He is an engineering technologist specializing in municipal infrastructure improvements, including water, storm and sanitary sewer systems, street improvements and agricultural drainage projects.

Bill Suess, PG, has been added as a geologist and will manage construction materials, asbestos and lead testing, and environmental site assessment services. He joined Braun Intertec in 1999 in the La Crosse, WI, office.

Garic Abendroth, PE, has also been hired as a geotechnical engineer in the Rochester office, which will work closely with Braun Intertec's Mankato office to serve southern Minnesota. Abendroth, who specializes in environmental and engineering services in the transportation sector, will support the needs of the Mankato office.

For more information contact Laurie M. Wedmann at (952)995-2070, lwedmann@braunintertec.com.

New MDH Fee Schedule Effective July 1, 2006

Effective July 1, 2006, new state fees for well construction notifications, well sealing notifications, permits, variance requests, and well disclosures will be implemented by the Minnesota Department of Health, Well Management Section. These fees were adjusted during the 2005 Legislative session. Fees for licenses/registrations and hoist/drilling machine registrations are not changing. The fee schedule is as follows:

Well Construction Notifications

Water Supply Well $175
Dewatering Well. $175
Dewatering Project (5 or more wells) . . $875

Permits

Elevator Boring $175
Ground Water Thermal Exchange Device $175
Vertical Heat Exchanger (Heat Loop) . . $175
Monitoring Well $175
Well Maintenance $150

Well Sealing Notification . . . . . $ 35

Variance Application. $175

Monitoring Well Site Permits

Motor Fuel Retail Outlet. $175
Petroleum Bulk Storage Site. $175
Agricultural Chemical Facility $175

License Fees (not changed)

Qualification Application . . . . . $ 75
Renewal Late Fee $75
Elevator Shaft Contractor. $75
Monitoring Well Contractor $75
Limited Well/Boring Contractor $75
Explorer. $75
Well Contractor $250
Hoist/Drilling Machine Registration . . . $75

Well Disclosure Certificate $40

Any payments received prior to July 1, 2006, will be accepted at the current rates. Insufficient fee payments for notifications, permits, variances, or licenses on or after July 1, 2006, will be returned to the contractor or the individual making payment. Permits and variance requests will not be reviewed, and notifications and license applications will not be processed, until sufficient funds are submitted to the MDH. The county recorder will not accept submittal of well disclosure certificates without the appropriate fee.

Federal, state, and local government entities are exempt from payment of fees, but are not exempt from other requirements, including well disclosure, licensing, notification, and permitting requirements.

Well fees in jurisdictions of delegated well programs (see below) are established by the delegated program. Individuals should check with the delegated program for fee amounts and any other administrative requirements. For more information contact the MDH Well Management Section at (651)201-4600.

MINNESOTA MDH DEPARTMENT OF HEALTH

Orville L. Freeman Building
625 Robert St. N
PO Box 64975
St. Paul, MN 55164-0975
www.health.state.mn.us

City or County	Delegated Programs	Telephone Number
City of Bloomington	Delegated Water, Monitoring, and Dewatering Well Programs	(952) 563-8934
City of Minneapolis	Delegated Water and Monitoring Well Programs	(612) 673-5897
Blue Earth County	Delegated Water Well Program	(507) 304-4381
Dakota County	Delegated Water, Monitoring, and Dewatering Well Programs	(952) 891-7556
Goodhue County	Delegated Water Well Program	(651) 385-6130
LeSueur County	Delegated Water Well Program	(507) 357-8231
Olmsted County	Delegated Water, Monitoring, and Dewatering Well Programs	(507) 285-8213
Wabasha County	Delegated Water Well Program	(651) 565-5200
Waseca County	Delegated Water Well Program	(507) 835-0655
Winona County	Delegated Water, Monitoring, and Dewatering Well Programs	(507) 457-6405

Learning About a Sensitive Landscape with the Wabasha County Geologic Atlas

On April 21, 2006, about 70 people gathered in Plainview, southeastern Wabasha County, to learn what makes the karst landscape of Wabasha County sensitive to pollution and how it results in sensitive ground water resources. The program introduced the maps and other information packed into the Wabasha County Geologic Atlas and how it can be used to help decision-makers make better environmental choices. The program included presentations, a problem-solving session with atlas maps, and a field trip. Figure 1 shows attendees working hard on map problems and Figure 2 shows them that afternoon learning about sinkholes at one of the field trip stops.

Featured speakers were Tony Runkel and Bob Tipping, Minnesota Geological Survey (MGS); Todd Petersen and Jeff Green, Department of Natural Resources, Division of Waters; Darrin Thompson, Wabasha County; and Art Persons, Minnesota Department of Health.

DNR Waters completed the Wabasha County Geologic Atlas, Part B, in 2005, which contains three map plates of ground water conditions and pollution sensitivity. The report joins the seven plates of the Part A report of geology and karst completed by MGS a few years ago. Wabasha County geology and karst is discussed in more detail in the MGS Report of Investigations 59.

The Wabasha County Geologic Atlas can be viewed on-line at www.dnr.state.mn.us/waters/programs/gw_section/mapping/platesum/wabacga.html. Digital data can also be downloaded through the web page. Printed copies are available from the MGS at www.geo.umn.edu/mgs/index.html or Wabasha County by calling (651)565-5200. Printed copies are also available by interlibrary loan. A short summary of the report was in the September 2005 issue of the MGWA Newsletter, which is available online to members.

— submitted by Jan Falteisek, MGWA Newsletter Team.

Figure 1 – Attendees working hard to solve problems with atlas maps at the Wabasha Atlas workshop April 21, 2006 in Plainview.

Figure 2 – Bob Tipping (sixth from right), Minnesota Geological Survey, explains sinkhole formation on the workshop field trip.

Dancing Waters Sinkhole: Summary of Events

On October 4, 2005, the Woodbury, Minnesota area experienced heavy rainfall over a large area of the city. Total accumulation was nearly seven inches of rain and some areas received in excess of four inches of rain in 2.5 hours. Water levels in many ponds and lakes in the city rose dramatically. In one newly constructed stormwater pond known as Dancing Waters Lake, nine sinkholes of varying size developed shortly after the storm event.

Dancing Waters Lake was excavated during grading activities for the Dancing Waters development in 2003 - 2004. Its main purpose was to function as a regional stormwater holding pond for flood control purposes, with water quality features incorporated into the design. The original topographic surface of the area was at an elevation of approximately 930 to 940 feet. The pond was excavated into an eroded depression in the St. Peter Sandstone. The approved plan for the pond was for the bottom to be at an elevation of 900 feet, with an impermeable liner installed up the sides to an elevation of 910 feet. The engineered outlet elevation is 916 feet. The intended operation of the pond was to have ten feet of standing water in the bottom, with infiltration occurring through the sides of the pond from elevation 910 to 916 feet. Water surface elevations above 916 feet would overflow downstream to a water body known as Fish Lake.

During excavation operations, sandy material, later determined to be eroded St. Peter Sandstone, was encountered. This material was stockpiled for later use on the development site as subgrade for streets and buildings. As there was an abundance of this material, excavation continued deeper than the originally planned base elevation of 900 feet, to an elevation of 882 feet in one location. The excavated material was replaced with lesser quality material from the site until the originally planned bottom elevation of 900 feet was again in place.

Prior to the October storm event, Dancing Waters Lake had never been significantly above the level of the liner at 910 feet. All water above 910 feet had infiltrated through the sides of the pond so water had never risen to the level of the outlet. After the October storm event, however, the water level rose to the outlet elevation of 916 feet. Three days after the storm event, on Friday, October 7, the pond was observed at its outlet elevation of 916 feet. By the afternoon of October 8, however, the pond was essentially empty. Approximately 70 acre-feet of water had drained away in less than 48 hours. A large main sinkhole had developed on the east end of the pond, about 100 feet long, 60 feet wide, and 20 feet deep. Smaller sinkholes were visible in the vicinity of the large sinkhole with two smaller sinkholes visible on the side slopes on the north end of the pond.

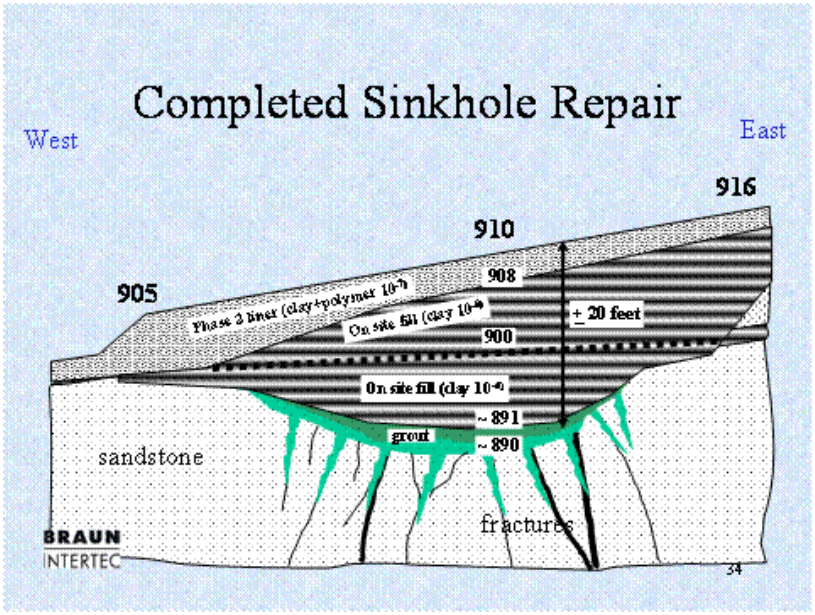


Figure 1 – Conceptual drawing showing the plans to remediate the primary sinkholes that developed in the Dancing Waters Lake stormwater basin.

Subsequent investigations, consisting of electrical resistivity imaging, borings, and sinkhole excavations showed that the pond excavation had come within approximately two feet of the uneroded St. Peter Sandstone in some locations. The investigations also showed that the St. Peter Sandstone in the area of the pond is fractured. Although a liner of topsoil and clay had been placed in the bottom of the pond, the high water in the pond after the storm event created additional hydrostatic pressure that caused water to begin flowing through the liner into some of the cracks in the sandstone. Once water started flowing into these passageways, sand that had been plugging the cracks was flushed out, and the water began flowing unimpeded into the bedrock, carrying large amounts of sand and soil with it. This process caused the sinkholes to develop.

Repair of the sinkholes has involved two phases. Phase 1 consisted of sealing the known sinkholes. Minor sinkhole locations were excavated down to competent bedrock (i.e., St. Peter Sandstone), and cracks were sealed with a grout mix. Compacted clay was then placed until the area was brought up to grade. The main sinkhole turned out to be a collapsed dome in the St. Peter filled with large blocks of sandstone and fill. Grouting the width of the unstable area was determined to be unsuitable, since concrete may not have been able to "bridge" any gaps that would occur with further settlement. Consequently, in this area, multiple layers of compacted clay were placed, and brought up to an elevation eight feet higher than the original pond contours (Figure 1). The intent was to create a deformable plug in the area of the collapsed dome. Phase 1 activities are essentially complete.

Phase 2 consists of installing a liner over the entire pond area, to prevent further seepage of water into the bedrock. The developer is proposing to use a vegetable polymer product sold by Seepage Control, Inc. which reduces the spaces between clay particles. This allows the clay soil to be compacted to a greater density, and provides a somewhat deformable liner. The details of Phase 2 are still being worked out between the developer and the City.

— Steve Kernik, Environmental Planner, City of Woodbury

Report of Quarry and Gravel Pit Impacts Available On-line

In 2005, the Minnesota Department of Natural Resources (DNR Waters) completed a report of a two-year study of the hydraulic impacts of quarries and gravel pits. The study examined the impacts of eight aggregate quarries, primarily in southeast Minnesota, on ground water. The report was prepared by Jeff Green, Jeremy Pavlish, Bob Merritt, and Jeanette Leete, DNR Waters, for the Legislative Commission on Minnesota Resources; the work was funded by Minnesota Environment and Natural Resources Trust Fund (LCMR/trust).

Natural aggregate (crushed stone, sand, and gravel) is a vital part of Minnesota's economic infrastructure. Aggregate is used for road and bridge construction and in a variety of building materials. In 2003, the value of construction sand and gravel and crushed stone in Minnesota was approximately $245,000,000. As Minnesota's economy continues to expand, the demand for aggregate will continue to grow. Sand and gravel pits are located in every county in Minnesota. In 1990, there were an estimated 1500 active and inactive operations. Quarries for mining limestone, dolomite, sandstone, and hard rock (granite and quartzite) are found in 34 counties. In 1990, there were 165 active and 1,367 inactive operations, about three-quarters of which were limestone quarries.

Aggregate mining is an extractive use of resources that alters the landscape and its natural hydrologic system. Quarries and pits can affect ground-water and surface-water systems in various ways. The LCMR/trust funded research on aggregate mining that focused on the following potential impacts:

- Lowering of local ground-water and surface-water levels from mining operations and mine dewatering,
- Changes in turbidity levels in ground water due to blasting and quarry operations,
- Interruption of ground-water conduit flow paths by rock removal, and
- Temperature change (thermal impacts) in springs and surface-water streams.

Five limestone and three sand and gravel quarries, mostly in southeast Minnesota were studied to provide the first comprehensive assessment of aggregate mining impacts on ground-water systems in Minnesota. Table 1 lists the sites, the impacts that were studied during the project, and the general results. Study results show that in certain areas, aggregate mining can affect the local water resources.

This information can be used for siting of new aggregate mines and for more accurately assessing their impacts on local ground-water resources. It can also be used for planning purposes at the state and local level.

The 86-page report "Hydraulic Impacts of Quarries and Gravel Pits" is on-line at: www.dnr.state.mn.us/publications/waters/quarries_impacts.html.

Table 1 – Summary of impacts and study results.

Site	Impacts studied	Study results
Limestone aggregate quarries		
Kraemer Quarry Dakota Co.	Water level	Significant decline in aquifer water levels due to quarry dewatering and rock removal.
	Turbidity and well construction	No impacts observed.
Golberg Quarry Olmsted Co.	Water level	Significant decline in aquifer water levels due to quarry dewatering and rock removal.
	Turbidity and well construction	No impacts observed.
Spinler Quarry Steele Co.	Water level	Hydraulic gradient between the upper and lower aquifers has been reversed; the Straight River has been changed from a gaining to a losing stream.
Fountain Quarry Fillmore Co.	Turbidity	Blasting caused a slight increase in spring turbidity levels.
Big Spring Quarry Fillmore Co.	Spring diversion	Ground water that previously discharged directly at the Big Spring now discharges in the quarry. Some of it sinks and emerges at the Big Spring; the rest flows overland to Camp Creek.
	Temperature change	Significant temperature increases were noted in a summer measurement. Monitoring is continuing.
Sand and gravel quarries		
Donovan Pit Olmsted Co.	Water level	Mining had minimal impact on aquifer water levels.
	Temperature change	Ground-water temperature changes were noted but were not consistent. Monitoring is continuing.
Leitzen-Grabau Pit Olmsted Co.	Water level	Mining had minimal impact on aquifer water levels.
Felton Pit Clay Co.	Water level	Mining has altered ground-water flow paths affecting the water supply to a calcareous fen.

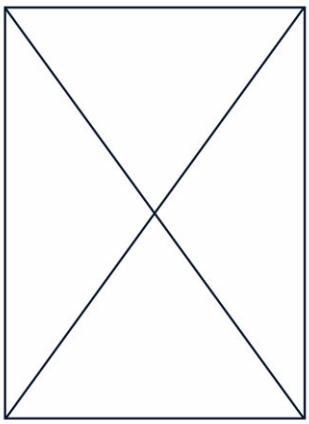
Figure 1 – The Fountain quarry in Fillmore County produces limestone aggregate.

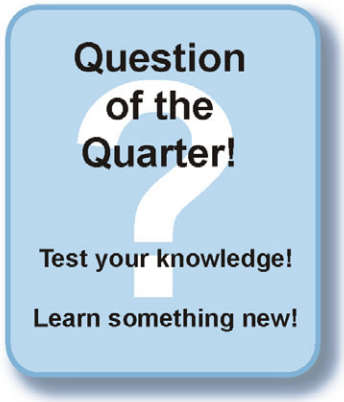
Figure 2 – The Donovan pit in Olmsted County produces sand and gravel from a site in the floodplain of the Zumbro River.

QUESTION OF THE QUARTER

The Sampling Network Puzzle

The Question of the Quarter is a continuing feature in our newsletter. Each quarter a different question is posed and all members are invited to respond. The June Question of the Quarter is:
A ground water professional has arrived at a well network of five wells that looks like the map to the right. The map surface features a set of paths represented by six lines. The wells are located at the intersections of the lines. Is there a spot on the pattern where our professsional can begin sampling and follow the entire pathway without retracing any steps? (Crossing a path is okay, however.) If so, where should our pro start sampling?





Email your answer and your "two cents worth" to: editor@mgwa.org

Answer to the March '06 Question of the Quarter

Approximately How Many Wells Are Constructed in Minnesota in a Year?

A. 5,000 B. 15,000 C. 25,000 D. 35,000

The answer is B, approximately 15,000. In the last 10 years, the number of wells and borings constructed in a year has ranged from 13,780 to 15,118. Borings make up a very small number of the total number of wells and borings. For 2004, the most recent year for which the Minnesota Department of Health has complete records, the number of wells was 14,231. The number of borings was 208, which includes environmental bore holes and elevator shafts. There were 86 records in the other or not sufficient information categories. The number of wells by well type is indicated in Table 1 below. The exact number of wells in each category is subject to change if records are submitted later. The number of wells and borings constructed by county in Minnesota in 2004 is indicated in Figure 1.

— Information provided by the Well Management Section, Minnesota Department of Health.

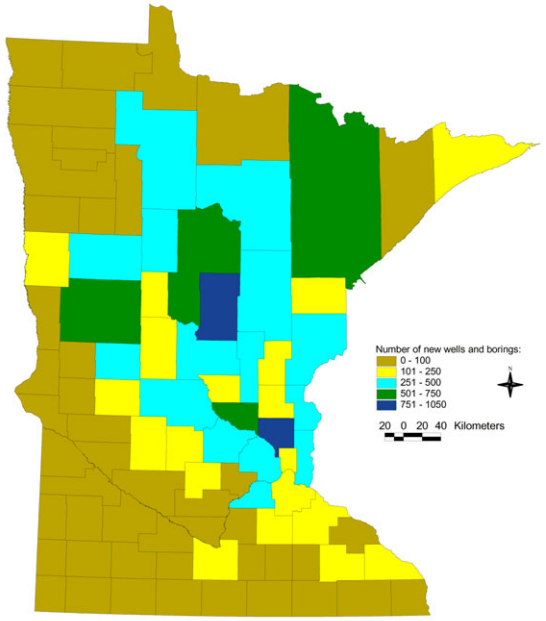


Figure 1. New Wells and Borings in Minnesota, 2004

Table 1 - Number of Wells by Well Type Constructed in Minnesota in 2004.

TYPE OF WELL	NUMBER
Commercial Wells	2
Domestic Wells	12805
Dewatering Wells	32
Industrial Wells	32
Irrigation Wells	274
Monitoring Wells	1097
Public Supply Wells	187
Recovery Wells	81
Municipal Test Wells	15
TOTAL WELLS	14231

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.

Share your knowledge!

Submit a newsletter article!

MGWA Newsletter Advertising Policy

Display ads:

Size	Inches H x V	Quarterly Newsletter 4 issues	Membership Directory 2 issues
Business Card	3.5 x 2.3 or 1.9 x 3.5	$66	$50
Quarter Page	3.5 x 4.8 or 5.4 x 3.5	$121	$99
Half Page	7.5 x 4.8	$225	$190
Full Page	7.5 x 9.75	$425	$360
Inside Cover	7.5 x 9.75	not available	$395

Many thanks for the support of MGWA newsletter advertisers

Classified ads:

Classified ads in the newsletter are charged at the rate of $3 per 45 characters (including spaces and punctuation) per newsletter issue.

E-mail notices:

A one-time e-mailing to the membership costs $10 for an individual (e.g., seeking a job), and $50 for an organization (e.g., announcing a new product, address change, etc.). E-mails from companies announcing job openings will no longer be accepted. A 200 word limit is imposed. The advantage of e-mail is the speed of dissemination.

There are no commissions on ads. Advertising copy must be received by the publication deadlines as published in the newsletter. Advertisers should submit material as a digital file in TIFF, GIF, JPEG or PCX format at 300 to 600 dpi.

Please make checks payable to "Minnesota Ground Water Association" or "MGWA." Direct your orders and questions concerning advertising rates to Jim Aiken, Advertising Manager, c/o MGWA, 4779 126th Street, White Bear Lake MN 55110-5910; (952)346-3854; jaiken@mccainassociates.com. Questions concerning advertising policy should be directed to the MGWA President: Dale Setterholm; (612)627-4780x223; sette001@umn.edu.

Join the Minnesota Ground Water Association!

If you are reading this newsletter second-hand, we'd like to take this opportunity to invite you to become a member of MGWA for 2006. Annual dues are $30 for professional members and $15 for students.

Members receive e-mail notice of the availabilty of the quarterly newsletter for downloading from the MGWA web site. If desired, members may subscribe to a printed edition of the newsletter (4 issues for $10).

Members are also entitled to purchase a paper copy of the annual membership directory for $7; an electronic version will be available on the website for paid members.

Tax deductible contributions to the MGWA Foundation scholarship fund will be gratefully accepted.

Dues paid to MGWA are **not** deductible as charitable contributions for federal income tax purposes. However, dues payments are deductible as ordinary and necessary business expenses to the extent allowed by law.

Just complete the form below and mail to: MGWA, c/o WRI, 4779 126th St. N, White Bear Lake, MN 55110-5910 or visit our web page and join on-line at www.mgwa.org.

- -

Name ____

Affiliation/Employer ____

Work Address ____

Work City, State, Zip Code ____

Work Telephone Number ____

E-mail Address ____

Fax Number ____

Home Address ____

Home City, State, Zip Code ____

Home Telephone Number ____

Which Address should we use for Mailings and for Directory Listing? ____________________

Which Telephone Number should we use for Directory Listing? ____________________

AIPG Annual Meeting to Meet in St. Paul

The Minnesota Section of the American Institute of Professional Geologists (AIPG) will be hosting the AIPG 43rd Annual Meeting in St. Paul on **September 23-28, 2006**. The theme of the conference is "Sustainability". The meeting will include technical sessions, short courses and exhibits. Five one-day field trips are offered: Geology of the Southern Outlet of Glacial Lake Agassiz, Geology and Hydrogeology of the St. Croix Valley, Aggregate Resources of the Twin Cities, Sandstone Karst Features of Pine County and Karst Geology of Southeastern Minnesota. Geologists/geoscientists are invited to share research, experiences and inspirations. If you are interested in submitting or discussing abstracts, contact Charlie Tiller, Technical Program Chair, at (651) 659-1302 or by email at ctiller@amengtest.com. The deadline for abstracts is July 1, 2006. For information about the conference, contact Jane Willard, Program Co-Chair at (651) 645-6330, or visit the AIPG web site at www.aipg2006.org.

Minnesota Water 2006, Annual Water Resources Conference

This joint event, successfully presented in 2005, will be presented again **October 24-25, 2006,** at the Earle Brown Heritage Center, Brooklyn Center, Minnesota. The Conference presents innovative and practical water resource management techniques and highlights research about Minnesota's water resources. The conference provides an opportunity to address emerging issues and present on lessons learned and best practices discovered. The conference will facilitate interactions among resource managers, researchers, state and local agency staff, and other water resources professionals, including consultants and practicing engineers. Conference information is available from Julie Grazier at conferences5@cce.umn.edu or 612-624-3044.

Dave Ford Water Resources Award

This honor is traditionally awarded to individuals within the field who have made significant contributions to water resouces. To nominate an individual, send a biographical sketch of the person and a justification for why the person should receive the award to Julie Grazier at conferences5@cce.umn.edu or 612-624-3044.

51st Midwest Ground Water Conference

Convergence of Rural and Urban Ground Water Issues

The 2006 Midwest Ground Water Conference will be held November 7-9, 2006 and hosted by the University of Nebraska-Lincoln at the Embassy Suites Hotel in Lincoln, Nebraska.

Session Topics

- Ground Water Regulation and Management
- Source Water Protection and Sustainability
- Ground Water Resource Economics
- Technology Transfer - Public Education
- Data Management and Visualization
- Ground Water Resources Conflicts
- Rural - Urban Contamination Issues
- General Session

Who Should Attend

All professionals with an interest in ground water resources and protection (hydrogeologists, hydrologists, geologists, planners, researchers, environmental consultants, water resource professionals, students).

Call for Abstracts

Abstracts for both oral and poster sessions are invited for a variety of topics above. Oral presentations in the technical sessions will be 15 minutes in length, with an additional 5 minutes for questions. Poster space will be 4'x8', with at least one author required to be present during the poster session. Indicate in your submission a preference for oral or poster session. Abstracts can be up to 350 words. They should include the affiliation and contact information for each author. For more information, see http://snr.unl.edu/midwest.

The Abstract Submission Deadline is June 30, 2006 and Notification of Acceptance will be July 1, 2006.

Don't forget: Professional Geologist license renewals are due June 30, 2006

Metric Conversions

From: Stan Liebenberg, Gig Harbor, WA (as heard on CarTalk)

For years Americans have found the metric system difficult to deal with. Here are some conversion factors that may simplify things:

- 1 million microphones = 1 megaphone
- 2000 mockingbirds = 2 kilomockingbirds
- 10 cards = 1 decacards
- 1 millionth of a fish = 1 microfiche
- 453.6 graham crackers = 1 pound cake
- 1 trillion pins = 1 terrapin
- 10 rations = 1 decoration
- 100 rations = 1 C-ration
- 10 millipedes = 1 centipede
- 3 1/3 tridents = 1 decadent
- 2 monograms = 1 diagram
- 8 nickels = 4 paradigms
- 2 wharves = 1 paradox

Legislative Update

Late in the evening of May 21, the 2006 session of the Minnesota legislature ended, having finished all necessary business by the constitutional deadline for adjournment. This session will be remembered for passage of significant environmental policy and funding legislation affecting Minnesota water resources:

- Mercury Emissions Reduction Act
- Clean Water Legacy Act, including first-year startup funding of $24.95 million
- Bonding funding for the environment of $259 million, including $80.3 million for clean water, drinking water and wastewater projects and grants, $25 million for flood hazard mitigation projects, and $10.8 million for mitigating environmental impacts of closed landfills

As a part of funding the new Legislative-Citizen Commission of Minnesota Resources (formerly, the LCMR), the legislature appropriated $250,000 to the University of Minnesota to study impacts of climate change on water resources, and $150,000 to the Science Museum of Minnesota for ground water education, specifically, "enhancing civic understanding of ground water."

CALENDAR

Regional and Local Events

May 22 - June 30 2006

International Stone Carving Symposium
Saint Paul College Lawn
Kellogg Blvd. at Summit Avenue
St. Paul, Minnesota
Information: Minnesotarocks.org

September 24-28, 2006

14th National Nonpoint Source Monitoring Workshop
Minneapolis, MN
Information: gregory.johnson@pca.state.mn.us

November 14, 2006

MGWA Fall Conference
Topic: TBA, see President's Letter
Continuing Education and Conference Center
University of Minnesota, St Paul Campus
Information: www.mgwa.org/meetings/

Washington County Groundwater Project Receives Minnesota Environmental Initiative Award

The project "Intercommunity Groundwater Protection, Sustaining Growth and Natural Resources, in the Woodbury/Afton Area" was awarded the 2006 Minnesota Environmental Initiative Award for Public Sector Innovation.

The primary purpose of the project was to develop a groundwater model to evaluate the "sustainability" of groundwater withdrawals in the Woodbury/Afton area. The groundwater flow model was used to predict the future effects of pumping the City of Woodbury wells on groundwater levels and base flows into Valley Creek (a designated trout stream).

Funding for the groundwater model project was recommended by the Legislative Commission on Minnesota Resources from the Minnesota Environment and Natural Resources Trust Fund, coupled with funding from project partners. The consultant was Barr Engineering, Inc. and the grant was administered by the Washington County Department of Public Health & Environment. Partners were the City of Woodbury, City of Afton, South Washington Watershed District, and Valley Branch Watershed District. A technical advisory committee consisting of interested parties and water resource professionals met regularly to discuss the project goals and outcomes. The committee included representatives from the Cities of Woodbury and Afton, South Wash-

continued on page 20.

Wanted: Multi-Million Dollar Citizen Advice

Legislative Commission on Minnesota Resources

Here is your chance to give advice on future funding priorities for Minnesota's environment and natural resources. Beginning July 1, 2007 there will be approximately $22 million dollars each year available from the Environment and Natural Resources Trust Fund. Your advice is requested for future priorities for the Trust Fund money. Log onto the LCMR website and complete the Citizen Input Form.

Log on and make your thoughts known!!

www.lcmr.leg.mn

Four Keys to an Internet Portal for Minnesota Ground-Water Information

A Four-Part Series Highlighting the Minnesota Ground-Water Information Guide

By Tim Thurnblad, Minnesota Pollution Control Agency

This is the second in a series of four articles about the Minnesota Ground-Water Information Guide (Guide). This article focuses on the Information Resources Component (IRC). To access the IRC, visit the Guide's home page at mgwa.org/gwig/index.html and click on the "Information Resources" icon in the left margin.

Minnesota Ground-Water Information Resources

A Guide to Minnesota Ground-Water Information Emphasizing Internet-Available Resources

The original 2003 release of the Guide had only one component — the Information Resources Component. This component's comprehensiveness reflects the problem it was designed to solve: Minnesota ground-water information and expertise was so widely distributed among various organizations and programs that many people had a hard time finding them — even with the Internet. How serious was the problem? First note that many web sites with ground-water information do not have a "main" page that links all the ground-water pages together. Then look at the following numbers. The IRC, a relatively thorough catalog of the best Minnesota ground water web pages, contains an estimated 400 hypertext links to external web pages and a total of 98 pages printed.

If you try to scroll through the Information Resources Component, the 98 pages and 400 links will overwhelm you. But if you use the navigation methods described here, you will benefit from its comprehensiveness.

The Six Ways

A 98-page catalog will frustrate readers if they can't find information quickly and easily. Fortunately, the Six Ways to Find Information in Adobe Portable Document Format (PDF) documents (Six Ways) provide the speed and ease. The best way to learn the Six Ways is to print out one or both of these web pages and look at them together:

- Navigating the Guide
- Six Ways to Find Information

The text that accompanies the hypertext links in all components of the guide was included so readers could search it to quickly find the associated links.

Quick Start

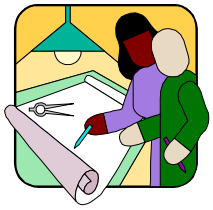
If you're not interested in learning the "Six Ways", there's still help for you. The dozen icons on the first page of the IRC allow visitors to quickly jump to hot spots in the guide — content areas anticipated to be of greatest appeal to visitors. Some of these content areas are fairly deep in the hierarchical structure, so the icon path is a good alternative to scrolling. And note that both Tables of Contents (Overview and Detailed versions) are "hot-linked". Just click on any entry and it will take you to the correct page. Minimize scrolling by using the custom internal navigation system (indicated by milepost signs) at the end of subsections.

What's Inside?

The remainder of this article features examples (excerpts) of what you will find in the Information Resources Component. The icons used below match those used on the first page of the IRC. To browse the part of the IRC where the excerpts came from, navigate to the IRC and click on the equivalent icon.

County Atlas – Regional Assessment Program (DNR)

Minnesota Department of Natural Resources (DNR). Two publication series are available from the County Atlas – Regional Assessment Program in paper media as a set of map plates and related reports:



1) County Geologic Atlases by the DNR and Minnesota Geological Survey (MGS) and

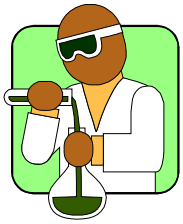
Four Keys to an Internet Portal for Minnesota Ground-Water Information, cont.

2) Regional Hydrogeologic Assessments by the DNR and MGS. PDF images of the more recent reports, and the corresponding Geographical Information System (GIS) data, are also available for download from the DNR or the MGS.

Baseline Water Quality of Minnesota's Principal Aquifers (MPCA)

Minnesota Pollution Control Agency (MPCA) Ground Water Monitoring and Assessment Program (GWMAP), March 1998.

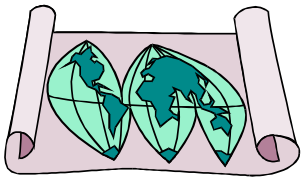
What is the baseline quality of the ground water in Minnesota's principal aquifers? In March 1998, the MPCA released this landmark five-year study assessing Minnesota's ground-water resources. The study analyzed 954 drinking-water wells across the state for baseline or "background" concentrations of metals, solvent chemicals, nitrates, dissolved minerals (such as calcium, magnesium, potassium and sodium) and more.



Bedrock Geology Map of Minnesota (MGS)

View a smaller (1996) version (quicker download) of a bedrock geology map of Minnesota.

This simplified geologic map shows the general distribution of rock types underlying Minnesota's landscape. "Some of the rocks are 3.6 billion years old the oldest found so far in the United States".



Minnesota Ground Water Provinces (DNR)

The occurrence of ground water in Minnesota is related primarily to local geologic conditions that determine the type and properties of aquifers. This map divides the state into six ground-water provinces based on bedrock and glacial geology. Within each province, ground-water sources and the availability of ground water for drinking water, industrial, and agricultural uses are similar.

Minnesota Geology (Online Directory) (MGS)

This online directory includes hypertext links to Minnesota at a Glance PDF documents, General Geology, Regional Geology, Geophysics-Aeromagnetic Data, Borehole Geophysics data, the County Well Index, the Publication Directory and more.

Search Your Community (U.S. EPA)

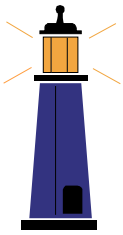
The U.S. Environmental Protection Agency (U.S. EPA) "Search Your Community" provides access to a wealth of information through online environmental and water information databases for a specific area of interest. It includes "Envirofacts", "EnviroMapper" and "Surf Your Watershed".

Upper Mississippi NAWQA Bibliography (USGS)

The U.S. Geological Survey (USGS) National Water-Quality Assessment (NAWQA) Program, Upper Mississippi River Basin Bibliography index page includes sections on ecology, geology, and hydrology. It is an index of references for aquatic ecology, hydrology, water-quality, and geology reports written about the Upper Mississippi River study area.

GIS Data Themes: Geology and Hydrogeology (LMIC)

This Minnesota Land Management Information Center (LMIC) web page lists GIS data, much of it free, that is documented on the Land Management Information Center node of Minnesota's GeoGateway. Most data sets provide statewide coverage of Minnesota, unless otherwise indicated in the title. The metadata includes information about how to access the data set.



Searching Libraries Online for Ground-Water Information

It's a fact; Google has not yet put every book ever published online. Sometimes the only place you're going to find that key source of ground-water information for your local project is … the library. But relax, you can still use the Internet to find it:

Minnesota Library Information Network (MNLINK)

MNLINK is the most comprehensive Minnesota library catalog search.

Minnesota's Statewide Project For Automated Library Systems (PALS)

PALS can be used to search only for documents available in an individual library.

Lumina Digital Library Gateway - University Of Minnesota

This gateway features the University of Minnesota system library catalogs.

Washington County Ground Water Project, cont.

ington WD, Valley Branch WD, Lower St. Croix Watershed Management Organization, state agency staff, Minnesota Geological Survey, Metropolitan Council, Science Museum of Minnesota, Washington Conservation District, hydrogeologists from private consulting firms, and interested citizens.

The award is sponsored by the Minnesota Environmental Initiative (MEI). The Environmental Initiative Awards honor innovative projects that have achieved extraordinary environmental outcomes by harnessing the power of partnership. MEI believes that partnership is one of the most effective ways to develop solutions to Minnesota's environmental problems. Some of the most innovative environmental projects in Minnesota have been accomplished through collaborative processes, often involving a broad range of organizations from the business, nonprofit and government sectors.

MGWA Foundation Board of Directors

MGWA Foundation Grant Request Deadlines are now quarterly:
March 1
June 1
September 1
December 1

MGWA FOUNDATION NEWS

MGWA Foundation Grant Request Deadlines Change

The Minnesota Ground Water Association Foundation (MGWAF) Board announces a change in the deadlines for grant request submittals. New deadlines are March 1st, June 1st, Sept. 1st and Dec. 1st. Requests will be considered at the next MGWAF Board meeting following the deadline. Application forms are on the internet at www.mgwa.org/MGWAF-proposal.pdf. A signed copy must be submitted for the request to be considered.

The Minnesota Ground Water Association Foundation is a 501(c)3 charitable scientific and educational organization established to carry out the scientific and educational goals of the Minnesota Ground Water Association. Specifically, purposes of these grants are to provide support of institutions engaged in training students studying ground water, to educate the public on a variety of ground water related environmental issues through support of ground water related events, and to support the publication of educational or scientific literature about ground water.

Funds donated by the MGWA membership to MGWAF have been used to provide assistance to the University of Minnesota Hydrogeology Field Camp, the Children's Water Festival, the National Ground Water Education Foundation, the Metro Area Ground Water Alliance, and the Minnesota Water Line. The MGWAF has also provided many scholarships, mostly to university groups for field trips, to assist in the education of future ground water professionals. By far our most visible project is the well that MGWAF funded at the Big Back Yard of the Science Museum of Minnesota. Stop in sometime to see it - we are still seeking financial support to build the ground water display that will use it!

Educational Event at Science Museum of Minnesota a Success

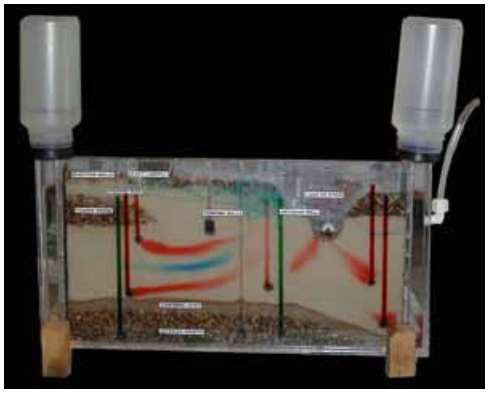
by Amanda Goebel, MGWA Foundation

MGWA members volunteered at an educational groundwater display for a 'Science Madness' event at the Science Museum of Minnesota on Friday, March 31st and Saturday, April 1st. It was 36 hours full of amazing science, science fun, and hands-on science activities. MGWA members were able to connect with museum visitors and provide education on groundwater resources. MGWA volunteers, whose names are listed below, used a groundwater model and other demonstrations to introduce visitors to groundwater concepts. Over 800 visitors walked away with a bookmark of the water cycle and a better understanding about groundwater.

A special thank you to Mike Trojan and the MGWA Environmental Education Committee for designing and setting up the booth. Also thank you to MGWA and MGWA Foundation for funding and thanks to the Department of Natural Resources Division of Waters and Johnson Screens for the groundwater models and permeameters used at the event.

Educational Event Volunteers:

Jim Almendinger, Science Museum
Chris Engelmann, DPRA, Incorporated
Gil Gabanski, GJG Environmental Consultants
Amanda Goebel, Washington County
Tim Grape, STS Consultants
Diana Griffith, LCMR
David Jaeger, Hennepin County
Tim Lockrem, AMEC Earth & Environmental
Jeff Neisse, ATC Associates
Dane Ralston, ATC Associates
Lanya Ross, Shakopee Mdewakanton Sioux Community
Al Smith, Johnson Screens
Mike Trojan, Minnesota Pollution Control
Mary Williams, Student Member – U of MN



A model similar to that pictured above was used at this event. Models are available for loan from DNR-Waters. They are available for purchase through a student-run project at the University of Wisconsin-Stevens Point.

MGWA BOARD MINUTES

Minnesota Ground Water Association Board Meeting Minutes
Regular Monthly Meetings

Meeting Date	**3/10/06**
Place	Keys Café, Lexington and Larpenteur in Roseville, Minnesota
Attending	Dale Setterholm, President; Laurel Reeves, Past President; Jeff Stoner, President Elect; Craig Kurtz, Treasurer; Jon Pollock, Secretary; Norm Mofjeld, Newsletter Editor; Jennie Leete, WRI; Sean Hunt, WRI.
Agenda	See attached. Meeting called to order at 1136.
Past Minutes	Two corrections to Foundation portion of the minutes for the meeting held 2/10/06. "Requesting another Foundation Board member to increase the number to seven." was revised to "Requesting to add another Foundation Board member that would increase the number to seven." "Foundation considering meeting on a quarterly basis." was revised to "Foundation considering reviewing applications on a quarterly basis." Minutes were approved as corrected.
Treasurer	$30,130.18 in total checking/savings. $17,980.00 in dues. $1,432.00 in advertising. Net Income thus far in 2006 is $16,242.87. Treasurer will be conducting internal audit of 2005.
Membership	550 plus members thus far. Final dues notice has been sent out.
Web Page	Conference page up. Conference online store up. Updating calendar. Sent email to membership concerning request from science museum for help with teaching about groundwater. Sent out paid advertisement.
Foundation	Will be meeting Monday
Education	Amanda Goebel will be organizing MGWA appearance at Science Museum on March 31st and April 1st of 2006.
Newsletter	Discussion of costs associated with printing newsletter including costs associated with using WRI, Kinkos, and Office Depot. Motion: MGWA to spend no more than $1300.00 to purchase an HP Color Laser Duplexing printer. Motion passed. Discussion of new format for newsletter including size and fonts. Newsletter team may look at naming newsletter, also considering looking back over the last 25 years.
Old Business	Spring 2006 Conference: On schedule. Speakers have draft arrangement. Have requested abstracts, and given directions on registering. Speakers can email PowerPoint file to MGWA email address. Minnesota Environmental Partnership (MEP): Past President is following up with MEP.
New Business	Financial support for student attendance at MGWA Conferences: Application from MGWA will go to Foundation requesting support for student attendance at conferences. Emailing Employment Opportunities to Members: MGWA emailed employment opportunity notice to membership and received a complaint for doing so. Issue was discussed and tabled with practice being suspended until a decision is made.
Next Meeting	Next meeting is at 1130 on Wednesday, April 19, 2006, at Keys Café at Lexington and Larpenteur in Roseville. Meeting adjourned at 1255.

Meeting Date	**4/19/06**
Place	Keys Café, Lexington and Larpenteur in Roseville, Minnesota
Attending	Dale Setterholm, President; Laurel Reeves, Past President; Jeff Stoner, President Elect; Craig Kurtz, Treasurer; Jon Pollock, Secretary; Tom Clark, Newsletter; Sean Hunt, WRI.
Agenda	See attached. Meeting called to order at 1138.
Past Minutes	Two corrections for the meeting held 3/10/06. Treasurer Report: "Treasurer is conducting internal audit of 2005." changed to "Treasurer will be conducting internal audit of 2005." Education Report: March 31, and April 1st dates added to discussion of MGWA representative appearance at Science Museum. Minutes were approved as corrected.
Treasurer	$31,108.79 in total checking/savings. Printer has been purchased. Net income thus far is $19,237.54
Membership	630 range for members representing an all time high.
Web Page	Presentations from spring conference will go on website.
Foundation	Agreed to fund student attendees at MGWA conferences. Agreed to fund Science Madness at the Science Museum ($762.50). Will meet again in June. Looking at potential bylaw changes next meeting.
Education	No Report.
Newsletter	Request for $500.00 for WRI to experiment with font size and readability (spacing between letters and lines etc.) for the newsletter. Approximately $1800.00 in newsletter redesign thus far. May 12 deadline for June issue. Printer has been purchased and was used for March issue.
Old Business	Emailing Employment Opportunities to Members: Motion: MGWA will no longer offer the service of emailing employment opportunities to the membership. Motion was passed. Advertising Policy and Authority: MGWA Board will maintain advertising policy not

The MGWA Board of Directors meets once a month.

All members are welcome to attend and observe.

Send your comments to editor@mgwa.org

Minnesota Ground Water Association Board Meeting Minutes
Regular Monthly Meetings, cont.

	the advertising manager. Minnesota Environmental Partnership (MEP): MGWA is a member.
New Business	Archiving of MGWA Board Meeting Minutes: Past President will review bylaws to see if any changes are required so that minutes in the newsletter can serve as official minutes and archive. Hill Slope Development: DNR looking at holding a workshop in Winona this fall. Discussion of potential MGWA involvement with the workshop. Fall Conference: Date for fall conference is November 14th. No conference topic yet. Groundwater modeling suggested as possible topic.
Next Meeting	Next meeting is at 1130 on Tuesday May 23, 2006, at Keys Café at Lexington and Larpenteur in Roseville. Meeting adjourned at 1305.

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

The user name is mgwa and the password is emailed to members with each announcement of newsletter availability.