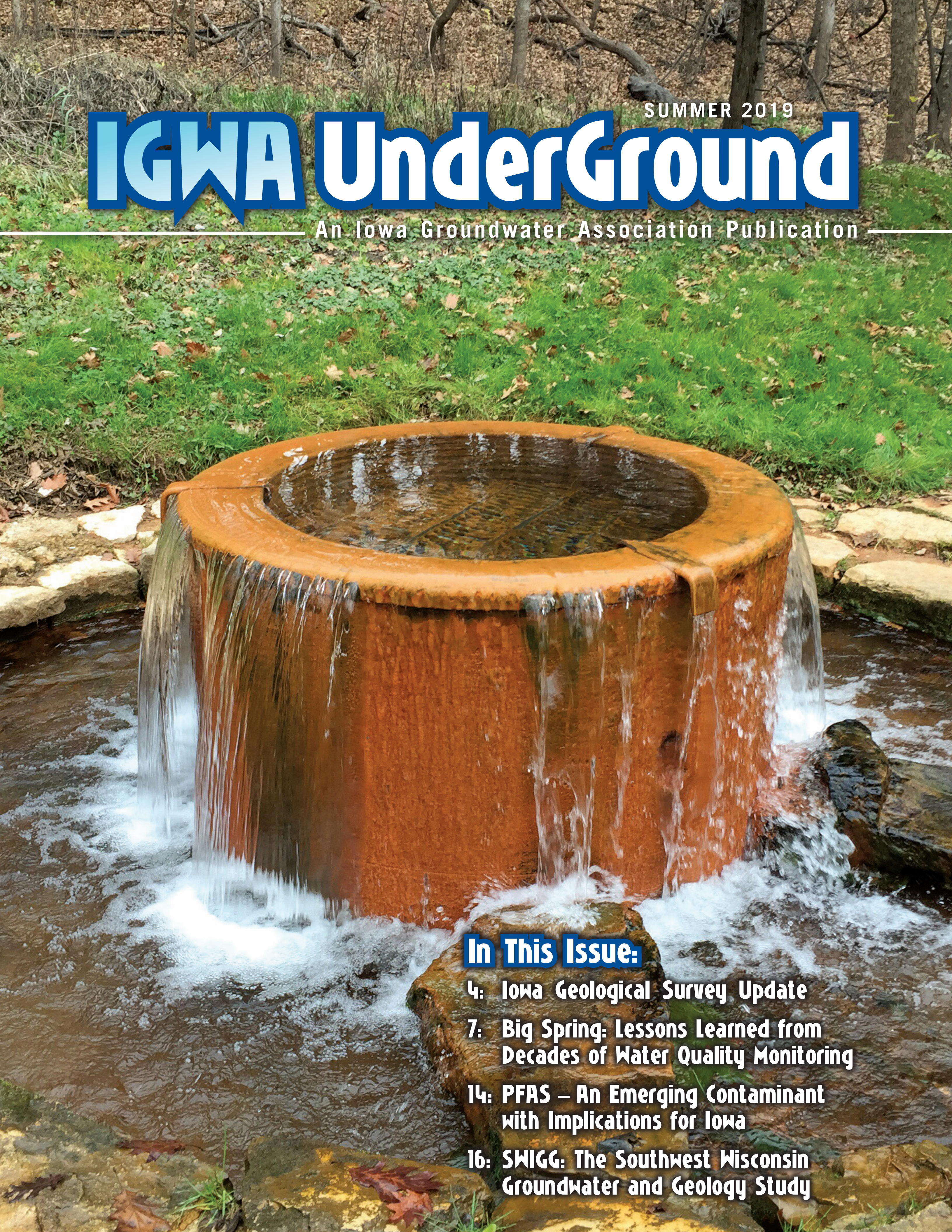
SUMMER 2019

IGWA UnderGround

An Iowa Groundwater Association Publication

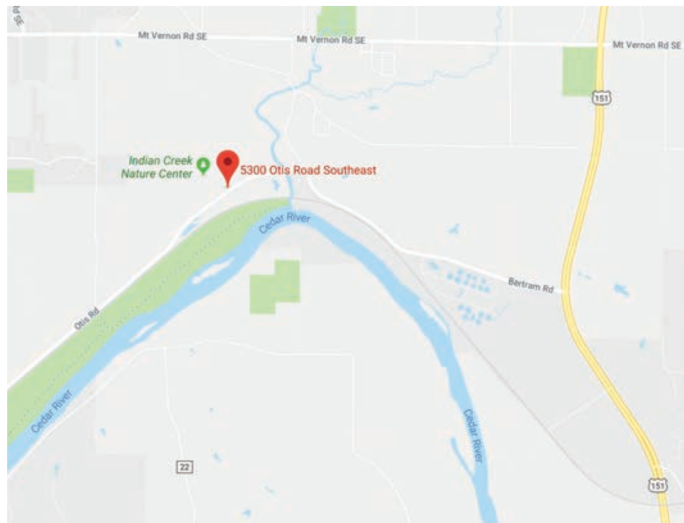


In This Issue:

Iowa Groundwater Association 2019 Fall Meeting

OCTOBER 17, 2019

INDIAN CREEK NATURE CENTER
5300 OTIS ROAD SE | CEDAR RAPIDS, IOWA



FALL CONFERENCE SCHEDULE:

CEUs: Groundwater Professionals (3), Certified Well Contractors (5), and Water Treatment Operators (5)

ADDITIONAL OPPORTUNITY | October 16 @ 5:30 PM | Informal Pre-meeting Social Gathering | at the Lion Bridge Brewing Company, downtown Cedar Rapids

8:00 AM **Registration and Refreshments**

8:30 AM **Introductory Remarks – IGWA Updates! – Discussion of Online CEU's**

8:40 AM **Cedar Rapids' Response to Flooding**
Rob Davis, City of Cedar Rapids

9:20 AM **The Iowa Well Forecasting System (IWFoS): A web application to predict aquifers and groundwater quality**
Richard Langel, Iowa Geological Survey

10:00 AM **Break**

10:20 AM **Duane Arnold Radiological Environmental Monitoring Program and Groundwater Protection**
Daron Tanko, Duane Arnold Energy Center

11:00 AM **Sewage Diplomacy in the Middle East**
Anne Dare, Ph.d. - USAID

12:00 PM **Lunch and Tour of the Facility**

1:15 PM **Application of the Optical Image Profiler (OIP) and the Combined OIHPT Probe**
Wesley McCoy, Geologist, PG - Geoprobe

2:00 PM **Use of N Stable Isotopes for Identifying Groundwater Contamination**
Adam Hirsh, PE, CFM - Felsburg Holt & Ullvig

2:30 PM **Break**

2:45 PM **Complex PFAS Sampling at Two Industrial Sites**
Jack Sheldon, Antea Group

3:15 PM **Making Water a Priority**
Senator Robb Hogg

4:00 PM **Closing Remarks**

Register online at www.igwa.org

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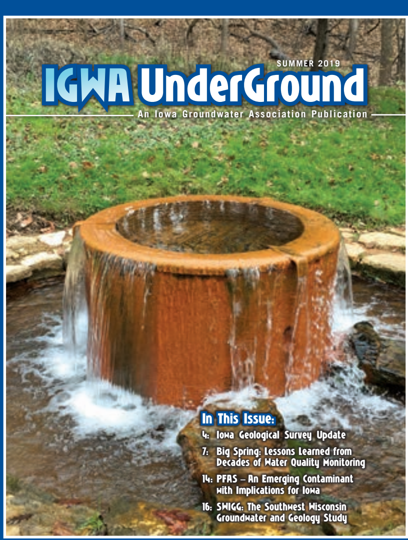

For more information on the cover photo check out page 21.

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Objectives

- Promote education and research on Iowa groundwater issues.
- Foster cooperation and information exchange throughout its membership.
- Improve communication among state regulatory officials, professionals, and technicians working with groundwater.
- Cooperate with the activities of various state and national associations organized in the interest of groundwater use, conservation, management, and protection.

IGWA Iowa Groundwater Association

We are a not for profit organization.

Iowa Groundwater Association
P.O. Box 744 • Des Moines, IA 50303
www.IGWA.org

Iowa Public Drinking Water Program 2018 Annual Compliance Report

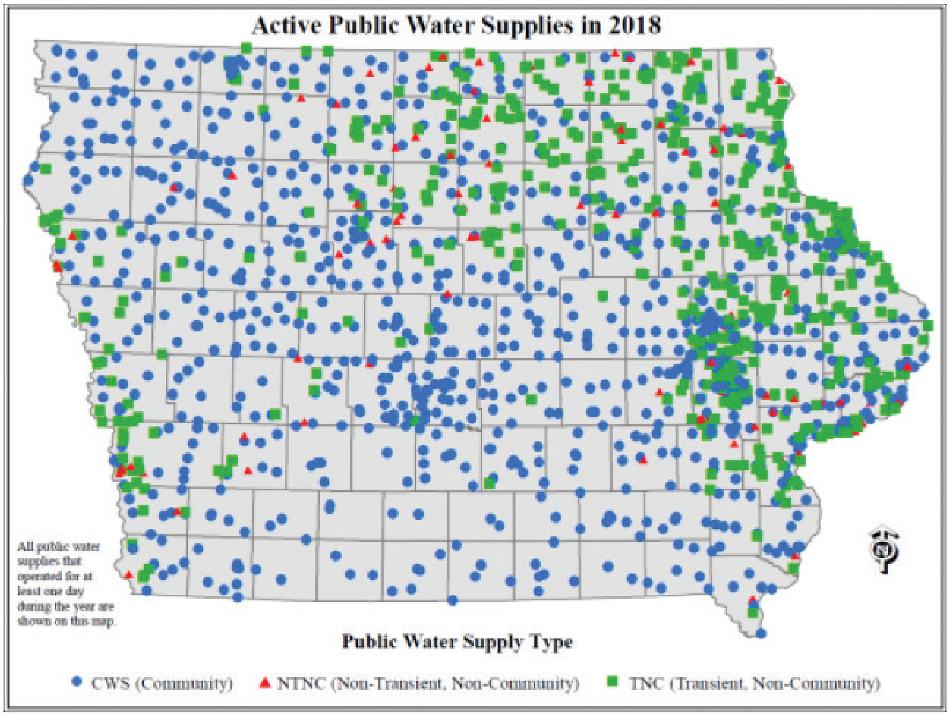
Diane Moles, Executive Officer 2, DNR's Water Supply Engineering Section

State of Iowa
Public Drinking Water Program
2018 Annual Compliance Report

Environmental Services Division
Water Quality Bureau
Water Supply Engineering & Operations Sections

June 2019

Iowa Department of Natural Resources
Bruce Trautman, Acting Director



As required by the federal Safe Drinking Water Act (SDWA), the Iowa Department of Natural Resources, which has delegated primacy for SDWA, compiles an annual compliance report to provide information on the activities, measures, and violations of national primary drinking water regulations in the public drinking water program for that year. The report lists the public water supply program components, the violations that occurred during the year of health-based standards and major monitoring and reporting requirements, and statistical information. The report for calendar year 2018 is available at this website: www.dnr.iowa.gov/ws-annual-compliance-report.

A public water supply (PWS) provides water to the public for human consumption, which includes such activities as drinking, handwashing, bathing, ice-making, food preparation, and dishwashing. The PWS must have at least 15 service connections or regularly serve an average of at least 25 individuals daily at least 60 days out of the year. A PWS is further classified as a community water system (residential; 1,079 CWS in 2018), a non-transient non-community system (business, daycare, or school; 132 NTNC in 2018), or a transient non-community system (golf course, bar, restaurant, camp, park, etc.; 627 TNC in 2018).

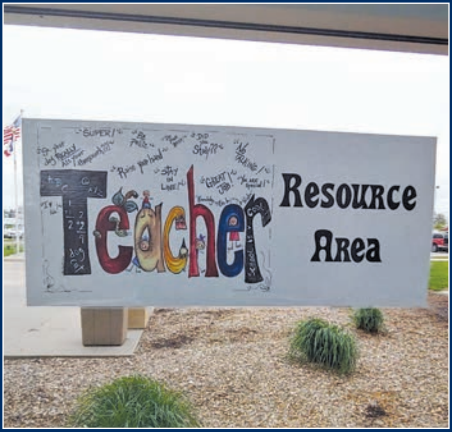
Of the 1,838 active PWS in 2018, 95.2% met all health-based standards and 82.1% met all major monitoring and reporting requirements. Approximately 93% of the state population is served by CWS, with the remaining 7% using private wells. Surface water and groundwater under the direct influence of surface water sources are used at 8% of systems which serve 45% of the population, with groundwater source used at 92% of the systems and serving 55% of the population. ■

REFLECTIONS ON THE IOWA CHILDREN'S WATER FESTIVAL

Michael Anderson, Iowa DNR Water Supply Engineer

The Iowa Children's Water Festival (ICWF) has been held at Des Moines Area Community College-Ankeny Campus annually since May of 1997. An estimated 2,000 fifth graders attend this free one-day educational event focusing on water resource awareness issues every year. The Iowa Groundwater Association (IGWA) has financially supported the festival since its initiation. I have been volunteering with the ICWF for 21 of its 23 years promoting awareness of source water characterization and as a classroom guide. In 2017, I was honored to accept a volunteer position as IGWA's representative for the planning of the festival. Being part of the festival's planning committee takes a considerable amount of time and work, but it truly is an enjoyable experience.

On the day of the festival it is rewarding to see the wonderful results of all our planning efforts! Kids are excited to learn about everything from turtles and mussels to drinking-water quality. The event is a great opportunity for teachers, too. For the past two years, my wife and I have served as the teacher's resources contact. We staff a table in the FFA Enrichment Center atrium and provide resources to educators who seek additional lesson plans and other water resource educational materials. We answer questions, especially about Iowa DNR-suggested curriculum additions and distribute a considerable amount of donated materials about the aspects of environmental protection and ways kids can learn about water resources. It is a long, fun, and tiring day! Most of the time, the atrium is a quiet place where we can engage educators. However, when the kids pass through the atrium on the way to their scheduled activities, the sound bounces off of the open atrium walls, and it is akin to a loud sound waveform washing over us. The noise and the energy of the kids makes quite an impression.



In my opinion, the Iowa Children's Water Festival is one of the best ways to engage 5th graders in science in an interactive, fun, and educational way that is a true learning experience. As I reflect, I have enjoyed my 21 years of volunteering in various capacities at ICWF. I hope to see you all again next May for the next ICWF!

Over 200 volunteers are needed at the festival every year. To find out more go to http://www.iowachildrenswaterfestival.org/ ■

IOWA GEOLOGICAL SURVEY UPDATE

SUMMER 2019

SEISMIC MONITORING AND NATURAL GAS STORAGE

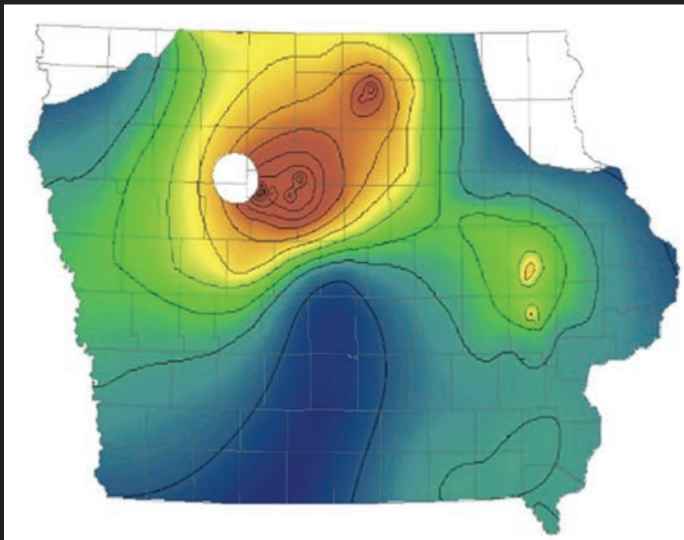
The IGS is embarking upon an exciting new effort: seismic monitoring for micro-earthquakes. A network of seismometers has been installed near Redfield, Iowa, to monitor a deep geologic structure, used by Northern Natural Gas to store gas. Water injection operations at the site have the potential to induce or enhance micro-seismic activity. The IGS is working with Northern Natural Gas to monitor the region continuously, to determine if micro-seismicity is occurring. Induced micro-earthquakes, if observed, are anticipated to have very small magnitudes which cannot be felt at the land surface.

Seismometer installation at Redfield.

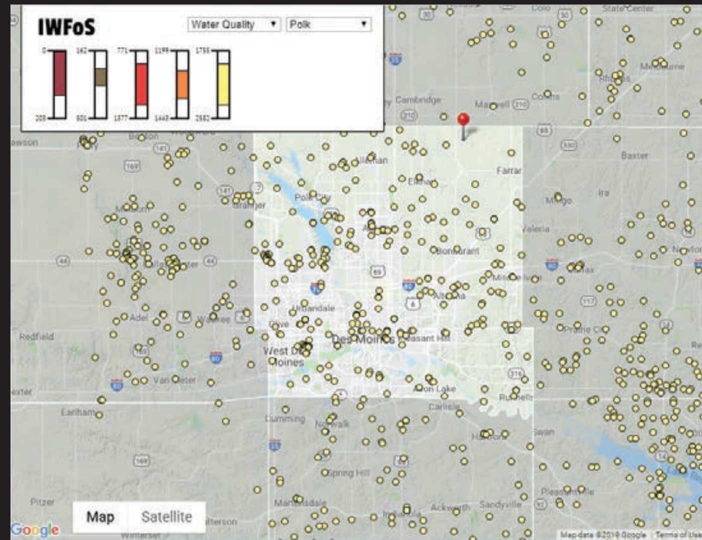
STREAMBANK CONTRIBUTIONS TO STREAM PHOSPHORUS LOADS

Excessive loss of phosphorus (P) to fresh water systems can lead to eutrophication, nuisance algal blooms and the development of hypoxic conditions in coastal water bodies, including the Gulf of Mexico. Mitigation requires an accurate estimate of P loads exported from the landscape. In response, a GIS methodology was developed to identify severely eroding segments located along 1st to 6th order river systems using LiDAR topographic data. Soil samples were collected to quantify total P concentrations and soil bulk density in exposed banks. Stream bank erosion rates were compiled from ongoing research and previous studies conducted throughout Iowa, and were also estimated from GIS analysis of aerial imagery. The database of total P concentrations and bulk density will be combined with the eroding stream lengths and recession rates to estimate annual P loads from stream banks. These will be compared to river loads of P estimated from water quality monitoring. Preliminary results indicate P contributions from streambanks are a component of P export from agricultural watersheds.

Stream Banks contribute significant P to Iowa streams.



Additional Drawdown in Cambrian-Ordovician Aquifer 2039 With Increased Water Usage in Mason City and Fort Dodge.



Well Forecasting with IWFoS.

MODELING HIGH-USE CAMBRIAN-ORDOVICIAN AQUIFER AREAS

Previous aquifer characterization and modeling, along with recent water use trends, identified several areas where long-term water level declines in the Cambrian-Ordovician (C-O) aquifer are a potential concern. These are Linn and Johnson counties; a region in north-central Iowa stretching from Mason City to Fort Dodge; and the metro Des Moines area. IGS is working with major water users in these areas, and is currently focusing on the Fort Dodge-Mason City area. This area was incorporated into a regional groundwater flow model in order to evaluate the collective drawdowns that could occur between the two areas, as well as potential changes in groundwater flow patterns. By incorporating both areas into one model, long-term predictions of water levels at the local-scale can be achieved while accounting for regional, collective well interference.

Preliminary model results indicate groundwater withdrawals from the C-O Aquifer could be increased by 50% in the Mason City area and 50–75% in the Fort Dodge area without water users reaching "Tier 2" regulatory levels, over the next 20 years. There is greater uncertainty in the prediction for the Ft. Dodge area, because the long-term regional impacts of the Manson Impact Structure on groundwater production and well drawdowns is unclear. IGS is recommending future C-O Aquifer pump tests be designed to assess the aquifer properties in areas close to the Manson Structure.

WEB-AVAILABLE WELL FORECASTS

The University of Iowa Center for Health Effects of Environmental Contamination, UI Hydroinformatics Lab, and IGS collaborated to create the Iowa Well Forecasting System (IWFoS). A well forecast is an evaluation of the groundwater quantity and quality. IWFoS integrates geology data from the IGS' GeoSam database with water quality data from the Iowa DNR's Private Well Tracking System. With a mouse click, IWFoS will display a well forecast showing the aquifers and the water quality results for nearby wells for any site. IWFoS is available at https://www.iihr.uiowa.edu/igs/wellforecasting/.

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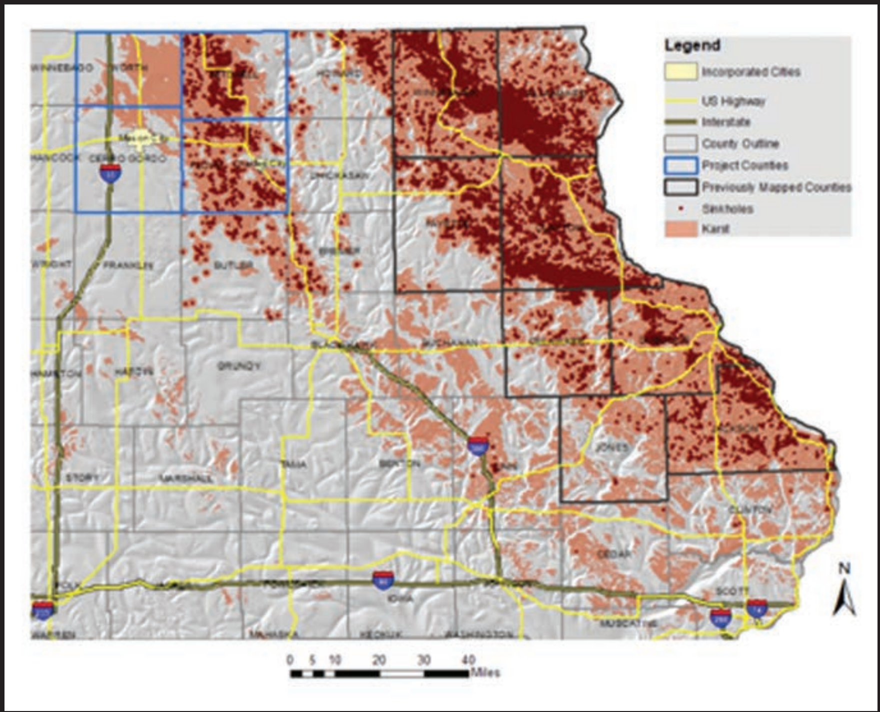
IGS JOINS THE NATIONAL GROUNDWATER MONITORING NETWORK

The USGS' National Groundwater Monitoring Network (NGMWN) recently funded the IGS to pump water and conduct slug tests on a series of monitoring wells in the Silurian/Devonian aquifer. The wells all have long historic static water level records, which is the reason they are included in the NGWMN. The IGS lacks any data suggesting these wells have been pumped or tested since they were drilled in the early to mid-1970s. The goal of the project was to ensure the wells still had connection to the aquifer. As expected, the initial water pumped was extremely orange in color. The average hydraulic conductivities found ranged from 0.2 to ~1,000 feet/day in the wells. Only 1 of the 9 wells tested had performance issues that suggested it is no longer in connection to the aquifer.

Purging long abandoned monitoring wells.

SINKHOLE MAPPING RETURNS

IGS and IDNR, with support from the Iowa Department of Transportation, have begun a project to expand and update the Iowa sinkhole and karst potential mapping for the state. The first sinkhole map for Iowa was generated based primarily on the Natural Resource Conservation Service (NRCS) county soil surveys. These data sources have proven to vastly underrepresent the number of actual sinkholes. Nearly ten years ago, the IDNR initiated a project by the that mapped an eight-county area in northeast Iowa using LiDAR imagery and historic aerial photography. This mapping identified 33,729 sinkholes, but was never completed for the remainder of the state. This effort provided a large improvement in the total number of sinkholes identified; however, the remainder of the state still relies primarily on county soil survey data which may be more than 30 years old and varies county by county. The current project will map Worth, Cerro Gordo, Mitchell, and Floyd counties in north-central Iowa, an area for which the surficial and bedrock geology has recently been mapped with support from the USGS STATEMAP program. Both the bedrock geology and depth to bedrock maps were highly improved over the state wide map and will provide additional information for the sinkhole and karst potential mapping. By synthesizing more recent geologic mapping data, the previous map resolution can be improved upon to further characterize the bedrock and identify areas with high karst potential. ■



Areas with sinkhole mapping completed and planned.

BIG SPRING:

Lessons learned from decades of water quality monitoring

Claire Hruby, Ph.D., Iowa Department of Natural Resources

One of the longest and most complete water quality monitoring records in Iowa comes from Big Spring at the Iowa Department of Natural Resources' (IDNR) trout hatchery near Elkader (**FIGURE 1**). The data collected at this spring directly reflect the impacts of rural land use practices within the 103 square mile karst-dominated springshed in Clayton County. Monitoring at Big Spring has focused on nitrogen in the form of nitrate since 1950, but has also included measurements of other forms of nitrogen, phosphorus, total suspended sediments, turbidity, pH, dissolved oxygen, major ions, metals, pesticides, microbial contaminants, and even pharmaceuticals. Long-term monitoring at this location has given us insights into the complicated relationships between geology, contaminant transport, weather conditions, and changing land use practices.

SEDIMENTS:

Water flowing out of the ground at Big Spring is great for raising trout…most of the time. Unfortunately, this water does not always flow clear, and suspended sediments can clog up raceways and make it hard for fish to see food (**FIGURE 2**). Total suspended solids (TSS) data from Big Spring for 2001 – 2016 show that 90% of the time the waters run clear (<10 mg/L TSS), but TSS levels up to 260 mg/L (110 NTU) have been recorded. Considerable efforts at soil conservation, including adoption of no-till practices and cover-crops, have taken place in northeast Iowa, but these data indicate that there is still more work to do.

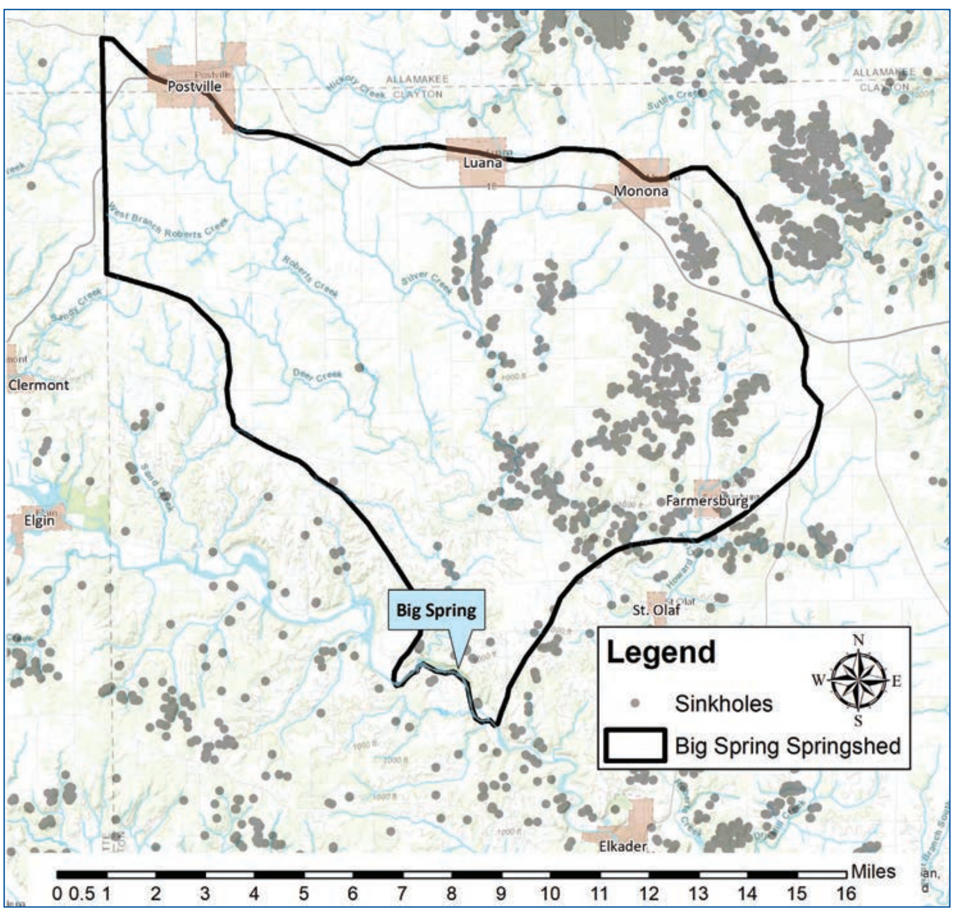


FIGURE 1. Map of the Big Spring springshed determined by multiple dye traces.

NITRATE:

Previous summaries of Big Spring water quality describe how average annual nitrate (as N) concentrations rose steadily from 2.9 mg/L in 1951 to 9.0 mg/L in 1981, in response to higher rates of fertilizer application on increased acres of corn. Since then, multiple efforts to reduce nitrogen losses have taken place. The fertilizer set-aside Payment-In-Kind program of 1983, resulted in a 40% decline in nitrogen applications for one year. Two-years later, a substantial drop in the average nitrate concentration at Big Spring was observed (**FIGURE 3**). This program, however, was not continued, and nitrate concentrations rebounded. From 1986-1993, new best management practices were implemented as part of the Big Spring Demonstration Project, which aimed at changing the timing and application rate of farm chemicals.

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FIGURE 2. Gary Siegwarth, IDNR Fisheries, scoops mud out of one of the raceways at Big Spring Trout Hatchery during an Environmental Protection Commission field trip in 2018.

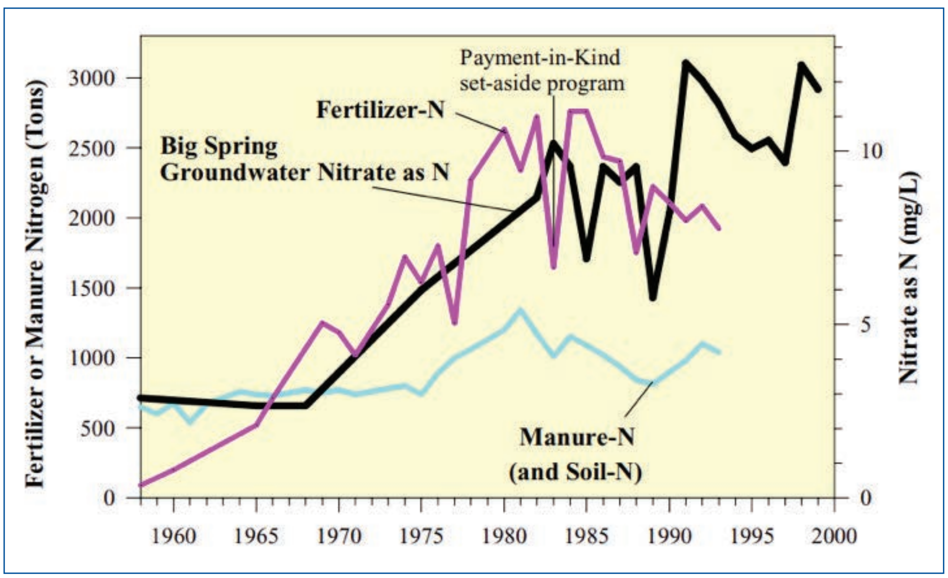

FIGURE 3. Trends in average annual nitrate as N (scale on right) at Big Spring and quantities of commercial fertilizer and manure nitrogen (scale on left) used in the basin from 1958 – 1999. Reproduced from the Big Spring Retrospective (2002).[1]

(continued from page 7)

This project resulted in a reduction of average nitrogen fertilizer use on corn from 174 lb/acre to 115 lb/acre with little or no effect on corn yields. Any benefits to water quality from this project were overshadowed by variations in precipitation and resulting discharge, which led to record low nitrogen losses (5% of the fertilizer-N applied) during the drought years ('88-'89) followed by substantial losses (80%) in wet years. Between 1981 and 1999, the average nitrate concentration was 10.10 mg/L as N.[1]

Iowa DNR and the Iowa Geological Survey continued to collect samples on a monthly basis (with a few exceptions) until 2016, when researchers from the University of Iowa's IIHR Hydroscience & Engineering installed continuous nitrate monitoring sensors. All available nitrate data as of July 2019 are summarized in **FIGURE 4**. Keith Schilling, Chris Jones, and others recently published an article comparing the continuous monitoring trends at Big Spring and a spring near the IDNR's Manchester Fish Hatchery. The authors showed how nitrate concentrations at Big Spring drop sharply in response to precipitation events as runoff that enters the subsurface dilutes the higher levels of nitrate in groundwater. Once the dilution effect has past, nitrate concentrations revert to baseline levels, or increase only slightly,

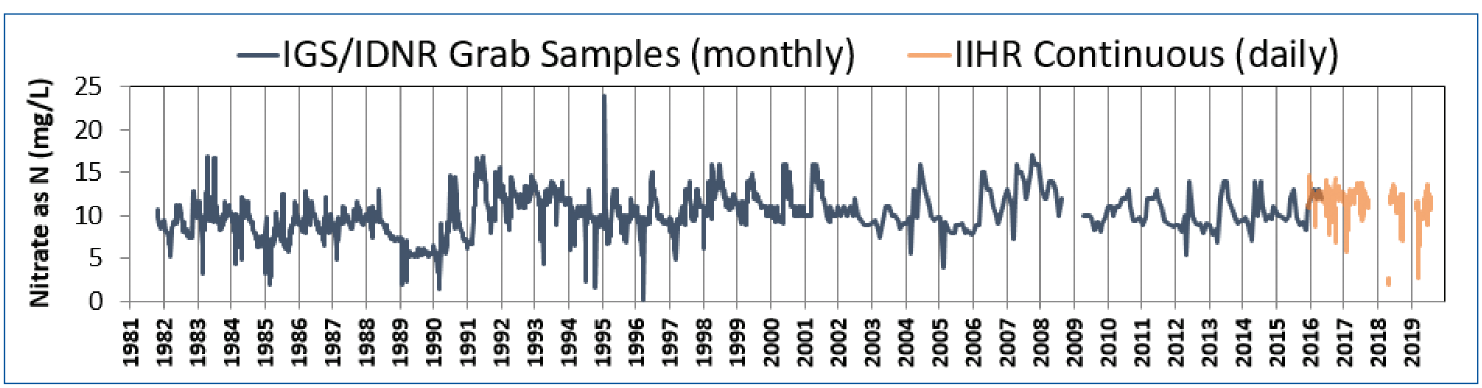

FIGURE 4. Nitrate concentrations at Big Spring from 1981 to July 2019.

before returning to pre-event concentrations. In contrast, very little dilution occurs at Manchester, which has fewer sinkholes in its springshed. At Manchester, nitrate concentrations rise after rainfall events, as new nitrate is lost from the soil profile, followed by a gradual decline back to baseline concentrations (around 15 mg/L).[2]

PESTICIDES:

Pesticides, including insecticides and herbicides, were monitored at Big Spring from 1981 until 2006. Atrazine was the most frequently detected pesticide at Big Spring during that time. The peak atrazine concentration was 6 micrograms per liter (µg/L), reported in 1991. The current maximum contaminant level (MCL) for atrazine in drinking-water is 3 µg/L based on cardiovascular and reproductive effects from chronic (long-term) exposures above the MCL. **FIGURE 5** shows levels of atrazine and desethylatrazine from 1993 – 2014 (with a gap from 2007-2012). From 1993 – 2006, atrazine levels often spiked in late spring (May-June), while remaining generally low or not detectable in fall and winter. While long-term exposures remain low, these data indicate that short-term exposures to higher concentrations may occur. These short-term exposures could be a concern for aquatic life and developing fetuses.

After a 6-year hiatus, pesticide monitoring was continued from mid-2012 until mid-2014. In those two years, atrazine and its degradates were rarely detected. Monthly

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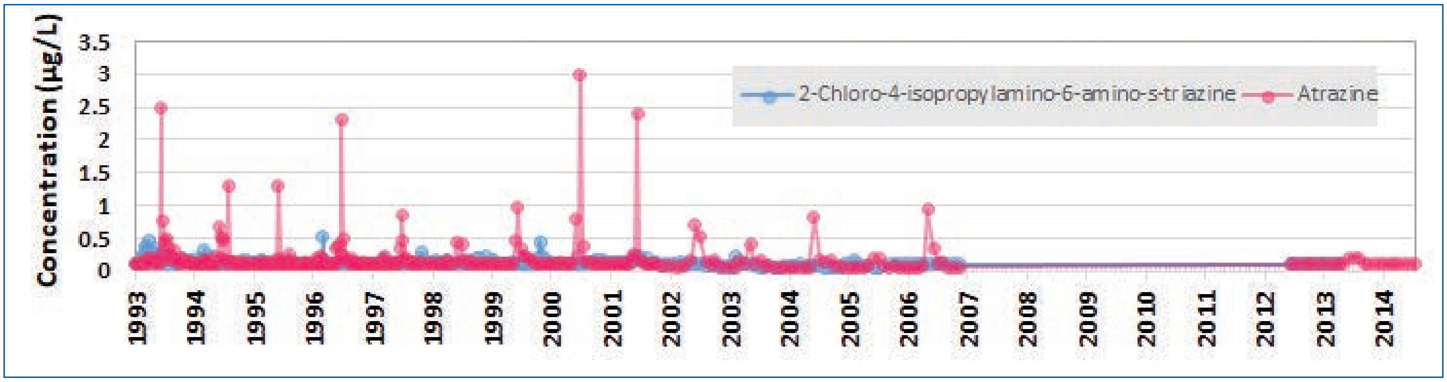

FIGURE 5. Concentrations of atrazine and desethylatrazine in monthly samples from Big Spring (1993-2014).

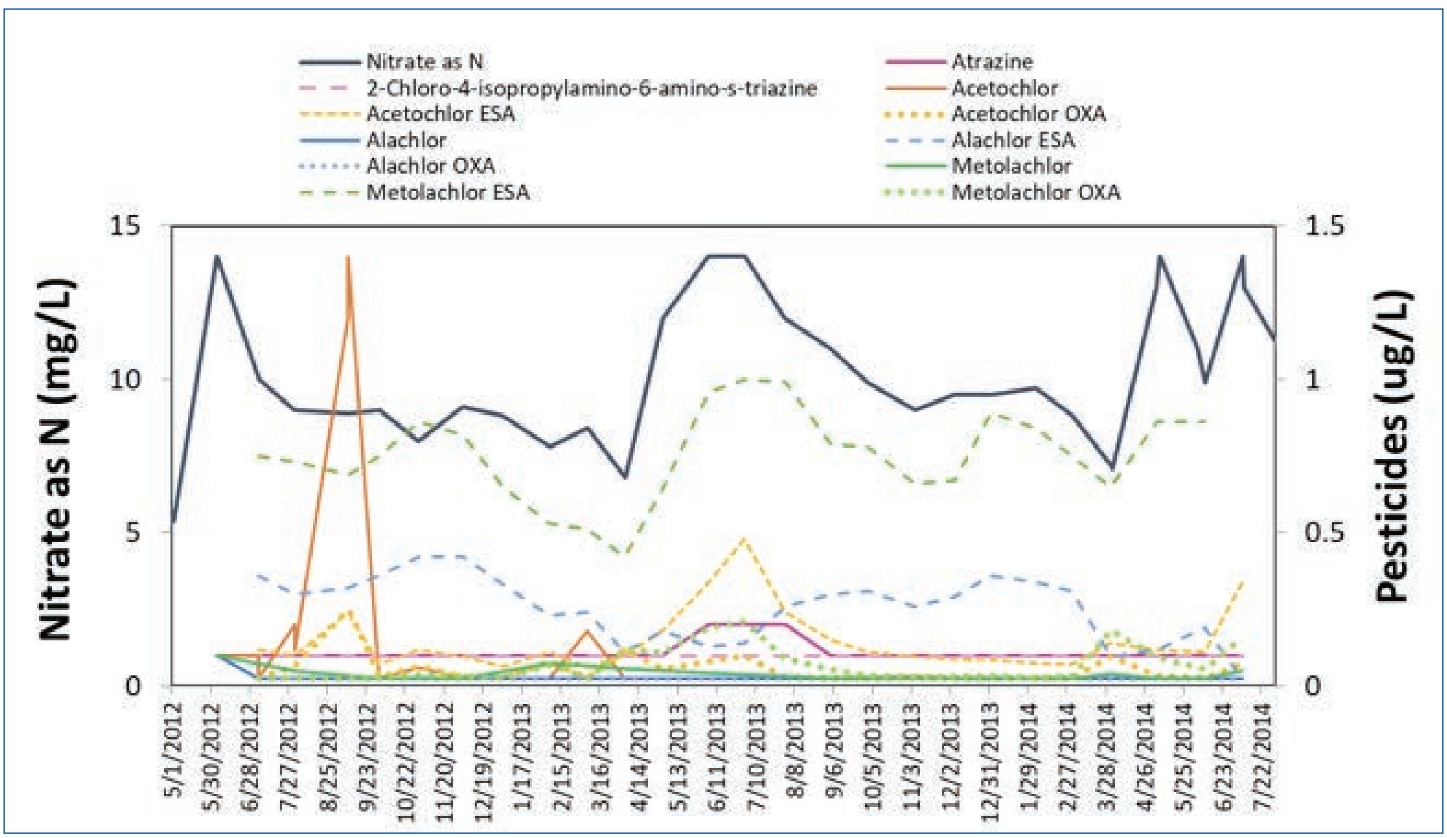

FIGURE 6. Measured concentrations of nitrate as N and selected pesticides from monthly samples at Big Spring (2012-2014).

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samples were also analyzed for degradates of the chloroacetanilide pesticides. Two degradates (metolachlor ESA and alachlor ESA) were consistently detected throughout this time period. These degradates did not spike, but instead paralleled the nitrate concentrations, while still remaining at concentrations below 1 µg/L (**FIGURE 6**).

Pesticide monitoring completed at Big Spring has allowed us to characterize the variability and persistence of these compounds in a karst system. However, pesticide use changes over time and questions about the transport of the chemicals remain. For example, estimated alachlor use has dropped dramatically since the 1990s, while the use of new products, like glyphosate (Round-Up) and neonicotinoids have increased. Little is known about the health impacts of mixtures of these chemicals, and additional monitoring is needed to evaluate the risks from these compounds.

BACTERIA:

Another contaminant that has been documented at Big Springs is bacteria. Over the years, samples have been analyzed for total coliforms, *Escherichia coli*, and enterococci. In general, bacteria concentrations are lower (<100 MPN/100ml) in the cooler months (November-April) than in the summer season (May-October). Between 2001 and 2016, the median *E. coli* concentration was 170 MPN/100ml for samples collected monthly, and the maximum concentration reported was 53,000 MPN/100ml for a sample collected July 7, 2010 (**FIGURE 7**). The presence of these bacteria suggest that fecal pollution from humans and/or animals is occurring and could contain infectious disease-causing organisms. However, additional research is necessary to determine whether sufficient concentrations of pathogenic viruses and bacteria are being transported in these karst systems to cause disease.

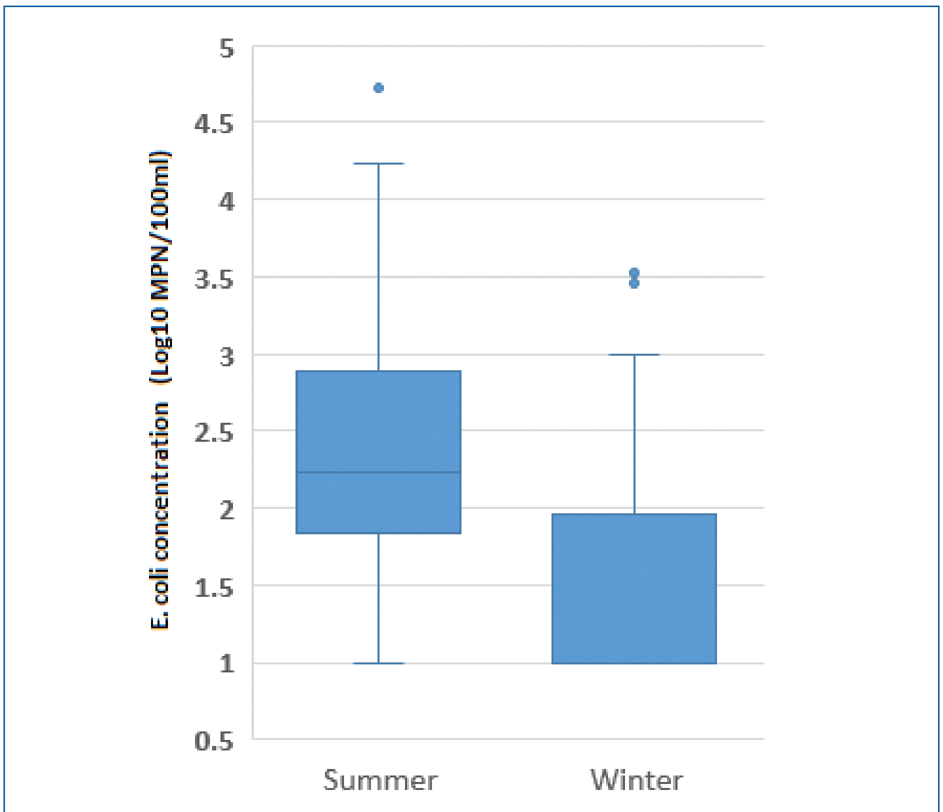


FIGURE 7. Box-plots showing range of E. coli concentrations in summer and winter months in Big Spring samples from 2001 - 2016. Samples with reported values of <10 MPN/100ml were assigned values of 10 (Log_{10} of 10 equals 1).

Recent studies by Luther College faculty, Dr.'s Eric Baack and Jodi Enos-Berlage, and their students, at springs and streams in the Decorah area, confirm that the highest concentrations of *E. coli* occur following summer rain events. Source tracking analyses have shown both human and cattle genetic material are present in these samples. In addition, some of the *E. coli* from these samples were found to be resistant to up to 3 different kinds of antibiotics (out of 8 tested). These researchers recently conducted a study which found gene sequences unique to Cryptosporidium and other microbial pathogens in wells, springs, and streams near Decorah (see Dr. Eric Baack's presentation from the Spring 2019 IGWA Conference on the IGWA website for more information!).[3]

PHARMACEUTICALS:

In 2013 and 2014, eighteen monthly Big Spring samples were analyzed for a suite of pharmaceutical compounds including acetaminiphen, caffeine, gemfibrozil, lincomycin, carbamezapine, triclosan, and sulfamethoxazole. Caffeine was the only pharmaceutical compound to be detected, and its maximum concentration was 0.1 µg/L.

WHERE TO FIND MORE INFORMATION:

Although the monthly sampling at Big Spring has ceased for the time being, there is still much to learn from the extensive collection of monitoring records. Results of grab sample monitoring at Big

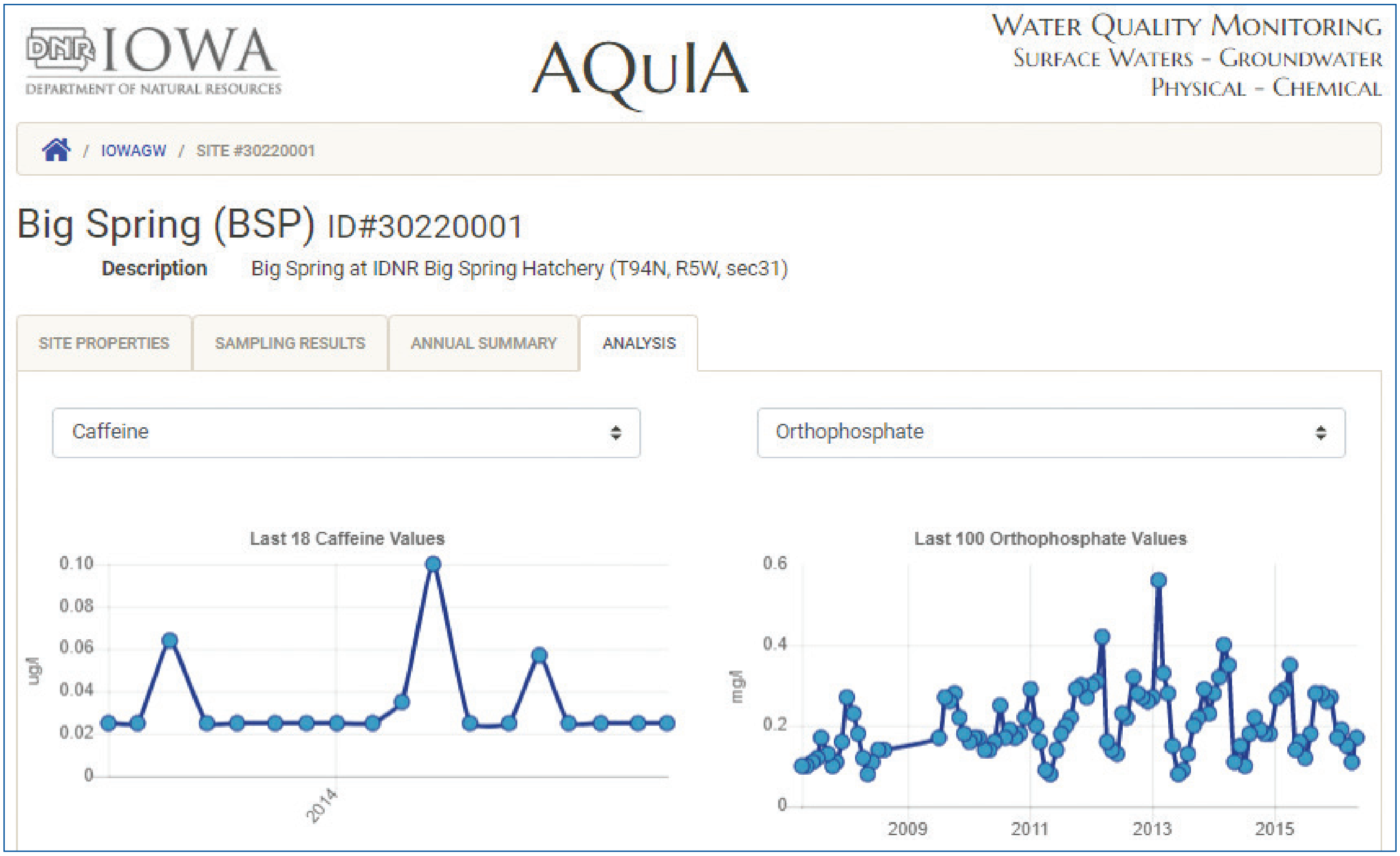


FIGURE 8. Example of display of results available in IDNR's AQuIA database.

Springs starting in 1993 can be found in the Iowa DNR's AQuIA website: https://programs.iowadnr.gov/aquia/. The Big Spring data are within the IowaGW dataset, and the site number is 30220001. You can either select the site, view all records, and preview the data under the Analysis tab (**FIGURE 8**), or use the Data Search function to select specific records by water quality parameter and/or date range, which can then be exported as a .csv file. Nitrate results in AQuIA are listed under "Inorganic nitrogen (nitrate + nitrite) (as N)."

Continuous monitoring data can be viewed on IIHR's Iowa Water Quality Information System (IWQIS) website at https://iwqis.iowawis.org/. Click on "WQ Sensors," then zoom in. First click on the marker on the Turkey River just northwest of Elkader (SENSOR – IIHR WQS0031), then click on the "Annual" button and choose "Nitrate + Nitrite as N" to view the records.

Many more detailed water quality summaries from 1983 – 2002 can be found on the Iowa Geological Survey Publications website: https://www.iihr.uiowa.edu/igs/publications/search. Just type in the key word "Big Spring."

CONCLUSIONS:

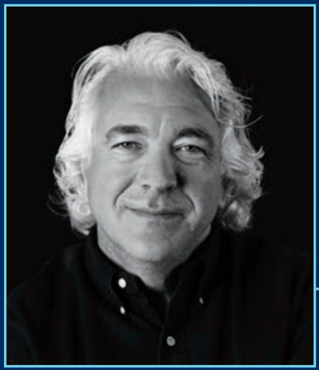
Many lessons can be learned from long-term monitoring at Big Spring. We have seen that despite decades of conservation efforts, nitrogen and sediment losses in this highly vulnerable region continue to impact our water resources. Many of these contaminants have the potential to impact human health and many small communities are currently struggling to address high nitrate concentrations in their municipal wells. In addition to these challenges, the mixture of contaminants found in these waters have the potential to impact fish health and hatchery operations, aquatic life, private well users, and livestock health. As efforts to protect these valuable natural resources continue, long-term monitoring at Big Spring will be critical for evaluating the effectiveness of these programs. ■

References:

1. Big Spring Retrospective, 2002. Iowa DNR Water Fact Sheet (WFS 2002-5), 4 p. https://www.iihr.uiowa.edu/igs/publications/uploads/wfs-2002-05.pdf

2. Schilling, K.E., Jones, C.S., Clark, R. J., Libra, R.D., Liang, X., and Y-K Zhang, 2019. Contrasting NO3-N concentration patterns at two karst springs in Iowa (USA): insights on aquifer nitrogen storage and delivery, Hydrogeology Journal, 12 (4), pp 1389-1400. https://doi.org/10.1007/s10040-019-01935-y

3. Baack, E., Enos-Berlange, J, Chavez, J., Hamilton, C., Khadka, S., Kaleso, M., Mullenback, B., Penningroth, R., Tank, J., and F. Teramayi, 2019. Presentation given to the Iowa Groundwater Association, April 17, 2019. http://www.igwa.org



REMEMBERING BILL STOWE

Katie Goff and Claire Hruby, Ph.D.

> *"None of us own the water that flows through our farms or through our water plant. We all own it. It is something that connects us. I think we Iowans see ourselves as community-committed and generous and honest. But when it comes down to this commodity called water, we fill it full of pollutants and push it downstream and pretend we're not accountable for it."*
>
> *-Bill Stowe in an interview with Christine Riccelli for DSM Magazine, 2016*

William Gaylord Stowe, the CEO and General Manager of Des Moines Water Works (DMWW) died on April 14, 2019. He was 60 and fought a brief battle with pancreatic cancer. A public servant, Stowe had spent 7 years at DMWW. Prior to that he was the Director of Public Works for the City of Des Moines for 13 years. Stowe was born and raised on a farm in Nevada, Iowa, and played basketball at Grinnell College. He earned masters' degrees at the University of Wisconsin and the University of Illinois, and later, a law degree at Loyola. Stowe spent time in the steel, coal, and energy industries prior to entering the realm of public works. His varied background in business, law, and engineering provided unique expertise and problem solving for public issues. Stowe is survived by his wife, Amy, and their son, Liam.

Stowe spearheaded DMWW's lawsuit filed in 2015 against three Iowa counties located northwest of Des Moines. The counties are home to tile-drainage districts in the upper reaches of the Raccoon River, which is the primary source of drinking-water for the Des Moines metro area (approximately 500,000 people). The argument stated that the ratepayers of DMWW were paying a premium to clean up the unregulated agricultural discharge entering the watershed upstream. Stowe estimated that to accommodate the increased nitrate loads, the utility needed to spend an additional $80 million dollars to upgrade capacity of their nitrate-removal facility. The lawsuit was dismissed by a judge in 2017, on the grounds that the issue was a matter for the Iowa legislature to sort out.

"Bill was unwilling to allow today's reality to be the master of tomorrow's possibilities," writes Graham Gillette, in Stowe's eulogy. Gillette is a board member of DMWW.

Stowe's philosophy was that you should not sit back and wait for the "right time" to get things done. He was inspired by the tragic loss of his older brother in a work-related accident when Bill was still in high-school. This quote from 2016 is, in hindsight, eerily prescient:

> *"When you're young and you lose people who are so important to you in a relatively short period of time, it impresses upon you that if you're going do anything substantive in the limited amount of time you have, you'd better just do it—and not assume that you're going to do it when you're 70 or 60 or 50 or even 40. It also helps you realize the importance of faith—the ability to understand that some things are not readily understandable."*
>
> *-Bill Stowe in an interview with Christine Riccelli for DSM Magazine, 2016*

Those who knew him well, and worked with him for years, were inspired by his unwavering commitment to fairness. "Bill was committed to the struggle for equality, fairness, clean water, environmental reform, and restoring the rights of the silenced. He was painfully aware, as we all are in these uncertain times, the job is far from finished," writes Gillette.

> *"Iowans and all concerned about water quality and the environment lost Bill's articulate and robust voice. Bill was a visible and vocal advocate for environmental protection, public health, social justice and water quality in our state. He not only tasked his fellow Des Moines Water Works colleagues to challenge the status quo throughout the utility, he also asked Iowans to challenge the status quo to think downstream. Perhaps Bill's final challenge to us is to continue the vigorous but respectful debate he launched to advocate for Iowa becoming a clean water state. If we agree Iowa's declining water*

quality is unacceptable, and use our voices and actions, Bill's challenge will not be lost."

-Laura Sarcone, Public Affairs Manager at Des Moines Water Works

Stowe presented at IGWA's spring 2016 meeting about the lawsuit, Iowa's degraded surface waters, and who foots the bill for agricultural contamination. In his presentation, Stowe praised the science behind Iowa's Nutrient Reduction Strategy, but criticized the voluntary nature of its approach as woefully insufficient to meet the ambitious goals of 45% reduction in both nitrogen and phosphorus. This opinion earned him a lot of praise from water quality advocates, and also a lot of heat. Bill expressed frustration about being labeled by some as "anti-farmer" and by the often repeated "urban vs. rural" narrative. "Farmers drink this water," he said, "their animals drink this water, their children drink this water, and their grandchildren will drink this water, too."

As the "face" of Des Moines Water Works, Stowe ended up acting as a lightning-rod for all those who questioned the water-quality status quo. With an easy smile, affable nature, piercing blue eyes, and, of course, his memorable head of wavy white hair, Stowe earned celebrity status in Des Moines. He got used to the attention, but he remained modest and often tried to down-play the hype.

Claire Hruby remembers, "I bumped into Stowe at Palmer's Deli once, and I told him I just saw someone running in an "I'm With Stowe" Raygun t-shirt. He laughed, and said, "It was probably my mother!"

For many of us, the void Stowe left behind is palpable. A great leader in water quality gone too soon and there is a lot of work left to do. Iowa's water quality woes remain and continue to plague not only the citizens of Des Moines, but many communities across the state and beyond our local watersheds. When asked to describe Stowe and his impact on the larger community, Mary Skopec, currently the director of Iowa Lakeside Laboratory and formerly of the Iowa DNR, responded aptly:

" Capturing the essence of Bill Stowe is like trying to catch lightning in a bottle. Anyone who has witnessed a lightning strike up close never forgets that experience. The flash of brilliance and the rumbling reverberations that last long after the light is gone. The first time I met Bill, he peppered me with questions about the Iowa DNR water monitoring program, the nitrate trends we were seeing and the role of citizens in engaging to protect the State's waters. He challenged me with every question to consider every angle. It was evident from that first conversation that he cared deeply about Iowa and the health and welfare of all Iowans. And every time there is a discussion about water quality in Iowa, I think of that rumbling thunder and the man who startled us awake…"

Whether you agree with Bill Stowe, or not, we can all agree that he moved the water-quality discussion forward, he pursued his career with conviction, he dedicated his life to public service, and he was not afraid to speak up. In the fight for clean water, the world needs more brave souls. Bill Stowe will be missed. ■

PFAS – An Emerging Contaminant with Implications for Iowa

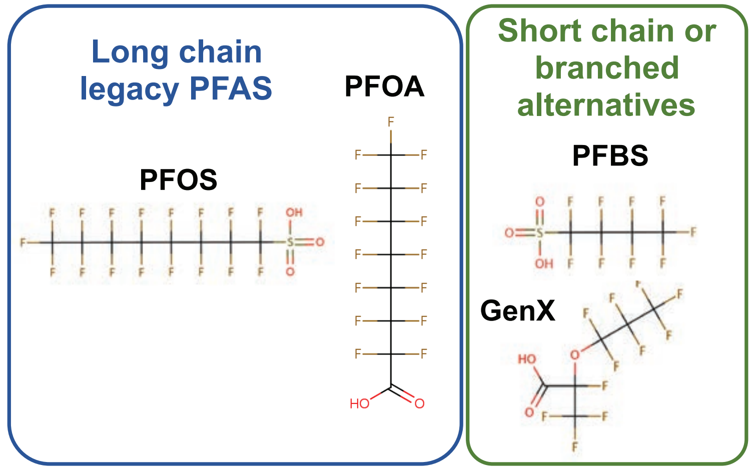
David Cwiertny, Professor Civil and Environmental Engineering at the University of Iowa and Director of the Center for Health Effects of Environmental Contamination

It is nearly impossible to look at the news these days without seeing something about Per- and polyfluoroalkyl substances (PFAS). PFAS are what many might call an "emerging contaminant" even though their discovery dates back to the 1930's, and many in the research community have been focused on their occurrence, fate and effects for decades. By way of introduction to PFAS, it is worthwhile to highlight a few of the important attributes of this chemical class:

- As a family, PFAS are extensive and diverse. Some estimate that there are as many as 4,500 synthetic (man-made) fluorinated organic chemicals that can be classified as PFAS. Two of the most common are perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS), longer chain species whose production has been phased out due to mounting concerns over their environmental and public health effects. Newer alternatives marketed as replacements for PFOA and PFOS tend to be shorter-chain perfluoroalkyl or polyfluorinated substances, often with more complex chemical structures. But the science on these newer PFAS species is incomplete and rapidly evolving, with questions persisting as to whether they are actually any safer than PFOS and PFOA.

- PFAS possess unique physical and chemical properties that impart favorable attributes including water, oil/grease and temperature-resistance and friction reduction. Consequently, PFAS are used broadly in consumer and industrial products, often far more than the average consumer may realize. You can find PFAS in a myriad of goods including carpets, foams, fast food wrappers, non-stick cookware, clothing, and, even personal care products like dental floss.

- In the environment, certain PFAS are persistent, mobile and tend to bioaccumulate. Longer-chain PFAS species like PFOS and PFOA are incredibly stable because they are assembled from very strong carbon-fluorine bonds. Like a surfactant, PFOS and PFOA are characterized by the presence of a charged group on one end of the molecule, a negatively charged sulfonate or caboxylate group, respectively. The rest of the molecule is an 8-carbon chain that is fully fluorinated. Beyond stability, this structure also confers mobility. PFOS and PFOA can migrate great distances once released into the environment. Certain PFAS also readily bioaccumulate. Because of their widespread commercial and industrial use, consumers have been routinely exposed to PFAS, often without knowing. As such, many (if not all) of us have detectable levels of PFOS and PFOA in our blood, and recent reports have raised concern about the presence of these and other PFAS in the food chain.



Structure of PFAS and related molecules

- PFAS are toxic at very low levels. Although they are not yet regulated in drinking water, the EPA has established a non-enforceable health advisory for lifetime exposure to PFOA and PFOS from drinking water. This health advisory is set at 70 parts per trillion (or nanogram per liter) based on cumulative exposure to both PFOA and PFOS. Suspected health effects associated with PFAS exposure include developmental effects to fetuses during pregnancy or to breastfed infants (e.g., low birth weight, accelerated puberty, skeletal variations), cancer (e.g., testicular, kidney), liver effects (e.g., tissue damage), immune effects (e.g., antibody production and immunity), and thyroid effects.

From the perspective of groundwater contamination, perhaps the most important source of PFAS is their use in fire-suppressing foam widely used by the military. From such applications, there are numerous reports of groundwater contamination near military installations across the United States, including Iowa. A recent military report from the Air National Guard Base in Sioux City revealed that PFAS had contaminated groundwater in the area. The chemicals, including PFOS, PFOA and three other PFAS species, are suspected to have come from PFAS-containing aqueous film forming foam (AFFF) used for fire suppression on the premises. At some testing locations, levels of PFOS and PFOA exceeded the federal health advisory levels for drinking water by over 100 times. The report also indicated that PFAS are migrating off site and called for more testing to assess potential contamination of nearby water resources.

In coordination with Iowa Department of Natural Resources, the military is conducting additional testing of water and soil on and around the site to better assess the totality of PFAS contamination near the Base.

A subsequent report also found PFAS contamination from historical use of AFFF at the Des Moines Air National Guard Base. Notably, the contamination in Des Moines resulted in release to surface water ultimately reaching Frink Creek which feeds the Raccoon River upstream of the Des Moines Water Works. Recent testing by the Water Works showed no detectable PFAS in their finished water.

These reports in Sioux City and Des Moines illustrate the challenge of managing PFAS contamination. In both instances, releases of PFAS-containing AFFF were reported to be limited at both National Guard facilities (~30-50 gal/year), it was not currently being used, and its use was highly localized at specific locations on both bases. Nevertheless, unsafe levels of PFAS persisted in groundwater at the sites; the mobility of the chemicals allowed for migration off site where other surface water and groundwater sources could be impacted; and additional PFAS species apart from PFOA and PFOS were detected. AFFF often included a complex mixture of PFAS, such that there could be far more members of the PFAS family present at these contaminated sites than initially revealed by the relatively limited testing conducted.

What should Iowa and those that care about our state's water resources do to address PFAS? First, we should be proactive. Common sources of PFAS are well known, and many other states have already grappled with PFAS contamination and established best management practices. State agencies and researchers should work collectively to identify and document where PFAS have historically or are currently being used and prioritize those locations to test whether surrounding soil and water resources have been contaminated. For example, in addition to military uses, PFAS-containing AFFF has been used at many larger municipal airports across the country and other states have identified PFAS groundwater contamination at private drinking water wells near airport facilities. Have PFAS-containing AFFF been used at any of Iowa's larger municipal airports? It's a question we need to be asking. Likewise, other states have also found PFAS contamination at firefighting training locations. Are we engaging our fire fighting community to see where there may be unrecognized and undocumented release into the environment? Finally, some of the most deeply affected communities in the US have been those living adjacent to facilities producing PFAS or manufacturing products containing PFAS. Are there companies in Iowa that are using PFAS, and if so, which species and how have they been stored, handled and disposed?

These questions should lead to action to better assess exposure risks and minimize impacts of PFAS. The State Hygienic Laboratory is able to conduct the EPA recommended method for the analysis of roughly 20 different PFAS species, and such testing could be

Fire-fighting foam is one source of PFAS contamination in groundwater

prioritized for those most vulnerable to contamination from known or likely discharge points (e.g., private well users near Air National Guard Bases or airports with documented use of PFAS-containing AFFF). Another proactive measure is to limit opportunities for future release. For example, Massachusetts instituted a take-back programs to help dispose of any legacy PFAS-containing AFFF still in possession of fire departments while assisting them in finding PFAS-free alternatives for use in fire suppression. We should also be creating an inventory of industrial and commercial users of PFAS in Iowa, and provide appropriate oversight and guidance to ensure their safe use and appropriate disposal of the compounds.

Finally, some states are electing to enforce their own standards to protect water resources from PFAS contamination. Although EPA has recently announced an action plan with the intent to create new drinking water standards for PFOS and PFOA, recent history tells us this can be a long, slow process that may run into several roadblocks that ultimately prevent a Maximum Contaminant Level from ever being established. In the meantime, many states aren't waiting for the EPA to act. States including New Jersey and New Hampshire have recently proposed strict drinking water standards for PFOS and PFOA. Other affected states are likely to follow suit.

To date, with what little we know, it certainly doesn't look like communities in Iowa will be ravaged with PFAS contamination similar to places like Hoosick Falls, New York or Grand Rapids, Michigan, among others. Then again, the old saying in analytical chemistry is "you only find what you are looking for", and right now, we aren't really looking for PFAS in Iowa in some places we probably should. Because of their extreme persistence, PFAS have been given the nickname of "forever chemicals". I recently quipped that we should probably start calling them "foreverywhere chemicals" because they aren't just hard to get rid of but they also seem to pop up just about everywhere we look. Without critical analysis of potential sources and more robust monitoring, it would be foolish to presume that Iowa has already seen the worst from these chemicals.

Adapted in part from a CHEEC *In Focus* piece written by Derek Tate, Darrin Thompson, and David Cwiertny. ■

SWIGG: THE SOUTHWEST WISCONSIN GROUNDWATER AND GEOLOGY STUDY

Ken Bradbury (WGNHS), Mark Borchardt (USDA/ARS), and Joel Stokdyk (USGS)

The Southwest Wisconsin Groundwater and Geology (SWIGG) project is a collaborative study with the goals of documenting the quality of drinking water produced by private wells in three southwestern Wisconsin counties and then examining relationships between water quality and local hydrogeologic factors. Approximately 44% of the population in Grant, Iowa, and Lafayette Counties rely on private groundwater wells (Wisconsin DNR). Collectively, these residents are served by over 18,000 known private wells. Private wells in Wisconsin are not monitored or regulated by federal, state, or local government; instead, homeowners are responsible for the maintenance and testing of their well, including any treatment or corrective action to address contamination.

Contamination of private wells is commonly assessed using tests for nitrate and indicator bacteria (total coliform and E. coli). Existing data showed that across the three counties 13% of 4,283 samples exceeded the nitrate drinking water standard of 10 ppm NO_3-N, while 29% and 3% of 1,747 samples were positive for total coliform bacteria and E. coli, respectively. Samples collected for these measurements were voluntary and therefore may not reflect the true extent of contamination as certain geographic areas or geologic settings may be over- or under-represented. Moreover, assessments based on nitrate and indicator bacteria can describe the extent of groundwater contamination, but the causes and sources of contamination remain unknown.

Grant, Iowa, and Lafayette Counties are in the Driftless Area of southwest Wisconsin. Unlike much of northern and eastern Wisconsin, these counties were not covered by continental glaciation during the Pleistocene. Consequently, the landscape there is geologically much older than the glacially-modified landscapes found in other parts of the state, and consists of high ridges and deep valleys. The uppermost bedrock in the region is mostly dolomite and limestone of the Ordovician-age Sinnipee and Prairie du Chien Groups. These carbonate rocks contain ubiquitous fractures and heterogeneities, including karst features (sinkholes, conduits, and small caves). Generally in the three counties these rocks are within 50 feet of the surface (**FIGURE 1**). Along some of the valley walls and in valley bottoms the St Peter Sandstone is exposed. The Maquoketa Shale is the uppermost bedrock in patches in southernmost Grant and Lafayette Counties. Much of the uplands in the three counties are covered with a silty-clay material known as the Rountree Formation, thought to consist of weathered residuum from the underlying carbonate bedrock intermixed with loess, or windblown silt, deposited during the Pleistocene.

(continued on page 18)

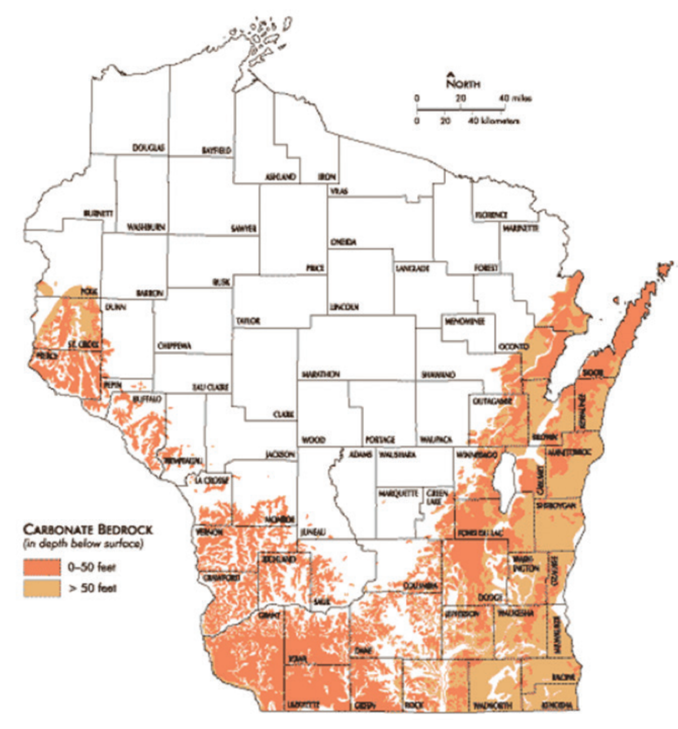


FIGURE 1. Shallow carbonate bedrock in Wisconsin (source: WGNHS).

County	November event (301 wells tested) Total coliform	E. coli	High Nitrate*	Total coliform or High Nitrate*	April event (539 wells tested) Total coliform	E. coli	High Nitrate*	Total coliform or High Nitrate*
Grant	38	7	12	43	14	1	14	25
Iowa	26	3	13	33	14	1	13	25
Lafayette	40	3	27	55	23	4	21	36
All	**34**	**4**	**16**	**42**	**16**	**2**	**15**	**27**

*High nitrate exceeds the health standard of NO_3^--N > 10 mg/L

TABLE 1. Percentage of wells positive for total coliform, E. coli, and high nitrate* for two sampling events.

(continued from page 17)

Groundwater can occur in any of the rock formations in these counties, depending on the elevation of the water table. Rocks of the Sinnipee Group, St Peter Sandstone, Prairie du Chien Group, and the Cambrian sandstones all form interconnected aquifers. Deep wells in this area receive most of their water from the Cambrian sandstone aquifer, but locally shallower wells are finished in rocks of the Sinnipee or Prairie du Chien Groups or in the St Peter Sandstone. Perched groundwater conditions are known to occur in the bedrock aquifers in some areas. Along major river valleys sand-and-gravel aquifers supply water to wells.

Bedrock type, as described above, and the depth to that bedrock are important hydrogeologic characteristics when considering groundwater contamination, and they are both central to recent revisions to the Wisconsin code that regulates manure application, NR 151. Carbonate bedrock aquifers are vulnerable to contamination because water is transported quickly through bedrock fractures. Given the bedrock's limited ability to filter contaminants, the soil overlying the bedrock is essential for removing contaminants prior to them reaching the groundwater. The NR 151 revisions aim to address contamination of vulnerable groundwater resources where fractured carbonate bedrock is overlain by thin soils (that is, shallow depth to bedrock). **FIGURE 1** shows that such conditions occur in Iowa, Grant, and Lafayette Counties, but revisions to NR 151 pertain exclusively to the Silurian dolomite bedrock in the eastern part of the state. The southwest region of the state has similar hydrogeologic characteristics and may therefore be vulnerable to groundwater contamination from human and agricultural fecal sources. However, the hydrogeology of the region and the extent and sources of groundwater contamination are not well characterized, which leaves important questions including: How many wells are contaminated? What roles do well construction and geology play? What is the source of contamination, agriculture or septic systems? The SWIGG project is designed to address these questions.

The current project has three objectives:

1) Evaluate private well contamination in three counties using indicator bacteria (total coliform and E. coli) and nitrate based on randomized synoptic sampling events.

2) Identify the source of contamination in a subset of total coliform- and nitrate-positive wells once per season using microbial tests that distinguish between human, bovine, and swine fecal sources.

3) Assess well construction and geological characteristics (e.g., well age, depth to bedrock) that affect total coliform and nitrate contamination.

"THE EVIDENCE OF FECAL MATERIAL FROM BOTH HUMAN AND LIVESTOCK SOURCES IS CLEAR FROM THESE DATA, BUT THERE IS NOT A STRAIGHT-FORWARD STEP FROM THESE RESULTS TO HEALTH RISK."

Microbe group	Microorganism	No. Positive Wells
Human-specific pathogens	*Cryptosporidium hominis*	1
	Human adenovirus groups A-F	2
	Human enterovirus	1
Human or livestock pathogens	*Cryptosporidium parvum*	2
	Cryptosporidium spp.	4
	Rotavirus group A (NSP3 gene)	3
	Rotavirus group A (VP7 gene)	1
	Salmonella (invA gene)	7
	Salmonella (ttr gene)	5
Human wastewater	*Bacteroidales*-like Hum M2	6
	Human *Bacteroides*	29
Bovine manure	Bovine polyomavirus	1
	Ruminant *Bacteroides*	16
Swine manure	Pig-1-*Bacteroidales*	3
	Pig-2-*Bacteroidales*	3
Pathogen*		13
Any microorganism*		32

*The value for Pathogen and Any microorganism are less than the sum of individual microorganisms because some wells were positive for more than one microorganism.

TABLE 2. Results from the first round of well testing for pathogens and microbial source tracking. Only organisms we detected are listed.

The first objective was completed through two synoptic ("snapshot") sampling events (November 9-10, 2018 and April 12-13, 2019) that tested a total of 840 samples from randomly selected wells across the three-county region. Overall, 42% (November) and 27% (April) of sampled wells had evidence of contaminated groundwater (See **TABLE 1**).

The first of four sampling events for objective two was completed in April 9-13, 2019. Thirty-five wells were randomly selected from those previously testing positive for total coliform bacteria or with nitrate that exceeded the drinking water standard (10 mg/L). Samples were analyzed for pathogens and non-pathogenic microorganisms capable of distinguishing human wastewater and livestock manure ("microbial source tracking").

In the April sampling, researchers detected contamination of fecal origin in 32 of 35 wells, including microorganisms that indicate human wastewater (30 wells), cattle manure (17 wells), and swine manure (5 wells; see **TABLE 2**). In 13 wells we also detected microorganisms capable of causing illness.

The evidence of fecal material from both human and livestock sources is clear from these data, but there is not a straight-forward step from these results to health risk. The percentage of wells that test positive will likely change in subsequent sampling events because weather and land use change over time. And these tests only identify fecal sources of contamination, such as wastewater and manure, and do not capture other potential contaminants or sources of contamination, such as fertilizers.

Work on the third, hydrogeologic, objective began this summer. The team is assessing well construction and geological characteristics (e.g., well age and construction, depth to bedrock) that affect total coliform and nitrate contamination. We are currently locating well construction reports for sampled wells to compile well characteristics. We will begin the statistical analyses after the sampling campaign is completed.

The Southwest Wisconsin Groundwater and Geology study is a collaborative effort among Grant, Iowa, and Lafayette Counties and researchers from USDA, USGS, and the Wisconsin Geological and Natural History Survey, with additional funding from the Lafayette Ag Stewardship Alliance and the Iowa County Uplands Watershed Group.

For additional information and project updates visit the project web site at *https://wgnhs.wisc.edu/southwest-wisconsin-groundwater-and-geology-study-swigg/* ■

BMC Aggregates L.C.

EARTH SCIENCE WEEK

University of Northern Iowa

In honor of Earth Science Week (October 13-19, 2019):

Join your friends and colleagues for a special Earth Science educational opportunity!

SUNDAY AT THE QUARRY

OCTOBER 6, 2019 | 11 AM - 4 PM

BMC AGGREGATES' MORGAN QUARRY

4618 E. DONALD ST., WATERLOO, IOWA (JUST EAST OF DEWAR, IOWA)

Program participants and presentations include University of Northern Iowa Earth Science Department, Iowa Geological Survey, Mid-America Paleontological Society, Iowa Learning Farms Conservation Station, Tall Grass Prairie Center, Black Hawk County Soil and Water Conservation Watershed Program, Black Hawk Gem and Mineral Society, City of Waterloo, Iowa Flood Center, Middle Cedar Watershed Group, and many more.

There will be programs and activities for young and old, School Groups, Scouts, All Youth Organizations, information stations for the Public, and everyone interested in the Earth Sciences. Everyone will have the opportunity to do rock, fossil, and mineral collecting with the Gem and Mineral Society, do a Geology Tour of the Quarry, and many other programs. The Theme this year is: "**The Earth Has A History**." Learn how Earth's landscapes and life forms have changed throughout Geological History and how those changes have impacted the landscape. As a special bonus this year, the UNI Earth Science Department will be co-sponsoring this event with many fascinating activities for Sunday at the Quarry.

Also, for the past several years BMC Aggregates has supplied area Educators with the Earth Science Week Tool Kits produced by the American Geological Institute which include posters, activities, and great information including subject matter CDs. This year the Tool Kits will again be available from BMC Aggregates at no charge.

For more information, contact the BMC Aggregates' Elk Run Heights office at 319-235-6538 or email Sherman Lundy at sherml@bmcaggregates.com ■

Osage Spring Cover Photo

Bob Libra, Iowa Geologic Survey (retired) **Cover photo by Stephanie Surine**

Our cover photo shows Osage Spring discharging into the Cedar River valley near the town of Osage, Mitchell County. Historically, the spring and forested surroundings attracted local residents who developed the area as a privately-owned park in the 1890's. While the park was actively used for years, by the late 1930's many of the owners had lost interest and the park was falling into disrepair. The City of Osage was deeded the land in 1938 and has managed the park ever since.

The Osage Spring issues from the Coralville Formation of the Devonian strata that serves as a major aquifer in the upper Cedar River watershed. The groundwater feeding the spring in under a degree of artesian pressure rising above land surface. This likely results from shale intervals within the predominantly limestone aquifer creating localized confined conditions.

The spring was sampled monthly for over a year in the mid-1980's as part of Iowa Geological Survey groundwater studies. The sampling produced no detections of nitrate, common herbicides, or coliform bacteria; results which is uncommon for spring flow in agricultural areas. This suggested the water was relatively old, pre-dating modern agriculture. However, further testing showed tritium was present in the water, indicating relatively recent recharge was present. It also showed a lack of dissolved oxygen. Putting all the evidence together suggests denitrification may well be occurring as groundwater within the Devonian aquifer becomes anaerobic while flowing to river-valley discharge zones.

Occasional testing of the water by city staff have continued to show essentially no nitrate or coliform bacteria, and the water is still used by some local residents. Not something we recommend (without treatment) for most other springs! ■

KAELA GOLLOB

IOWA STATE UNIVERSITY

The 2019 IGWA Student Research Grant was awarded to Kaela Gollob. Kaela is a student of Dr. Bill Simpkins, and a double major in Geology and Environmental Science at Iowa State University. Kaela plans to focus on hydrogeology in graduate school after her graduation next spring. When Kaela is not in class, she stays busy as a lab technician intern for the USDA National Lab for Agriculture and the Environment on campus and as a manager for the ISU Outdoor Recreation Program. She has led backcountry trips to Utah, Georgia, and Arkansas. In her free time, Kaela loves to enjoy the outdoors, especially by backpacking, kayaking, and traveling.

PROJECT: Kaela's project will test the hypothesis that nitrate-N is transported from a losing reach of the South Skunk River, where denitrification removes nitrate-N in the adjacent alluvial aquifer. The objectives are to investigate the seasonal variability of nitrate-N in the South Skunk River and its variability with depth in the alluvial aquifer; and to document the process of denitrification in the aquifer and identify the source(s) of nitrate-N. The results of this investigation should help improve our understanding of nitrate-N occurrence in alluvial aquifers used for municipal drinking water. ■

GROUNDWATER HEROES

JIM CALDWELL & KAYLENE CARNEY

Like many IGWA members, the path to hydrogeology for Jim Caldwell and Kaylene Carney of the USGS' Iowa Water Science Center (WSC) was not a straight line. But, once they landed in their WSC careers, they dedicated themselves to science and education with passion! And now, though both are retired, they continue to pass their love of the natural world on to future generations! Thank you Jim and Kaylene!

Jim was born in New York City where his father was stationed. At the end of WWII, his parents moved back to Minnesota, then Iowa in 1950. He graduated from Ottumwa High School in 1963, attended Indiana University (pre-med) for 2 years, then took a hiatus from college to refocus on his career choices, and save some dough. During that time, he worked as a chemistry laboratory technician for a large defense/aerospace contractor, and for a local health department.

His fascination with geology was piqued in his early years in Duluth, hanging out with his grandfather, skipping stones into Lake Superior, and by later road trips out west that stimulated his interest in learning more about the earth processes that created the magnificent uplifts that characterize the Front Range of the Rocky Mountains. Coincidentally, this was about the time that the concept of plate tectonics was becoming more widely understood and accepted.

Jim realized that any profession that would allow him to spend a lot of time outdoors was worth exploring. He returned to college at the University of Iowa in 1972 to major in geology. Following graduation , he worked as an exploration geologist. Massive layoffs occurred throughout the energy industry in the mid-80's, and following the closure of his office in Denver, Jim and his family moved back to Iowa. Jim joined IGWA in 1989, and was hired by the USGS in Iowa City, as a hydrologist in 1990.

Jim always considered himself to be a "Dirty Boots" geologist, and the USGS afforded him plenty of opportunity to practice that dress code with abundant field work. In the late 90's, Jim was appointed the Iowa WSC Groundwater Specialist. Jim worked on projects that involved groundwater-surface water interaction, exchange of agricultural chemicals from surface water into shallow groundwater, contaminant transport, assessment of potential community water supplies, surface and groundwater quality sample collection. Other projects included assessments of regional aquifer systems, and project oversight during field work at EPA hazardous waste facilities.

Kaylene grew up in Cedar Falls and graduated from the University of Northern Iowa. After 13 years in Des Moines working in Younker's buying offices and then as the Members Service Representative for the National Association of Credit Management, she landed in Iowa City, and began her career at the USGS just before the 1993 floods. She began in the Administrative Section, but her marketing background made her a perfect fit to assume duties as the WSC's Communications Officer. Without a background in science, Kaylene's strength was helping to interpret complex hydrologic concepts for the non-scientific community.

A USGS-wide effort was initiated in the mid '90's to spread the message about the nation's Water Science Centers and earth science in general. At the Iowa WSC, Kaylene and Jim were tapped to lead this effort. They became involved with various area science festivals, giving presentations at local public schools, and participating in conferences with the professional water community. In 1997, Jim and Kaylene, along with their friend Paul Van Dorpe of the Iowa Geological Survey Bureau (IGSB), were among the founding members of the Iowa Children's Water Festival Steering Committee.

The USGS and the GSB recognized an opportunity to collaborate and connect with the public via one of the State's iconic annual summer events: RAGBRAI. Beginning in 2005 they began to produce "Learn About the Land" brochures for each day's ride. These became a favorite of the RAGBRAI crowd, as they included colorful illustrations, maps of the route, as well as interesting local geological, hydrological, and historical tidbits. For 11 years, Jim and Kaylene took vacation time to follow the route and distribute the brochures to riders.

In retirement, Kaylene continues to assist with the Volunteer Committee at the Children's Water Festival (hasn't missed one yet!), loves to travel, enjoying trips to Houston and to Denver to visit family (on a recent trip she learned to ski the mountain slopes!). Kaylene, both brothers, and their entire families just returned from Ireland where several of their relatives live. She is looking forward to the day when her husband, Patrick, decides to sell his business, The Frame Station, so they can spend more time exploring. She also continues to volunteer at the Shelter House in Iowa City and loves spending time with her dog, bike-riding, and taking care of all those projects at home that sat unattended for years.

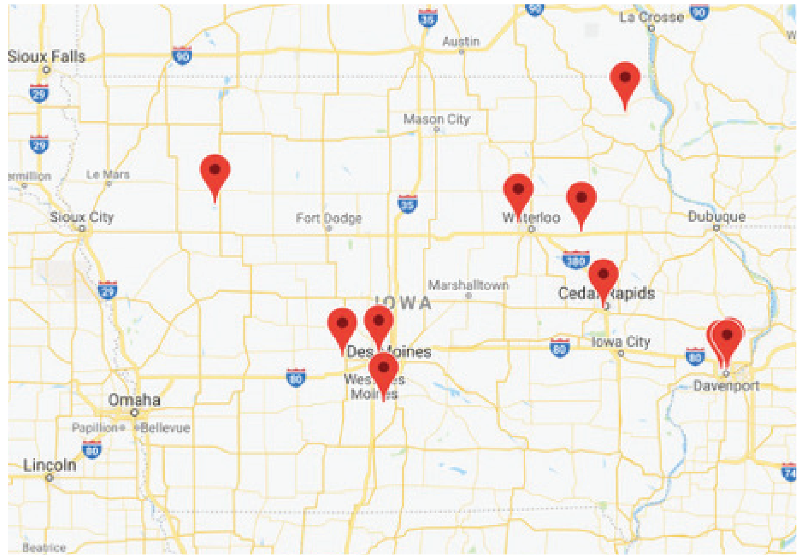
Jim describes retirement as "fabulous!" His wife, Brinda, retired from Cornell College about 6 months before Jim. Incomprehensibly, they find themselves busier now than they'd been when they were working. They have family in Iowa City and are fully encompassed with the joys of grand-parenthood. They love to fish, hike, visit the Rockies (their daughter lives in Idaho), and visit old friends from their days in Montana, Wyoming, and Colorado. Jim and Brinda did a 6-week, road trip to Alaska in 2016, and are making plans to explore Ireland, the UK, Europe, and with luck, Australia and New Zealand. If future winters are anything like what was endured in 2018-19, they'll incorporate midwinter travels to visit more thermally hospitable areas in the future.

Lastly, Jim and Kaylene are grateful for this recognition, and wish to commend the members of the IGWA for their dedication to promote education and research on Iowa groundwater and water resource issues for the citizens of Iowa. ■

IGWA Member News

MEMBERSHIP RECOGNITION

The graphic to the right shows where our members are located throughout the state.



New Members

- Emily Smar • Steven Darrah • Gerald Hentges
- Kimberly Grandinetti • Scott Killip
- Kevin Gowing

1-Year Members

- Alana Peterson • Robert Hunt • Tom Engelken
- Ben Gleason • Ellie Wilder • Klint Gingerich
- Ray Francis • Sandra McGrath • Lyle Hammes
- Dave Gammon • Christina Murphy • Mark Thurow
- David Wildharber • Krista Dawson • Bryand Bross

5-Year Members

- Rose Amundson • Amanda Husband

10-Year Member

- Deborah Williams

15-Year Member

- Skipp Slattenow

20-Year Member

- Michael Wichman

25-Year Members

- Laurie Moody • Warren Riekenberg

30-Year Member

- William Simpkins

Thank you to the following members for being with IGWA for over 30 years:

- Michael Burkart • Reed Craft • Bob Drustrup • Nancy Hall
- Dana Kolpin • Gary Shawver

DID YOU KNOW

that IGWA accepts government groups, such as Iowa DNR sections or county public health departments and corporate memberships?

Contact an IGWA Board member for details.

IGWA
Iowa Groundwater Association

Upcoming Events

National Association of Abandoned Mine Land Programs (NAAMLP) Annual Conference

September 8-11, 2019

Pittsburg, Pennsylvania • *https://Information@NAAMLP2019.com*

Iowa Rural Water Association (IRWA) Okoboji Fall Conference

September 17-18, 2019

Arrowwood Resort, 1405 Hwy 71, Okoboji, Iowa • *www.iowaruralwater.org*

Region 4 Environmental Health Conference

October 3-4, 2019

The DoubleTree by Hilton Downtown, Omaha, Nebraska • *https://neha7.wildapricot.org/event-3381449?*

IRWA Dubuque Fall Conference

October 15-16, 2019

Grand River Center, 500 Bell Street, Dubuque, Iowa • *www.iowaruralwater.org*

Iowa Groundwater Association (IGWA) Fall Meeting

October 17, 2019

Indian Creek Nature Center, Cedar Rapids, Iowa • *www.igwa.org*

Indiana Ground Water Association (IGWA) Annual Meeting and Topgolf Event

October 24-25, 2019

(Location TBD) • *www.indianagroundwater.org/*

Minnesota Ground Water Association (MGWA) Fall Conference

November 12, 2019

Continuing Education and Conference Center, 1890 Buford Ave, Saint Paul, MN • *www.mgwa.org*

National Brownfields Training Conference

December 10-13, 2019

Los Angeles Convention Center, Los Angeles, California • *https://brownfields2019.org/*

Iowa Rural Water Association (IRWA) 45th Annual Conference

February 17-19, 2020

Veterans Memorial Community Choice Credit Union Convention Center Host Hotel,
Hilton Des Moines Downtown, Des Moines, Iowa • *www.iowaruralwater.org*

Iowa Groundwater Association
P.O. Box 744
Des Moines, IA 50303

www.IGWA.org

DNR and IGS staff share the wonders of karst with members of the Environmental Protection Commission on their August 13, 2018, field trip.