

**University of Wisconsin Water Resources Institute
Annual Technical Report
FY 2017**

Introduction

The University of Wisconsin Water Resources Institute (WRI) serves as the gateway to federal Water Resources Research Institute (WRRI) grants for all Wisconsin colleges and universities. While the WRI's federal base funding from the U.S. Geological Survey totals less than \$100,000 per year, every federal dollar is matched with at least two nonfederal dollars. All WRRI grants are awarded on a competitive, peer-reviewed basis. WRI funds are leveraged with additional funding from the UW System Groundwater Research Program, part of Wisconsin's Groundwater Research and Monitoring Program. Faculty members and research staff who have achieved PI status from any UW System campus are eligible to apply for this funding. Guided by the Wisconsin Groundwater Coordinating Council (<http://dnr.wi.gov/topic/groundwater/gcc/>), this program is the mechanism whereby the UW System and the state departments of Natural Resources, Safety & Professional Services, and Agriculture, Trade & Consumer Protection pool limited state and federal resources to support a coordinated, comprehensive and multidisciplinary response to the state's critical water resource issues. Together, these programs have helped establish the University of Wisconsin as a national leader in groundwater research. The Wisconsin WRI funds an average of 15 short-term research projects of either a fundamental or applied nature that typically involve dozens of faculty, staff and students at a half-dozen campuses around the state each year. By supporting short-term projects, the institute is able to quickly respond to issues as they emerge. WRI annually provides about 30 graduate and undergraduate students in the UW System with opportunities for training and financial support while they work toward their degrees.

WRI research and other water-related information is readily accessible via a website (www.wri.wisc.edu) and the Water Resources Library (WRL), a nationally unique collection of documents covering every major water resource topic. The library's catalog is available online and searchable via the Internet, making the WRL a national and global resource. The WRL became the first academic library in the state to make its collection available online to the public when it launched the "Wisconsin Water Library" (<https://waterlibrary.aqua.wisc.edu/>) in 2003. The portal permits Wisconsin residents to check out WRL books and other documents free of charge via their local libraries.

WRI also helps organize and cosponsor state and regional conferences on water issues. The WRI is housed in the UW-Madison Aquatic Sciences Center, which also houses the UW Sea Grant Institute, part of another federal-state partnership of 33 university programs that promote research, education, and outreach on Great Lakes and ocean resources. This unique administrative union of Wisconsin's federal Water Resources Research Institute and Sea Grant programs enables the Aquatic Sciences Center to address the full range of water-related issues in Wisconsin, from surface water to groundwater, from the Mississippi River to the shores of Lakes Michigan and Superior.

Research Program Introduction

As established by Wisconsin's Groundwater Law of 1984, the state provides \$270,000 annually to the UW System to support groundwater research and monitoring. In 1989, WRI became the UW System's lead institution for coordinating the proposal solicitation and review processes for prioritizing UWS groundwater project funding. WRI's priorities for groundwater research are established annually by the Wisconsin Groundwater Research Advisory Council (GRAC) made up of representatives from academia, federal and state agencies, and the private sector. The GRAC convenes annually to set priorities and to review and make recommendations to WRI on the selection of UW System-funded groundwater projects.

Also established in 1984, is the Wisconsin Groundwater Coordinating Council (GCC) (<http://dnr.wi.gov/topic/groundwater/gcc/>) which is made up of representatives of state agencies with groundwater protection responsibilities and state funding allocations, including the UW System and departments of Natural Resources, Safety & Professional Services, and Agriculture, Trade, & Consumer Protection. The GCC provides consistency and coordination among multiple state programs in funding groundwater monitoring and research to meet various program needs. To better target groundwater research funding, these state programs agreed to establish an annual Joint Solicitation for Wisconsin Groundwater Research and Monitoring. This solicitation is coordinated jointly to facilitate proposal writing, streamline the review process, curtail duplication, improve coordination among agencies and researchers, and enhance communication among the agencies and among principal investigators. WRI plays a lead role in coordinating the solicitation, a rigorous review process, project reporting and making all technical reports available through our institute's library and website. Collectively, since its inception and through state FY18 (July 1, 2017-June 30, 2018), this annual joint solicitation has funded 461 groundwater research and monitoring projects and has helped establish Wisconsin as an international leader in groundwater research. During state FY18, 10 groundwater projects totaling over \$375k were funded through the Wisconsin Groundwater Research and Monitoring Program.

Although these projects are not funded (or in some cases, only partially funded) with our 104(B) allocation, WRI is the administrator of the following UW System state-funded research projects. Below, we include these and other non-UW System state-funded projects that were submitted, vetted, and selected through the Joint Solicitation for the Wisconsin Groundwater Research and Monitoring Program:

State-funded projects through the Wisconsin Groundwater Research and Monitoring Program during state FY 2017 (July 1, 2016-June 30, 2016), including title, investigators, affiliation, contract period, funding agency, and amount:

Linking groundwater and nutrients to monitor fen ecosystems using airborne imaging spectroscopy. Eric Booth, UW-Madison. 7/1/17 - 6/30/19. University of Wisconsin System. \$50,265.

Historic changes in groundwater use by trees in Wisconsin due to high-capacity groundwater pumping and climate variability. Steven Loheide, UW-Madison. 7/1/16 - 6/30/18. University of Wisconsin System. \$52,244.

Mapping the base of the Cambrian aquifer through geophysical modeling of Precambrian topography, southern Wisconsin. Esther Stewart, UW-Extension. 7/1/16 - 6/30/18. University of Wisconsin System. \$30,747.

New proxy-based hydrological reconstructions over the past five centuries in southwest Wisconsin. Christopher Underwood, UW-Platteville. 7/1/16 - 6/30/18. University of Wisconsin System. \$24,440.

Research Program Introduction

Anthropogenically driven changes to the metagenome of a shallow groundwater and its effect on aquifer reactivity. Tim Grundl, Ryan Newton, UW Milwaukee. 7/1/16 – 6/30/18. University of Wisconsin System. \$32,541.

Geologic sources of radium to municipal wells in Wisconsin. Matthew Ginder Vogel, Madeline Gotkowitz, UW Madison. 7/1/16 – 6/30/18. University of Wisconsin System. \$41,287.

Quantifying effects of crop rotation on nitrate loading using lysimetry and groundwater monitoring approaches. Kevin Masarik, UW-Stevens Point. 7/1/17 – 6/30/19. Wisconsin Department of Natural Resources. \$24,035.

Multi-instrument stream surveys with continuous data for better groundwater/surface water understanding in Wisconsin. David Hart, UW-Extension. 7/1/17 – 6/30/19. Wisconsin Department of Natural Resources. \$46,840.

Linking groundwater and climate to understand long term lake level fluctuations in Wisconsin. Noah Lottig, UW Madison. 7/1/16 – 6/30/18. Wisconsin Department of Natural Resources. \$54,208.

Source investigation of nitrate contamination for private wells in Eau Claire County. Laura Suppes, UW Eau Claire. 7/1/16 – 6/30/18. Wisconsin Department of Natural Resources. \$18,508.

TOTAL - \$375,115

Beginning in 2010, WRI's annual 104(B) allocation was used to expand the scope of the Joint Solicitation to include research on the effects of climate change on Wisconsin's water resources. Priorities for climate change research were established through a partnership between the WRI and the Wisconsin Initiative on Climate Change Impacts (WICCI). Established in 2007, WICCI is a university-state partnership created to: (a) assess and anticipate the effects of climate change on specific Wisconsin natural resources, ecosystems and regions; (b) evaluate potential effects on industry, agriculture, tourism and other human activities; and (c) develop and recommend adaptation strategies that can be implemented by businesses, farmers, public health officials, municipalities, resource managers and other stakeholders. We believe these partnerships with other state agencies provides WRI with the ability to fund highly relevant research and allows our limited funds for 104(B) to be leveraged to the fullest extent. WRI has funded five research projects related to these priorities since 2010. WRI is now sponsoring WICCI's phase 2 with the goal of advancing climate adaptation projects related to water resources challenges in Wisconsin.

Evaluating the Effectiveness of Surface Covers for Controlling Fluxes of Water and Radon at Disposal Facilities for Uranium Mill Tailings

Basic Information

Title:	Evaluating the Effectiveness of Surface Covers for Controlling Fluxes of Water and Radon at Disposal Facilities for Uranium Mill Tailings
Project Number:	2015WI359S
USGS Grant Number:	
Sponsoring Agency:	Nuclear Regulatory Commission
Start Date:	1/27/2015
End Date:	11/16/2017
Funding Source:	104S
Congressional District:	
Research Category:	Not Applicable
Focus Categories:	None, None, None
Descriptors:	None
Principal Investigators:	Craig H Benson

Publication

1. Michaud, 2018, Long term performance of radon barrier in limiting radon flux from four uranium mill tailings containment facilities, MS Thesis, University of Wisconsin-Madison.

WRI - USGS FY17 ANNUAL REPORT

William Likos

Evaluating the Effectiveness of Surface Covers for Controlling Fluxes of Water and Radon at Disposal Facilities for Uranium Mill Tailings

WR15R008

Submitted On: 04/24/2018 10:54:22 AM

METRICS & MEASURES

No **Metrics & Measures** added for this Report

REQUESTED INFORMATION

Publications

Long term performance of radon barrier in limiting radon flux from four uranium mill tailings containment facilities

Publication Type: Thesis

Publication Year: 2018

Publication Authors:

Publisher Info: MS Thesis, University of Wisconsin-Madison

Notes: publication in review

Related URLs:

Keywords:

Publication URLs:

Abstract:

Citation: Michaud, 2018, "Long term performance of radon barrier in limiting radon flux from four uranium mill tailings containment facilities," MS Thesis, University of Wisconsin-Madison, i review.

Citation for Coverage:

SG can post PDF online?:

Uploaded File:

Pedogenic process in engineered soil systems: I. Emergence of pedoturbation induced hydraulic conductivity gradients

Publication Type: Journal Article

Publication Year: 2018

Publication Authors:

Publisher Info:

Notes: journal paper in review

Related URLs:

Keywords:

Publication URLs:

Abstract:

Citation: Williams, M., Albright, W., Benson, C.H., Fuhrmann, M., Larsen, L., Likos, W., Waugh, J., 2018, "Pedogenic process in engineered soil systems: I. Emergence of pedoturbation induced hydraulic conductivity gradients," Vadose Zone J., in review.

Citation for Coverage:

SG can post PDF online?:

Uploaded File:

STANDARD QUESTIONS

WRI - Awards and Achievements

No WRI - Awards and Achievements information reported

WRI - Conference Participation

No WRI - Conference Participation information reported

WRI - Number of Personnel Involved

(1)

Participating faculty/staff	2
Supported post-docs	0

WRI - Progress Report

(1)

Reporting Period	March 1, 2017 – February 28, 2018
Report Title	Evaluating the Effectiveness of Surface Covers for Controlling Fluxes of Water and Radon at Disposal Facilities for Uranium Mill Tailings
	<p>Objectives: Disposal facilities for uranium mill tailings generated by current and historic uranium beneficiation operations have been constructed at locations throughout the United States as required by the Uranium Mine Tailings Radiation Control Act (UMTRCA). Nearly all UMTRCA facilities rely on a surface cover to control the rate at which contaminants migrate in the gas and water phases from the tailings and into the surrounding environment. This study is evaluating the effects of soil structure formation on the hydraulic conductivity and gaseous diffusivity of Rn barriers, how structural development varies with depth and thickness of the Rn barrier, and how structure influences transmission of radon and seepage carrying ground water contaminants.</p> <p>Field Investigation: Field work was conducted at two UMTRCA surface barriers under surveillance by Department of Energy Legacy Management (LM): the Shirley Basin, WY site (primary field work conducted September 2017) and the Lakeview, OR site (primary field work conducted October 2017). Field work was similar to that conducted at two additional sites (Falls City, TX and Bluewater, NM) during the previous reporting period for this project. Combined, the four sites were selected to represent a wide range of climatic conditions (dry, humid,</p>

warm, frigid). Goals of the field work were to (1) characterize the morphology of disposal cell cover soils to understand the natural processes that are changing engineering properties and to project the degree of change over decades and millennia, (2) measure the effects of soil-forming processes on gas diffusivity and soil hydraulic properties, (3) determine how changes in engineering properties vary with soil depth in cover profiles, and (4) measure and model how these changes influence radon flux rates and rainwater percolation.

**Principal findings and significance
(Limit 600 words)**

The field data demonstrate structure at some locations has developed in the radon barrier due to factors such as biota intrusion (roots, insect burrowing) and wet-dry cycling. Nevertheless, the radon barriers remain effective in controlling radon fluxes below regulatory limits. The field data also illustrate that radon fluxes are not particularly sensitive to measurement scale, with larger scale chambers yielding similar fluxes as smaller chambers, although the variability in the flux is greater for measurements made with smaller chambers. Higher fluxes are measured using the RAD7 device relative to activated carbon in part because the activated carbon measurement misses the early part of the radon build up curve. These observations are being disseminated in the form of recommendations for effective measurement of Rn flux in the future.

Pb-210 Analysis: Field sampling and analysis was conducted to compare observed Pb-210 concentration profiles in the barrier material to Pb-210 concentrations estimated to be deposited in the barrier by the decay of Rn-222, based on modeled fluxes of Rn-222 within the barrier. Pb-210 measurements taken at the four field sites were evaluated for their ability to provide an alternative method that can be used to quantify the long-term average Rn-222 flux at different depths within the barrier, such that the Rn flux over the lifetime of the barrier can be calculated. Preliminary results demonstrate feasibility of the approach. Recommendations are currently being formulated.

Summit Meeting: A summit meeting including all participating personnel was held to summarize data, findings, draw preliminary conclusions, and outline plans for project dissemination, including journal publications and a NUREG report to NRC. Recommendations for long term maintenance, monitoring, management, and future design of uranium disposal facilities are being developed for reporting and dissemination.

No WRI - Research Patent or Copyright information reported

WRI - Students Supported

(1)

First name	Alex
Last name	Michaud
Affiliation	University of Wisconsin - Madison, Masters Student
Email	amichaud2@wisc.edu
Degree	MA/MS
Major/Specialization	Geological Engineering
Thesis title (if applicable)	Long term performance of radon barrier in limiting radon flux from four uranium mill tailings containment facilities
Job placement (if graduated)	Consulting

(2)

First name	Ross
Last name	Koderl
Affiliation	University of Wisconsin, Undergraduate Student
Email	rkoderl@wisc.edu
Degree	BA/BS
Major/Specialization	Geological Engineering
Thesis title (if applicable)	n/a
Job placement (if graduated)	----

(3)

First name	Chris
Last name	Enos
Affiliation	University of Wisconsin - Madison, Masters Student
Email	cenos@wisc.edu
Degree	MA/MS
Major/Specialization	Geological Engineering
Thesis title (if applicable)	n/a
Job placement (if graduated)	----

(4)

First name	Simon
Last name	Hensen
Affiliation	University of Wisconsin, Undergraduate Student
Email	sshensen@wisc.edu
Degree	BA/BS
Major/Specialization	Geological Engineering
Thesis title (if applicable)	n/a
Job placement (if graduated)	----

(5)

First name	Todd
Last name	Chojnowski

Affiliation	University of Wisconsin, Undergraduate Student
Email	tchojnowski@wisc.edu
Degree	BA/BS
Major/Specialization	Geological Engineering
Thesis title (if applicable)	n/a
Job placement (if graduated)	----

Detection of sewage contamination in urban areas of the Great Lakes

Basic Information

Title:	Detection of sewage contamination in urban areas of the Great Lakes
Project Number:	2016WI354G
USGS Grant Number:	
Start Date:	9/1/2016
End Date:	8/31/2019
Funding Source:	104G
Congressional District:	WI-004
Research Category:	Water Quality
Focus Categories:	Non Point Pollution, Wastewater, Water Quality
Descriptors:	None
Principal Investigators:	Sandra McLellan, Steve Corsi

Publications

There are no publications.

WRI - USGS FY17 ANNUAL REPORT

Sandra McLellan

Detection of Sewage Contamination in Urban Areas of the Great Lakes

WR16R005

Submitted On: 05/01/2018 03:37:44 PM

METRICS & MEASURES

No **Metrics & Measures** added for this Report

REQUESTED INFORMATION

Publications

No **Publications** information reported

STANDARD QUESTIONS

WRI - Awards and Achievements

No **WRI - Awards and Achievements** information reported

WRI - Conference Participation

(1)

Title	Navigating the Future of Water: a Vision for Our Cities.
Location	Milwaukee, WI
Dates	October 18-20, 2017
Number of supported students attending	1
Presentations by staff (include titles and authors)	"The Interface between the Urban and Natural Environment." McLellan, S.L.
Presentations by students (include titles and authors)	"Quantifying Human-Associated Indicator Bacteria Contamination in Urban Stormwater Outfalls in Metropolitan Milwaukee." McAdams, A., Dila, D., McLellan, S.

(2)

Title	Environmental Microbial Biofilms and Human Microbiomes: Drivers of Future Sustainability.
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Location	Nanyang Technical University, Singapore
Dates	February 15-15, 2017
Number of supported students attending	0
Presentations by staff (include titles and authors)	"The Microbiome and Ecological Signatures of Urban Water Systems." McLellan, S.L. (Invited Speaker)
Presentations by students (include titles and authors)	

(3)

Title	National Conference on Science and Technology
Location	Washington D.C.
Dates	January 23-24, 2017
Number of supported students attending	0
Presentations by staff (include titles and authors)	"Water Availability, Quality, and Environmental Health: Implications for Human Health." McLellan, S.L.
Presentations by students (include titles and authors)	

(4)

Title	International Association of Great Lakes Research
Location	Detroit, MI
Dates	May 15-19, 2017
Number of supported students attending	0
Presentations by staff (include titles and authors)	"Host-associated fecal indicators driven by hydrology, precipitation and watershed land use." Deborah K. Dila, Steven R. Corsi, Peter L. Lenaker, Austin K. Baldwin, Melinda J. Bootsma, Sandra L. McLellan
Presentations by students (include titles and authors)	

Presentations by students (include titles and authors)	
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(5)

Title	Water@UW-Madison
Location	Madison, WI
Dates	May 2017
Number of supported students attending	0
Presentations by staff (include titles and authors)	"Tracking Sources of Pollution in Wisconsin Waters." McLellan, S.L.
Presentations by students (include titles and authors)	

(6)

Title	Midwest Society for Environmental Toxicology and Chemistry
Location	Minneapolis, MN
Dates	March 20-22, 2017
Number of supported students attending	1
Presentations by staff (include titles and authors)	
Presentations by students (include titles and authors)	"Quantifying Human-Associated Indicator Bacteria Contamination in Urban Stormwater Outfalls in Metropolitan Milwaukee." McAdams, A., Dila, D., McLellan, S. and Templar, H.

WRI - Number of Personnel Involved

(1)

Participating faculty/staff	3
Supported post-docs	0

(1)

Reporting Period	3/1/2017 through 2/28/2018
Report Title	Detection of Sewage Contamination in Urban Areas of the Great Lakes
Principal findings and significance (Limit 600 words)	<p>Objective 1 - To examine the confounders of sewage detection by the beta version of the portable optical sensor:</p> <p>Approximately 20% of the samples for optical signal and human alternative indicators do not match-up in stormwater samples from contaminated pipes. Mismatched samples and controls were selected from the 2016 USGS-GLPF Portable Sewage Sensor project to follow up on the issue. Samples were analyzed for additional host-associated markers (human Lachnospiraceae³, Dog, and Raccoon) and were sequenced (Illumina - MiSeq) to further describe the confounding bacterial communities that are found in stormwater pipe samples. We found there was too much variability of carbon signals on a small spatial scale for the optical sensor to perform reliably. This was further complicated by difficulty validating true sewage signals at a small scale (a few households) because of individual microbiome variability; but we found they could be resolved using the additional markers and sequencing.</p> <p>USGS has moved its efforts to using optical sensors with more mixed samples (see stream work below), and the McLellan lab is pursuing additional genetic marker testing schemes to identify sewage when only a few individuals are contributing. Although portable sensor work is ending, we found that the additional qPCR for host-associated markers was successful in small scale areas to discern sources. We plan on following up with developing 'qPCR in a truck, i.e. a rapid test to look for these signals, rather than further development of a portable sensor. Developing a portable qPCR method will meet the goal of giving municipalities and other interested parties the ability to quickly track sewage contamination.</p> <p>Objective 2 - In Situ stream sewage sensor:</p> <p>The USGS in situ stream sewage sensor shows an optical signal that is more consistent and reliable because fecal contamination is pooled into a reproducible signature in downstream receiving waters in comparison to up-the-pipe samples (Objective 1). Field season began in April 2017 for</p>

composite samples and in April 2018 for sequential ISCO samples. The sites on the Menomonee River, and its tributary Underwood Creek, are done in collaboration with the Milwaukee Metropolitan Sewerage District and multiple parameters (including pathogens and organic waste compounds) are being measured to evaluate water quality. Human-associated indicators are used to measure sewage contamination against which the sensors limit of detection will be measured. Samples from these collections will be added to samples from Objective 1 for sequencing. Sequencing results should be available at the end of summer 2018.

Objective 3 - Translation and dissemination of findings:

The potential of utilizing the in situ stream sensor to validate TMDL implementation strategies was discussed in a meeting with Wisconsin Department of Natural Resources in January 2017 and with the Milwaukee TMDL advisory committee in August 2017. Both groups are looking forward to an in situ sewage river sensor for following nowcast trends in river contamination. The sensor could be essential in locating TMDL sources along the rivers. Additionally, both groups are interested in portable "qPCR in a truck" and how this solution could advance sewer pipe remediation. See the "Presentations" report tab for more info about preliminary dissemination of our work.

Objective 4 - Training water resource scientists:

A MS graduate student has been working on the NIWR project since September 2017. She is adding automated sequential ISCO measurements at the Milwaukee River and the estuary at Jones Island to the work that USGS is doing on the Menomonee. These samples have been run for nutrients (Nitrate, Sulfate, Chloride, Phosphate, Total Nitrogen, Non-Purgeable Organic Carbon). MMSD is processing some of these samples for Total Phosphorus so we can directly compare the phosphorus levels run for TMDLs.

WRI - Research Patent or Copyright

No **WRI - Research Patent or Copyright** information reported

WRI - Students Supported

(1)

First name	Alexis
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Last name	McAdams
Affiliation	SFS Master's Student
Email	amcadams@uwm.edu
Degree	MA/MS
Major/Specialization	Aquatic Sciences/Water Policy
Thesis title (if applicable)	
Job placement (if graduated)	----

Analytical Services for Use of Mercury Isotopes to Inform Human Health and Ecosystem Health Decisions

Basic Information

Title:	Analytical Services for Use of Mercury Isotopes to Inform Human Health and Ecosystem Health Decisions
Project Number:	2016WI369S
USGS Grant Number:	G16AP00135
Sponsoring Agency:	U.S. Geological Survey
Start Date:	5/1/2016
End Date:	4/0/2017
Funding Source:	104S
Congressional District:	None
Research Category:	None
Focus Categories:	
Descriptors:	None
Principal Investigators:	

Publications

1. Rothenberg, S.E., R. Yin, J.P. Hurley, D.P. Krabbenhoft, Y. Ismawati, C. Hong and A. Donohue. 2017. Stable Mercury Isotopes in Polished Rice (*Oryza sativa* L.) and Hair from Rice Consumers. Environmental Science and Technology. In press. DOI: 10.1021/acs.est.7b01039.
2. Rothenberg, S.E., R. Yin, J.P. Hurley, D.P. Krabbenhoft, Y. Ismawati, C. Hong and A. Donohue. 2017. Stable Mercury Isotopes in Polished Rice (*Oryza sativa* L.) and Hair from Rice Consumers. Environmental Science and Technology. In press. DOI: 10.1021/acs.est.7b01039.

Use of Mercury Isotopes to Inform Human Health and Ecosystem Health Decisions

Reporting Period: 7/1/2016 - 6/30/2017

Project

AAB2192 - Use of Mercury Isotopes to Inform Human Health and Ecosystem Health Decisions

Principle Findings and Significance

Our results initial results were focused mainly on the Fox River, Wisconsin for the first phase of the study. Results indicated relative to baseline, enhanced Hg sediment deposition began in the 1890s in Green Bay and was evident in the early 1800's in offshore Lake Michigan. Isotopic signatures allowed for the utilization of a binary mixing model reliant on HgT concentration and $\delta^{202}\text{Hg}$ values (Yin et al. 2016). Model output confirmed that the contamination evident in Green Bay is most likely due to local sources that are mainly constrained to Green Bay whereas offshore elevations in HgT concentrations are more likely the result of increased Hg in the global pool. This study also showed an increase in odd isotope mass independent fractionation (MIF) from within Green Bay to offshore Lake Michigan. Greater positive odd MIF is likely indicative of both enhanced photoreduction in offshore regions as well as proportionally more atmospherically-derived Hg and proportionally less watershed-derived Hg in the offshore region. This is consistent with data from our comparative Great Lakes sediment study (Lepak et al. 2015).

A preliminary food web investigation of the Fox River was also conducted. For the study, baitfish (Emerald Shiner and Gizzard Shad), benthivores (Redhorse Sucker), and piscivorous fish (Walleye and Smallmouth Bass) were electroshocked in three locations along the Fox River: below the Little Rapids Dam, below the De Pere Dam and just outside the harbor walls in Green Bay. Isotopic Hg signatures in fish of these regions were compared to surface sediment from a nearby site in Green Bay to help determine whether Hg found in the food web resembled legacy Hg in Green Bay. As fish contain primarily methylmercury, sediment Hg speciation is typically dominated by inorganic Hg. The processes that convert a portion of an Hg pool from inorganic to the methylmercury found in fish (methylation, demethylation, photochemical reduction and photochemical demethylation) are highly complex and may result in Hg fractionation, mass-dependent and mass-independent, prior to organism uptake. For this reason, Hg isotope signatures found in biota may not be directly comparable to the legacy Hg found in the sediment.

Lastly, an initial assessment of the St. Louis River was conducted using archival sediment and biota samples provided by the USGS Mercury Research Lab (Middleton, WI) and US EPA (Duluth, MN), respectively. A simple sediment-mixing model for the St. Louis, encompassing the lower estuary to Thomson Reservoir, identifies that legacy hotspots are isotopically heavier in $\delta^{202}\text{Hg}$ and can be clearly distinguished from light $\delta^{202}\text{Hg}$ background sediments with lower concentrations. Mercury isotope compositions in fish tissue from the St Louis were also easily separated between riverine and open water sources, despite all individuals being collected in the St Louis River. Highly enriched isotope values ($\delta^{202}\text{Hg}= 0.8\text{-}1\text{‰}$ and $\Delta^{199}\text{Hg}= 1\text{-}2\text{‰}$) for sub-populations of walleye and white suckers were attributed to the Superior food web due to the elevated $\Delta^{199}\text{Hg}$, as observed in the Great Lakes, and further supported by $\delta^{13}\text{C}$ isotopes indicating an open water food source. Calculations were performed to correct for photochemical demethylation in fish tissues in order to estimate the starting signature of the source Hg. Results

showed a strong overlap between estimates for riverine fish and sediment compositions for $\delta^{202}\text{Hg}$, indicating that the legacy sediment is still a major Hg contributor to lower estuarine food web. Fish with the Superior Hg signature do not reflect sediment isotope compositions after this correction, supporting a secondary source in Lake Superior.

Number of Personnel Involved

1 Participating faculty/staff

1 Supported post-docs

Students Supported

Name

Ryan Lepak

Affiliation

University of Wisconsin-Madison

Degree

PhD/DSci

Major/Specialization

Environmental Chemistry and Technology

Graduation

6/2018

Conference Participation

Title

Determination of MeHg Sources to Fish in the St. Louis River, MN, USA, using Hg Stable Isotopes

Location

International Association for Great Lakes Research, Detroit, MI

Dates

May 15 - 19, 2017

Number of supported students attending

1

Presentations by Staff

KRABBENHOFT, D.P., JANSSEN, S.E., LEPAK, R.L., HOFFMAN, J.C., MONSON, B., OGOREK, J.M., DEWILD, J.F., and TATE, M.T.

Title

Use of Mercury Stable Isotope Signatures to Ascertain Sources to Piscivorous Great Lake's Fish.

Location

International Association for Great Lakes Research, Detroit, MI

Dates

May 15-19, 2017

Number of supported students attending

1

Presentations by Students

LEPAK, R.L., YIN, R., JANSSEN, S.E., KRABBENHOFT, D.P., OGOREK, J.M., DEWILD, J.F., TATE, M.T., HOLSEN, T.M., and HURLEY, J.P.

Title

Changes in Stable Isotope Composition in Lake Michigan Trout - a 40 year perspective.

Location

International Association for Great Lakes Research, Detroit, MI

Dates

May 15-19, 2017

Number of supported students attending

1

Presentations by Students

LEPAK, R.L., HOFFMAN, J.C., JANSSEN, S.E., KRABBENHOFT, D.P., OGOREK, J.M., DEWILD, J.F., BABIARZ, C.L., TATE, M.T., YIN, R., MURPHY, E.W., and HURLEY, J.P.

Journal Articles and Other Publications

Title

Stable Mercury Isotopes in Polished Rice (*Oryza sativa* L.) and Hair from Rice Consumers

Type of Publication

Book or Monograph

Complete Citation

Rothenberg, S.E., R. Yin, J.P. Hurley, D.P. Krabbenhoft, Y. Ismawati, C. Hong and A. Donohue. 2017. Stable Mercury Isotopes in Polished Rice (*Oryza sativa* L.) and Hair from Rice Consumers. Environmental Science and Technology. In press. DOI: 10.1021/acs.est.7b01039.

Awards and Achievements

No awards and achievements reported.

Research Patent or Copyright

No research patents or copyrights reported.

Completion Summary

The recent advancement in instrumental capability of high-resolution mass spectroscopy, allowed us to measure natural Hg isotope abundances in environmental samples and essentially “fingerprint” varying Hg sources. These protocols were applied to two EPA-designated Areas of Concern to conduct preliminary assessment of sources of Hg bioaccumulating in fish. The initial work, while focusing on the St. Louis and Fox Rivers, showed significantly different patterns in isotopic composition of predatory fish residing within the river versus those from lake populations in the nearshore regions. We further compared Hg isotopic composition of lake trout for the five Great Lakes related to this project. Previously, by measuring stable isotopes of Hg ($\delta^{202}\text{Hg}$, $\Delta^{199}\text{Hg}$, and $\Delta^{200}\text{Hg}$) in sediments across the Laurentian Great Lakes, we were able estimate source contributions of Hg. We identified isotopically distinct Hg signatures for Great Lakes top predators among the five Great Lakes.

During this project, we were fortunate to collaborate with a researcher from North Carolina who was able to obtain samples of rice and hair samples from distinct regions of China, U.S., and Indonesia. Since rice has been shown to contain low levels of methyl Hg due to its cultivation in wetted soils, it is important to track the fate of this isotopically distinct bioaccumulative form of Hg. Results from that study suggest that Hg isotopes (especially mass independent fractionation) in human hair can be used to distinguish methylmercury intake from rice versus fish.

We have now established an agreement to access the Great Lakes Fish Archive from the USEPA, as well as fish from the Wisconsin and Minnesota fish monitoring programs to determine trends in fish Hg isotopes from small inland lakes and the Great Lakes themselves. By combining the Hg fingerprinting results from the fish and human hair samples, we will be able to provide a new level of understanding of the most important factors leading to human Hg exposure. Our ongoing work builds from the significant results obtained during this phase of our research and directly related to significant issues in human health.

Wisconsin Initiative on Climate Change Impacts: Water Resources Working Group

Basic Information

Title:	Wisconsin Initiative on Climate Change Impacts: Water Resources Working Group
Project Number:	2017WI363B
Start Date:	3/1/2017
End Date:	2/28/2018
Funding Source:	104B
Congressional District:	2
Research Category:	Not Applicable
Focus Categories:	Climatological Processes, Management and Planning, Water Quantity
Descriptors:	None
Principal Investigators:	Daniel J. Vimont, David S Liebl

Publications

There are no publications.

WRI - USGS FY17 ANNUAL REPORT

Dan Vimont

Wisconsin Initiative on Climate Change Impacts: Water Resources Working Group
WR16R003

Submitted On: 05/11/2018 05:28:23 PM

METRICS & MEASURES

No **Metrics & Measures** added for this Report

REQUESTED INFORMATION

Publications

No **Publications** information reported

STANDARD QUESTIONS

WRI - Awards and Achievements

No **WRI - Awards and Achievements** information reported

WRI - Conference Participation

(1)

Title	Wisconsin Lakes Partnership Convention
Location	Stevens Point, Wisconsin
Dates	April 19, 2018
Number of supported students attending	1
Presentations by staff (include titles and authors)	
Presentations by students (include titles and authors)	Magee MR, McIntyre PB, Hein CL, Hauxwell J, Liebl DS, Vimont DJ. 2018. "Climate Change and Inland Lakes Workshop: assessing and adapting to climate change impacts."

(2)

Title	Inland Lakes and Climate Change Workshop
Location	Tomahawk, Wisconsin

Dates	January 17, 2018
Number of supported students attending	1
Presentations by staff (include titles and authors)	Vimont, DJ. 2018. "Overview and update on climate change in Wisconsin."
Presentations by students (include titles and authors)	Magee, MR. 2018. "Water quality and climate change: New knowledge, adaptations, and next steps."

WRI - Number of Personnel Involved

(1)

Participating faculty/staff	4
Supported post-docs	1

WRI - Progress Report

(1)

Reporting Period	03-01-2017 to 02-28-2018
Report Title	Wisconsin Initiative on Climate Change Impacts: Climate Change and Inland Lakes Workshop
	<p>The Wisconsin Initiative on Climate Change Impacts (WICCI) Water Resources hosted an interdisciplinary workshop on Climate Change and Inland Lakes, which brought together approximately 60 participants from 15 different organizations in January 2018. Participants were diverse, including university and agency researchers, state and local lake managers, and tribal leaders. The goal was to bring together scientists and stakeholder representatives to share recent research, discuss new research needs, and identify potential adaptation strategies for climate change impacts on Wisconsin's inland lakes. We focused the workshop on climate change impacts and adaptations for four themes: (1) Lake Levels; (2) Water Quality; (3) Aquatic Invasive Species; and (4) Fisheries and Native Aquatic Species. Breakout sessions focused on the four themes, and additional plenary talks were given on manoomin (wild rice), temperature modeling, genomics as an adaptation tool, building</p>

**Principal findings and significance
(Limit 600 words)**

community capacity, communicating adaptation, and examples of successful adaptation strategies. The overarching workshop goal was to strengthen the statewide research and management communities and create partnerships and exchange lessons learned between researchers, managers, and stakeholder groups. Workshop products include a workshop report disseminating key findings and take-home messages generated by participants and an accessible pamphlet on the latest research pertaining to lakes and climate change and possible adaptation strategies.

During the workshop, participants identified two main findings pertaining to adaptation strategies moving forward. First, we need to work within the social framework of lake users. TO produce the most effective resource management strategies, we need to understand how users interact with and value the lakes. Outreach efforts have historically proven very useful in mitigating changes, for example, managing aquatic invasive species, and we need to continue to improve upon these methods. However, we also need to start managing lake user expectations so it is clear to the public that we cannot expect lakes to be the same in the future as they are today. Second, developing a multi-faceted approach will be key to minimizing negative impacts of climate changes. The 3R's approach of "Resistance, Resilience, Response" may be a useful framework for developing these adaptation strategies. Resistance encompasses defending high value lakes against climate changes. Resilience involves improving the capacity of the lake to maintain prior conditions by reducing stress and minimizing vulnerabilities. Response is intentionally accommodating some changes and minimizing undesired outcomes. During breakout sessions, participants covered adaptation strategies for each of the four themes that may fit into this holistic approach of lake adaptation to climate changes.

WRI - Research Patent or Copyright

No **WRI - Research Patent or Copyright** information reported

WRI - Students Supported

(1)

First name	Madeline
Last name	Magee
Affiliation	

Alma mater	University of Wisconsin - Madison
Email	mrmagee@wisc.edu
Degree	PhD/DSci
Major/Specialization	Civil Engineering, Limnology
Thesis title (if applicable)	
Job placement (if graduated)	Government

Geologic sources of radium to municipal wells in Wisconsin

Basic Information

Title:	Geologic sources of radium to municipal wells in Wisconsin
Project Number:	2017WI364B
Start Date:	3/1/2017
End Date:	2/28/2018
Funding Source:	104B
Congressional District:	2
Research Category:	Water Quality
Focus Categories:	Geochemical Processes, Water Quality, Radioactive Substances
Descriptors:	None
Principal Investigators:	Matthew GinderVogel, Madeline Beth Gotkowitz

Publications

There are no publications.

WRI - USGS FY17 ANNUAL REPORT

Matthew Ginder Vogel
Geologic sources of radium to municipal wells in Wisconsin
WR16R006
Submitted On: 05/21/2018 10:40:02 AM

METRICS & MEASURES

No **Metrics & Measures** added for this Report

REQUESTED INFORMATION

Publications

No **Publications** information reported

STANDARD QUESTIONS

WRI - Awards and Achievements

(1)

Title	Best Student Presentation Award at WI AWRA meeting
Recipient(s)	Madeleine Mathews
Awarded by	AWRA
Type of award	Research
Description	
Student award	Yes
Number of students receiving the award	1

WRI - Conference Participation

(1)

Title	2018 GSA North-Central Section – 52nd Annual Meeting;
Location	Des Moines, IA
Dates	April 16, 2018.

Number of supported students attending	1
Presentations by staff (include titles and authors)	
Presentations by students (include titles and authors)	Madeleine Mathews, Madeline Gotkowitz, Matthew Ginder-Vogel. "Radium sources and mobility in discrete hydrostratigraphic units within the Midwestern Cambrian-Ordovician aquifer." Oral presentation at: 2018 GSA North-Central Section – 52nd Annual Meeting; April 16, 2018.

(2)

Title	AWRA - Wisconsin
Location	Appleton, WI
Dates	March 8-9
Number of supported students attending	1
Presentations by staff (include titles and authors)	
Presentations by students (include titles and authors)	Madeleine Mathews, Madeline Gotkowitz, Matthew Ginder-Vogel. "Ra source characterization in the Cambrian-Ordovician aquifer through isotopic and geochemical study." Oral presentation at: AWRA Wisconsin Section – 2018 Annual Meeting; March 8, 2018.

(3)

Title	WGWA Annual State Conference
Location	Brookfield, WI
Dates	February 9, 2018
Number of supported students attending	1
Presentations by staff (include titles and authors)	
	Madeleine Mathews, Madeline Gotkowitz, Matthew

Presentations by students (include titles and authors)	Ginder-Vogel. "Effects of groundwater geochemistry on radium in the Cambrian-Ordovician aquifer system." Oral presentation at: 2018 WGWA Annual State Conference; February 9, 2018.
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(4)

Title	AWRA Wisconsin Section – 2017 Annual Meeting;
Location	elkhart lake, wi
Dates	March 9-10
Number of supported students attending	1
Presentations by staff (include titles and authors)	
Presentations by students (include titles and authors)	Madeleine Mathews, Madeline Gotkowitz, Matthew Ginder-Vogel. "Radium characterization in the Cambrian-Ordovician aquifer." Poster presented at AWRA Wisconsin Section – 2017 Annual Meeting; March 10, 2017

(5)

Title	Navigating the Future of Water Conference
Location	Milwaukee, WI
Dates	October 19, 2017
Number of supported students attending	1
Presentations by staff (include titles and authors)	
Presentations by students (include titles and authors)	Madeleine Mathews, Madeline Gotkowitz, Matthew Ginder-Vogel. "Effect of aquifer conditions on radium in the Cambrian-Ordovician aquifer." Poster presented at: Navigating the Future of Water Conference; October 19, 2017.

WRI - Number of Personnel Involved

(1)

Participating faculty/staff	
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Participating faculty/staff	2
Supported post-docs	

WRI - Progress Report

(1)

Reporting Period	March 1, 2017 to February 28, 2018
Report Title	Effect of geochemical conditions on radium mobility in discrete intervals within the Midwestern Cambrian-Ordovician aquifer system
Principal findings and significance (Limit 600 words)	<p>We have analyzed aqueous samples collected from short-screened wells within the Midwestern C-O-AS near Madison, WI, USA to determine geochemical parameters including dissolved oxygen, pH, major and minor ions, and metals including ^{226}Ra and ^{228}Ra. Additionally, the elemental composition of aquifer solids is determined as a function of depth. Radium parent isotopes, ^{238}U and ^{232}Th, occur in both shaley facies and as coatings on sandstone minerals. Overall, groundwater samples contain dissolved total Ra lower than 2.5 pCi/L; however, a minority of groundwater samples from either the confined or unconfined portions of the aquifer contain total Ra in excess of 3 pCi/L. In the confined system, anoxic conditions are correlated with elevated Ra concentrations, while elevated total dissolved solids are positively associated with Ra in the upper oxic aquifer. Our results demonstrate that there are multiple sources of Ra contributing to elevated dissolved Ra in the regionally unconfined portion of the Midwestern C-O-AS. Results demonstrate that background concentrations of Ra in this region of the Midwestern C-O-AS range from non-detectable to 2.4 pCi/L. Multiple mechanisms, including dissolution of Fe and Mn (hydr)oxide coatings and elevated dissolved ion content, appear to result in elevated Ra within these discrete aquifer intervals. This study expands knowledge of the contribution of dissolved Ra by distinct hydrostratigraphic units within the Midwestern C-O-AS.</p>

WRI - Research Patent or Copyright

No WRI - Research Patent or Copyright information reported

WRI - Students Supported

(1)

First name	Madeleine
Last name	Mathews
Affiliation	University of Wisconsin - Madison
Email	mmathews2@wisc.edu
Degree	PhD/DSci
Major/Specialization	Environmental Chemistry and Technology
Thesis title (if applicable)	Effect of geochemical conditions on radium mobility in discrete intervals within the Midwestern Cambrian-Ordovician aquifer system
Job placement (if graduated)	----

Information Transfer Program Introduction

None.

University of Wisconsin Water Resources Institute - Information Transfer Program

Basic Information

Title:	University of Wisconsin Water Resources Institute - Information Transfer Program
Project Number:	2017WI361B
Start Date:	3/1/2017
End Date:	2/28/2018
Funding Source:	104B
Congressional District:	2
Research Category:	Not Applicable
Focus Categories:	None, None, None
Descriptors:	None
Principal Investigators:	Moira Harrington

Publications

1. White, Elizabeth; et al. 2016 41st Annual Meeting Program and Abstracts Working Together for Wisconsin's Water: Balancing Industry, the Environment and Public Health, 2017, 63 pages, <http://state.awra.org/wisconsin/2017meeting/AWRAProgram2017.pdf>
2. White, Elizabeth; Marie Zhuikov, Aaron Conklin, Moira Harrington, Anne Moser. 2017 Volume 1, Aquatic Sciences Chronicle 12 pages <http://www.aqua.wisc.edu/chronicle>
3. White, Elizabeth; Marie Zhuikov, Aaron Conklin, Moira Harrington, Anne Moser. 2017 Volume 2, Aquatic Sciences Chronicle 12 pages <http://www.aqua.wisc.edu/chronicle>
4. White, Elizabeth; Marie Zhuikov, Aaron Conklin, Moira Harrington, Irene Miles, Anne Moser. 2017 Volume 3, Aquatic Sciences Chronicle 12 pages <http://www.aqua.wisc.edu/chronicle>
5. White, Elizabeth; Marie Zhuikov, Aaron Conklin, Moira Harrington, Anne Moser. 2017 Volume 4, Aquatic Sciences Chronicle 12 pages <http://www.aqua.wisc.edu/chronicle>
6. Kurth, Lynn; Anne Moser, Kathleen Kline, Elizabeth Whitel 2017, Remotely Operating Vehicles and Engineering Teacher's Guide, 14 pages, <http://www.seagrant.wisc.edu/home/Portals/0/Files/Educators/ROVe%20Teachers%20Guide%202.pdf>
7. Conklin, Aaron; Marie Zhuikov, Moira Harrington. 2017 Facebook.com/UWiscSeaGrant
8. Conklin, Aaron; Marie Zhuikov, Moira Harrington. 2017 @UWiscSeaGrant Twitter account
9. Moser, Anne. 2017 facebook.com/WiscWaterLib
10. Moser, Anne 2017 @WiscWaterLib
11. Conklin, Aaron March 30, 2017 news release This is Your Soil on Acid: WRI Researchers Explore Link Between Nitrates and Uranium in Groundwater
12. White, Elizabeth. May 25, 2017 news release Undercurrents--the Hidden Knowledge of Groundwater <https://www.wri.wisc.edu/news/undercurrents-the-hidden-knowledge-of-groundwater/>
13. Conklin, Aaron. June 30, 2017 news release Fen-Tastic <https://www.wri.wisc.edu/news/undercurrents-the-hidden-knowledge-of-groundwater/>
14. Conklin, Aaron. Aug. 24, 2017 news release The Impact of Our Use <https://www.wri.wisc.edu/news/the-impact-of-our-use/>
15. Conklin, Aaron. Sept. 15, 2017 news release The Forgotten User <https://www.wri.wisc.edu/news/the-forgotten-user/>
16. Harrington, Moira. Nov. 6, 2017 news release Poster Session Demonstrates Scope and Diversity of UW-Madison's Water Explorations

University of Wisconsin Water Resources Institute - Information Transfer Program

- <https://www.wri.wisc.edu/news/poster-session-demonstrates-scope-and-diversity-of-uw-madisons-water-explo>
17. Zhuikov, Marie. Dec. 12, 2017 news release A Model Fellow
<https://www.wri.wisc.edu/news/a-model-fellow/>
 18. Harrington, Moira. Jan. 31, 2018 news release March Meeting Will Bring Together State's Leading Water Managers and Researchers
<https://www.wri.wisc.edu/news/march-meeting-will-bring-together-states-leading-water-managers-and-research>
 19. Zhuikov, Marie. Feb. 14, 2018 news release Unique State Council Coordinates Wisconsin Groundwater Research and Protection
<https://www.wri.wisc.edu/news/unique-state-council-coordinates-wisconsin-groundwater-research-and-protect>

The Information Transfer Program of the University of Wisconsin Water Resources Institute (WRI) supports the institute's mission of addressing through research present and emerging water quality, quantity and management challenges. This is accomplished through the effective use of extension services and the implementation of a communications strategy.

The WRI Information Transfer Program has a complementary communications program that disseminates the University of Wisconsin Sea Grant College Program's research findings and supports its extension and education efforts. Great efficiencies are achieved by advancing the branding and information transfer work of the two water programs.

Such efficiency and its resultant successes begin with an understanding of the intended audiences for WRI messages. WRI audiences are researchers, policy makers, decision makers, water managers, students and, in certain instances, members of the public.

The desired outcomes of the Information Transfer Program's work are to 1) foster learning among the intended audiences, 2) encourage these audiences to perceive their role and actions related to water quantity, quality and management in an informed and perhaps reconsidered manner and 3) take action based on the information to be gained from the WRI's research into Wisconsin-specific water issues.

An annual WRI Information Transfer Program strategy is developed. To implement the strategy, tactics and products are put into use throughout the year. The tactics and products for 2017-18 are outlined in this report. The Wisconsin Water Library provides extension services and those activities will also be included in the following report.

Tactics and Products

Much of WRI's information is shared via an online publication store, <http://aqua.wisc.edu/publications>. A fact sheet about groundwater drawdown was the most popular WRI download in the publications store. There were about 400 downloads in this reporting period.

Another publication to note is the Aquatic Sciences Chronicle, which is produced and distributed quarterly. It highlights water research and the people who conduct water research and outreach. The Chronicle's dedicated readers consist of roughly 5,500 online and print subscribers, which includes local and state water-management agencies, and water-related non-governmental organizations. Readers are found in Wisconsin and across the country. The newsletters are also posted online. At aqua.wisc.edu/chronicle, all issues of the publication are archived and searchable. There were about 24,000 online visitors to the newsletter in the last year. Plans are in place to increase subscribers. These include signing up more people at events, using contests as an incentive and stepped up solicitation through the website.

Social media facilitates engagement with audiences. WRI is active on Facebook and Twitter. Through the Twitter account, for example, one analytical tool shows that WRI has the potential to deliver about 700,000 impressions a week. WRI also uses the social media tools Flickr and YouTube.

WRI's video catalog includes "What's a Spring," "Streams Neutralize Nitrates in Groundwater," "A New Measure of Groundwater Flow," "Got Oaks" and "Drought in Southwest Wisconsin as Told by Oaks." "Testing Well Water for Microorganisms" is the most popular video in the catalog. To date, it has more than 11,000 views, which is a large number for a video on a scientific topic. It was first posted in 2011. All of the videos are shared through the program's website and its YouTube channel, <http://www.youtube.com/user/UWASC/>.

Audio podcasts on water topics are very popular with visitors. The eight-episode "Aquifers and Watersheds" audio podcast series, which demystifies for general audiences these geological formations and the geoscience involved in studying them, can be found at bit.ly/1e5a1jQ. In 2017-18, there were nearly 49,000 visitors to the podcast.

In 2017-18, about 23,000 people visited the audio episodes located at <http://www.seagrant.wisc.edu/home/Default.aspx?tabid=601&AudioGroupID=33>. This is a WRI-sponsored seven-part audio podcast series. "Water, Wisconsin and the Mercury Cycle" details mankind's historic uses of mercury, Wisconsin's water resources and mercury in Wisconsin waters. A major part of the series also focuses on WRI-funded research on mercury.

Finally, a newer audio podcast series, "Undercurrents: The Hidden Knowledge of Groundwater" drew about 650 visitors in this reporting period. It can be found at bit.ly/29hYqTF

The WRI website <http://www.wri.wisc.edu> orients visitors to the Wisconsin program. It was relaunched in this reporting period and now offers a fresher look, clearer navigation and fast-loading pages. The site had about 84,000 visitors in this reporting period.

News releases on WRI projects and people are distributed as appropriate. In this reporting year, there were nine news releases.

AWRA 2017 Annual Conference – Another Communication Tool

The Wisconsin Section of the American Water Resources Association conducts an annual meeting. WRI has long assisted with meeting planning and all of the associated printed material for the event. WRI takes the lead on—and funds—the writing, editing, graphic design, printing and mailing of a conference registration brochure, and the writing, editing, graphic design and printing of the conference program. WRI joined other conference sponsors—the University of Wisconsin-Stevens Point Center for Watershed Science and Education, Wisconsin Department of Natural Resources, Wisconsin Geological and Natural History Survey and the U.S. Geological Survey's Wisconsin Water Science Center—to stage the 2017 event that attracted about 200 people, including resource managers, researchers and students.

Wisconsin Water Library Reaches Out Via the World Wide Web

During this reporting period, the Water Library site <http://www.waterlibrary.aqua.wisc.edu>, was populated and usability monitored. The site is a portal to the breadth and depth of water-related scholarship in the state, and beyond. It is a way to explore on topics that align with visitors' interest to facilitate greater interdisciplinary collaboration and exploration. The site had about 20,000 visitors in this reporting period.

Wisconsin's Water Library Reaches Out Into Communities

The Wisconsin Water Library is a unique resource for researchers, resource managers and all Wisconsin citizens. It contains more 30,000 volumes of water-related information about the Great Lakes and other waters of Wisconsin. The library includes a curricula collection, dozens of educational videos, children's collection, journals and newsletters. Each year, more than 1,000 publications circulate among interested patrons.

Wisconsin's Water Library continues to catalog all groundwater research reports from WRI projects into WorldCat and MadCat, two library-indexing tools. This ensures WRI's cutting-edge water exploration is broadly available locally, regionally, nationally and globally.

In addition to archival benefits, the library provides outreach by answering many in-depth reference questions on a wide range of water-related topics. It also provides a water research guide <http://researchguides.library.wisc.edu/waterscience>.

It is active on social media. It prepares recommended reading lists on topics such as climate change, groundwater, water conservation and water supply.

In partnership with the Wisconsin Department of Natural Resources and the Wisconsin Wastewater Operator's Association (WWOA), the library has continued its long-term assistance to current and future drinking water and wastewater operators in Wisconsin. The library has cataloged the essential technical manuals into the library's collection and provides loans to WWOA members around the state in support of their required state license examinations as well as in support of the educational needs of their daily work.

In addition to its website, Wisconsin's Water Library employs other technology tools to reach library patrons. Using email, the library sends out a bimonthly "Recent Acquisitions List" to about 500 contacts. The message also includes recent updates to the library website and contact information for users to ask any water-related question. The library also supports an email account at askwater@aqua.wisc.edu, which is monitored daily.

The library maintains an extensive curriculum collection of guides with innovative approaches and other educational materials for teaching water-related science in K-12 classrooms. The curricula are available for checkout by all teachers and residents in Wisconsin. The librarian also has extensive experience providing programming to Pre-K children. She has put that experience to use in developing field-tested science, technology, engineering, art and math (STE(A)M) activities and packaging them into curriculum kits. Each kit contains several books, tips on a guided water-science experiment and other themed activities. The kits will eventually number 27 on topics such as the water cycle, aquatic invasive species and art and water. The current kits are Jump Around With Frogs, Does it Sink or Float and Once Upon a Pond.

To build water literacy, information transfer staff structures and conducts story hours around Wisconsin and around WRI themes. In this reporting period, staff visited 27 locations and reached 654 people. She also has a passion for linking the arts and water science and this year coordinated an art show focused on water quality and lake sturgeon, which attracted 20 people.

In this reporting period, staff also facilitated mentoring for teachers on a Great Lakes research/educator cruise for Wisconsin teachers.

Notable Accomplishments

The relaunch of the WRI website, <http://www.wri.wisc.edu>, was a notable accomplishment for this reporting period. The prior site was more than 10 years old, had an outdated appearance, and was not organized in an optimal manner. The new site was created using WordPress, which is a platform supported by WRI's home institution, the University of Wisconsin-Madison. While WRI has a skilled web developer on staff, this institutional support for the website minimizes the risk of service disruption. The new site serves users in anticipating their needs. For example, water researchers can easily find funding opportunities due to the site's reconfigured content, as well as deeper profiles of past and current funded investigators, including published findings. The site feels and operates in a more dynamic manner and provides a home-page look at WRI's social media stream, video and audio podcast choices and news about the people and projects who make up WRI scholarship in Wisconsin.

A notable WRI accomplishment in this reporting period was the investment in professional development for a group of international aquatic and marine science librarians. WRI's Wisconsin Water Library librarian is an active member of this organization and she planned and hosted a regional gathering of a branch of the International Association of Aquatic and Marine Science Libraries and Information Centers, along with the Shedd Aquarium. Twenty-five people attended the conference held in Madison, Wis., in spring 2017. Members of this branch are drawn from the southeastern U.S. Gulf Coast, the Atlantic Coast of North America, including central and eastern Canada, Bermuda, Bahamas, Caribbean, eastern Mexico and Panama. It marked the first time in 27 years that the regional group met in a freshwater location. WRI's librarian said this conference was a continuation of her goal to encourage more Great Lakes librarians in the group and to raise the visibility of freshwater scholarship.

Wisconsin Water Resources Fellowship: Collaborating with Water Managers

Basic Information

Title:	Wisconsin Water Resources Fellowship: Collaborating with Water Managers
Project Number:	2017WI362B
Start Date:	3/1/2017
End Date:	2/28/2018
Funding Source:	104B
Congressional District:	2
Research Category:	Not Applicable
Focus Categories:	Groundwater, Education, Management and Planning
Descriptors:	None
Principal Investigators:	Jennifer Hauxwell

Publications

There are no publications.

WRI - USGS FY17 ANNUAL REPORT

Jennifer Hauxwell

Wisconsin Water Resources Fellowship: Collaborating with Water Managers Education
WR16E002

Submitted On: 04/11/2018 05:22:00 PM

METRICS & MEASURES

No **Metrics & Measures** added for this Report

REQUESTED INFORMATION

Publications

No **Publications** information reported

STANDARD QUESTIONS

WRI - Awards and Achievements

No **WRI - Awards and Achievements** information reported

WRI - Conference Participation

(1)

Title	Predicting daily total phosphorus and suspended solids across Wisconsin stream reaches for impairment assessment.
Location	Elkhart Lake, WI
Dates	3/2017
Number of supported students attending	0
Presentations by staff (include titles and authors)	Latzka, A.W. & M. Diebel. Predicting daily total phosphorus and suspended solids across Wisconsin stream reaches for impairment assessment. American Water Resources Association – Wisconsin Section Annual Meeting. Elkhart Lake, WI. March 2017.
Presentations by students (include titles and authors)	

(2)

Title	But what about my stream? Communicating local
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Title	results and implications from macrosystem-scale studies
Location	Raleigh, NC
Dates	6/2017
Number of supported students attending	0
Presentations by staff (include titles and authors)	Latzka, A.W. & M. Diebel. But what about my stream? Communicating local results and implications from macrosystem-scale studies. Society of Freshwater Sciences. Raleigh, NC. June 2017.
Presentations by students (include titles and authors)	

WRI - Number of Personnel Involved

(1)

Participating faculty/staff	1
Supported post-docs	1

WRI - Progress Report

(1)

Reporting Period	3/1/17-2/28/18
Report Title	Wisconsin Water Resources Fellowship: Collaborating with Water Managers
	State agencies often are challenged by the ability to attract and recruit professional talent that best suits their needs. Additionally, students with diverse scientific backgrounds oftentimes do not apply to positions in the public service sector. Many factors may account for this disconnect, including perceptions of limited salary flexibility, a sense of an inability to apply scientific knowledge and experience, the complexities of the hierarchical structure of state government, and/or a lack of awareness of career opportunities beyond the traditional academic path. This conflicts directly with employee job satisfaction and long tenures of many Wisconsin state

employees who face considerable challenges in managing complex technical problems within a tapestry of diverse societal and political perspectives on water resource management issues. This program is intended to help attract some of the state's best graduate students and postgraduates in water resources management and analysis to gain key experience and perhaps consider state agency careers. This opportunity will allow students to apply and grow both their technical abilities as well as their leadership skills. It also allows state agencies to benefit from knowledge gained by recent graduate students for sound resource management. We envision this investment as a cornerstone of a fellows program that will continue to expand and form a self-sustaining entity on a state level that is similar to the national Sea Grant Knauss Fellows Program.

During the 2016-17 academizing year, the University of Wisconsin Water Resources Institute partnered 50:50 with the Wisconsin Department of Natural Resources (DNR) to create a one-year fellowship for a recent postgraduate to apply newly minted technical skills toward real-world water science-policy challenges. The selected fellow, Dr. Alex Latzka, worked side-by-side with DNR professionals to study and model suspended sediments across Wisconsin streams to improve water-quality management. The first phase developed a model that predicted daily sediment concentrations based on a stream's upstream land use and each day's precipitation. To make this model useful for regional and county biologists who manage stream water quality, the fellow developed tools that allow biologists to view and interpret the model's findings for specific streams in print-out reports and interactive web tools. The Fellow also implemented automatic reporting of site-level model results and trained staff in R and statistics.

This project led not only to future workforce professional development, but also cutting-edge modeling and analysis and innovative technologies aimed directly at the needs of water resource managers. Ultimately, the results and tools developed will help decision-makers to efficiently identify streams amenable to water-quality improvements, assess the impacts of their efforts, and better manage water quality across the state. This fellowship experience was highlighted in the NIWR glossy 4-pager this past year.

Due to DNR partner concerns regarding their available funding, we had a delay in launching the 2017-18 academic year fellowship. In December 2017, we received a commitment from Wisconsin DNR to provide half of the funding plan to apply

**Principal findings and significance
(Limit 600 words)**

WRI's USGS 106(B) carried funds (the other half) to host a new Water Resources Fellow, with a focus again in water quality. This position is under recruitment and we anticipate a summer/fall 2018 start.

Key Accomplishments by Water Quality Fellow:

- Extracted and cleaned a database of TSS measurements from SWIMS, resulting in 513 sites with a total 11,859 measurements that fit criteria needed to build a predictive model.
- Although the initial model was based on pre-processed daily weather data, the fellow has downloaded and summarized hourly precipitation and temperature datasets for each watershed in the state for a new hourly version of the model.
- A predictive model for daily stream TP using weather and watershed characteristics was previously developed by Matt Diebel was adapted for this project. We fit a mixed effects model to TP and TSS measurements across the state, where each is dependent on the agriculture and urban land use percentages, slope, soil permeability, contributing area, a seasonality effect, the anomaly of the 7-day average temperature, and an antecedent precipitation index. Antecedent precipitation is a weighted sum of precipitation in the contributing area on the 365 days prior, where each day's weight depends on how recently it occurred. We allowed the shape of the weighting function to vary depending on a watershed's slope and area, where larger and flatter watersheds had longer lag times less flashiness in response to precipitation, where the shape of this variation was controlled by an optimization routine. Uncertainty is being tracked via bootstrapping.
- Created automatically-generated PDF reports that display predictions from the TP and TSS models for each site in an easy-to-understand document complete with text, maps, and several graphs, using RMarkdown.
- Extracted macroinvertebrate and fish data for streams for all of Wisconsin to test for TSS effects.
- We have used the TSS model to calculate various summary statistics of TSS conditions at each site (mostly areas under the curve above certain TSS thresholds). We are combining these (and raw TSS measurements) with measured biological data, including macroinvertebrate and fish indexes of biotic integrity based on DNR stream monitoring and available in the SWIMS database. We have fit preliminary general additive models to assess how these IBIs respond to these TSS characteristics. In all cases, we see strong negative effects of TSS, although threshold types of responses are not common across all IBIs or TSS indicators tested.
- Gave presentations at several conferences and meetings. Conference presentations are listed

above. Additional presentations in DNR team settings included presentations on the TP/TSS model to the DNR water quality modeling technical team, on the fellow's past and current work at a DNR informal seminar, on the model and site reports to the DNR streams technical team, and on new R-based methods for acquiring and processing gridded data for Wisconsin's watersheds to the DNR water quality modeling technical team.

- Began preparation of two manuscripts related to the research completed

- Co-led and organized workshop: "Introduction to R: Computer programming for DNR Water Quality professionals" workshop. July 2017. Madison, WI.

- Model results at the daily level indicated a need to better capture short, intense precipitation events that were not obvious in daily precipitation data. To begin the construction of an alternative hourly model, we prepared hourly precipitation and temperature datasets. We pulled data from the NLDAS database which includes hourly precipitation since 2002, and summarized each hour for each watershed, resulting in over 44 billion geo-processed data points, ready to be inputted into future models.

- Prepared and submitted a proposal for a SESYNC Pursuit Grant:

Short, intense precipitation events and their socio-environmental context as drivers of stream water quality. SESYNC Pursuit Grant. Co-PIs: A.W. Latzka & M.W. Diebel. May 2017. Rejected, with invitation for resubmission.

- Prepared and published an online 'shiny' application to view TP/TSS model results. Visualizations are geared toward interpreting model results, understanding model accuracy, viewing predicted water quality dynamics, understanding the site-level drivers of water quality, testing for changes in water quality over time, assessing minimum detectable change for water quality improvements, and identifying conditions in which additional monitoring data are needed. Application is currently available for use at:

http://34.223.230.186:3838/latzka/TP_TSS_miniapp/

WRI - Research Patent or Copyright

No **WRI - Research Patent or Copyright** information reported

WRI - Students Supported

No **WRI - Students Supported** information reported

USGS Summer Intern Program

Basic Information

Start Date:	3/1/2017
End Date:	2/28/2018
Sponsor:	USGS Wisconsin Water Science Center
Mentors:	
Students:	James McFeeters

Internship Evaluation

Question	Score
Utilization of your knowledge and experience	Good
Technical interaction with USGS scientists	Very Good
Treatment by USGS as member of a team	Very Good
Exposure and access to scientific equipment	Good
Learning Experience	Very Good
Travel	About Right
Field Experience Provided	About Right
Overall Rating	A+

Additional Remarks

Listed Mary Bucknell and Scott Lewein as mentors, not in drop-down menu above

Basic Information

Start Date:	3/1/2017
End Date:	2/28/2018
Sponsor:	USGS Wisconsin Water Science Center
Mentors:	
Students:	Stanley Kaymen

Internship Evaluation

Question	Score
Utilization of your knowledge and experience	Good
Technical interaction with USGS scientists	Very Good
Treatment by USGS as member of a team	Very Good
Exposure and access to scientific equipment	Acceptable
Learning Experience	Very Good
Travel	About Right
Field Experience Provided	About Right
Overall Rating	A

Additional Remarks

Listed Andrew Yan as mentor, not available on Mentor drop-down menu.

I have had a very positive experience working as an intern at the USGS in Middleton and am very satisfied overall.

Basic Information

Start Date:	3/1/2017
End Date:	2/28/2018
Sponsor:	USGS Wisconsin Water Science Center
Mentors:	David P. Krabbenhoft
Students:	Ryan Lepak

Internship Evaluation

Question	Score
Utilization of your knowledge and experience	Very Good
Technical interaction with USGS scientists	Very Good
Treatment by USGS as member of a team	Very Good
Exposure and access to scientific equipment	Very Good
Learning Experience	Very Good
Travel	About Right
Field Experience Provided	About Right
Overall Rating	A+

Additional Remarks

While working within the USGS MRL, I feel as though I'm treated as an equal team member. It has been a delightful experience!

Basic Information

Start Date:	3/1/2017
End Date:	2/28/2018
Sponsor:	Wisconsin Water Science Center
Mentors:	Charles P Dunning
Students:	Luke Loken

Internship Evaluation

Question	Score
Utilization of your knowledge and experience	Good
Technical interaction with USGS scientists	Acceptable
Treatment by USGS as member of a team	Very Good
Exposure and access to scientific equipment	Very Good
Learning Experience	Good
Travel	About Right
Field Experience Provided	About Right
Overall Rating	A-

Additional Remarks

My interaction with USGS in Middleton was fairly limited in my position. I don't think this is necessarily a bad thing as I have developed my own connections with several USGS staff at other centers.

Basic Information

Start Date:	1/1/2017
End Date:	1/1/2017
Sponsor:	USGS Wisconsin Water Science Center
Mentors:	
Students:	Garritt Moede

Internship Evaluation

Question	Score
Utilization of your knowledge and experience	Very Good
Technical interaction with USGS scientists	Very Good
Treatment by USGS as member of a team	Very Good
Exposure and access to scientific equipment	Good
Learning Experience	Very Good
Travel	About Right
Field Experience Provided	About Right
Overall Rating	A

Additional Remarks

Listed Scott Lewenin, Mary Bucknell. Jordan Read as mentors (not available in drop-down menu).

Learned a lot here and had a great time. They are very organized with their software processes and I appreciated every minute of my work there. Pay was a little low, but I understand that. Resources were utilized to their max.

Student Support					
Category	Section 104 Base Grant	Section 104 NCGP Award	NIWR-USGS Internship	Supplemental Awards	Total
Undergraduate	0	0	3	3	6
Masters	0	1	0	2	3
Ph.D.	2	0	2	1	5
Post-Doc.	1	0	0	0	1
Total	3	1	5	6	15

Notable Awards and Achievements

Wisconsin Water Resources Science-Policy Fellowship: A new partnership to merge models, technology, and decision-making for Wisconsin water quality

River, stream and lake water quality supports tourism, residential development, and recreation, yet can be impaired by agricultural and urban runoff. In streams, suspended sediment commonly causes impairment resulting in brown water color and poor habitat quality.

In FY16-17, partnering 50:50, the University of Wisconsin Water Resources Institute and the Wisconsin Department of Natural Resources (DNR) created a one-year fellowship for a recent postgraduate to apply newly minted technical skills toward real-world water science-policy challenges. The selected fellow, Dr. Alex Latzka, worked side-by-side with DNR professionals to study and model suspended sediments across Wisconsin streams to improve water-quality management. The first phase developed a model that predicted daily sediment concentrations based on a stream's upstream land use and each day's precipitation. To make this model useful for regional and county biologists who manage stream water quality, the fellow developed tools that allow biologists to view and interpret the model's findings for specific streams in print-out reports and interactive web tools.

This project led not only to future workforce professional development, but also cutting-edge modeling and analysis and innovative technologies aimed directly at the needs of water resource managers. Ultimately, the results and tools developed will help decision-makers to efficiently identify streams amenable to water-quality improvements, assess the impacts of their efforts, and better manage water quality across the state.

This project was featured in the NIWR recent highlights publication.

University of Wisconsin Water Resources Institute Updates Website for Maximum Impact

Over FY17, the University of Wisconsin Water Resources Institute overhauled its website to provide better service to the people of the state and beyond - <https://www.wri.wisc.edu/>.

University of Wisconsin Water Resources Institute Continues to Partner With Wisconsin Sea Grant to Reach Millions of People

Wisconsin Water Resources Institute (WRI) and Sea Grant Institute are housed together administratively at the Wisconsin Aquatic Sciences Center (ASC). This structure enables synergies related to water impacts and outreach efforts. The communications team works to extend research results to the people of Wisconsin and beyond. This occurs in a variety of ways, by interacting with investigators and telling the stories of their work through writing, video and podcasts and then sharing these products in a variety of ways (website, social media, newspapers, campus news, television, community events, etc.). A list of 2017 WRI-specific and general ASC communications accomplishments (not including those outreach efforts that are exclusively related to Sea Grant; e.g. Sea Grant website and products) are below. Over the past year, our center, in some form, reached more than 5.8 million people in telling the stories related to Wisconsin's water resources. In addition, our Communications Team received an AVA Digital Platinum Award for a podcast series on groundwater (<https://www.wri.wisc.edu/news/undercurrents-the-hidden-knowledge-of-groundwater/>).

WRI and ASC Communications team summary during 2017 - number of visits, followers or readership

WRI Website - 83,503

ASC Earned media, 120 News Stories - 5,730,027

ASC Chronicle, hard copy - 2,400

ASC Chronicle, electronic copy 3,000

ASC Chronicle, online visitors - 24,188

ASC Publications Store - 10,925

ASC Social media - 5,202