Minnesota Ground Water Association

www.mgwa.org

Volume 22, Number 3: September, 2003

Harvey Thorleifson New MGS Director

Harvey Thorleifson has been appointed Director of the Minnesota Geological Survey (MGS) and Professor in the Department of Geology and Geophysics at the University of Minnesota. He assumed his duties on July 1, 2003, succeeding Dr. David Southwick who fulfilled the role from 1993 until 2002, and Dr. Val Chandler, who served as Interim Director over the past year. In his role, Dr. Thorleifson will direct the very active program of geological mapping conducted by MGS, a program that increasingly addresses the statewide information needs of groundwater management.

MGS is Minnesota's geological mapping agency. As the State's primary source of regional earth science information, MGS plays a key role in supporting topics such as groundwater management, engineering, industrial minerals planning, mineral exploration, and geological research. The survey produces geological, geochemical, and geophysical maps, databases, sections, and models that depict the subsurface of our state, increasingly in interactive digital formats. MGS produces these products through programs such as County Geologic Atlases, Regional Hydrogeologic Assessments, and the County Well Index.

Dr. Harvey Thorleifson, new MGS director as of July 1, 2003.

Dr. Thorleifson is originally from western Manitoba. He completed undergraduate education in geography and biology at University of Winnipeg, and then completed a Masters program in geology at University of Manitoba. His Masters thesis dealt with the history of Lake Agassiz, including a compilation of related investigations across northern Minnesota from the Red River Valley to the Lake Superior basin. He subsequently spent three years at the University of Colorado in Boulder, where he completed a doctoral dissertation on the glacial history of the Hudson Bay Lowland in northern Ontario. After joining the Geological Survey of Canada in 1986, he managed field programs across much of Canada. He spent the late 1980s working on gold exploration, and his early 1990s work emphasized supporting the fabulously successful Canadian diamond exploration scene. In recent years, his work has increasingly emphasized water-related topics, including regional groundwater modeling, Red River flooding, offshore surveys, soil chemistry, Lake Winnipeg shoreline erosion, and climate change. Concurrently, he has been active in helping to coordinate innovations in geologic mapping methods, to enhance application of mapping to topics such as groundwater modeling.

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President's Column

This has been an exciting quarter for the Minnesota Groundwater Association. After a successful Spring Conference the MGWA Board has continued making some promising decisions for the association.

The biggest news is that MGWA has become involved in the Science Museum of Minnesota's 1.2 acre outdoor exhibit space to be know as Science Park. The museum will be investing over $4 million dollars to transform this park into an outstanding outdoor educational experience. There will be six major elements of the park that include:

- *Science House* – a 1200 square foot building that will serve year-round as classroom, laboratory, event space and operations center for Science Park. The environmentally designed building will heat, cool and light itself through solar photovoltaic roofing.
- *EarthScapes* – this is the major public education outlet for earth-process science. There will be a 9-hole miniature golf course that will allow participants to golf through make-believe landscapes

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2003 Newsletter Deadlines

December 2003	11/07/2003

MGS Director, cont.

Harvey presently is the President of the Geological Association of Canada. He is registered as a Professional Geoscientist with the Association of Professional Geoscientists of Ontario. He is an Associate Editor of the journals Geoscience Canada and Journal of Great Lakes Research. He is Past Chair of the Ottawa Branch of the Canadian Institute of Mining, Metallurgy, and Petroleum (CIM), and he toured Canada to speak on diamond exploration as a CIM Distinguished Lecturer in 1999/2000. He also spoke on diamonds at investment seminars in Hong Kong, Japan, Korea, and Australia, and has represented Canada in international diamond-related meetings. He has served on expert panels, including the Expert Technical Advisory Committee of the Ontario Mineral Exploration Technologies Program. He has been active in outreach, and recently authored two chapters for a book on the history of the junction of the Red and Assiniboine Rivers in downtown Winnipeg, Manitoba.

In recent years, Dr. Thorleifson's work has increasingly focused on groundwater. Having a broad background in water-related matters, and having expertise in sedimentary geology, he has been active in developing new approaches to the construction of regional hydrostratigraphic models for groundwater-related applications. For example, he was co-chair of workshops held on new 3D geologic mapping methods for groundwater applications that were held in Illinois in 2001 and in Denver in 2002, and he will be co-organizer of similar sessions in Seattle this November, and in Niagara Falls in May 2004.

According to Thorleifson, these new geological mapping methods are particularly applicable to regional applications in groundwater protection and groundwater management. He observes that, in the case of regional groundwater analyses, it is not possible to obtain new, consistent, high-quality subsurface information for the entire area, so it is necessary to find ways to appropriately use previously acquired data of varying detail, and it is critical to guide interpretations with high-quality data from cored sites and geophysical surveys, as well as the best available insights into the origin of the deposits. But as our computing power increases, as our insights into geological processes progress, as the amount of available data rapidly increases, and as the urgency of optimal protection and wise use of our groundwater increases, sound regional geological models will increasingly be required, and users will be best served if the mapping is digital and interactive. Thorleifson has developed new geological mapping methods that address these needs, including interactive 3D reconstructions of large drillhole databases and associated geologic interpretations that can be implemented in a truck, on a desktop, or in a 3D virtual reality room.

Harvey reports that he is pleased and excited to have arrived in Minnesota. He anticipates being able to make rapid progress in the groundwater-related geological mapping research and methods development in which he has been involved, given the highly advanced state of groundwater information already in place in the state, coupled with clearly identified needs and a well-established commitment to optimally protecting and wisely utilizing our groundwater resources. Harvey reports that he is happy to have joined the Minnesota Geological Survey team, and he looks forward to cooperation with groundwater professionals across the State.

Member News

Tom Reppe of Delta Environmental Consultants, Inc. writes that Epoch Environmental has been aquired by Delta. We have two active members who were with Epoch and are now with Delta - Tom Reppe and Cindy Demers.

To contribute news regarding job changes, corporate buyouts, and other items affecting the MGWA membership, email us at newsletter@mgwa.org.

Membership News and Information Update:

Now ground water information can flow two ways! Our Newsletter can be a forum for every member to share information they encounter. Are you working on an interesting project? Have you come across an interesting fact? Describe something you experienced or witnessed. What progress or developments is your organization making? Let us know if you've changed job positions recently. Let's keep our membership in touch with one another! Selected comments will appear in the next issue (See "Flowing Both Ways" on page 6 for current comments). Email your comments to: newsletter@mgwa.org

President's Column, cont.

introducing the public to real landscape processes shaping today's world.

- *The Soils Project* – designed to help people appreciate that soils are living resources and that close links exist between soil, vegetation, and water quality. The horticulture landscaping will include fruit and nut bearing vegetation as much as possible.
- *WaterScapes* – this exhibit with be the MGWA's main focus and contribution. It is designed for people to explore why our urban and rural landscapes generate large amounts of runoff and to discover the underground plumbing systems that swiftly carry contaminated runoff from these landscapes to nearby water bodies.

It is proposed that the MGWA will provide visitors to draw drinkable water up to the surface using a hand pump, have local bedrock samples in the vicinity to show what water must travel through, use Plexiglass groundwater tubes to illustrate how water occupies the pore spaces between unconsolidated sediment, install one or more graphic panels for further elaboration and clarification, and finally array the bedrock drill cores around the groundwater exhibit platform for visitors to see and touch the cores of rock that have been extracted from the ground directly below their feet.

The cost estimate for this educational exhibit is $30,000. We encourage MGWA members to consider making a tax deductible donation to the Science Museum of Minnesota for Science Park (checks should be made out to the MGWA Foundation and should be labeled SMM-GW Exhibit). The names of all contributors will be included on an acknowledgement panel to be displayed at the entrance to Science Park. Please consider this campaign as a way to support our mission at an education level. For more information on how you can help with this exciting project see the separate article on the project in this issue.

Upcoming events for MGWA include the Fall Field Trip in conjunction with AIPG. The dates are September 26-27. This year's trip is a Geology and Hydrogeology tour along the St. Croix River Valley. Late registration might still be possible for $190 for members when you read this. Payment for late registrations can be made online at www.mgwa.org; be sure to check with the field trip organizers to see if your late registration can be accomodated. If you need more information contact: Keith Rapp at 612/382-3763 or kbrapp@comcast.net.

And don't forget to mark your calendars for MGWA's Fall Conference to be held on Monday, November 10th at the Earle Brown Continuing Educations Center on the St. Paul Campus of the University of Minnesota. The conference focus is water conservation/ water demand management. We have a great lineup of speakers and will be finalizing the program and registration information soon.

Finally, get involved! We are currently soliciting nominations for MGWA officers. See the announcement elsewhere (page 5) in this newsletter.

I look forward to seeing everyone in the fall.

Marty Bonnell, MGWA President

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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.

Bottled Water in Minnesota — A Multi-Million Dollar Business

Author's note: Much this report is based on a presentation on bottled water and notes provided by Tim A. Anderson, Food Standards Compliance Officer, Minnesota Department of Agriculture, to the Minnesota Department of Health on July 22, 2003. I would like to thank Tim for his review and comments.

Introduction

Minnesota Ground Water Association (MGWA) Newsletter Team member Jon Pollock posed the following "Question of the Quarter" to readers in the June issue:

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

- 13 times
- 32 times
- 320 times
- 3200 times

Jon did the math and came up with the following answer, which several newsletter readers figured correctly as well. Suppose 20 ounces of bottled water in a vending machine sells for $1.00 (not uncommon). According to the U.S. Environmental Protection Agency (EPA), the average cost for water supplied to a home in the United States is about a penny for five gallons. There are 128 ounces in a gallon, or 6.4 twenty-ounce bottles. This works out to $6.40 per gallon of bottled water, or 3200 times as much!

Selling bottled water in Minnesota is now a multi-million dollar business. This market has not gone unnoticed among the nation's soft drink bottlers and the two largest, Coca-Cola (which sells Dasani™) and Pepsi-Cola (which sells Aquafina™) have each opened large bottled water operations in conjunction with their Midwest bottling plants in Eagan and Burnsville, respectively. At Coke's Eagan plant, water is supplied from three deep wells and passes through a state-of-the-art on-site treatment plant that would be the envy of many municipalities.

One might reasonably ask why Americans shell out more than $10,000/day (Consumer Reports, August 2000) for drinking water, a product most have cheap and easy access to. The convenience of bottled water is undoubtedly one factor, but an underlying reason may be that, at least in part, the nation's confidence in tap water has been shaken. When cryptosporidium, a parasite from animal waste, entered Milwaukee's Lake Michigan water supply in 1993, it killed 50 people, sent over 4,000 to hospitals and sickened thousands more. In 1999, EPA began requiring local water utilities to send "consumer confidence reports" to their customers each year. Even so, by the turn of the century, Americans drank over ten times the amount of bottled water than they consumed in 1976.

Who regulates bottled water?

In Minnesota, the Dairy and Food Inspection Division of the Minnesota Department of Agriculture (MDA) regulates the labeling, licensing and inspection of bottled water. If the water goes interstate, the U.S. Food and Drug Administration (FDA) is involved as well, under the authority of Code of Federal Regulations (CFR) 21, Parts 129 and 165. Although consumers in the United States take safe drinking water for granted virtually everywhere in the country, it is not uncommon for bottled water to be shipped great distances between the point where it is bottled and eventually consumed. For example, a 12-pack of K-Mart's American Fare™ brand bottled water I purchased here in the Twin Cities has as its source the Quincy, Illinois municipal water supply, according to the label! Both the MDA and FDA could be involved with regulating this brand of bottled water.

There were 21 bottled water plants in Minnesota licensed and inspected at least annually by MDA as of July 2003. In addition to government regulation, which is the minimum, some companies choose to meet higher standards of the International Bottled Water Association (IBWA) or the National Sanitation Foundation (NSF). For example, IBWA has published a Model Regulation (http://www.bottledwater.org) containing a comprehensive list of Standards of Quality (SOQs) for chemical parameters that, in some cases, are more stringent than the U. S. Environmental Protection Agency's Maximum Contaminant Levels (MCLs).

What do different descriptors on bottle labels mean?

There are a myriad of descriptors used by bottled water manufacturers, some of which have regulatory meaning, and others that are merely marketing terms. It can be confusing for the average consumer to know the difference. Minnesota State Rules, Chapter 1550 and 21 CFR Part 165 set labeling standards that bottled water manufacturers must follow. Some examples include:

- *mineral water*: contains at least 250 parts per million of dissolved solids, usually calcium, magnesium, sodium, potassium and bicarbonates or some combination of these.
- *spring water*: water derived from an underground formation from which water flows naturally to the surface of the earth.
- *artesian water*: ground water from a confined aquifer under hydrostatic pressure so that the water level stands at some height above the top of the aquifer.
- *sparkling water*: naturally carbonated water containing carbon dioxide; bubbles lost during treatment may be replaced with the same amount of carbon dioxide the water held originally.

Words such as "premium", "natural" and "quality" are marketing terms and, when used in conjunction with any of the above, they have no regulatory meaning.

Bottled water in Minnesota must meet drinking water regulations. Bottled water with added sugar, flavoring or salt is regulated as a beverage and requires ingredient labels. However, bottled water marketed as being sodium-free must also have an ingredient label (Nutrition Facts) showing that it contains no sodium.

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Bottled Water, cont.

How is a source for bottled water typically processed?

The following is an example of the usual steps involved in processing bottled water with city water as its source:

- hardness is removed by a water softener
- softened water is passed through a carbon filter
- softened, filtered water is treated with reverse osmosis to under 10 parts per million (ppm) total dissolved solids content (water may then be labeled as "purified")
- minerals (generally up to 60 ppm) may be added back in for taste, if declared in the ingredient listing and identified as such, for example, "minerals added for taste"
- water may be treated with ozone (0.1-0.4 ppm) or ultraviolet light to disinfect
- "finished" water is sent to a holding tank
- water is sent to bottling equipment and into containers
- bottles are labeled and date coded (note: expiration dates on bottled water are advisory only); however, all bottled water must have a product code and a recall procedure must be in place

This scenario describes the maximum amount of treatment in a typical bottled water plant. Bottled water labeled as "spring water" may undergo much less treatment, perhaps only ozonation for disinfection. Although all bottled water regulated by the FDA nationwide must meet standards for sanitary production, contaminants that occur in tap water can occur in bottled water as well. In an August 2000 study of 36 bottled waters, Consumer Reports (CR), a nonprofit independent organization providing consumers with information on goods and services, found some contaminants in concentrations high enough to be of concern. For example, arsenic at a level of 18 parts per billion (ppb) was found in one brand of mineral water, and two spring water samples showed levels of 10 ppb. This testing was done after EPA proposed lowering the arsenic standard for drinking water from 50 ppb, but before it adopted the final standard of 10 ppb (to become effective January 2006). By law, FDA must now establish a quality standard in bottled water of 10 ppb or less, or make a finding that such a regulation is not necessary, no later than 180 days before January 2006.

What about the container?

In regulatory parlance, all plastic used in food containers must be "GRAS" (generally regarded as safe) and meet FDA requirements to be used as a food contact. The CR study cited above tested four commonly-used container types including polyethylene terephthalate (PET), high-density polyethylene (HDPE), polycarbonate, and glass. CR tests showed that PET and HDPE containers leached no harmful chemicals into their contents, but both sometimes imparted a slight plastic taste or odor to the samples tested. Glass was the most inert container type and imparted no taste whatsoever to the samples tested The most problematic container type was polycarbonate which is used most often in five-gallon water cooler jugs. Eight of the ten jugs tested by CR contained from 0.5 to 11 ppb of Bisphenol-A (BPA), a carcinogen. There are no standards or health risk limits for BPA and CR concluded, "Any health effects would be most likely to occur in developing fetuses, judging from animal research." For another perspective on bottled water, see the cover story entitled "Message in a Bottle" by Brian Howard in the September/October 2003 issue of emagazine.com. The link to the article is http://www.emagazine.com/september-october_2003/0903feat1.html

Prepared by: Tom Clark, Senior Hydrologist, Minnesota Pollution Control Agency. To comment on this article, send e-mail to: newsletter@mgwa.org or select this link.

Question of the Quarter!

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

The question for this issue is modified from the classic Monte Hall Problem.

You are a studying a site that has three monitoring wells, and are told by the owner that one of the three wells is contaminated and the other two are clean. You select one of the three wells, say Well A, after which the owner informs you that Well C is clean and offers to let you change your selection. The question is, do you change your selection to Well B, and, if so, why? [Hint: The focus of this question is on probability, not geology or hydrogeology, so there is intentionally no information provided in that regard.]

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

newsletter@mgwa.org

2004 MGWA Officer Positions Open

MGWA needs to fill two officer positions — Secretary and President-Elect — for 2004. The Secretary keeps the minutes of all MGWA Board meetings and is the custodian of the Association's official paperwork. He or she also assists with conference planning. The President-Elect takes a leadership role in the planning of one or more of the MGWA meetings while "learning the ropes" of MGWA leadership. Here's a chance for you or your nominee to get in on the front end of ground water resource protection in Minnesota. The Secretary serves a two-year term, and the President-Elect serves for one year before becoming President in 2005, followed by a year as Past-President. Send nominations by November 1, 2003, to MGWA, 4779 126th Street North, White Bear Lake, MN 55110-5910.

Flowing Both Ways

George M from Madison, WI writes:

I recognize that it is too late to have my ballot officially counted in the debate on whether or not ground water is one word or two. But I thought I would belatedly vote anyway.

You can see from the attached pictures of my 1989 Jeep Comanche pickup truck that there definitely is a space between the two separate words. Although I live and work in Wisconsin, I have been a member of MGWA since the mid 1980s, so I hope I do not have to apologize for having a license plate from the wrong state.

Water Quality Data Now Available Online

Making good decisions about water quality issues requires access to the latest data. But until recently, that data has been difficult to come by. Now, those who need access to this information can view and download it whenever they want using the MPCA's Environmental Data Access Web page at www.pca.state.mn.us/data/eda/index.html.

The MPCA and other organizations have collected large quantities of water quality data over the years, but determining what type of data was available and who to get it from required a significant amount of detective work. Minnesota legislators recognized this problem, too, and in 2001 they directed funding to the MPCA to create an Internet-based method to deliver this data.

Types of data that can be accessed include water chemistry data, biological monitoring data and summaries of discharge monitoring reports from facilities that hold MPCA water quality permits. Data collected by organizations other than the MPCA is available through this Web page, too.

The system is designed to be easy to use so people can readily find, view, and retrieve environmental data and information. Users will be able to:

- find locations of Minnesota monitoring stations along with various geographic features using a map-based viewer;
- find basic information about a specific monitoring station; and
- view a "station page" for each monitoring site that provides general information, a photo of the site (when available), data summaries and downloading options.

A second viewer can be used to look at water bodies that have been studied to determine whether they meet their intended uses, such as being suitable for fishing or swimming.

The ability to deliver water quality data is merely the first phase of a larger project to make all MPCA environmental data available through the Web. Air quality data will follow in 2004 and, in 2005, ground water data should be available, too.

For additional information about the Environmental Data Access Web page, contact John Seaberg at (651) 296-0550 or by e-mail at john.seaberg@pca.state.mn.us.

MGWA Thanks its Corporate Members

Our list of corporate members includes:

Interpoll, Inc.

Environmental Strategies Corp

Liesch Associates, Inc

Soil Engineering Testing

TestAmerica, Inc.

New From the USGS

Comparison of two methods for delineating land use near monitoring wells fo assessing quality of shallow ground water by D.L. Lorenz, R.M. Goldstein, T.K. Cowdery, and J.D. Stoner, 2003, U.S. Geological Survey Water-Resources Investigations Report 03-4067, 13 p. Internet accessible at http://mn.usgs.gov/redn/biblio.html#reports

Influence of local riparian cover and watershed runoff potential on invertebrate communities in agricultural streams in the Minnesota River Basin by J.R. ZumBerge, J.A. Perry, and K.E. Lee, 2003, U.S. Geological Survey Water-Resources Investigations Report 03-4068, 13 p.

Relation of periphyton and benthic invertebrate communities to environmental factors and land use at selected sites in part of the Upper Mississippi River Basin, 1996-1998 by J.R. ZumBerge, K.E. Lee, and R.M. Goldstein, 2003, U.S. Geological Survey Water-Resources Investigations Report 03-4121, 41 p.

For more information, contact the USGS, WRD, 2280 Woodale Drive, Mounds View, MN 55112, (763) 783-3100 or http://mn.water.usgs.gov/ .

Goodhue County Geologic Atlas

Part B Links Hydrostratigraphy and Pollution Sensitivity

by Jim Berg, DNR Waters

Part B of the Goodhue County Geologic Atlas is now available. The report, recently published by DNR Waters, includes four map plates that describe the county's ground-water conditions, pollution sensitivity, karst features, and sinkhole probability. The Goodhue County Geologic Atlas is the twelfth report in the County Geologic Atlas Series, a cooperative effort between the Minnesota Geological Survey (MGS) and DNR Waters **(Figure 1)**. This atlas joins the previously published portion of the report, Part A, prepared by the Minnesota Geological Survey, which includes six maps of surficial and bedrock geology, stratigraphy, and mineral resources

Interpretations of the county hydrostratigraphy and three-dimensional understanding of ground-water residence times were greatly facilitated and influenced by the work of Runkel and others (2003). Ground-water residence time data (tritium and carbon-14 age data) produced for the Goodhue atlas project were a good test of one of the major conclusions of the MGS report: that the hydrogeologic properties of most of the bedrock formations in the region are strongly controlled by the depth of the formation. Bedrock formations that are not aquifers in the southwestern portion of the county are used as aquifers in northeastern Goodhue County where these units exist at shallower depths and are more permeable. In the northeastern portion of the county and in the major river valleys, where these units are relatively shallow (less than 200 feet below the top of the bedrock), the permeability of these units has increased dramatically through formation of fractures and solution-enlarged (karst) cavities.

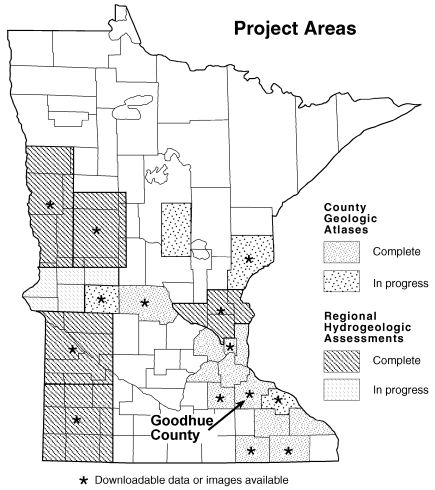

Figure 1: Project Areas.

Aquifers of Goodhue County

Most of ground water used in the county (95 percent) is drawn from bedrock aquifers. Aquifers of the Prairie du Chien Group, Jordan Sandstone, and Franconia Formation are the most commonly used; 80 percent of the wells listed for Goodhue County, in the County Well Index data base (Plate 1, Part A), are completed in those three formations **(Figure 2).**

Prairie du Chien Group aquifers. These aquifers comprise the Shakopee Formation (upper portion of the Prairie du Chien Group) and the overlying St. Peter Sandstone, in the western portion of the county, and the Oneota formation (lower portion of the Prairie du Chien Group) in the eastern portion of the county. The Shakopee Formation is a thin-to-medium-bedded dolostone with minor amounts of sandstone and sandy dolostone. The Oneota formation is described as a massive or thick-bedded dolostone. The Prairie du Chien Group thickness is typically 250 feet in western Goodhue County, thins in the north and northeast, and is absent in the extreme northeast.

Jordan aquifer. This unit comprises very fine-grained feldspathic sandstone, siltstone, and shale coarsening upward to quartzose sandstone. This aquifer is used mostly under deep conditions (greater than 200 feet below the top of the bedrock) in the county. The aquifer is approximately 100 feet thick across most of the county and is abruptly truncated in the northeastern valleys. Under deep conditions, this aquifer is separated from the overlying St. Peter-Shakopee aquifer by the Oneota confining unit.

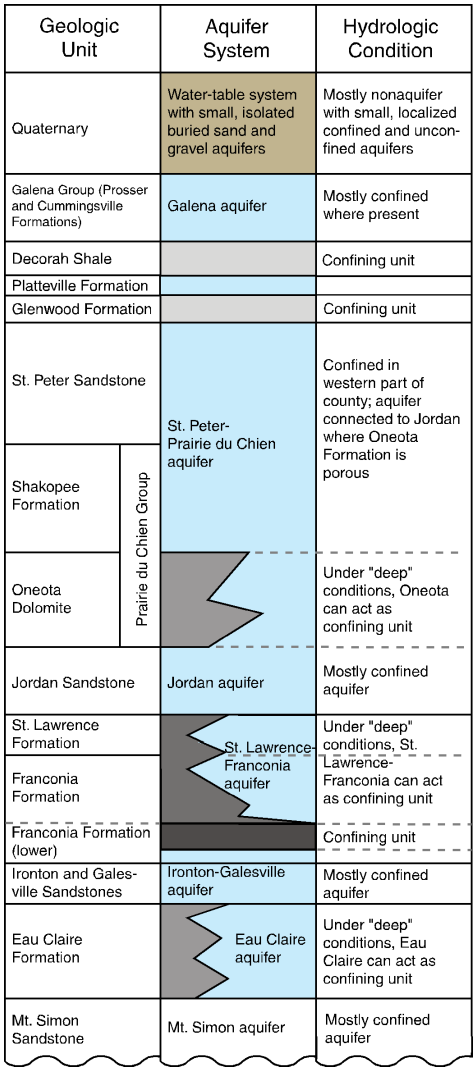

Figure 2. Sequence of aquifers and aquifer characteristics in Goodhue County. Some rock units are aquifers or confining units wherever they exist in the county but other rock units have varying hydrogeologic characteristics. For example, the Oneota Dolomite and the St. Lawrence, Franconia, and Eau Claire formations are aquifers only in the northeast.

Franconia aquifer. The Franconia Formation is mostly a clayey, feldspar-rich, very fine- to fine-grained sandstone. It also consists of shale and sandy-clayey dolostone. The aquifer is used under deep and shallow conditions in northeastern Goodhue County. The upper portion of this formation is used as an aquifer under shallow conditions. Much of the

— continued on next page

Goodhue Atlas, cont.

lower portion of the formation has very low hydraulic conductivity even under shallow conditions and is considered a confining unit.

Potentiometric Surfaces of the Uppermost Water-Supply Bedrock Aquifers

Figure 3 shows the combined surfaces of the three primary aquifers or aquifer systems in the county: the St. Peter-Prairie du Chien aquifer system, the Jordan aquifer, and the St. Lawrence-Franconia-Ironton-Galesville aquifer system. Ground water in the uppermost water-supply bedrock aquifer generally flows from the south and central portions of the county to the north, northeast, and southeast toward the drainages of the Cannon, Mississippi, and Zumbro rivers, respectively. The smaller river valleys alter the local ground-water flow directions creating the complicated patterns shown on **Figure 3**. All of the perennial river valleys are ground-water discharge areas. The 1000-foot-contour areas near Goodhue and Zumbrota are important recharge areas of the Prairie du Chien and Jordan aquifers.

Pollution Sensitivity and Ground-Water Residence Time

The primary purpose of the Part B atlases is to show or predict the sensitivity of the important aquifers to water–borne pollution. The sensitivity prediction, based on a conceptual model, is shown in **Figure 4**, with red representing the highest sensitivity and dark green representing the

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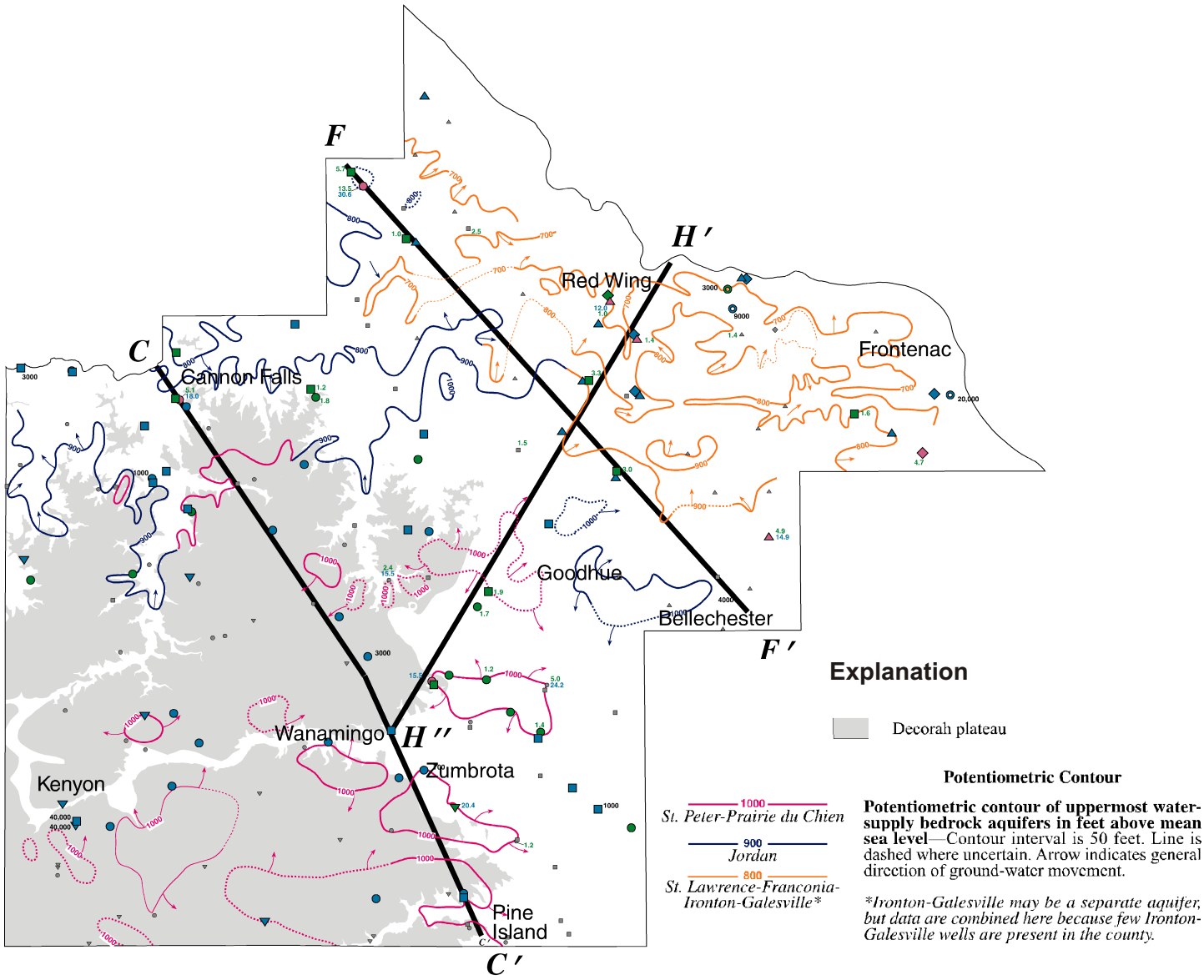

Figure 3: Potentiometric surfaces of the uppermost water-supply bedrock aquifers in Goodhue County. For clarity only 100-foot contours are shown, 50-foot contours are shown in the published report.

Goodhue Atlas, cont.

lowest. The predicted sensitivity can be tested by ground-water residence time data as shown by the pink, green, and blue colors on the three hydrogeologic cross sections of **Figure 5**. Ground-water residence time is the approximate time that has elapsed since the moment the water infiltrated the land surface to the time it was pumped from the aquifer for this investigation. Tritium (^3H) is a naturally occurring isotope of hydrogen. Concentrations of this isotope in the atmosphere were greatly increased from 1953 through 1963 by above-ground detonation of hydrogen bombs (Alexander and Alexander, 1989). Since this isotope decays at a known rate (half life of 12.43 years), the proportion of recently (last 50 years) recharged water in an aquifer can be estimated from tritium concentrations. Water samples with concentrations of tritium greater than 10 tritium units (TU) are considered recent water (mostly recharged in the past 50 years, shown in pink). Concentrations less than the detection limit (0.8 TU) are considered vintage water (recharged prior to 1953, shown in blue). Concentrations between these two limits are considered a mixture of recent and vintage and are referred to as mixed (shown in green).

Ground-water residence time is related to pollution sensitivity. Portions of the aquifers that contain recent water are considered moderately to very sensitive. Conversely,

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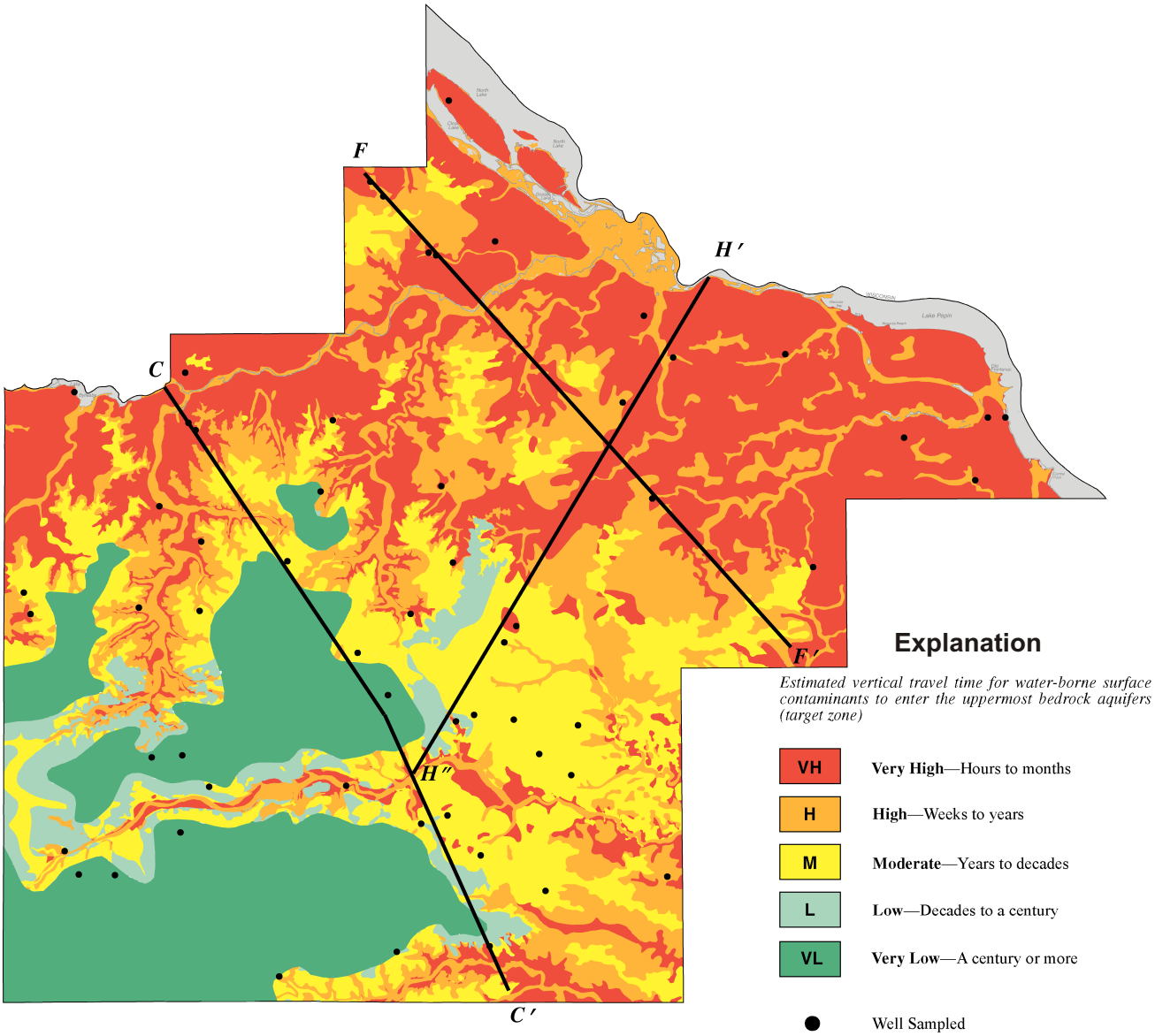

Figure 4: Sensitivity to pollution of the uppermost bedrock aquifers in Goodhue County.

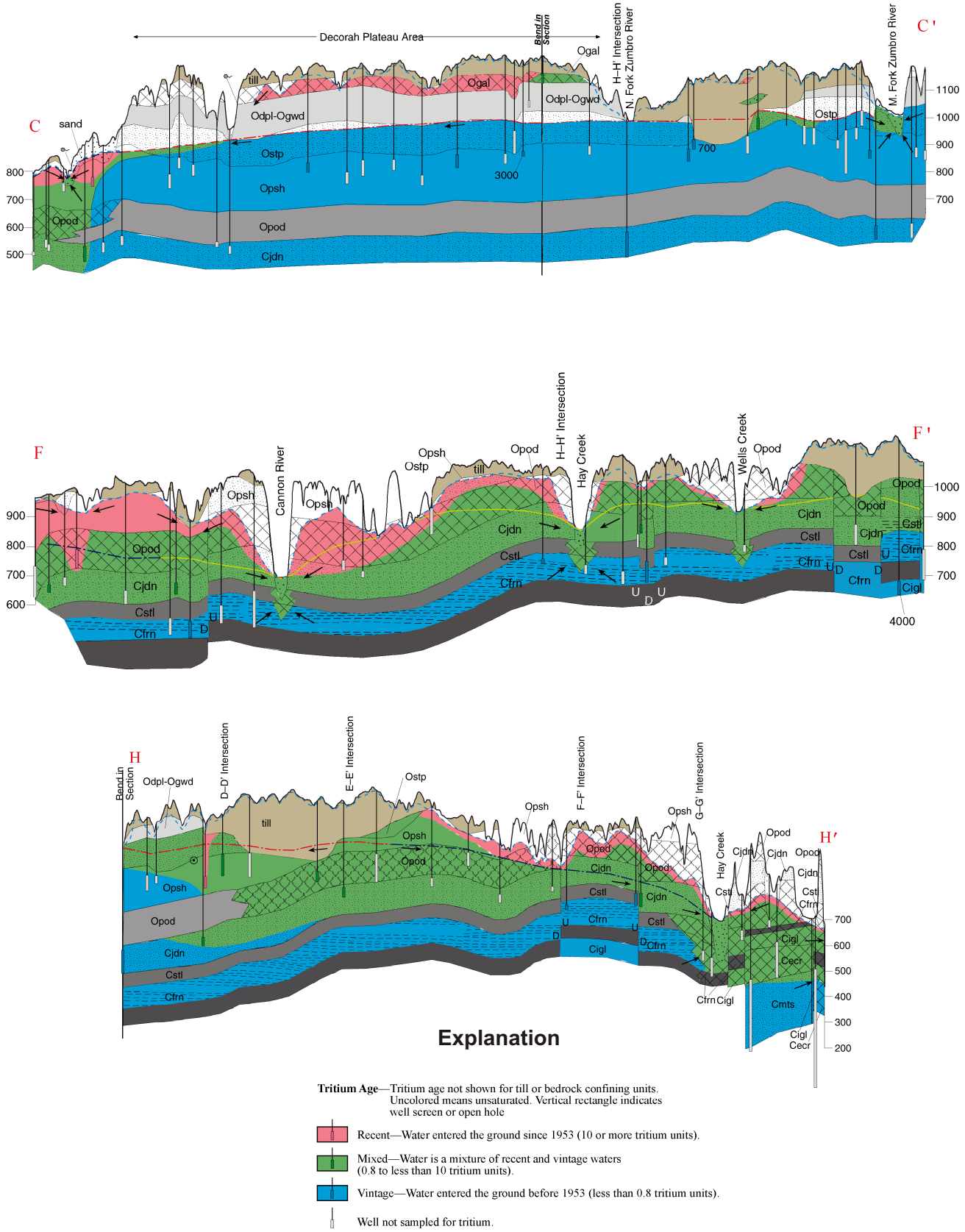

Figure 5: Selected hydrogeologic cross sections of Goodhue County from Plate 8, Part B. See Figure 3 for locations of cross sections.

Goodhue Atlas, cont.

aquifers that contain vintage water are considered less sensitive.

The presence or absence of the Decorah-Platteville-Glenwood confining unit overlying any of the uppermost water-supply aquifers was one of the most important considerations in the sensitivity evaluation. The other factors affecting vertical flow included overlying high-permeability materials, such as alluvium or outwash, or low-permeability materials such as glacial till.

Three general areas emerged from the sensitivity evaluation: the very low to low sensitivity of the Decorah plateau, the low to moderate sensitivity of the till-covered Zumbrota-Goodhue area, and the high to very high sensitivity of the northeastern area and major river valleys.

Decorah Plateau Area

The Decorah Plateau consists of remnants of the Galena Group over the Decorah-Platteville-Glenwood confining unit. The Decorah Plateau is resistant to erosion and dominates the topography of southwestern Goodhue County **(Figure 5, cross-section C–C′).** Water infiltration through the till in this area is rapid enough to create recent and mixed tritium concentrations in ground-water samples from wells completed in the underlying Galena aquifer. The low permeability of the Decorah-Platteville-Glenwood confining unit produces a shallow water table across most of the plateau, except for the river bluff areas.

A very low rate of surface water infiltration through the Decorah-Platteville-Glenwood confining unit is indicated by the predominance of vintage ground water sampled from the underlying St. Peter-Shakopee aquifer. In this area **(Figure 4),** 16 ground-water samples were collected from the St. Peter-Shakopee aquifer for analysis of tritium concentrations. All of the samples had tritium concentrations indicating vintage water (greater than 50 years old). Two samples analyzed for carbon-14 age yielded values of 3000 years and 40,000 years before present. In addition, none of the sampled wells contained elevated concentrations of chloride (values greater than 12 parts per million [ppm]).

Zumbrota–Goodhue Area

East of the Decorah-Platteville-Glenwood edge, in an area north of Zumbrota and southwest of Goodhue, surface water infiltration through thick till layers may be responsible for detectable concentrations of tritium in the underlying Shakopee, fractured Oneota, and Jordan aquifers **(Figure 5, cross-section H″–H′).**

In this area **(Figure 4)**, 14 well water samples were collected for tritium analysis. Most (11 of 14) of these samples contained mixed water indicating some infiltration of recent water. In addition, seven of these samples contained elevated nitrate concentrations ranging from 1.2 ppm to 5 ppm, and three had elevated chloride concentrations from 15 ppm to 24 ppm.

Northeastern Goodhue County And Major River Valleys

In these remaining parts of the county, the Decorah-Platteville-Glenwood confining unit has been eroded and thick till layers only exist in isolated areas. The water table tends to be deeper in these areas with no surficial or near-surface confining layers that limit infiltration elsewhere in the county. The Oneota Dolomite, which is a confining unit beneath the Decorah Plateau, is commonly a shallow aquifer (less than 200 feet below the top of the bedrock) in the northeastern portion of the county **(Figure 5, cross-sections F–F′ and H″–H′).** Recent and mixed tritium values in ground-water samples from these areas indicate relatively rapid recharge through the permeable shallow bedrock. Recent tritium concentrations were detected in five bedrock water samples in this area from somewhat deep wells (100 feet to 200 feet) suggesting enhanced permeability resulting from extensive fractures or solution features in these areas (left end of **cross-section F–F′**).

Eleven of the 26 samples from these areas were located in major river valleys and contain concentrations of tritium indicating vintage or mixed water. As shown on **Figure 3**, these valleys are important discharge areas for bedrock aquifers. Strong upward and lateral flow may have brought older and deeper water near the surface into these areas. In some places, mixing of waters with recent and vintage concentrations of tritium probably occurs where local shallow flow systems converge with the deeper systems creating mixed water. In other places, all or most of the water intercepted by the wells is vintage water discharging to the river systems. Elevated nitrate values (1.1 ppm to 5.1 ppm) were detected in seven of the recent and mixed water samples.

Summary and Conclusions

- Three general areas of pollution sensitivity of the uppermost water-supply aquifers are the very low to low sensitivity of the Decorah plateau, the low to moderate sensitivity of the till-covered Zumbrota-Goodhue area, and the high to very high sensitivity of the northeastern area and major river valleys. These map classifications are generally well supported by ground-water residence time data.
- Ground-water residence time data support the hydrostratigraphic framework proposed by Runkel and others (2003), which shows bedrock depth is a major control of bedrock hydraulic conductivity.

To Obtain Reports and Data

County Geologic Atlases underway include Pine, Wabasha, Pope, and Crow Wing. Part A reports for Pine, Wabasha, and Pope counties have been published by the Minnesota Geological Survey. Reports in the County Geologic Atlas Series can be purchased at the Minnesota Geological Survey, Publications Office, at 2642 University Avenue, St. Paul, 55114, phone (612) 627-4782.

The Goodhue County Geologic Atlas was prepared using geographic information systems (GIS) technology. Data files and portable document

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Goodhue Atlas, cont.

format (PDF) images of plates are available for download. Please see the DNR Waters web site at: http://www.dnr.state.mn.us/waters/groundwater_section/mapping/status.html for Part B data availability and download instructions. PDF images and data for Part A of the report are downloadable from the MGS ftp site at ftp://156.98.153.1/pub3/c-12/ . More information is on the MGS web site at http://www.geo.umn.edu/mgs/

For more information contact Jim Berg or Jan Falteisek, DNR Waters, at (651) 296-4800 or Dale Setterholm, Minnesota Geological Survey, at (612) 627-4780.

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Alexander, S.C., and Alexander, E.C., Jr., 1989, Residence times of Minnesota groundwaters: Minnesota Academy of Sciences Journal, v. 55, no.1, p. 48–52.

Runkel, A.C., Tipping, R.G., Alexander, E.C., Jr., Green, J. A., Mossler, J.H., Alexander, S.C., 2003, Hydrogeology of the Paleozoic bedrock in southeastern Minnesota: Minnesota Geological Survey, Report of Investigation 61, 105 p., 2 pls.

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Fetzer Center, Western Michigan University, Kalamazoo, MI
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PCA Study and Otto Strack featured in separate articles in July/August Issue of Ground Water

The July/August 2003 of Ground Water (Volume 41, No. 4) contains two articles of potential interest to groundwater scientists in Minnesota. The first is a summary of studies performed by PCA staff on the effects of land use on groundwater quality in central Minnesota. Much of the research presented in the article is derived from information collected as part of the PCA's ambient groundwater monitoring program. MPCA's web site (http://www.pca.state.mn.us/water/groundwater/gwmap/rpt-landuse-sc-short.pdf) contains a document in which some of the same material in the *Ground Water* article for those who don't have access to the journal. Full citation: Trojan, M.D. and J.S. Maloney, J.M. Stockinger, E.P. Eid, and M.J. Lahtinen, 2003, Effects of Land Use on Ground Water Quality in the Anoka Sand Plain Aquifer of Minnesota: Ground Water, v. 41, no. 4, pp. 482-492.

Also in the July/August 2003 issue of Ground Water is a short autobiographical sketch of Dr. Otto Strack, Professor of Civil Engineering at the University of Minnesota.

It's worth taking a look at this article to see what Otto looked like as a child!

Note: A review article on the Analytic Element Method appeared in Reviews of Geophysics in June: Strack, O. D. L., 2003, Theory and Applications of the Analytic Element Method: Reviews of Geophysics, 41(2)1005

Pollution Control in the Netherlands:

An example of determining Volatile Organic Chlorides contamination in groundwater.

By Hans Zwijnenberg

Introduction

My name is Hans Zwijnenberg and I am from the Netherlands. I am on a sabbatical leave in the USA and one of the reasons I am here is my interest in how contamination problems are tackled in your country.

Jim Lundy invited me to come to the MGWA Spring Conference. He introduced me to several people including Norman Mofjeld, who asked me to write an article in the MGWA Newsletter about how we handle contamination problems in the Netherlands. So I did, as you can see.

I have had my education at the University of Groningen as a chemical engineer. I have lived and worked in the city of Oss in the public service sector. One of my tasks was to manage the continuity in the process of solving contamination problems in groundwater. I will describe a problem that we have looked at for over twenty years and which only now (in 2003) do we understand in full scale.

General

The city of Oss (latitude 51°45', longitude 5°30' E, [for comparison, Winnipeg is at latitude 51°00']) is situated south of the Maas River and has a built-up area of about 35 km^2 within which live and work 55,000 people. The city is highly industrialized, and many companies produce a diversity of finished products out of semi-manufactured materials, or operate in the transport sector. The city does not have the full supply-function for the region in a way like for instance St. Cloud because there are many (larger) cities within an hour's drive.

Introducing the problem

In 1980, during construction of houses in the heart of the city on the site of a former factory, we found out that a large volume of groundwater was polluted by tetrachloroethylene

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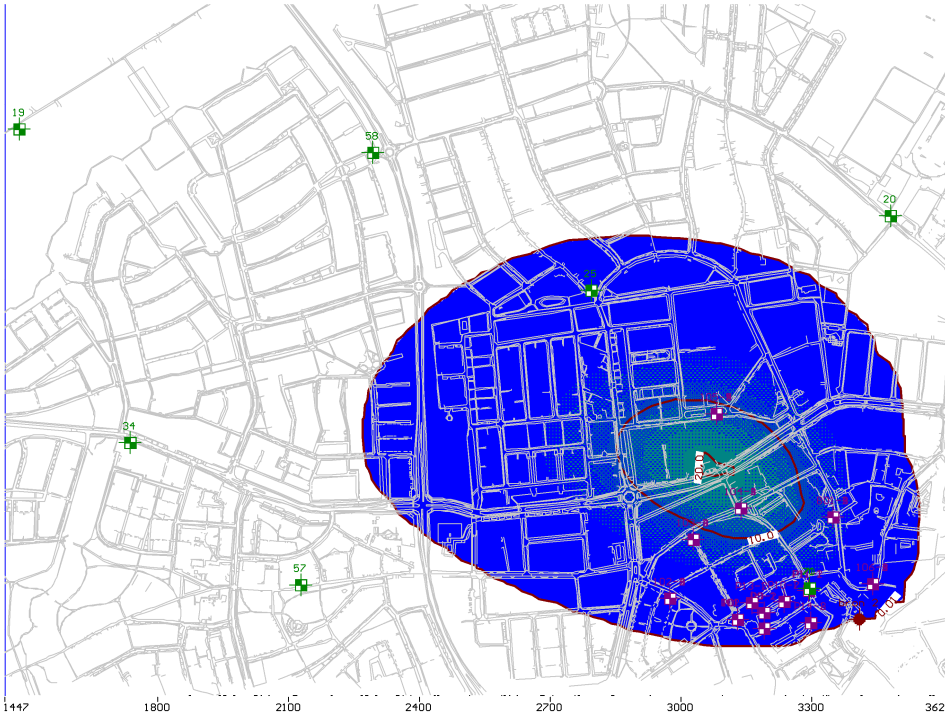

Figure 1. Cis-1,2-DCE concentrations after fifteen years natural situation (no degradation).

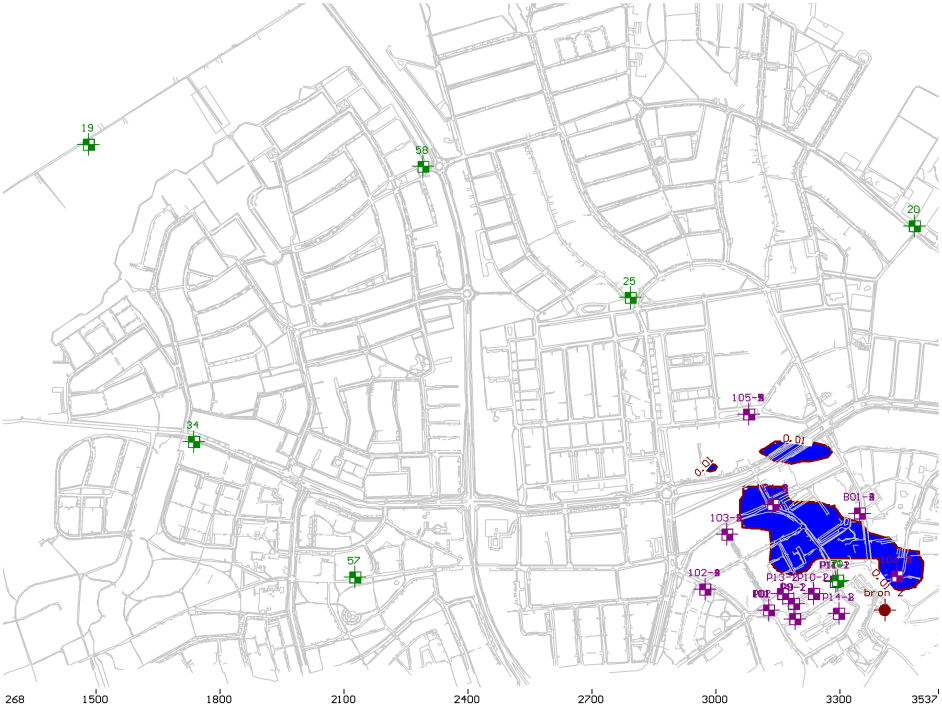

Figure 2. Cis-1,2-DCE concentrations after fifteen years following addition of carbon source.

Pollution in the Netherlands, cont.

(tetra) and trichloroethylene (tri). These solvents were used for about 5 decades to clean the iron parts of the lamps produced at the factory.

"Solving" the problem

During the eighties and beginning of the nineties various investigations and re-investigations were done and measurements were taken to tackle the problem. At that time there was little knowledge of the behaviour of dense non aqaeous phase liquids (DNAPL) in groundwater. The problem was regarded as a hydrologic issue, and after modeling the groundwater system[1] by means of MicroFem in 1994 we started to pump and treat. One well, yielding 40 m^3/hour, had a screened interval of 10 to 30 meters below surface (m-bs). We used about 40 monitoring-wells at various depths and places to observe the effects.

[1]*First aquifer: thickness about 50 m (starting at 1 m-bs)*
Stratigraphy : 0.0 – 1.0 m-bs: humid soil (podzol), O.S.: = 5 %
1.0 – 12 m-bs: gravelly sands, partly eolian, partly fluvial
12 – 18 m-bs: gravelly sands or sandy gravel with lens-shaped clay-layers varying from 0.1 m to 3 m in thickness
18 – 50 m-bs: gravelly sands or sandy gravel
> 50 m-bs: marine clays mixed with fine sands (confining layer)

What did we see? We saw:

- where volatile organic chloride (VOCl) contamination was found there was a very large fluctuation in it during the period of monitoring;
- a definite asymptotic decline in the concentration of the inflowing water at the treatment well (a quite normal pattern);
- places where we assumed the water was contaminated but it was not and reverse;
- one of the degradation products of tetra and tri, dichloroethylene (dce), was analyzed in significant amounts in the middle deep (≈15 m-bs) and deep (> 25 m-bs) zones.

However, we had no clear idea of what exactly we were doing or what was happening down there.

Thinking about the real problem

In 2000 we made a major effort by digitizing the hundreds of figures we got from the monitoring-program so we could produce relevant graphs. We redefined the stratigraphy near the bottom by giving the lens-shaped clay-layers a more profound role. We studied the soil's potential to naturally attenuate the pollution. We redefined the groundwater-flow-model using data from the groundwater-surface-level monitoring-program, and we used Modflow because it computes mass-transfer effects. Well, Hans, do you know now what's going on down there? Yes!

We know now what's going on down there

Over time, the contamination has flowed in a direction opposite of the natural groundwater flow (NW) due to the nearby enormous groundwater withdrawals (3,000,000 m^3/y) in the past. We already had a pretty good idea of that, but we were not able to quantify that. The contamination was originally leaked at various places on the lens-shaped clay-layers and through the holes in it. A large amount of it has been taken away by the treatment well. But still a significant amount is absorbed by them. They act like sponges who keep to deliver contaminations in time. In the clay-layers there is also just enough carbon to let a few bacteria grow that are able to convert a fair amount of tetra and tri into dce. Dce has a more ionic character so it is dissolved in greater amounts than the other components and is thereby more widely spread in the middle deep and deeper zones. That is the pattern we now look at.

The last news I heard (I was already in the USA), the city of Oss is planning an investigation-program to look at the possibilities of stimulated attenuation to convert all VOCl into CO_2, H_2O and Cl^-.

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

Source Water Assessments Prepared for all Public Water Supplies in Minnesota

What is Source Water Protection?

Source water protection reflects efforts to keep contamination levels in public water supplies below levels that present a concern to human health. The Minnesota Department of Health (MDH) is the lead agency in Minnesota for source water protection activities.

The source water protection and wellhead protection programs are practically the same thing for public water supply systems that use groundwater. However, source water protection activities will also apply to systems that use surface water as a source of supply (of which there are 23 community systems statewide, including St Paul, Minneapolis, St. Cloud, and Duluth).

What is a Source Water Assessment?

A Source Water Assessment (SWA) is a document that provides basic information to public water suppliers – and the general public – about their drinking water. Under agreements made with the US EPA to comply with the 1996 Amendments to the federal Safe Drinking Water Act (SDWA), MDH was required to produce a SWA for all public water supply systems in Minnesota by the end of May, 2003. An example of a Source Water Assessment starts on page 16. You may wish to refer to this example as you read the following information.

Specifically, a SWA must include the following:

- A description of the drinking water source, such as a well or a lake, and the area (source water protection area) that provides water to that source.
- A determination of the "susceptibility" of the drinking water source to contamination. Susceptibility describes how likely it is that a

— continued on page 15

Source Water Assessment, cont.

water source may become contaminated. For wells, susceptibility is based on well construction, the type of aquifer supplying the water, and any identified potential sources of contamination.

- Drinking water contaminants of concern to anyone using the water source. For wells, this is based on any identified potential sources of contamination within the area that supplies water to the well.

Along with the text portion of the assessment, a map will be generated showing the Inner Wellhead Management Zone (IWMZ) for the well(s) or a Drinking Water Supply Management Area (DWSMA), if one has been approved. Note that only systems that have formally entered the wellhead protection planning process will have an approved DWSMA.

See the graphic of an example Source Water Assessment on page 16 to see what a SWA looks like and the amount of detail included.

How Are Source Water Assessments Created?

Source Water Assessments are generated by the Minnesota Department of Health using existing data from water sampling, water system surveys, and well records. One Source Water Assessment will be produced for each public water system – even if the system has multiple wells. Once printed, assessments will be mailed to public water systems by MDH.

Owing mainly to the number of public water supply systems in Minnesota (over 8000), these reports are generated automatically based on current information in MDH databases – which may miss some real time events (such as a well in a given community that may have been sealed last week). Owners/operators will be reviewing the draft SWAs sent out in the Spring of 2003, and will be looking for inaccuracies that develop from incomplete or incorrect database entries. MDH will be updating the databases used to generate the SWAs as the information becomes available.

What will be done with the Assessments?

The SWAs are for informational purposes only. However, the assessment does contain information that can be used in helping to manage potential sources of contamination near wells and other sources. Some systems may find that a SWA is a good starting point for the wellhead protection planning process. In the end, the information contained in a SWA will be available to the public. At the state level, SWAs will be used by permitting and cleanup programs to identify risks of known or potential contamination sources to public water supplies.

A Source Water Assessment Is Not A Wellhead Protection Plan

A Source Water Assessment and a Wellhead Protection Plan are two separate and distinct documents. However, the assessment can aid a water system in its wellhead protection process and provides an update of the system's progress in source water protection. Keep in mind that

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Example Source Water Assessment*

***Note that this is example only and specific language will be unique for each public water system.**

ID Number: 1590001

Facility Contact: Wilson Vanderloy
Edgerton
(507) 442-4361
Edgerton Watre Superintendent
City Hall
Edgerton, MN 56128

MDH Contact: Terry Bovee
(507) 389-6597
Nichols Office Center
410 Jackson Street, Suite 500
Mankato, MN 56001-3752
terry.bovee@health.state.mn.us

Status of the Source Water Protection Plan:

The water supply system is implementing the wellhead protection plan that has been approved by the Minnesota Department of Health under Minnesota Rules 4720.

Source Water Protection Area - See accompanying map(s).

Description of the source water - The water supply for Edgerton is obtained from 1 primary well. Well depth (in feet), well status, aquifer(s) used, and sensitivity of the source(s) of drinking water are listed in the following table.

Unique Well No	Well ID	Depth	Well Use	Aquifer	Aquifer Sensitivity	*Well Sensitivity
100696	Well #9	44.0	Primary	Glacial Deposits	High	See (2)

Well construction assessment - The water well used by the Edgerton meets current standards for construction and maintenance. These factors do not contribute to the susceptibility of the source water to contamination.

Well Sensitivity - Well sensitivity refers to the integrity of the well due to its construction and maintenance. It is based on the results of the well construction assessment. It can be one of the following:

(1) The well is susceptible to contamination because it does not meet current construction standards or no information about well construction is available, regardless of aquifer sensitivity.
(2) The well is not susceptible because it meets well construction standards and does not present a pathway for contamination to readily enter the water supply.

Aquifer Sensitivity - Aquifer sensitivity refers to the degree of geological protection afforded the aquifer(s) used by the public water supply.

High - The glacial aquifer is considered to exhibit a high sensitivity to contamination because of the local geological setting.

Source Water Susceptibility - Source water susceptibility refers to the likelihood that a contaminant will reach the source of drinking water. It reflects the results of assessing well sensitivity, aquifer sensitivity, and water quality data.

High - The source of drinking water is considered to exhibit a high susceptibility to contamination because of the local geological setting.

Contaminants of concern - The following statement summarizes the potential contaminants for which a source of drinking water may be at risk:

The public water supply system is being monitored on a quarterly or monthly basis because one or more contaminants that are regulated under the federal Safe Drinking Water Act have been detected in the source water. However, the water supplied to users meets state and federal drinking water standards for potability. For further information, please contact the MDH representative listed at the beginning of this assessment.

Contact Information Given for public water supply and MDH SWP Planner.

Status of the Source Water Protection Plan Summarizes a system's status in wellhead protection planning process.

Source Water Protection Area Refers to the attached map, which will show either an IWMZ or a DWSMA.

Description of Source Water Summary of existing well and aquifer data. Also summarizes aquifer and well sensitivity, as described later in the assessment.

Well Construction Assessment This is a brief summary of information known about the construction of the well(s) in the system, based on a review of five key construction elements.

Well Sensitivity States whether a well is "susceptible" or "not susceptible" to contamination, based on the well construction assessment. Note that if well construction information is not available, a well will be considered susceptible.

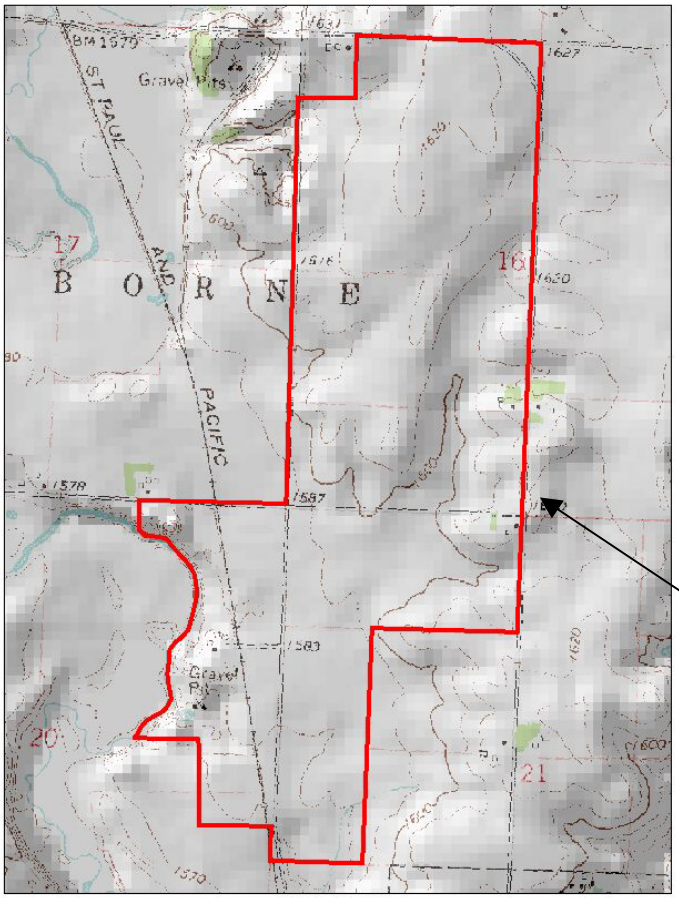
Aquifer Sensitivity States whether the aquifer supplying a well has "high" or "low" sensitivity to contamination, based on information available about the aquifer (or lack of information).

Source Water Susceptibility This is the overall assessment of the susceptibility of a water source to contamination. **This can be viewed as the "bottom line" of assessment, since it will impact decisions made on wellhead protection measures and the phasing in of systems into the wellhead protection program**.

The source(s) will be classified as either "high" or "low" susceptibility, based on well sensitivity, aquifer sensitivity, and water sampling results (regulated contaminants plus tritium). Note tritium results can "override" other elements in determining source water susceptibility.

Contaminants of Concern This section describes contaminants of concern for the water supply. The contents of the section are based primarily on the results of required water sampling.

If there has been a previous detection or MCL violation for a regulated contaminant, a paragraph indicating this will be inserted. Otherwise, a statement will appear indicating that no regulated contaminants have been detected in the source water.



Map of Inner Wellhead Management Zone or DWSMA (if approved) The last page of the assessment is map showing the Inner Wellhead Management Zone for the well(s) or a Drinking Water Supply Management Area (DWSMA) – if a DWSMA has been approved.

Note that the only maps served on the web site will be those of approved DWSMAs for public water systems (with specific well locations removed). Until the DWSMA has been approved, no map will appear on the website.

the assessment is a document produced by MDH, while the wellhead protection plan is developed by the public water system and its wellhead protection planning team.

How Is The Process Different For Public Water Systems Using Surface Water?

Due to the unique issues involved in creating assessments for surface water systems, and the limited number of surface water systems, source water assessments for water supplies using surface have been developed on a case-by-case basis, in close consultation with the water system.

How do I obtain the Source Water Assessment for the community where I live or work? SWAs will be available via MDH's web site beginning in October, 2003.

Contributed by Steve Robertson, MDH, with help from Dave Hokanson, MDH. To comment on this article, send email to

newsletter@mgwa.org or click here.

The Impact of Budget Changes on Groundwater Programs at MDA

The Minnesota Department of Agriculture is the lead state regulatory agency for pesticides and fertilizers (excluding manure). This includes responsibility for monitoring groundwater, and for developing voluntary best management practices (BMPs) and rules, if required. Changes in funding from the 2003 legislative session had an impact on some of the MDA's groundwater programs.

The MDA fertilizer program is funded by dedicated fees, which are used for a wide range of regulatory and related activities including: product registration, inspecting and permitting of facilities, cleanup of spills, enforcement, monitoring and BMP development and evaluation. Starting in state fiscal year 2004 (FY04), the fertilizer program is facing nearly a 40% reduction in funding. As a result, in FY04 the MDA eliminated four positions that were in the program in FY03. This means fewer inspections of facilities such as anhydrous ammonia storage areas, and a smaller fertilizer non-point source program. This comes after several years of ongoing reduction in resources as a result of increasing costs. Four years ago the MDA had four positions dedicated to the fertilizer non-point source area, and now there is only one.

The MDA also had a reduction in general funds over the last two years. This resulted in a reduction of pass-through funding to the University of Minnesota Extension Service for two manure education specialists. Despite recent reductions, general funding for groundwater programs has not been significantly reduced.

Pesticide groundwater programs appear to have sufficient funding to maintain current program activities, providing there is not a significant

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Education Committee Activities

Steve Thompson attempts to convince skeptical fourth graders that ground water flows from high head to low head. Steve and Jim Lundy, both of the Minnesota Pollution Control Agency, visited the "Rock World" class at Summer Academy for gifted and talented grade school students in Columbia Heights, Minnesota in June.

About 85 students learned about weird water properties, the flow of water through earth materials, preventing and cleaning ground water pollution, and many other important concepts. If you are a ground water professional interested in bringing ground water to the classroom, or if you are a teacher of students who would like to hear about ground water, please visit www.mgwa.org and click on "education".

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Full Page	7.5 x 9.75	$425	$360
Inside Cover	7.5 x 9.75	not available	$395

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E-mail notices: A one-time e-mailing to the membership costs $10 for an individual (e.g., seeking a job), and $50 for an organization (e.g., announcing a new product, job opening etc.). A 200 word limit is imposed. The advantage of e-mail is the speed of dissemination.

The Advertising Manager has final determination on the acceptance of materials submitted. There are no commissions on ads. Copy must be received by the publication deadlines: 14 February, 16 May, 15 August, or 14 November. Advertisers should submit their material as a digital file in TIFF, JPEG or PCX format at 300 to 600 dpi. A set-up charge will be applied to non-digital ad material.

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

Budget Cuts at MDA, cont.

increase in costs. However, the MDA is currently reallocating resources internally. This includes expanding groundwater monitoring over the next year to cover all of the major agricultural regions in Minnesota. Currently the MDA groundwater monitoring program focuses on a dedicated monitoring well network in the hydrogeologically sensitive central sand plains. The current monitoring network will be maintained while additional monitoring will be conducted using existing public and private wells. With no additional funds available, the laboratory, staff and other costs for increased groundwater monitoring were obtained by shutting down four of the eight MDA continuous surface water monitoring points. The points that were eliminated were primarily on the edge of the Twin Cities metropolitan area. The MDA continues to operate surface water monitoring stations in southeast and south central Minnesota, in addition to a limited survey of surface water quality in several other watersheds across Minnesota.

The MDA point source cleanup program, including emergency response, the voluntary pesticide cleanup program and the agricultural chemical response and reimbursement account (ACRRA), continue to cleanup sites with similar resources as in FY03.

MDA monitoring program annual reports are available on the MDA web site at www.MDA.state.us/appd/ace/maace.htm.

Please direct any questions on these programs to Dan Stoddard at Dan.Stoddard@state.mn.us or 651-297-8293

Brezonik to step down after 19 years with WRC

Patrick Brezonik will step down this fall from his positions with the Water Resources Center (WRC) at the University of Minnesota. Brezonik was one of the founders of the WRC, its co-director and its Director of Graduate Studies.

Appointed director of the Water Resources Research Center in 1985, Brezonik saw "the potential to build something multidisciplinary, to bring the University's dispersed water faculty together." At that time, The Water Resources Research Center's office housed only its director and a secretary, and its main activities were those of the Water Resources Research Institute Federal Grant Program. Pat founded the *Minnegram* newsletter in 1987, and organized the first biennial water conference, Minnesota Water, in 1988.

Pat was instrumental in starting the graduate studies program, Water Resources Science (WRS). "We were doing a great job here at the University training ecologists, hydrologists, and limnologists, but we weren't training people in the big picture of water resources," he said. WRS began as a graduate minor in 1989 and became an interdisciplinary major in 1995. Today, the program enrolls nearly 80 students and includes faculty from over 25 departments in both the Twin Cities and Duluth.

In 1996, the Water Resources Research Center, the WRS graduate program, the extension Water Quality Program, and the Center for Agricultural Impacts on Water Quality came together in one location as the Water Resources Center. The new co-directors, Brezonik and Jim Anderson, saw the WRC as a place to further the goal of cooperation among water programs at the University. Today, Brezonik says that the WRC has become "more than just a co-location of programs, but a true collaboration." Anderson says "Without Pat's persistence and efforts at developing interdisciplinary programs, neither the WRC nor the WRS programs would be a reality."

Suceeding Brezonik will be Deb Swackhamer, who will join Jim Anderson as co-director of the WRC. Dr. Swackhamer holds her tenure in the School of Public Health. Her background is as an environmental chemist in the Division of Environmental and Occupational Health. She received a M.S. in Water Chemistry in 1981 and a Ph.D in Oceanography and Limnology in 1985 from the University of Wisconsin, Madison. She started her career at the University of Minnesota in 1986.

Adapted from articles in the June 2003 edition of the Minnegram, a quarterly newsletter of the University of Minnesota's Water Resource Center.

MGWA Board Meetings

May 1, 2003

Place: Black Bear Crossings, St. Paul.

Attending: Marty Bonnell, Norm Mofjeld, Eric Hansen, Rob Caho, Chris Elvrum, Jennie Leete, Sean Hunt, Gordie Hess

Approval of Minutes: Minutes for the previous meeting were approved as corrected.

Treasurers report: $450 pass through to Foundation from money donated by members with their dues; $8,400 from MGWA to the Foundation as approved in January; net income of $9,000 was realized from the Spring Conference; transfer of $6,800 from the checking account to the money market account.

Membership: up to 512 following the Spring Conference which is about where it has been in previous years.

Web Page: The groundwater guide created by Tim Thurnblad of the PCA was put up on the MGWA website. A draft of an online form for newsletter comments has been prepared.

Foundation: Funding requests have been made by the Childrens Water Festival, the University of Minnesota and University of Wisconsin River Falls.

— *continued on next page*

Board Minutes, cont.

Spring Conference: There were about 240 attendees. Approximately 100 comments were received mostly positive. We missed an opportunity to give the award for service to Jim Stark at the conference. MGWA Board members will take it up to his office and present it to him there.

Legislative Oversight Process: The process prepared by the Education Committee for providing educational information to decision makers on proposed legislation that had some groundwater aspect was discussed. There was some concern that virtually all groundwater legislation would have more than one side and that the membership would not agree on any one side. If it were strictly used for educating decision makers then it could be valuable. The Board decided to adopt the proposed legislative process initiative on a trial basis to last through the 2004 Legislative Session at which time it would be re-evaluated with the amendment that any decision to submit comment must be voted on by the full Board and must be unanimous.

June 5, 2003

Place: Black Bear Crossings, St. Paul.

Attending: Marty Bonnell, Norm Mofjeld, Eric Hansen, Rob Caho, Chris Elvrum, Jennie Leete, Sean Hunt, Cathy Villas-Horns, Gordie Hess

Approval of minutes: Norm Mofjeld pointed out that his name was misspelled in the May minutes. Motion by Caho second by Hansen to approve the May minutes. Motion passed.

Treasurer's Report: Financial information was distributed to the Board. An invoice was received from WRI for services rendered and will be immediately paid.

Membership: There have been a few additional members signing up but membership typically doesn't increase significantly over the summer.

Foundation: An official request was received from the Children's Water Festival; a check will be sent. A letter was sent to the U of M saying that their request was not in line with the mission of the Foundation. A check will be sent to the University of Wisconsin River Falls for funding for a field trip.

Education: The Education Committee is going to start meeting quarterly instead of monthly. Various projects are ongoing and presentations continue to be given upon request. A description of the outdoor science park was given and the groundwater related aspects were detailed. Due to the involvement of the MGWA Education Committee members, two separate groundwater displays are being considered for the outdoor park. One would be a hand pump and treatment for shallow groundwater which has low level contamination. The other would be a bedrock well used for a drinking fountain. MGWA Members have been willing

— continued on page 23

For Sale:
Almost new ground water sampling equipment. ISCO bladder pump (3 pumps, gas-powered compressor, controller, lines), ISCO peristaltic pump, Reel-EZ Grundfos submersible pump without controller, Keck WL and Interface tapes, ESD turbidity meter, Solomat MPM 4000 multiparameter meter and probes, Geoguard data logger model 32. Asking $3,000. Contact Neal Wilson at Neal.Wilson@pca.state.mn.us

Board Minutes, cont.

to donate time and material and further requests will be made. A request for funding to the Foundation will be prepared.

Newsletter: Sean will provide both a screen optimized and print optimized version of the newsletter beginning with the June newsletter.

Motion by Hansen second by Caho that the newsletter would remain password protected for the current membership cycle. Motion passed. Members would have access to newsletters for the calendar year. Newsletters from the previous years would be available on the web site to nonmembers. So all 2003 issues will be restricted to members only until January 2004.

Motion by Hansen second by Caho that in lieu of the development of an MGWA editorial policy the Board authorizes the newsletter editor to edit submittals for length and content. Motion passed. The Board wants the newsletter team to review how other newsletters handle the issue before writing a policy in the newsletter.

Motion by Bonnell second by Hansen that the Secretary review past minutes for policy decisions for preparation of a policy manual. Motion passed. The Board also requests that the newsletter editor review past newsletters and report to the Board of pertinent information.

Fall Conference: November 10, 2003, at the Earle Brown Center (U of M). The topic will be water conservation. Jennie has reserved an extra room for displays. Marty will organize a conference committee for a meeting in the next couple weeks.

July 10, 2003

Place: Black Bear Crossings, St. Paul

Attending: Marty Bonnell, President; Chris Elvrum, President Elect; Rob Caho, Past President; Eric Hansen, Treasurer; Jon Pollock, Secretary; Jennie Leete, WRI; Sean Hunt, WRI

Approval of Minutes: Minutes for the Regular Board Meeting held on June 5, 2003, were approved by the Board.

Treasurer's Report: $22,602.00 in current cash accounts. Collection efforts have begun on outstanding invoices from fall and spring conferences

Membership: Sean and Jennie have made a draft of the directory.

Web Page: Newsletter online. WRI working on bad email addresses – tracking addresses down to see if they are correct or if they have changed; this work must be done after every mass e-mailing.

Education: On break for summer, but still working on Science Museum project.

Newsletter: June issue on line.

Old Business: Fall Conference: Marty has two speakers lined up and needs help. Meeting to be held immediately after Board Meeting. Fall Field Trip: Sean has written draft

August 6, 2003

Place: Black Bear Crossings, St. Paul

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

Approval of Minutes: Minutes for the Regular Board Meeting held on July 7, 2003, were approved by the Board.

Treasurer's Report: Outstanding invoices from fall and spring conferences have been or are being paid.

Membership: Interpoll corporate membership renewal received.

Web Page: Sean working on field trip info for web page. Have signed up for another year of service from provider.

Foundation: No requests have been received.

Education: Schools are on break for summer, committee working on Science Museum project.

Newsletter: Norm brought up making a CD of past newsletters and bibliography. Board thought newsletter should be preserved. WRI will provide quote for bibliography, enhanced image (OCR, bookmarks, and searchable), and scanned image only.

Old Business: Science Museum. Rotosonic well exhibit will be about $30,000. Education committee looking for money from MGWA and would like to solicit membership. It was noted that any contributions from MGWA should go through Foundation to be certain that donations are tax deductible. Chris will distribute letter to Board members and after approval the letter will be sent on email to the membership. Fall Conference: Regular meetings have started. Volunteers are needed. Fall Field Trip: Brochure is being mailed after the Board Meeting (Board members are affixing labels and stamps during the meeting).

13th GIS/LIS Conference October 8-10, 2003

This year's GIS/LIS Consortium Conference will be in St. Paul, at RiverCentre.

October 8 is workshop day. Workshops will range from introductory to advanced, lecture style to hands-on, and half to full day. After the workshops there will be a conference welcome reception with refreshments, entertainment, and a cash bar.

October 9 will feature an opening plenary session, followed by concurrent sessions throughout the day. These sessions feature GIS practitioners. After the concurrent sessions, there will be a poster display session and an exhibitor reception. GIS maps and posters will display a variety of subjects. Refreshments will be served, and a cash bar will be available. Exhibitors will show off the latest in GIS technology and services.

October 10 will provide additional concurrent sessions as well as additional project and product demonstrations.Friday's lunch will feature a speaker. For more information, you can email **conference2003@mngislis.org**, call 651-203-7242, or visit our website at www.mngislis.org.

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