



Welcome!

Wisconsin Ground Water Association 2013 Annual Meeting

We are honored that you have chosen to spend the day with us, and we hope to provide you with a day filled with interesting presentations, good food and networking opportunities.

Looking for the latest cutting edge research? We have presentations offered from students at UW-Madison, UW-Milwaukee and UW-Oshkosh. A primary mission of WGWA is to encourage and support students entering water-related fields, and we are very pleased to offer presentations from these prestigious state universities.

Need the latest on hot topical issues? We will hear presentations regarding radium in groundwater from 2014 WGWA president-elect Ralph Smith, and Terry Evanson will address the relationship between groundwater contaminant concentrations and vapor intrusion risk. We have a strong contingent of policy and information updates including a new checklist for wellhead protection plans, Wisconsin's water withdrawal and reporting program, and Green Tier and its effect on groundwater quality.

We also have an array of cutting edge science and case studies. We will learn about groundwater dependent ecosystems, groundwater resource management in a shallow aquifer system, municipal well siting issues for the city of Madison, and new techniques for measuring groundwater flow! A couple of special treats this year: Dr. John Jansen, PhD, P.G. and the current McElhiney Lecturer will discuss aquifer sustainability. And we will have a demonstration on sand models as a teaching technique.

We hope you find the presentations stimulating, challenging and useful. We will provide breaks so that you can interact with speakers and network with other attendees. Please plan to join us for a cocktail/social hour after the conference to continue to network with your fellow water professionals.

The annual meeting is a major event for the Wisconsin Ground Water Association and one of our primary functions. Please ask questions of the speakers. Please share your insights and exchange ideas. Please meet someone new; most of all please enjoy the day.

Jim Bannantine

President
Wisconsin Ground Water Association

<http://www.wgwa.org/>



2013 WGWA Annual Meeting

EVENT SPONSORS

Geosyntec 

consultants

engineers | scientists | innovators



NATURAL
RESOURCE
TECHNOLOGY



Saga
Environmental &
Engineering, Inc.



Wisconsin Ground Water Association

2013 Annual Meeting

April 12, 2013

Marriott Milwaukee West Waukesha, Wisconsin

MORNING PROGRAM

7:30 - 8:15	REGISTRATION and NETWORKING	
8:15 - 8:30	Welcome and Introductory Remarks	James Bannantine - WGWA President
8:30 - 9:00	A New Checklist for Preparing Wellhead Protection Plans	Jeff Helmuth, Hydrogeologist – WDNR Norm Hahn, Public Water Engineer – WDNR Andrew Aslesen, Source Water Protection Specialist - Wisconsin Rural Water Association
9:10-9:40	Groundwater Dependent Ecosystems: Connecting Groundwater to the Surface	Troy Thompson, Regional Hydrogeologist - Eastern Region, USFS
9:50 -10:20	An Update on Development of New Techniques for Measuring Groundwater Flow	Steve Sellwood - University of Wisconsin-Madison Department of Geoscience David J Hart - Wisconsin Geological and Natural History Survey Jean M. Bahr - University of Wisconsin-Madison Department of Geoscience
10:20-10:40	NETWORKING BREAK	
10:40 - 11:10	Na-4 Mica - A Synthetic Clay Acting as a Ceramic Water Filter and More (Storage and Disposal) for Radium and Strontium, etc. (A Groundwater Story)	Ralph Smith, Hydrogeologist, WGWA President Elect
11:20 - 11:50	Groundwater Resource Management in a Shallow Aquifer System	Kurt O. Thomsen, PhD, PG - KOT Environmental Consulting, Inc.
11:50 -1:10	LUNCHEON & KEYNOTE	
	Keeping the Pump Primed: Aquifer Sustainability, John Jansen, PhD, PG	



ABOUT JOHN JANSEN, PhD, PG

John Jansen, Ph.D., PG, a principal and senior hydrogeologist for Cardno ENTRIX is the 2013 McElhiney Lecturer. He works on a wide variety of groundwater projects around the country, specializing in high-capacity wells and groundwater resource management. Formerly a partner in a Denver-based water rights company and the chief geoscientist for an international drilling company, he has broad experience in well construction and maintenance, as well as water rights issues. He is presenting Keeping the Pump Primed: Aquifer Sustainability.



AFTERNOON PROGRAM

1:10 - 1:40	Wisconsin's Water Withdrawal Inventory and Reporting Program	Robert A. Smail – WDNR
1:50 - 2:20	Municipal Well Siting in Madison: From Public Participation to Pumping Tests	Eric Oelkers, PG - SCS Engineers
2:20 - 2:40	NETWORKING BREAK	
2:40 - 3:10	Use of Groundwater Concentration Screening Levels to Assess Vapor Intrusion Risk	Terry Evanson, Hydrogeologist - WDNR
3:20 - 3:50	What is Green Tier and How has it Improved Water Quality in Wisconsin	Christine F Lilek, PG, CPG
4:00 - 4:30	Sand Model Demonstration	Kathi Ried - CH2M Hill
4:30 - 5:30	POSTERS AND SOCIAL HOUR	

POSTER PRESENTATIONS

Source Water Protection Planning using Chemical Testing for Nitrate Source Analysis and the Implications for Local Land Use and Planning Decisions	Andrew D. Aslesen - Wisconsin Rural Water Association Paul McGinley - Center for Watershed Science & Education
Hydrogeology of the Mink River Estuary, Door County, WI: Geologic Controls on Spring Locations	Kylie Larson-Robld and Maureen Muldoon – Department of Geology - UW Oshkosh Kenneth Bradbury and Aaron Pruitt, Wisconsin Geological and Natural History Survey
Minimizing the Effects of a Drained Wetland and Agriculture on Rock Lake: Source Investigation and Mitigation Strategies	Heather Davis, Katie Van Gheem and Ian Anderson – Nelson Institute for Environmental Studies, UW – Madison
An Initial Hydrogeophysical Investigation of the Cedarburg Bog	Michael S. Baierlipp, Geosciences Department, UW-Milwaukee, Milwaukee WI, David J. Hart, Wisconsin Geologic and Natural History Survey, Madison, WI Joanne Kline, Wisconsin Department of Natural Resources, Milwaukee, WI, William F. Kean, Geosciences Department, UW-Milwaukee, Milwaukee, WI

A NEW CHECKLIST FOR PREPARING WELLHEAD PROTECTION PLANS

JEFF HELMUTH, DNR HYDROGEOLOGIST

NORM HAHN, DNR PUBLIC WATER ENGINEER

ANDREW ASLESEN, SOURCE WATER PROTECTION SPECIALIST, WISCONSIN RURAL WATER ASSOCIATION.

The Wisconsin Department of Natural Resources has developed a checklist (DNR Form No. 3300-272) to help wellhead protection (WHP) plan preparers address all plan requirements as specified in s. NR 811.12 (6), Wis. Adm. Code. The checklist is required to be submitted along with all required WHP plans (plans are required for all new municipal wells constructed since May 1, 1992). The checklist guides plan preparers through the WHP planning process and assures that no essential elements are neglected. It also gives references for additional resources and useful tools. The checklist is now available on DNR's website:

<http://dnr.wi.gov/topic/DrinkingWater/WellheadProtection/>. The checklist is fillable from a computer.

This talk is one in a series designed to introduce the new checklist and train people on its use. The new checklist will expedite the approval process by insuring WHP plans meet NR 811 requirements when they are submitted.

NOTES

GROUNDWATER-DEPENDENT ECOSYSTEMS: CONNECTING GROUNDWATER TO THE SURFACE

Troy Thompson
Regional Hydrogeologist - Eastern Region
U.S. Forest Service

There has been a common, long-held belief or sense among many people that groundwater and the surface are completely separate realms. Even practicing surface water hydrologists may effectively treat or even see the two as separate. Finding a way to make this connection and demonstrate the importance of groundwater to traditional land management practices was the challenge faced by USFS hydrogeologists. Their solution was to begin with a visible example of the direct connection between the two: groundwater-dependent ecosystems or GDEs. These ecosystems represent a critical, but, until relatively recently, poorly recognized part of the overall surface ecosystem. Ranging from small patches of life around springs in otherwise arid environments to vast fens in the more humid parts of the country, they often support threatened and endangered species and critical habitats that could be harmed or destroyed by land management activities and proposed groundwater uses that fail to recognize them. To help the national forests better recognize and manage these ecosystems, and the importance of groundwater overall, USFS hydrogeologists have developed two state of the art field protocols for identifying and documenting GDEs. These protocols were developed through extensive reviews of the literature, consultation with experts, and field testing of techniques in a variety of GDE environments located across the United States. The level 1 protocol enables a small team of people with a basic understanding of the physical and biological sciences to systematically develop an initial inventory of GDEs. The level 2 protocol uses the expertise of specialists in hydrology, soil science, and botany to develop more detailed descriptions and inventories of GDEs deemed to be of critical importance or that could potentially be impacted by proposed activities.

NOTES

AN UPDATE ON DEVELOPMENT OF NEW TECHNIQUES OR MEASURING BOREHOLE FLOW

Steve Sellwood, University of Wisconsin – Madison Department of Geoscience
David J. Hart, Wisconsin Geological and Natural History Survey
Jean M. Bahr, University of Wisconsin – Madison Department of Geoscience

Measurements of fluid flow in a well or borehole provide valuable information about the adjacent formations, including the presence of permeable features such as fractures, the presence of aquitards, and whether flow is upward or downward. Borehole flow data are useful in evaluating the potential for wells or open boreholes to act as conduits for vertical contaminant migration. In addition, borehole flow data can be used to infer the direction of vertical flow in the adjacent aquifer.

We have researched the use of a simple, economical method for measuring flow in groundwater wells. The equipment consists of an electric heater that induces a heat pulse into the water column, and a submersible temperature measurement device. The heater consists of a 2000 watt cartridge heater, shrouded in a perforated steel housing, and attached to electrical cable. The heater runs on a 2000 watt generator. Temperature measurements can be made with a variety of instruments designed to measure water temperature. Results of our research with this equipment have identified some constraints on the use of heat as a fluid flow tracer, but suggest potential value of this technique with future refinements.

Our research has also included the use of a Distributed Temperature Sensing (DTS) system to monitor in-well heat tracer tests. We used DTS monitoring and the downhole electrical heater to profile the open portion of several bedrock wells. Using this system we were able to identify important flow characteristics in the wells, including borehole flow direction, velocity, and locations of inflows and outflows. The results indicate that DTS monitoring of induced heat pulses is an effective (although not low cost) method for detailed borehole flow regime characterization.

NOTES

NA-4 MICA – A SYNTHETIC CLAY ACTING AS A CERAMIC WATER FILTER AND MORE (STORAGE AND DISPOSAL) FOR RADIUM AND STRONTIUM, ETC. (A GROUNDWATER STORY)

**Ralph Smith, Hydrogeologist
WGWA President-Elect (2013) and President (2014)**

Wells with high radium levels from aquifers in Wisconsin, Minnesota, Iowa, Illinois, Missouri and the Mid-Atlantic States are negatively impacting drinking water and wastewater, etc. “Na-4 mica” (via kaolinite clay) is a synthetic clay. The synthetic clay of Professor Komarneni and his research team at PSU is cheaper (by about half) and better at removal and storage of Radium ($^{224,226,228}\text{Ra}$) from drinking water, groundwater, and wastewater. Removal of Ra is via conventional ion exchange systems and/or Permeable Reactive Barriers (PRBs), & permeable clay liners. This ceramic water filter is superior for other divalent metals ($^{90}\text{Sr}^{2+}$, Ba^{2+} , Co^{2+} , Ni^{2+} , Zn^{2+} , and Cu^{2+}) – from cradle to grave

NOTES

GROUNDWATER RESOURCE MANAGEMENT IN A SHALLOW AQUIFER SYSTEM

**Kurt O. Thomsen, Ph.D., PG
KOT Environmental Consulting, Inc.**

In northern Illinois and southern Wisconsin the shallow aquifer system includes the glacial drift deposits and the underlying bedrock. Groundwater from this system is used to augment municipal supplies from the deep aquifer system, for irrigation and for domestic supplies. The shallow aquifer system is also extremely susceptible to mismanagement. Management of this system entails striking a balance between consumption, recharge and discharge. KOT Environmental Consulting, Inc. (KOTECI) recently completed a hydrogeologic study of a 600 square mile area centered on the Village of Barrington, Illinois for the Barrington Area Council of Governments (BACOG). This study defined the glacial drift materials of the area and mapped the distribution of aquifer materials. Using this information, the location of glacial drift aquifers and an estimate of the total and the available amount of groundwater in the study area was established. This paper describes the approach KOTECI developed for BACOG's management of the shallow aquifer system groundwater resource to ensure resource sustainability.

NOTES

--

KEEPING THE PUMP PRIMED: AQUIFER SUSTAINABILITY

JOHN JANSEN, PH.D., PG

How will your groundwater resources fare in the future and how will that affect your business? How can we ensure the sustainability of our aquifers through sound science? How should groundwater contractors and scientists confront economic and political challenges affecting the resource that is pivotal to the success of their businesses? How is “sustainability” defined and what tools and strategies can be used to protect groundwater systems as well as those who obtain and develop it? What information must be gathered and compiled to build consensus and present a compelling case to regulators and policymakers?

By attending John Jansen’s presentation, you will gain an understanding of:

- How several different definitions of “sustainability” apply to the management of an aquifer, and how these different definitions may affect your business
- States’ varying approaches to aquifer management, reflecting their local conditions and history — with specific considerations of how the approach in your state affects you and your business
- How regulatory practices are evolving, and why they must balance local economic and political realities with environmental needs to be accepted and successful
- Meaningful ways that you provide information and build consensus, to help the regulatory evolution move in a positive direction
- Steps needed for successful management from all perspectives.

Currently, there are states that manage aquifers by pumping to balance groundwater recharge, which can cause stream depletion. Others limit pumping to protect surface flows, which can have negative economic impacts. Yet still others manage aquifers for controlled depletion in recognition of the severe economic disruption that would occur from either stricter goals or a lack of any planning and management. Many western states manage aquifers to protect surface water rights, while others ignore the connection between surface water and groundwater. Some eastern states seek the use of a hybrid “regulated riparian” approach to balance the free use of water with a reasonable use standard. What are the impacts of these approaches to your local groundwater industry and the reliability of water resources in the future?

No one can control, manage, or sustain what is not measured, so monitoring is the first step needed to ensure success. Monitoring can identify aquifers being used in an unsustainable manner and that information can be used to build information and consensus to find remedies to sustain groundwater systems as well as the industries and businesses that rely on them. One example of this is the deep sandstone aquifer of northern Illinois and southeastern Wisconsin, where decades of overpumping have created one of the largest cones of depression in the world. Both states have conducted detailed studies of the aquifer and have begun regional planning to control the human and environmental impacts. Other regional examples from around the country will be presented, and an emphasis will be given to the local conditions and issues of the McElhiney Lecture host organization.

NOTES

WISCONSIN'S WATER WITHDRAWAL INVENTORY AND REPORTING PROGRAM

Presentation Abstract

Robert A. Smail, Wisconsin Department of Natural Resources,
Robert.smail@wisconsin.gov

In 2008, the Wisconsin DNR undertook an effort to inventory and register high capacity groundwater and surface water withdrawals in the state. Furthermore, it expanded its effort to collect withdrawal reports from owners and operators of these sources. As a result, the state now has withdrawal data available for over 11,000 withdrawals from more than 5,000 properties capable of withdrawing greater than 100,000 gallons per day. This includes a range of users such as public water utilities, electrical power producers, irrigators, paper manufacturers and cranberry growers.

Detailed results will be presented from 2011 in which over 11,000 withdrawal reports were collected over 90% of all sources. Results of these reports will be presented demonstrating seasonal and spatial withdrawal trends as well as differences in withdrawals across water uses. In addition, this presentation will demonstrate tools and methods currently available and in-development for sharing withdrawal data with businesses, consultants, NGOs and local governments.

NOTES

MUNICIPAL WELL SITING IN MADISON: FROM PUBLIC PARTICIPATION TO PUMPING TESTS

Eric Oelkers, PG – SCS Engineers, Madison, Wisconsin

The city of Madison operates the largest groundwater-sourced municipal water system in Wisconsin with total withdrawals of more than 10 billion gallons per year from 22 active wells. As Madison has grown, the process for selecting sites for new wells has become more complex. Thirty years ago, the Madison Water Utility could simply require that a parcel of land in a new plat or subdivision be dedicated for the construction of a well; now the Utility must buy land on the open market. In 2008, the Utility responded to increasing public interest in water utility operations and drinking water quality issues and developed a formal public participation process for major projects. Until recently, test wells were drilled at only some well sites to identify the length of well casing needed; now test wells are drilled to assess water quantity and quality before a potential well property is purchased. New well sites must also be sized to allow the construction of future treatment facilities in addition to the well house and reservoir. A case study of SCS' project to site a new public water supply well on the southeast side of Madison demonstrates the many facets of the current site selection process.

NOTES

USE OF GROUNDWATER CONCENTRATION SCREENING LEVELS TO ASSESS VAPOR INTRUSION RISK

**Terry Evanson, Hydrogeologist
Wisconsin DNR, Bureau for Remediation & Redevelopment**

Most vapor intrusion guidance documents emphasize the use of multiple lines of evidence to establish whether vapor intrusion may be a risk to building occupants. These documents also provide methods of screening for vapor migration. Contaminant concentration in water table wells is one of the first lines of evidence that consultants rely upon to determine if further investigation of the vapor pathway is warranted and/or how far to extend the vapor investigation. Yao, et.al., have recently discussed factors contributing to variability in groundwater concentration (C_{gw}) to sub-slab vapor concentration (C_{ss}) attenuation factors and concluded that groundwater contaminant source uniformity, soil moisture levels and lateral diffusion may all contribute to order of magnitude or greater variability. This paper will examine several vapor intrusion investigations in Wisconsin where groundwater concentrations and sub-slab vapor concentrations have been measured. The ability to predict risk of vapor intrusion (as measured by C_{ss}) in light of data variability and current groundwater vapor risk screening levels will be discussed.

NOTES

WHAT IS GREEN TIER AND HOW HAS IT IMPROVED WATER QUALITY IN WISCONSIN?

Presentation Abstract

Christine F Lilek PG, CPG



The Wisconsin Green Tier law, s. 299.83, established on April 16, 2004 and expanded in June 2012, has provided Wisconsin communities and businesses a framework for economic growth and superior environmental performance. By adopting innovative best management practices (BMPs), these Green Tier communities and businesses have improved water quality throughout Wisconsin. Municipalities have found ways to: decrease water use, minimize storm water runoff impacts, beneficially reuse wastewater, and protect and restore wetlands. Businesses have found ways to: filter and reuse water, safely store and beneficially reuse wastewater, and manage their traffic and property land use to minimize soil erosion. This presentation will walk through the biennial Green Tier progress reports, showcase these water quality improvements and encourage others to follow in their superior environmental footprint!



NOTES

SAND TANK MODEL DEMONSTRATION

Kathi Ried, CH2M HILL



Two WGWA models available for your use

Eastern Wisconsin Model

Kathi Ried
CH2M HILL
(414)847-0464
kathi.ried@ch2m.com

Western Wisconsin Model

Lori Rosemore
Ayres Associates
(715)834-3161
rosemorel@ayresassociates.com

SOURCE WATER PROTECTION PLANNING USING CHEMICAL TESTING FOR NITRATE SOURCE ANALYSIS AND THE IMPLICATIONS FOR LOCAL LAND USE AND PLANNING DECISIONS

**ANDREW D ASLESEN, WISCONSIN RURAL WATER ASSOCIATION,
PLOVER, WI, ANDREW@WRWA.ORG**

**PAUL MCGINLEY, CENTER FOR WATERSHED SCIENCE & EDUCATION,
STEVENS POINT, WI, PAUL.MCGINLEY@UWSP.EDU**

Source water protection planning helps prevent contaminants from entering public water supply wells by appropriately managing the land that contributes water to the well(s). One of the most prevalent contaminants in private and public water supplies is nitrate. A variety of land uses can lead to elevated concentrations of nitrate in groundwater and the source of nitrate contamination is not always easy to pinpoint. In one Wisconsin community, wellhead protection planning identified an increasing trend in nitrate concentrations in one of the community's municipal water supply wells. Groundwater flow modeling indicated the well's capture zone included several large septic system drainfields. In order to help determine if the septic systems are contributing nitrate contamination to the municipal well, a nitrate source analysis was conducted by testing for a group of contaminants that are likely indicators of septic system contamination. . The analysis found caffeine and several artificial sweeteners present in the water. The presence of these constituents indicates that the water is likely being impacted by up gradient septic systems. The combination of source water protection evaluation and nitrate source analysis have given the local decision makers several tools to make land use and development decisions which will ensure a safe drinking water supply for the community.

NOTES

HYDROGEOLOGY OF THE MINK RIVER ESTUARY, DOOR COUNTY, WI: GEOLOGIC CONTROLS ON SPRING LOCATIONS

**Kylie Larson-Robl and Maureen Muldoon, Department of Geology,
University of Wisconsin Oshkosh
Kenneth Bradbury and Aaron Pruitt, Wisconsin Geological and Natural
History Survey,**

Located near the tip of the Door Peninsula, the Mink River Estuary (MRE) is one of the most pristine freshwater estuaries in the United States and it provides habitat to many endangered and threatened species, including the Hine's emerald dragonfly. The MRE is dominated by groundwater discharge through springs and seeps thus making groundwater quality and quantity critical to the long-term health of the estuary. The importance of springs to the MRE has long been recognized, however, there as has been little detailed characterization of the springs themselves or the underlying flow system.

We hypothesize that spring locations are controlled by two factors: depth to bedrock and the location of high-permeability bedding plane fractures in the underlying carbonate bedrock aquifer. Spring locations were identified in the winter of 2012 when much of the estuary was iced over. Detailed spring inventory data were collected during the summer of 2012. Depth to bedrock was determined using a combination of surface geophysical methods and hand coring using a Russian peat corer. While some springs are located in areas of shallow bedrock, other springs are located where there is >25 ft of low-permeability marl sediments. Geophysical data collected from four bedrock wells that surround the estuary were used to identify high-permeability bedding plane fractures within the carbonate bedrock aquifer. Well-to-well correlations based on these borehole geophysical data suggest that hydraulically-important bedding-plane fractures are important conduits for groundwater discharging at the springs, especially the springs located in areas with thick accumulations of marl.

NOTES

**MINIMIZING THE EFFECTS OF A DRAINED WETLAND AND
AGRICULTURE ON ROCK LAKE: SOURCE INVESTIGATION AND
MITIGATION STRATEGIES**

Heather Davis
Katie Van Gheem
Ian Anderson

Nelson Institute for Environmental Studies, UW – Madison

NOTES

A large, empty rectangular box with a thin black border, occupying the lower half of the page. It is intended for handwritten or typed notes related to the document's content.

AN INITIAL HYDROGEOPHYSICAL INVESTIGATION OF THE CEDARBURG BOG

Michael S. Baierlipp, Geosciences Department, UW-Milwaukee, Milwaukee WI
David J. Hart, Wisconsin Geologic and Natural History Survey, Madison, WI
Joanne Kline, Wisconsin Department of Natural Resources, Milwaukee, WI,
William F. Kean, Geosciences Department, UW-Milwaukee, Milwaukee, WI

The Cedarburg Bog, located in western Ozaukee County, Wisconsin is the southern most bog of its type in North America. The Bog consists of a wide range of ecosystems and provides important wildlife habitats including areas for endangered species. However, the controlling geology and hydrogeology of the area that is important for maintaining this ecosystem is poorly understood. For this reason geophysical studies were initiated to gain a better understanding of the subsurface lithologies. Electrical conductivity (EM) and electrical resistivity tomography (ERT) surveys were completed at the north, south and center sections of the Bog, while one seismic refraction survey was performed along the south side of the Bog. The depths of investigation vary from 3 meters to 20 meters depending on the method.

The results indicate variations in the geological environments among the three sections. The results from the northern area along Highway 33 show irregular lithologies consistent with hummocky topography and possibly paleochannels of coarse grain sediments. The two islands in the center section accessible from the boardwalk appear to be one feature and may have extended to the upland area to the west partially dividing the Bog creating different ecosystems to the north and south. Based on the seismic studies and the ERT results bedrock presumably of Silurian dolomite, is within 2 meters of the surface along sections of Cedar Sauk Rd. The presence of this bedrock high along the south side of the Bog may have limited drainage to the south and help promote the formation of the Bog.

NOTES

