

Utility of MGWA White Papers

Carrie E. Jennings and David Crisman
White Paper Committee



Manganese in Minnesota's Groundwaters

Emphasizing the Health Risks of Manganese in Drinking Water

September 2015

Manganese white paper work group members:

Dr. Mindy Erickson, US Geological Survey, chairperson

Bill Bangsund, Barr Engineering

Meghan Blair, Barr Engineering, lead writer

Vanessa Demuth, Dakota County

Dr. Sarah Johnson, Minnesota Department of Health

Linse Lahti, Minnesota Department of Natural Resources

Dave Lowell, retired

Jim Lundy, Minnesota Department of Health

White Paper Committee liaisons:

Mark Collins, retired

Bruce Olsen, retired

Other contributors:

Jeff Hill, Robert B. Hill Company

Prof. Patricia McGovern, University of Minnesota

Kate Sande, ECOLAB

Rich Soule, Minnesota Department of Health

Lisa Yost, ENVIRON International Corporation

From widespread nuisance to health risk

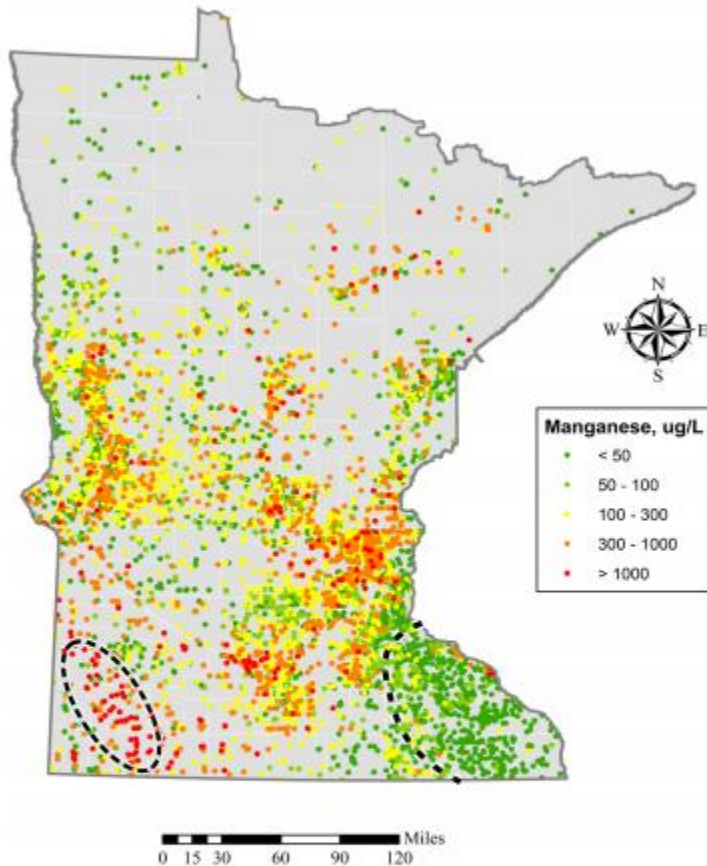
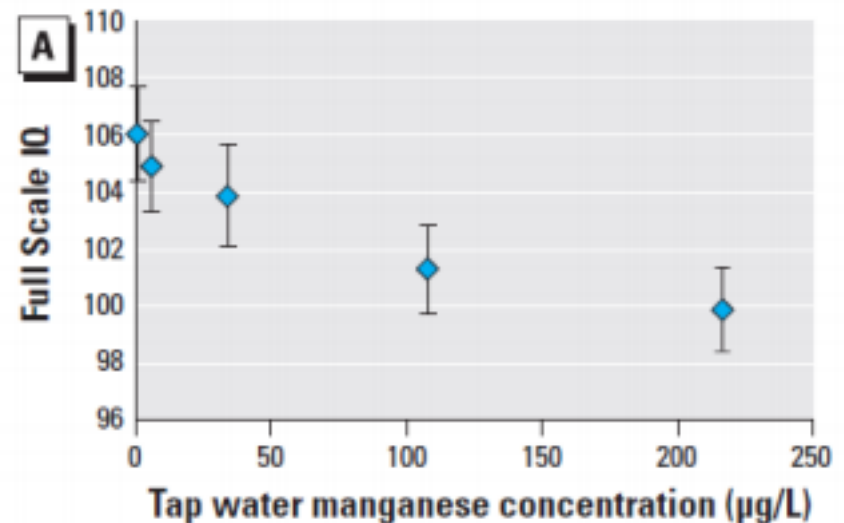


Figure 3. Manganese in groundwater measured at 7,574 wells. Samples collected at various times, for various studies. Data collated and map prepared by MDH, February, 2015. Dashed line encloses area of southeastern Minnesota with low (< 50 ug/L) manganese concentrations. Dashed ellipse encloses area of southwestern Minnesota where manganese concentrations exceed 1,000 ug/L.



Executive Summary

- MDH 2012 tiered health-based risk assessment advice
 - 300 ug/L for adults, children > 1
 - 100 ug/L for infants (formula)
- EPA
 - Less than 50 ug/L manganese
- Not enforceable
 - not regulated
 - not required to be monitored
- Standards unlikely to come soon
- Need education, risk communication, testing, and treatment



Recommendations

- Study neurological effects
- Correlate groundwater to tap water concentrations
- More on spatial distribution
- Coordinate monitoring
- Evaluate manganese removal

Table 3. Manganese Data Sets

Data Source	Number of records	Date Acquired	Note
MDH	1809	January 2015	Safe Drinking Water Act compliance data
MDH	1120	January 2015	Source Water Protection investigative data
MDH	861		Minnesota Arsenic Research Study (MARS)
Anoka County	190	1997	Marsh, 1997
MGS	59	1992	Lively, et. al, 1992
MDNR	2337	January 2015	County Geologic Atlas, LCCMR studies, Regional Hydrologic Atlas, etc.
MPCA	42	1994	Wall and Regan, 1994
MPCA	1664	January 2015	Ambient Groundwater Monitoring Program/Baseline Study
USGS	140	1995, 1998	Smith and Nemetz, 1995; Fong et al., 1998
Dakota County	788	February 2015	Ambient Groundwater Monitoring Program

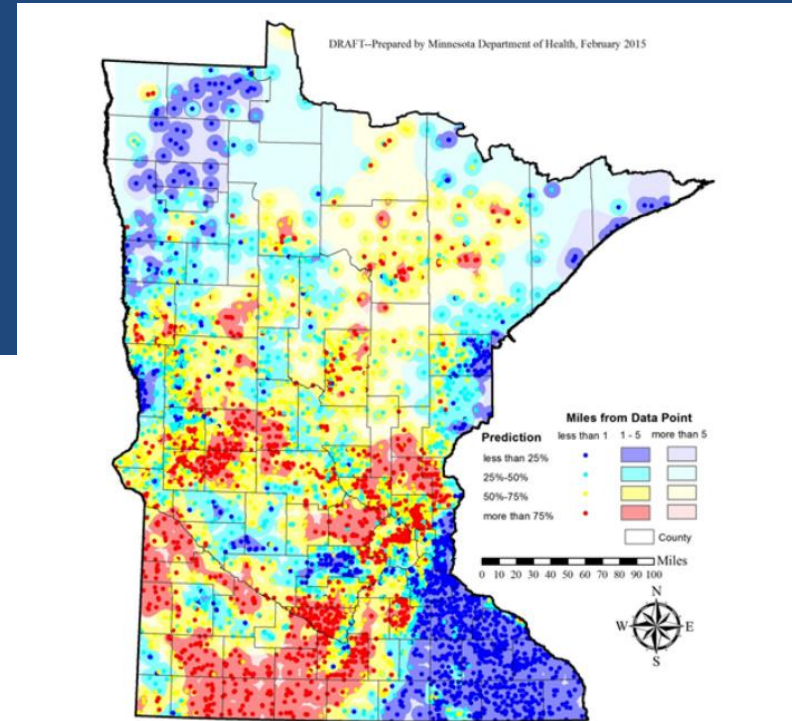


Figure 7. Probability map indicating areas where manganese concentrations in the groundwater will exceed 100 ug/L <25% of the time, 25%-50% of the time, 50%-75% of the time, and > 75% of the time. The map was derived using a general model of spatial variation based on the variability of manganese concentrations and the number of data points. Areas within 1 mile of a sampled well are shown as dots with the most intense color, and shading decreases with distance from each well.

Requests for Information

- Human activities that mobilize Mn
 - Landfills changing redox conditions down-gradient
- Negative health impacts
 - new research related to brain and neurological impacts to babies and young children
- Biogeochemical cycling of metals
 - Santelli Geomicrobiology Lab, U of M Metal(loid) Role of biogeochemistry in processes such as redox, complexation, and adsorptions
 - Specifically microbial manganese oxidation and biomineralization

Minnesota's Groundwater Education Gap Preparing Students to Effectively Manage our Groundwater Resources in the Future

MINNESOTA GROUND WATER ASSOCIATION
White Paper 02
DECEMBER 2016

ACKNOWLEDGMENTS

WHITE PAPER WORKGROUP MEMBERS:

Jeff Stoner	Retired, Chairperson
Gilbert Gabanski	GJG Environmental Consultants, Co-chairperson
Dr. Randal Barnes	University of Minnesota
Rachel Beise	Geochemist
Jonathon Carter	Barr Engineering
Ellen Considine	Minnesota Department of Natural Resources
Bruce Olsen	Retired
Cathy Udem	Professional Geologist
Karen Voz	Minnesota Department of Health

WHITE PAPER COMMITTEE LIASIONS

Kelton Barr	Braun Intertec
Mark Collins	Retired

OTHER CONTRBUTORS

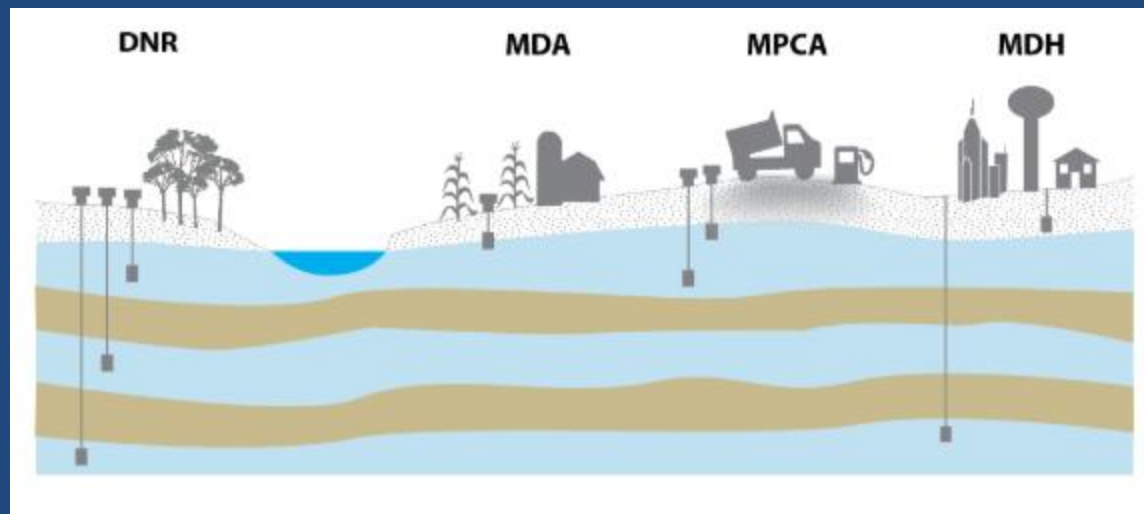
Terry Doud	E-STEM Program, Heritage Schol Dakota County
Dr. Fred Finley	STEM Education Center University of Minnesota
Darrell Gerber	Freshwater Society
Benji Kohn	Trout in the Classroom, Trout Unlimited
Janine Kohn	Project WET, Minnesota Department of Natural Resources
John Olson	Science Specialist, Minnesota Department of Education
Doug Paulson	STEM Specialist, Minnesota Department of Education
Cathy Udem	Professional Geologist
Stew Thornley	Drinking Water Academy, Minnesota Department of Health

MINNESOTA GROUND WATER ASSOCIATION ASSISTANCE

Sean Hunt	Electronic surveys, WRI Association Management Co.
Judith Finn	Final Layout, WRI Association Management Co.

Public education

- public lacks knowledge about quality and local resources
- uncertain about roles of local, state, and federal government
- limited coordination to promote a statewide approach to groundwater education



Improvements needed in 3 areas

- K-12
 - hydrologic cycle in the fourth and eighth grades
 - Revisions to academic standards scheduled for 2017-2018 school year
- postsecondary requirements for entry-level groundwater- related jobs
- water resources management

Post Secondary

- Communication of requirement for entry-level jobs
- Only 3 of 12 offered coursework beyond introductory level

Postsecondary School	Number of Groundwater-Related Courses Offered	Degree Offered
Minnesota Institutions		
Carleton College	2	Geology
Gustavus Adolphus College	1	Geology
Macalester College	1	Geology
Mankato State University	1	Geology
Moorhead State University	None	Geosciences
St. Cloud State University	5	Hydrology
University of St. Thomas	2	Environmental Science or Geology
Winona State University	2	Geology
University of Minnesota		
Duluth	4	Environmental Sciences or Geology
Crookston	1	Natural Resources
Morris	2	Environmental Science
Twin Cities	6	Earth Science, Environmental Engineering, or Geoenvironmental Engineering
Selected Schools in Surrounding States		
Iowa State University	7	Civil Engineering, Environmental Science or Geology
North Dakota State University	1	Geology
South Dakota School of Mines and Technology	1	Geology or Geological Engineering
University of Iowa	7	Civil Engineering, Environmental Engineering, Environmental Science, or Geology
University of North Dakota	5	Environmental Geoscience, Geology, or Geoenvironmental Engineering
University of Wisconsin		
Eau Claire	3	Geology
Madison	5	Geology or Geological Engineering

Table 2. Comparison of postsecondary coursework and degree programs in Minnesota and selected surrounding states

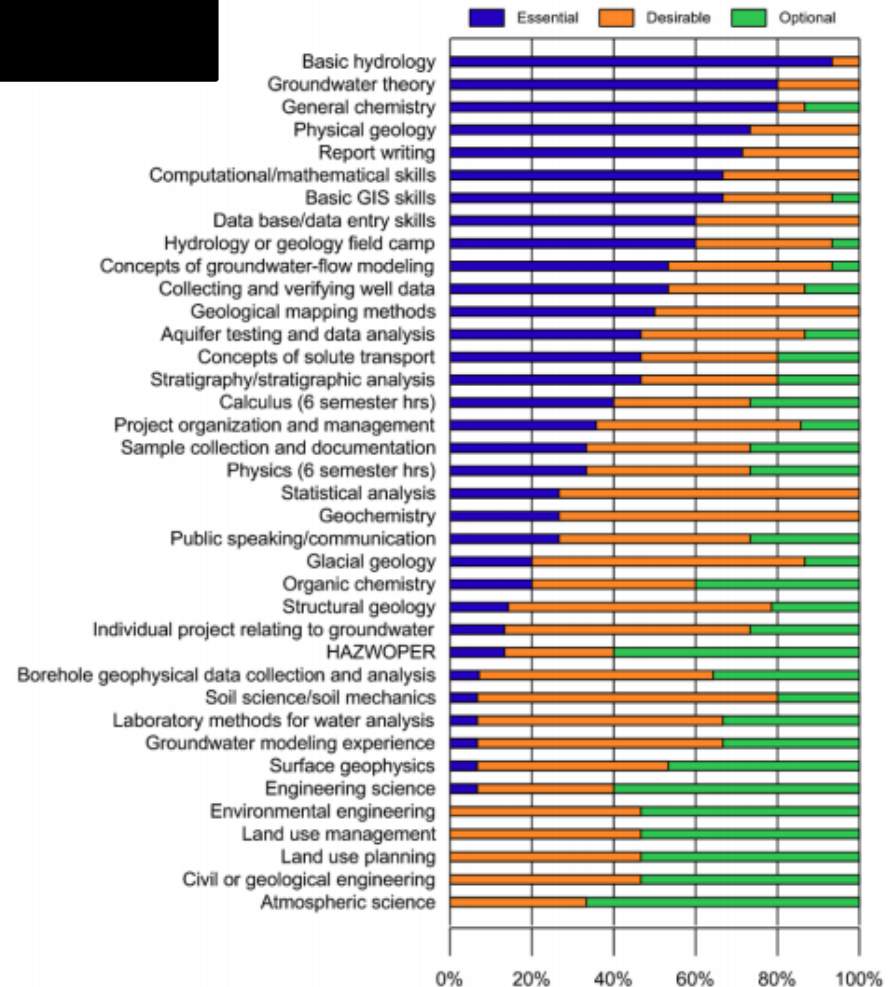


Figure 2. Employer survey respondents' ranking of skills required for entry-level professional-groundwater jobs

Statewide Groundwater Education

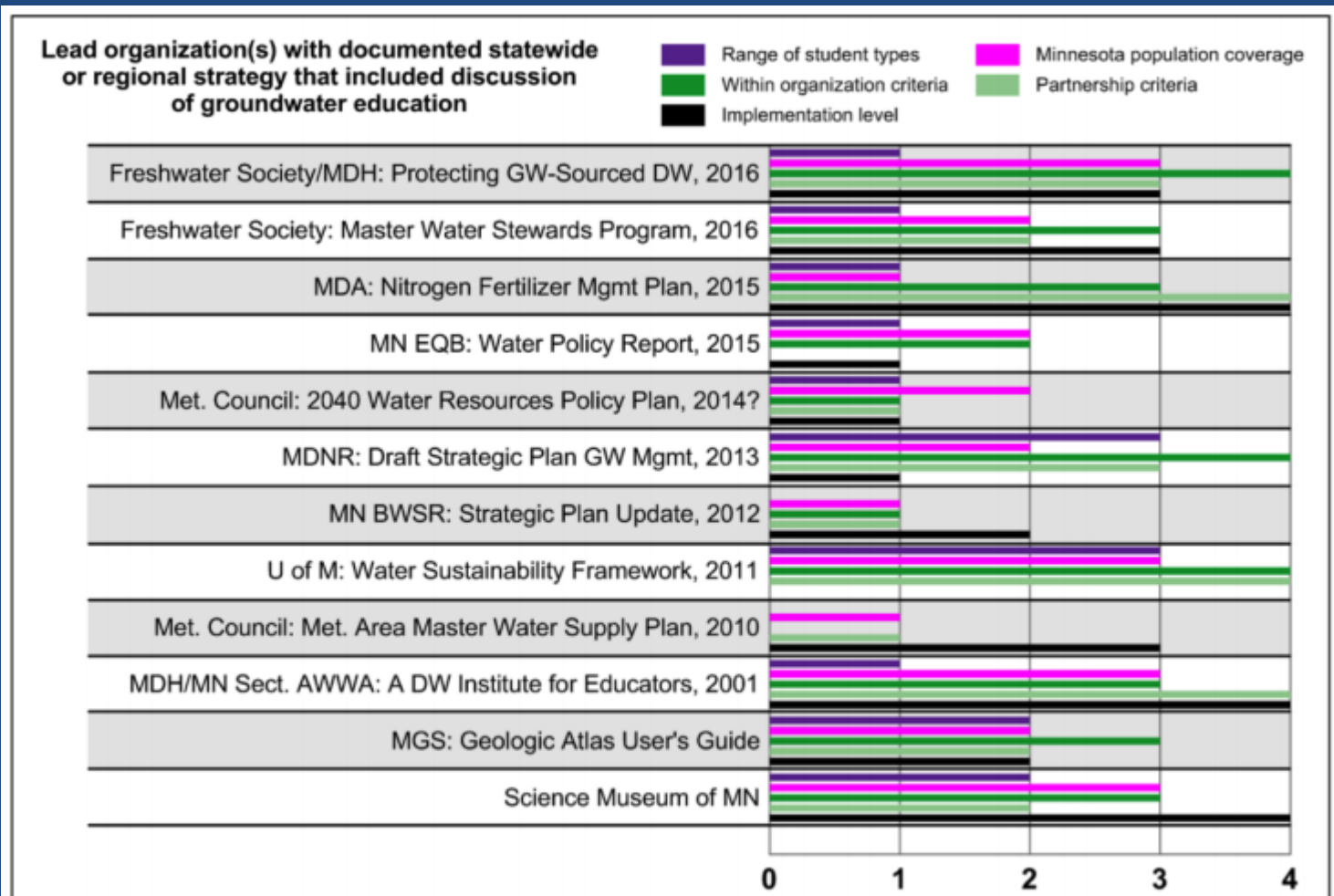


Figure 3. Summary of documented statewide strategies for groundwater education. [A relative score, in which 4 is the highest, is used to indicate the degree to which the review criteria have either been implemented or address all strategic goals. For example, a strategy that targets k-12, teachers, and adults would score 3. A strategy that targets about half of Minnesota population, such as greater Minnesota, would score 2. The number of strategy-attainment criteria for within organization and partnership (4 of each defined in appendix 4.1) is reflected by the score. A strategy that is fully implemented in function and funding would score a 4]

Solutions

Academic Standard "Understand That"	Grade Level	Benchmark
In order to improve their existence, humans interact with and influence Earth systems.	4	Describe how the methods people utilize to obtain and use water in their homes and communities can affect water supply and quality.
Water circulates through the Earth's crust, oceans, and atmosphere in what is known as the hydrologic cycle.	4	Identify where water collects on Earth, including atmosphere, ground and surface water.
	8	Describe the location, composition and use of major water reservoirs on the Earth, and the transfer of water among them. Describe how the water cycle distributes materials and purifies water.

Table 1. Minnesota academic requirements that include groundwater

- Standards
- Teacher access to information
- Filling education gaps
- Improved communication with post-secondary

Activities aligned with recommendations

- Earth Sciences Advisory Board
 - Alignment of curriculum with state needs
- Groundwater Conservation Training
 - Met Council—groundwater as drinking water
 - Online curriculum by Freshwater
- Groundwater Education
 - Sharon Pfeiffer, DNR pilot courses for local officials
 - MDH, statewide Groundwater Education for Soil and Water Conservation District field staff and local decision makers
- Carleton-geothermal project
 - Groundwater “laboratory”, Kelton Barr, Bob Tipping
- Recommendations from Legislative Water Commission

4. Chloride and Stormwater Infiltration

- Chloride in the Environment
 - Natural and anthropogenic
 - Movement in nature
- Chloride in Groundwater
 - Monitoring
 - Land use
 - Seasonal and temporal effects, predictions
- Stormwater practices



Name	Organization
Vanessa Demuth	Dakota County
Sharon Doucette	City of Woodbury
John Gulliver	U of M, Environmental Engineering
Sarah Jarman	Minnesota Department of Transportation
Greg Wilson	Barr Engineering
Tracy Lund	Minnesota Department of Health
Jim Berg	Minnesota Department of Natural resources
Mike Trojan	Minnesota Pollution Control Agency
John Jansen	Leggette, Brashears and Graham
Karen Jensen	Metropolitan Council
John Nieber	U of M, Department of Bioproducts and Biosystems Engineering
Sharon Kroening	Minnesota Pollution Control Agency
Jennifer Olson	Tetra Tech
Scott Alexander	U of M, Department of Earth Sciences
Nicklas Tiedeken	Minnesota Department of Transportation
John Woodside	Minnesota Department of Health
Robert Wahlstrom	
David Fairbairn	Minnesota Pollution Control Agency
Jim de Lambert	Carlson McCain, Inc. & Bassett Creek Watershed Management Organization
Alycia Overbo	U of M, Water Resources Sciences

Timeline

- Research complete
- Workgroups writing sections
- Lead writer selected
- Goal to have factsheet for Road Salt Symposium

SAVE THE DATE!

February 7, 2019

Mark your calendars now for the 18th annual Road Salt Symposium. More info coming soon.

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The Next Topic

- White Paper Purpose met
- Process Functioning & Results Valued
- It begins with topic, then well-defined scope
- Start discussing idea now with colleagues, or White Paper Committee Members
- Winter Newsletter/email call for idea
- Use the form provided/posted on MGWA.org
- Ideas & a nucleus of a Workgroup score high
- Finally, think about serving on a Workgroup

Current Topic Pool

- Groundwater Protection and Mining (2)
- Big Data associated with Managing Resources

