WATER CURRENT

NEBRASKA WATER CENTER
PART OF THE DAUGHERTY WATER FOR FOOD GLOBAL INSTITUTE AT THE UNIVERSITY OF NEBRASKA

SUMMER 2024

Core Research, Events, and News from the Nebraska Water Center

Tong Onanong running samples in the Water Sciences Laboratory

Inside

And More!

From the Director

Chittaranjan Ray, Ph.D., P.E.

Director, Nebraska Water Center (NWC)

Dear Reader,

This summer, the Nebraska Water Center team has taken advantage of the long days and warm weather to work diligently on field research and outreach events. I am glad to share a selection of our recent work with you in this newsletter.

A key summer highlight was our annual Water and Natural Resources tour. Along with the Central Nebraska Public Power and Irrigation District, we hosted several colleagues and partners in southeast Nebraska in June. You can read more about the tour on page 10.

Throughout the summer, we have been working hard on collaborations and research. In this newsletter, I am glad to share updates from the Know Your Well program (pages 4 and 5), a look at the last 20 years at the Water Sciences Laboratory (pages 6 and 7), and research on PFAS and nitrate (pages 5, 8, and 9).

We hope you will join us at the 2024 Nebraska Water Conference this fall. On October 9 and 10, we will gather in Lincoln to learn about successful collaborations and innovative projects in water management throughout the state and region. We are fortunate to have many partners throughout the state and we are glad to highlight different ways water professionals and researchers work together while also identifying future opportunities for collaboration. More details on the conference can be found on the following page, and registration will stay open until September 27.

As summer heads into fall, the Nebraska Water Center looks forward to continuing to build our partnerships and explore innovative water management through our research, extension, and outreach activities.

Chittaranjan Ray

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2024 Nebraska Water Conference to highlight successful collaborations

October 9 and 10, 2024

Nebraska Innovation Campus, Lincoln, NE

Registration is now open for the 2024 Nebraska Water Conference in Lincoln, Nebraska, on October 9 and 10. This year's conference theme is *Collaboration and Innovation in Nebraska Water*. The conference will highlight successful collaborations and innovations in Nebraska water and discuss future opportunities in water research and management.

Held at the Nebraska Innovation Campus conference center, this two-day event will feature discussions on emerging contaminants, drought preparedness, nutrient management, climate smart practices, nitrate research, water policy, climate water resilience, and modeling. Experts from the state and nation will share their work and lead discussions on future opportunities for innovative partnerships.

Each day will offer breakout sessions where attendees will have the opportunity to interact with session speakers through Q&A's and networking. Wednesday will also include student research poster sessions where students can compete for a cash prize followed by a reception where the poster competition winners will be announced.

Registration includes all sessions and meals.

To register for the 2024 Nebraska Water Conference, visit **go.unl.edu/waterconference**.

Registration Details

Regular Registration (August 9 - September 13): $400

Late Registration (September 14 - September 27): $450

Registration will be open until **September 27**.

Special pricing is available for students and faculty.

Know Your Well increases support for students and educators in Nebraska and beyond

By Ann Briggs, Public Relations and Engagement Coordinator

As Know Your Well enters its eighth year of bringing collaborative citizen science and science literacy to high schools throughout Nebraska, the program is building key upgrades to make it even more accessible for teachers and students.

The University of Nebraska and Daugherty Water for Food Global Institute was awarded an Environmental Education Grant of $99,795 from the U.S. Environmental Protection Agency (EPA). "The University of Nebraska – Lincoln will use the funding to expand the Know Your Well project and develop a science curriculum that will be rolled out to over 100 rural Nebraska high school students with the goals of increasing science literacy, awareness of agricultural practices, and groundwater stewardship," said Shannon Beisser, Lead Press Officer for EPA's Region 7.

A team of high school teachers, students, staff, and faculty at the University of Nebraska – Lincoln, University of Nebraska – Kearney, and Chadron State College are working together to develop the new curriculum. The Know Your Well classroom curriculum will outline key science concepts used in collecting samples and understanding the results. The curriculum will be designed to support state education standards for science and can be used as a unit or as individual lessons.

Lee Ann Stover, a science teacher at Westview High School and one of the Know Your Well curriculum writers, shared her perspective on how Know Your Well can best support classrooms and teachers. "Time is the biggest constraint for teachers. If some of these lesson plans could be pulled out individually, these plans are more accessible for different types of classrooms."

A complete draft of the curriculum is ready for testing in the classroom. Lessons focus on water use and availability, the Earth's water history, water cycle and watersheds, groundwater, irrigation and water use, wells and springs, water pollution, safe drinking water and human health, Know Your Well field sampling techniques, water chemistry, and careers in hydrology. The wide range of topics related to water use, sampling and test methods, and fundamental hydrological concepts allow teachers to select the lessons that best augment their existing curriculum and easily bring Know Your Well into their classrooms.

By having standardized curriculum, Know Your Well will be able to serve more schools and teachers across Nebraska. For many teachers, the idea of Know Your Well is appealing but they don't have the time or resources to easily integrate the program into their existing lessons. "The teachers are really excited to be involved in this program but didn't always have the support in the classroom to implement it."

Dan Snow, Water Sciences Laboratory director and Know Your Well program cofounder, shared. "By putting this curriculum together, we can support teachers in Nebraska and beyond."

Know Your Well has worked extensively with participating teachers to incorporate the citizen science aspect into classes and as an extracurricular activity for environmental science clubs and Future Farmers of America (FFA) chapters. "It helps so much to have the support of a university like UNL," said Chelle Gillan, a science teacher at Central City High School. "We are on a limited budget as a public school, so to have the resources of the testing kits is huge. But maybe even more so, it's the support of the training and the knowledge." Know Your Well's standards-based and interdisciplinary curriculum for classrooms increases accessibility and participation for schools that don't have existing environmental science clubs or FFA chapters.

Know Your Well is designed to support educators, but the program's core mission is to provide students with opportunities to learn about and contribute to impactful scientific research on groundwater quality. "Something that really gets kids interested in science is getting their hands dirty and experiencing different environments, especially as they're thinking about future careers," Michael Liete, Professor, Mathematical & Natural Sciences – Physical & Life Sciences, Chadron State College, shared at a curriculum development meeting. By adding classroom curriculums, students that may not have experienced hands-on environmental science can learn about their local water resources.

Lee Ann Stover (left) shares her thoughts on curriculum development at the planning meeting held at the Central Platte NRD in April.

Kamden Victory, a student who attended Crawford High School and participated in Know Your Well for two years, shared her experiences. "Know Your Well helped build a foundation for me with social and communication skills. It inspired me into the career path that I've chosen, so maybe it will inspire other people too." Kamden is studying physical sciences at Chadron State College and hopes to help Crawford High School continue their Know Your Well program in the upcoming school year.

The curriculum development team worked over the summer to create test versions of each lesson. Four high schools across Nebraska will be testing the curriculum during the 2024-2025 school year and providing feedback to the curriculum development team before a statewide launch planned for the 2025-2026 school year. As water resources vary greatly across the state, the final curriculum launch intends to include base lesson plans that can be used in any classroom and region-specific lessons to provide information that is relevant to different parts of the state.

Once the curriculum is completed, Know Your Well is positioned to implement the lessons beyond Nebraska. By using existing partnerships, other states and countries that use groundwater for drinking water, have private wells, or need support in environmental education can also utilize the Know Your Well curriculum.

To learn more about the Know Your Well program or to get involved, visit **knowyourwell.unl.edu.**

Know Your Well

Know Your Well is a youth-driven education and outreach program designed to train high school students to sample and test domestic well water quality, as well as evaluate factors leading to groundwater contamination. Since starting in 2016, the project involved students and teachers from 27 schools across Nebraska who sampled over 270 wells.

New funding to support international PFAS research

By Ann Briggs, Public Relations and Engagement Coordinator

The Water Sciences Laboratory continues to use their expertise in water quality testing to support groundbreaking research through international partnerships. The Polytechnic Institute of Bragança (IPB) in Portugal received funding from the Portugal Foundation of Science and Technology (FCT) to research the use of permeable reactive barriers at wastewater treatment plants as a method to reduce polyfluoroalkyl substances (PFAS) and other emerging contaminants before reusing effluents as irrigation water in agriculture. The Water Sciences Laboratory of the Nebraska Water Center will support the project by providing their advanced analytical services in the assessment of the quality of waters sampled during project implementation.

FCT awarded another project to IBP in 2022 that included the development of a collaborative research project and double diploma graduate program between UNL and IPB. UNL signed a memorandum of understanding with IPB to promote cooperation on teaching, curriculum development, publications, joint research, faculty and student exchange in 2023.

The Water Sciences Laboratory will be testing the samples taken during the study for PFAS and other emerging contaminants. The Water Sciences Laboratory is a key partner in this study because of their expertise in method creation for PFAS and emerging contaminant testing. PFAS testing requires highly sensitive, specialized equipment that the Water Sciences Laboratory was able to install in 2023 through financial support from the Daugherty Water for Food Global Institute (DWFI) and the Institute of Agriculture and Natural Resources. The full abstract for the study is included below.

INOVÁGUA - Permeable Reactive Barriers as an Innovative Solution to Improve the Quality and Reuse of Effluents from Wastewater Treatment Plants

Project INOVÁGUA was selected for funding in the program PROMOVE 2024, promoted by La Caixa Foundation, in cooperation with the Portuguese Foundation for Science and Technology.

The main objectives of the project are: (i) the monitoring of the quality of water bodies close to effluent discharge points from wastewater treatment units of different activities (urban wastewater and leaching water from municipal solid waste) and (ii) pilot-scale installation of permeable reactive barriers, as low-cost solutions, to improve the quality of effluents, aiming at reuse as irrigation water in agriculture.

The implementation of the project activities will allow the technical and economic evaluation of the proposed solution and the potential of the technology to expand to other scenarios/locations. It will be an opportunity to evaluate the efficiency of solutions developed at laboratory scale in complex and real scenarios, combining the scientific expertise of research laboratories with the field expertise of companies dealing with wastewater treatment.

Water Sciences Laboratory - Then and Now

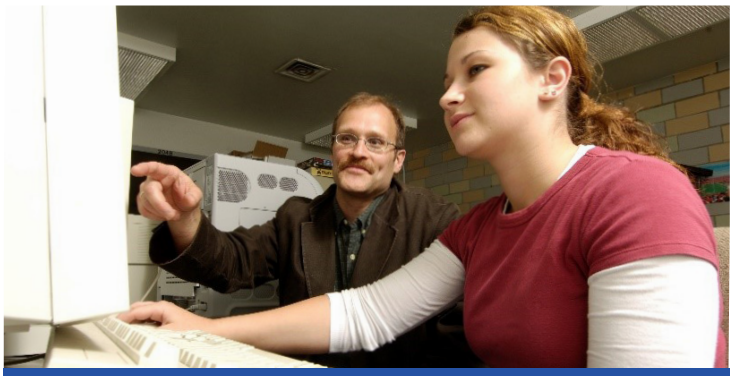
By Dan Snow, Director Water Sciences Laboratory

This fall, I will mark 20 years serving as director of the Water Sciences Laboratory. The lab has been through a lot of changes over the past two decades. I thought this would be a good opportunity to look back, share some of what I have learned and thoughts about the future. A lot of the lab's history was detailed in the 2020 Water Current when we celebrated its 30th anniversary. For this article, I'll try to provide my personal perspective and what I learned as director of one of the most advanced laboratories supporting water resources research in the U.S.

In 2004, the lab had finished developing a handful of methods on our first triple quadruple mass spectrometer. We had started to market our capabilities beyond a dozen or so faculty users. While we already gained some experience with new 'emerging' contaminants, I had not promoted these methods beyond giving a few talks. As a new laboratory director, I learned the lab was expected to operate as a business or nonprofit, generating income from our service fees and grant support to pay for equipment upkeep, staff salaries, and supplies. Promotion was suddenly very important. Our small but well-trained staff needed to keep equipment running and process incoming samples while developing and validating new methods for upcoming projects. I had to learn some accounting skills (at least how to read a balance sheet) and figure out how to best market the lab. With support from the Water Center director and staff and input from our faculty advisory committees, I learned how to promote capabilities more widely and prioritize equipment needs to keep the service list growing and better serve the water community.

I learned how important it is to cultivate relationships among faculty users and other clients; to learn why they are interested in the results we provide using analytical chemistry and technology. Faculty and student researchers, Nebraska natural resources districts, and state and federal agencies all have played a huge role in the laboratory's growth over the past 20 years. Many, if not most, analytical laboratories use methods developed and standardized through consensus or regulatory requirements. From its beginning, the Water Sciences Laboratory's mission was to develop and validate new methods supporting water resources research. This mission required understanding project requirements for measuring new groups of contaminants or developing new tools for understanding and managing water resources more effectively. New methods take a lot of time to develop and required educating users (and myself) about the complexity in developing them. I also learned about concepts outside of environmental analytical chemistry, so the analytical methods applied would help answer questions in these fields. I learned how to explain and promote equipment and methods in terms that others could understand and appreciate. For example, 'antibiotic resistance' could be used to explain and justify the need to measure antibiotic residues in the environment.

A university core facility serves multiple academic departments, campuses, and a huge variety of disciplines. Although designated the Water Sciences Laboratory, we have processed and analyzed almost any type of sample including animal and plant tissue, soils and sediment, and air and gas samples. Some of the most interesting and challenging samples included leachate from a carcass disposal



Dan Snow with undergraduate intern Megan Larsen in 2007.

Dan Snow at Al Farabi Kazakh National University in 2012.

experiment. Our staff still talk about how these made the lab smell. Our senior chemist identified the odorous compound as 'cadaverine.' I remember admiring the dedication of the graduate student who collected these over a very hot summer for her research project. On average, the lab sees about 10-12 graduate students per year and over the last 20 years has likely supported between 200-250 graduate students at the University of Nebraska. Because of the unique methods we offer, we support graduate and undergraduate student research at other universities, including those in other countries. Laboratory staff patiently work with new (mostly student) users, training them in proper laboratory procedures and helping them to obtain high quality results for their research projects.

Roughly 10 years ago, I was invited to visit and lecture at a colleague's university in Almaty, Kazakhstan. Formerly part of the Soviet Union, Kazakhstan is an expansive land-locked country with a landscape very similar to the U.S. Great Plains. This visit was reciprocated by my colleague and led to many trips back and forth, all the while learning how much our countries have in common and what opportunities there are to share knowledge. With several colleagues in Nebraska, we collaborated on many projects, one funded by the U.S. National Science Foundation and several funded by the Kazakh Ministry of Science and Education. Water is incredibly important

to Kazakhstan's agricultural and economic development, and unfortunately the country's water was overused and polluted by much of the military, industrial, and agricultural activities occurring during Soviet occupation. All water in Kazakhstan originates from outside its borders, presenting huge challenges to annually maintaining required flow for irrigation and ensuring proper quality for safe use. It is incredibly rewarding to share what we are doing in Nebraska to manage water for multiple beneficial uses. The Institute of Agriculture and Natural Resources at the University of Nebraska - Lincoln and the Daugherty Water for Food Global Institute have identified Kazakhstan as a priority country for future collaboration and partnerships and the lab's work is a part of this combined effort. It is also a privilege to share the analytical capabilities offered through the Water Sciences Laboratory with scientists and graduate students from other countries like Brazil, India, Kazakhstan, Portugal, and Nigeria. As part of the Daugherty Water for Food Global Institute, the lab has become a laboratory resource for water sciences and helps build the reputation of the University of Nebraska as a world-leader in water quantity and quality science.

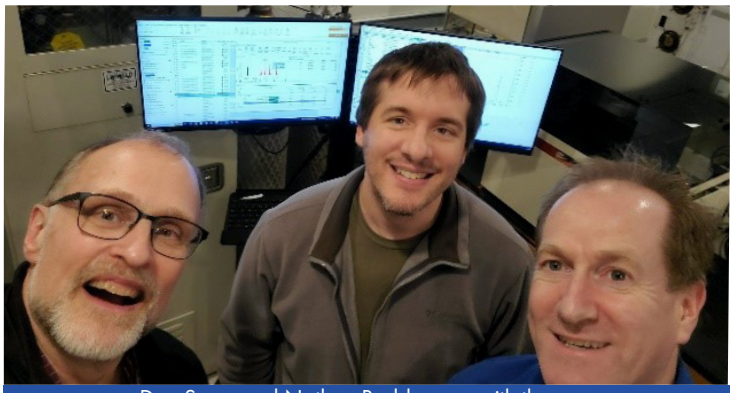
In researching this article, I looked at an old price list from around 2004. I noticed that we had less than 20 methods run on less than $1 million worth of equipment managed by three full-time staff and a director. Today we have over 200 methods using $3.5 million worth of equipment operated and maintained by five very talented full-time staff. (The director does not spend much time in the lab anymore.) The amazing variety of equipment and methods is now easily accessible on the 2024 service fee price list found on the lab's web site.

The latest equipment includes a compound specific isotope analyzer installed earlier this year. The first method developed on this instrument will very precisely measure the carbon isotope composition of fatty acids extracted from eroded soil and sediment. This technique will permit tracing sources of erosion in a watershed and potentially help water researchers and natural resource managers better target erosion control practices. Other uses for this equipment include tracing pollution sources and degradation, and even measuring soil carbon and nitrogen transformation. The list is almost endless!

To make room for the new analyzer, we had to part with one of the laboratory's first new isotope mass spectrometers. This instrument had been state-of-the-art in 1992 and had been used to analyze hundreds of samples for nitrate isotopes up until 2014 when we received funding for a device to measure nitrate isotopes through conversion into nitrous oxide. The automation improved our precision, increased throughput, and reduced staff time. Nitrate isotope testing is in high demand as a method for tracing sources of nitrate-nitrogen in groundwater throughout the U.S. and we have grown our client base because of this automation.

Maybe those of you who do not work in a lab will think it strange, but I found it sad to watch as our 32-year-old mass spectrometer was moved out of the building. It reminded me that nearly all technology will eventually become obsolete, and methods will always need to be 'faster, better, and cheaper.' Having spent the better part of my career at the Water Sciences Laboratory, I am now thinking about its future without me. The lab will likely continue to purchase new equipment, develop new methods, and find better ways to measure, study, and learn how to manage water for multiple beneficial uses in Nebraska and beyond. I imagine the next laboratory director will learn, as I have, to appreciate the privilege of using laboratory science to help make informed decisions about ways to take better care of our very finite and valuable freshwater resources.

Dan Snow with chemist Dave Cassada in 2006.



Dan Snow and Nathan Roddy pose with the new compound specific analyzer.

Dan Snow working in his office in 2024.

Groundwater nitrate in Nebraska: key factors and timescales of movement

By Crystal Powers, Water Extension Educator; Dan Snow, Director of Water Sciences Laboratory; Troy Gilmore, Assistant Professor, School of Natural Resources

Factors influencing groundwater nitrate concentrations

Recent nitrate-N levels in groundwater are the result of several factors. Key factors include land use, the amount and timing of precipitation and irrigation water applied, subsurface conditions (including soils and geology), distance from ground surface to the water table (vadose zone thickness), and depth of the well. These factors vary significantly across Nebraska. Variability increases the complexity and challenge of monitoring and managing nitrate in aquifers and connected surface water bodies.

Land use

Land use for crop production (Ag Fields) depends on soil, typical annual rainfall and/or availability of irrigation water, and other factors such as topography. Over-application of nitrogen fertilizers is a major source of nitrate-N in soils, vadose zone, and groundwater in Nebraska.

Well density

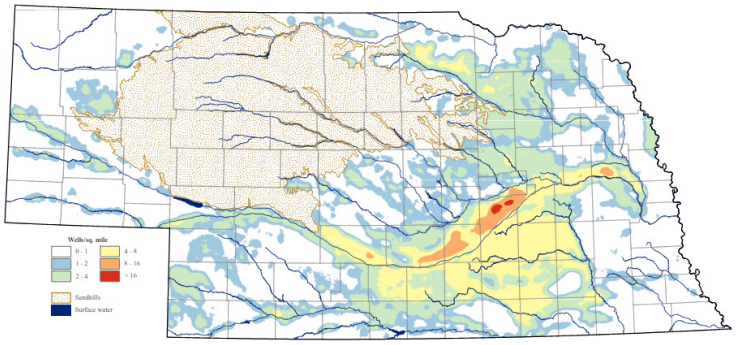
Well density depends on productivity of the underlying geology (aquifer), suitability of land for row crop production, and other factors including groundwater regulations. Water application combined with unpredictable precipitation events can cause high infiltration rates that carry nitrate downward through the root zone and into the vadose zone and groundwater.

Depth to groundwater

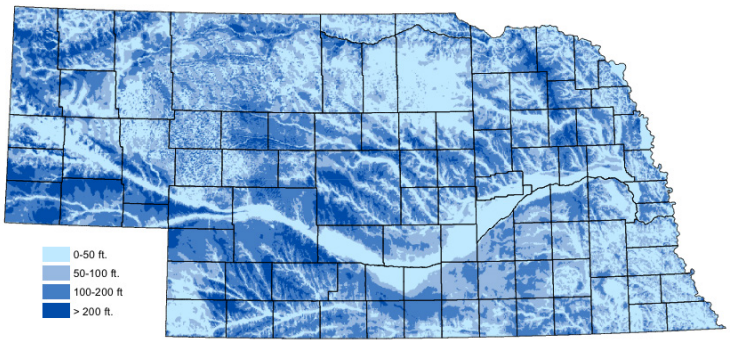
Depth to groundwater depends on topography, where groundwater is usually closer to the surface in valleys than in surrounding uplands. Annual rainfall, irrigation use, soils, geology, and irrigation canal operations can also affect depth to groundwater. In general, areas with shallow groundwater and high permeability soils overlying high conductivity geological materials (e.g., sand/gravel) show the most rapid response in groundwater nitrate concentrations to increases or decreases in inputs of nitrogen. In upland areas, or areas where depth to groundwater is greater, the impact of nitrogen on groundwater nitrate concentrations may not be as immediate, but substantial nitrate may be temporarily stored in the vadose zone as it travels downward toward the groundwater.

Key factors and timescales of movement

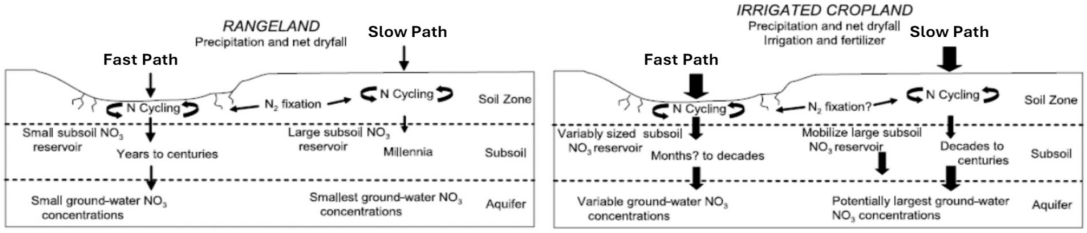
The timescales for nitrate movement through the subsurface is variable at local and regional levels across Nebraska. McMahon et al. (2006) provide descriptions of fast and slow path scenarios and related timescales for water and chemicals to reach groundwater. The examples in the figure below give an approximate sense of timescales through the vadose zone. Once nitrate reaches the groundwater, it may be present for years, decades, or more, before exiting the aquifer through pumping or discharge into surface water.



Well density in Nebraska. 2023. UNL CSD based on NDNR data.



Nebraska generalized depth of groundwater. Nebraska Department of Environment and Energy. 2023.



Factors and timescales of nitrate movement from McMahon et al. 2006.

Why does groundwater nitrate vary so much across Nebraska?

By Troy Gilmore, Assistant Professor, School of Natural Resources

Have you ever wondered why groundwater nitrate maps show so much variation across Nebraska? Or why wells near to your own tested well have such different nitrate levels? The answer has three parts. Nitrate in groundwater varies from place to place because of differences in:

- the amount of nitrate that travels below the root zone and toward the water table;
- the natural processes in the aquifer that remove nitrate from groundwater; and
- the length of time for nitrate to reach wells of a different depth or construction standard.

In the following, we'll break down those three pieces and explain how they affect nitrate levels.

Nitrate Seeping Underground

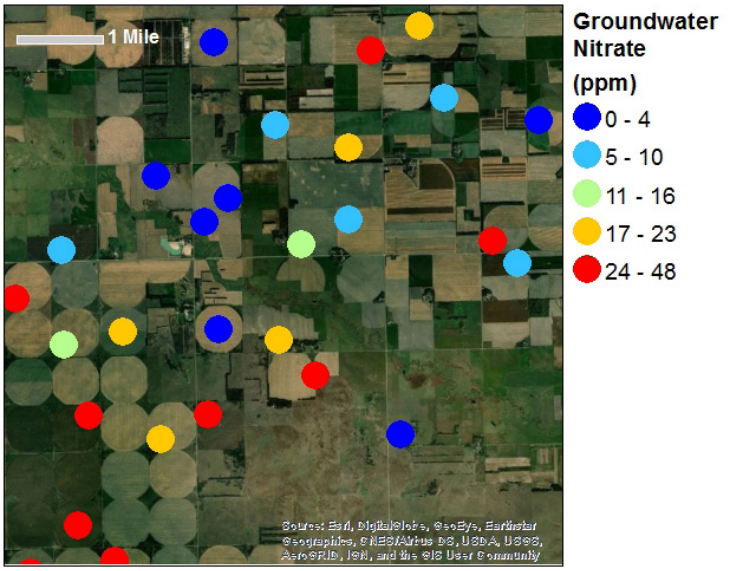
Nitrate reaches the deeper unsaturated subsurface regions — below crop root zones, for instance — due to over-application of fertilizers, mineralization of organic matter, and/or movement of animal or human wastes into the ground. The rate at which this occurs is highly dependent on local soils and the amount and timing of precipitation or applied water in the area. Once nitrate has moved below the root zone, where it can be utilized by plants, nitrate will easily move downward toward the water table and into the groundwater system. Most high-nitrate groundwater (e.g., > 10 ppm) is located near areas with intensive row crop production, although animal agriculture can also contribute. There are cases where nitrate is naturally released from subsurface sediments, but these are relatively rare and localized.

Naturally Breaking Down Nitrate

Since nitrate tends to stay dissolved in water, it moves along with groundwater through the aquifer. Once in the aquifer, nitrate can only be removed in two ways. One way is removal of nitrate-laden groundwater from the aquifer through pumping or through natural seepage into streams or springs. The second way nitrate can be removed is through natural removal processes within sediments. The primary natural process is denitrification, where bacteria in the aquifer sediments consume nitrate. Denitrification only occurs in low-oxygen environments, which does not occur everywhere in the unsaturated layer or groundwater system. In Nebraska, it is possible that groundwater flowing to one well will undergo denitrification and therefore have low nitrate concentration. Meanwhile, a nearby well might receive groundwater that has undergone minimal denitrification and still has high nitrate concentration. Even though these two wells might be located on the same farm, they can have very different nitrate concentrations.

Distance from the Source

Wells that are very shallow and close to a major source of nitrate are viewed as especially vulnerable to high nitrate concentrations. One reason is that nitrate can arrive at the well relatively quickly because it does not have far to travel in the soil profile. In fact, two wells installed at the same location but at different depths may have very different nitrate concentrations. The shallower well is more likely to have high nitrate, while the deeper well may have low nitrate. This is possible because groundwater, and the nitrate dissolved in it, moves slowly downward below the water table. In many locations groundwater moves only a few inches of feet downward vertically in a given year depending on geology and the rate at which groundwater is being replenished by recharge. So it is not hard to imagine that it could take many years for groundwater nitrate to reach a well installed deep in the aquifer. It is possible that the deep well will have high nitrate at some point in the future, but on current nitrate maps, these two wells would have very different nitrate concentrations even though they are in close proximity.



An example of groundwater nitrate variability in Nebraska.

2024 Water and Natural Resources Tour Visits Southeast Nebraska

By Emma Dostal, NWC Communications Intern

This summer the 2024 Water and Natural Resources Tour, *Discovering southeast Nebraska*, took industry experts to explore water practices in the region.

Hosted by the Nebraska Water Center and Central Nebraska Public Power and Irrigation District, the Tour featured projects and challenges faced by the Nemaha Natural Resource District, water use in orchards, second source water projects, water treatment, and more.

"Southeast Nebraska provided such an interesting tour because it's different from the rest of the state," said Ann Briggs, Nebraska Water Center's Public Relations and Engagement Coordinator, "this area receives more rainfall and is not connected to the High Plains Aquifer, requiring unique water management strategies. In addition, Nebraska City and the surrounding areas have a long and rich history due to its location on the banks of the Missouri River."

The first day of the Tour, Monday, included visiting Nemaha NRD projects in Adams, Tecumseh, and Peru, Nebraska. Attendees visited three examples of lake and flood management at Structure 7A, Doctor's Lake spillway, and Duck Creek Recreation Area while also visiting a recreation trail, Steamboat Trace. Kyle Hauschild, General Manager of the Nemaha NRD, provided insights on these projects.

An attendee shared that, "it was nice to tour places that the public would not normally have access to," since many of the Tour stops included private tours or a look into ongoing projects.

While at Steamboat Trace, attendees heard from Tori Schuetz, Peru City Clerk, about the newly completed Peru and Auburn water connection that provides the Peru community with accessible and drinkable tap water which was not previously drinkable due to contaminants from the 2019 flood.

Monday included bus speakers, Lee Orton with Orton Management, who shared information on the history of NRD's, and Katie Cameron with Lower Platte South NRD, who shared the Eastern Nebraska Water Resources Assessment and hydrogeology of the area.

Attendees explored Structure 7A in Adams, Nebraska - a Nemaha NRD project.

Dr. Erin Haacker observes a stream at Steamboat Trace in Peru, Nebraska.

City of Lincoln staff discussed the Lincoln Water 2.0 project at the Ashland wellfield.

Nebraska City Water Works explained the water treatment process to attendees.

The first day ended with a private tour of the Arbor Lodge State Historical Park and Mansion – a tour favorite. Participants learned about the impact of the Morton family who built the home and started the Arbor Day Foundation while also listening to a former resident of the home before it became a full museum.

Tuesday continued the Tour with a presentation on the history of Nebraska City by Laura Steinman with the Arbor Day Foundation before attendees toured the Nebraska City water treatment facility, more Tour favorites.

Participants took a private tour of Kimmel Orchard which featured a hayrack ride and lessons about the produce growing and selection process. Over lunch, attendees listened to a presentation by Alexa Davis with the Nebraska Department of Natural Resources on the Resilient Soils and Water Quality Act.

UNL Extension speakers on Tuesday included Ritika Lamichhane who presented on Nebraska Extension's water and cropping systems and John Nelson who presented on farming practices to reduce nitrate loss.

To end the Tour, attendees learned about the Lincoln Water 2.0 and Lead Safe Lincoln projects from Steve Owen with the City of Lincoln. Participants toured the Ashland wellfield and learned about how Lincoln currently gets its city water compared to the second source project which will create a way to access Missouri River water. This provided the opportunity to make connections between Lincoln's current water source project and Peru's newly completed project.

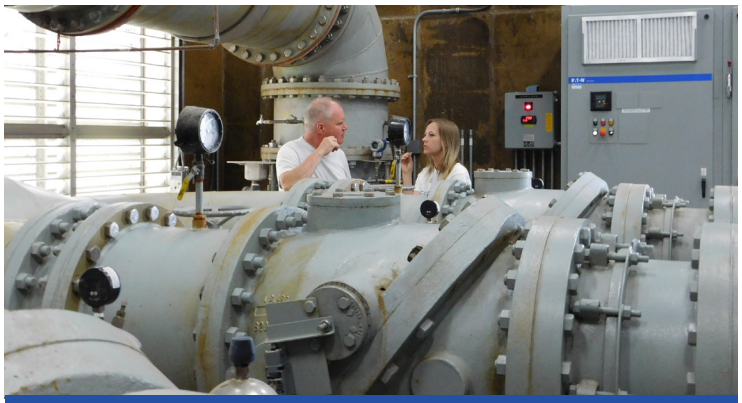
The Tour could not happen without the local support from water professionals in Adams, Peru, Nebraska City, and Ashland.

"All of the speakers were very insightful and passionate," an attendee said, "you could tell they care about their communities and make a lasting impact."

The 2024 Water and Natural Resources Tour would not be possible without its sponsors, University of Nebraska-Lincoln Institute of Agriculture and Natural Resources, HDR, Olsson, Lower Platte South NRD, and Daugherty Water for Food Global Institute.

The 2025 Water and Natural Resources Tour celebrates the 50th anniversary of the Tour and will be hosted in Phoenix, Arizonia, and surrounding areas.

To learn more about past and future tours, visit **watercenter.unl.edu**.



Joe Neary (left) and Alexa Davis (right) talking at the Ashland wellfield.

Group photo at Kimmel Orchard in Nebraska City, Nebraska.

Water and Natural Resources Tour History

Water Tours began in the mid-1970s under the direction of Dr. Leslie Sheffield, a UNL Extension Farm Management Specialist and later outreach programs coordinator for the Nebraska Water Center / Environmental Programs. The annual event began as an educational activity to highlight water resources projects and irrigated agriculture.

The tours were designed to enhance understanding and appreciation for water management in Nebraska and participants flocked to them from many water-related state and federal agencies, the Natural Resources Districts, from UNL and from farms, ranches and other locales across the state. 2025 is the 50th anniversary of the Tour.

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Join us at our upcoming events

For more details and to register to attend, visit **go.unl.edu/waterconference**