# PRESENTATION SUMMARIES & SPEAKER BIOGRAPHIES

**Minnesota Ground Water Association**
**Virtual Spring Conference 2021 – April 27, 2021**

## Groundwater Research: What's New *and* Useful?

**Peter K. Kang**
Department of Earth & Environmental Sciences, University of Minnesota – Twin Cities

### From Mapping Injection Capacity of Aquifer Storage and Recovery Sites to Predicting Solute Transport in Fractured Aquifers

**Presentation**

- Introducing aquifer storage and recovery and the importance of injection capacity estimation
- Injection capacity estimation tool & Application to several aquifers in Minnesota
- Introducing the challenges of predicting solute transport in fractured aquifers
- Stochastic transport modeling framework & Application to 3D fracture network systems
- Limitations and outlook

**Education**
Ph.D. (Hydrology), Massachusetts Institute of Technology, 2014
M.A. (Hydrology), Massachusetts Institute of Technology, 2010
B.A. (Civil & Environmental Engineering), Seoul National University, 2008

**Experience**
2018-present, University of Minnesota – Twin Cities (McKnight Land-Grant Assistant Professor and a Gibson Chair of Hydrogeology)
2015-2018, Korea Institute of Science and Technology (Researcher)
2014-2015, Massachusetts Institute of Technology (Postdoc)

**Affiliations**
American Geophysical Union (AGU)
International Society for Porous Media (InterPore)
Minnesota Ground Water Association (MGWA)

## Melinda L. Erickson
U.S. Geological Survey, Upper Midwest Water Science Center – Minnesota office

### What have we learned from 60,000 arsenic measurements in new wells? A lot!

**Abstract**
Geogenic (geologic-sourced) arsenic is common at high concentration (>10 µg/L) in Minnesota groundwater. Chronic exposure to high levels of arsenic through drinking water can cause certain cancers, skin abnormalities and other adverse human health effects. More than one million people in Minnesota (1 in 5 people) depend on groundwater from domestic wells as their source of drinking water. In Minnesota, an estimated 1 in 7 domestic well users (≈150,000 people) use groundwater sources with arsenic concentrations exceeding 10 µg/L (the U.S. Environmental Protection Agency's drinking water standard), and about half (≈500,000 people) have detectable arsenic in well water. Because high arsenic concentration is so common in Minnesota well water, the well construction code was changed in 2008 to require testing for arsenic in new drinking water wells. Approximately 60,000 arsenic measurements from new wells have been recorded so far.

The U.S. Geological Survey and the Minnesota Department of Health recently completed collaborative research to evaluate the effect of sampling protocols on measured arsenic concentrations in new domestic wells and to better delineate and help explain groundwater arsenic concentrations in Minnesota through space and time. The study design included comprehensive geochemical sampling at newly constructed domestic wells with two rounds of follow-up sampling 6 months and a year after well construction, and development of a statistical model to predict high arsenic in groundwater.

Study results characterized new well sampling protocols that reduce sample result variability, identified factors affecting arsenic mobilization, detected shortcomings in arsenic speciation sample preservation and laboratory protocols, modeled and mapped the spatial distribution of high groundwater arsenic in parts of Minnesota, and identified potential ways to drill domestic drinking water wells with a lower risk of high arsenic. Five recent journal articles present our major results (links to articles available **here**).

**Experience and Education**
Dr. Melinda (Mindy) Erickson is a research hydrologist with the USGS and adjunct associate professor at the University of Minnesota. Prior to joining USGS in 2009, Dr. Erickson worked for an environmental consulting company and state environmental agencies. Her primary research interest is the occurrence, geochemistry, fate, and transport of geogenic constituents (e.g., arsenic, iron, manganese) in groundwater in glacial and bedrock aquifer systems. Dr. Erickson has a B.S., M.S., and Ph.D from the University of Minnesota.

**Jessica Meyer**
University of Iowa

**A multidisciplinary approach to characterizing overlapping heterogeneities controlling a mixed organics contaminant plume in glacial sediments**

Co-authors: Tara Harvey, Emmanuelle Arnaud, Colby Steelman, Beth Parker

**Abstract**

At a site in south central Wisconsin, releases of non-aqueous phase liquids prior to 1970 created a complex NAPL source zone in Quaternary glacial sediments and shallow Paleozoic bedrock. Five decades of groundwater flow through the source zone created a dissolved phase plume migrating through the glacial sediments and discharging to a pond and drainage ditch. The precise contaminant migration pathways and their variability through time from the source zone to the pond were poorly understood. Our objective was to improve the conceptual site model (CSM) by quantifying the interaction between the groundwater system and the pond and characterizing the contaminant distribution. To achieve this objective, a variety of high resolution geological, geophysical, hydraulic, and geochemical data sets were collected along two transects just upgradient of the pond and along a longsect from the source zone to the pond.

The results showed a notable absence of aquitards in the glacial sediments, mild to moderate heterogeneity in the flow system, and a high degree of heterogeneity in the contaminant distribution. The discrepancy between the relatively simple flow system conditions and complex contaminant distribution is most like due to the overlapping influence of complex NAPL source zone architecture and subtle differences in degradation along adjacent flow paths rather than large differences in flow path residence times. This type of insight is critical to acquiring the right type and scale of additional data needed to develop CSMs that can be used as the basis for predictive modeling and management tools.

**Education**

Ph.D. (hydrogeology), University of Guelph, 2013
M.Sc. (hydrogeology), University of Waterloo, 2005
B.S. (geology), University of MT, 2002

**Experience**

2018-present, Assistant Professor, University of Iowa
2017-2018, PhD Research Associate, G360 Institute for Groundwater Research, University of Guelph
2013-2016, Postdoctoral Fellow, G360 Institute for Groundwater Research, University of Guelph
2008-2013, Senior Project Manager, G360 Institute for Groundwater Research, University of Guelph
2005-2008, Research Associate, University of Waterloo

**Affiliations**

National Groundwater Association
International Association of Hydrogeologists
Geological Society of America (GSA)
American Geophysical Union (AGU)

## Colby Steelman
University of Waterloo

### Can geophysics really be used to understand hydrogeological problems?

**Presentation**

- Geophysics can be a powerful tool in a hydrogeologist's tool kit – but…
- It can be oversold or misleading when the limitations are not understood
- Scale is very important to geophysicists and hydrogeologists – however they often do not overlap
- Integration of geophysical, geological, and hydrogeological communities continues to strengthen

**Education**

Ph.D. (Earth Science), University of Waterloo, 2012
B.Sc. (Earth Science, Geophysics specialization), University of Waterloo, 2007

**Experience**

2018-present, Lecturer, Department of Earth and Environmental Science, University of Waterloo, Canada
2012-2018, Postdoctoral Fellow and Research Associate, G360 Institute for Groundwater Research, University of Guelph, Canada. Colby Steelman's research focuses on the dynamic processes of groundwater flow systems. Specific interests include geophysical characterization and monitoring of groundwater process dynamics and their importance in regional flow systems. Recently, he is exploring surface and airborne geophysical techniques that support regional-scale groundwater resource characterizations, and how these styles of data can be integrated into conventional groundwater monitoring strategies.

**Affiliations**

Association of Professional Geoscientists of Ontario (APGO)

**John L. Nieber**
University of Minnesota

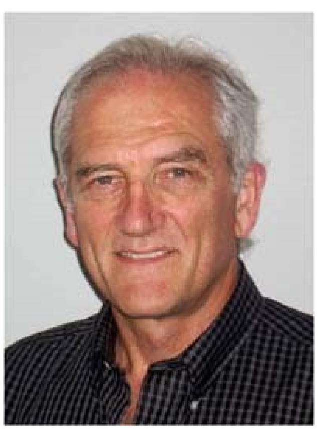
### The spatial and temporal distribution of total terrestrial water storage in the region extending from the Twin Cities to Moorhead, Minnesota

**Abstract**
The water stored in lakes, wetlands, streams, soil, and groundwater plays a critical role in the functioning of the ecosystems of the earth and human well-being. During a three-year project we developed estimates of terrestrial water storage in a region covered by 17 HUC-8 watersheds located between the Twin Cities Metro and Moorhead. Annual storage estimates were made using data from observation wells, soil moisture monitoring sites, lake levels, and the national wetland inventory, and independently by data from the GRACE satellite and by water balance calculations. The estimates of water storage were made on an annual basis. Estimated changes in water storage with time were found to be consistent across these different approaches.

**Education**

| | | | |
|---|---|---|---|
| Syracuse University | Forest Engineering | B.S. | 1972 |
| Cornell University | Civil and Environmental Eng. | M.S. | 1974 |
| Cornell University | Agricultural Engineering | Ph.D. | 1979 |

**Experience**
2015 – present, Professor, Bioproducts and Biosystems Engineering, and Co-DGS, WRS graduate program, Univ. of MN
2013 – 2015, Professor, Bioproducts and Biosystems Engineering, Univ. of MN
2012 – 2013, Professor and Interim Head, Bioproducts and Biosystems Engineering, Univ. of MN
1995 – 2012, Professor Bioproducts and Biosystems Engineering, Univ. of MN.
1985 – 1995, Assoc. Professor Agr. Eng. Dept., Univ. of MN.
1979 – 1985, Asst Professor, Agr. Eng. Dept., Texas A&M Univ.
1975 – 1979, Graduate Res. & Teaching Asst. Agr. Eng. Dept., Cornell University
1973 – 1975, Res. Techn. Agr. Eng. Dept., Cornell Univ.
1972 – 1973, Teaching Asst. Civil & Envir. Eng., Cornell Univ.



**Crystal Ng**
University of Minnesota-Twin Cities

## "First We Must Consider Manoomin": Tribally Directed Collaborative Research on Wild Rice

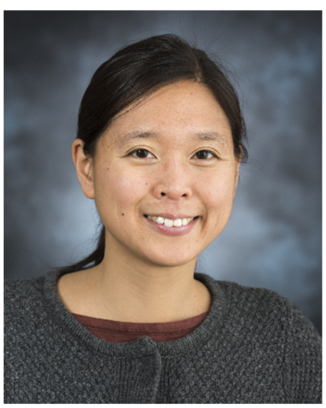
**Abstract**
Manoomin (in Ojibwe), or wild rice, is central to the culture and diet of many Native people throughout the Upper Great Lakes region. Sulfate entering our lakes and streams from mining discharge poses a critical threat, but there are many factors affecting the well-being of this sacred plant and its environment. Native people who have lived with manoomin for generations understand this intimately, but tribal views and resource rights have not been adequately incorporated into research and management of manoomin. Our project adopts a collaborative approach that prioritizes tribal values and knowledge.

**Education**
PhD, Environmental Engineering, Massachusetts Institute of Technology, 2009
BA, Applied Mathematics, Harvard University, 2003

**Experience**
2014-present: University of Minnesota-Twin Cities, Dept. Earth and Environmental Sciences (2020-present: Associate Professor, 2014-2020: Assistant Professor)

2000-2014: US Geological Survey, Menlo Park, CA (2012-2014: Research Hydrologist, 2000-2001: Mendenhall Postdoctoral Fellow)

**Affiliations:**
American Geophysical Union
Minnesota Ground Water Association



**Bonnie Keeler**
University of Minnesota Humphrey School of Public Affairs

## The Social Cost of Groundwater Pollution

**Abstract**
Contaminated groundwater affects multiple ecosystem services, including public health, treatment costs, and property values. A combination of biophysical and socioeconomic factors determine the risk, vulnerability, and cost of groundwater pollution, which means that the costs are not distributed equally. This talk will review recent findings on the economic value of groundwater protection, equity implications of water pollution, and insights from statewide surveys on water values in Minnesota.

**Experience and Education**
Dr. Keeler is an Assistant Professor at the University of Minnesota's Humphrey School of Public Affairs, where she is affiliated with the Center for Science, Technology, and Environmental Policy, the Institute on the Environment, and the Natural Capital Project. Dr. Keeler works at the intersection of sustainability science and environmental economics, with particular expertise in water management and policy. At the Humphrey School, Keeler's team partners with state and federal agencies, community-based organizations, and other stakeholders to co-develop solutions to environmental challenges. Current projects include investigating the impacts of climate change on water resources, mitigating the effects of green gentrification in cities, and developing new approaches to quantify the economic value of water resources. Dr. Keeler has an M.S. and Ph.D from the University of Minnesota and a BA from Colorado College.

**Jens Blotevogel**
Department of Civil and Environmental Engineering
Colorado State University

## Destructive Treatment Train Solutions for PFAS

**Presentation**

- Current treatment solutions for PFAS-contaminated water
- PFAS treatment technologies in development
- PFAS removal versus destruction and the need for treatment trains
- Case studies

**Education**

Ph.D. (Environmental Chemistry), Colorado State University, 2010
Dipl.-Ing. (Environmental Engineering), Technical University Berlin, 2004.

**Experience**

2010 – present, Colorado State University (Research Assistant Professor)
2004 – 2007, Arcadis (Project Engineer Groundwater Remediation)

**Affiliations**

American Chemical Society (ACS)
National Groundwater Association (NGWA)
University Consortium for Field-Focused Groundwater Research

**David Hart**
Wisconsin Geological and Natural History Survey

## Low cost and easy instrumentation for groundwater/surface water measurements

**Abstract**
The advent of low cost easily programmed microcontrollers with a wide user base and use of heat as a tracer has provided us an opportunity to develop instrumentation to measure groundwater/surface interactions. I will provide several examples of instrumentation and results and will discuss some successes as well as issues we've encountered. The result has been an expansion of our tool kit for characterizing groundwater/surface water interactions.

**Education**
PhD (Geoophysics), UW-Madison, 2000
Masters (Geophysics), UW-Madison, 1994
BA (Physics, Mathematics), Luther College, 1986

**Experience**

| | |
|---|---|
| 2001-present | Hydrogeologist/Geophysicist, Wisconsin Geological and Natural History Survey, Madison, WI 100% Extension appointment. |
| 2014 | Visiting Professor, University of Tokyo |
| 2000-2001 | Post-Doctoral Research Associate, Geology and Geophysics, UW-Madison |

**Affiliations**
Geological Society of America (GSA)
American Geophysical Union (AGU)

**Randy Hunt**
US Geological Survey, Upper Midwest Water Science Center

## New tools and approaches for groundwater problems

### Presentation

1) Why groundwater? What Models?

2) Advances in recharge estimation - improvements to SWB version 2

3) Advances in model code - MODFLOW6 strengths

4) Advances in model construction - Automated model construction SFRmaker and Linesink-maker

5) Advances in model calibration and uncertainty analyses - PEST++ Version 5

### Experience and Education

Dr Randy Hunt is a Research Hydrologist and Chief Science Officer at the United States Geological Survey's Upper Midwest Water Science Center. His research uses a variety of approaches such as computer modelling and ion and isotope chemistry to investigate groundwater systems. His work has emphasized a range of groundwater-surface water settings including wetlands, streams, and lakes. His work also includes investigation of ecohydrology, spanning areas such as effects of water on aquatic biotic/ecologic communities to how pathogens affect drinking water supplies. He serves as head of the USGS TC Chamberlin Modeling Center, a resource specializing in application of advanced computing to water science. As Chief Science officer, Randy overseas the water science programs of the USGS in Wisconsin, Minnesota, and Michigan. Randy has an M.S. and Ph.D from the University of Wisconsin Madison, and a B.A. from Gustavus Adolphus College.