

Groundwater and Surface Water Issues

“Surface water and groundwater are inexorably linked, and they should not be thought of as separate resources. In many cases, what affects one inevitably affects the other”.

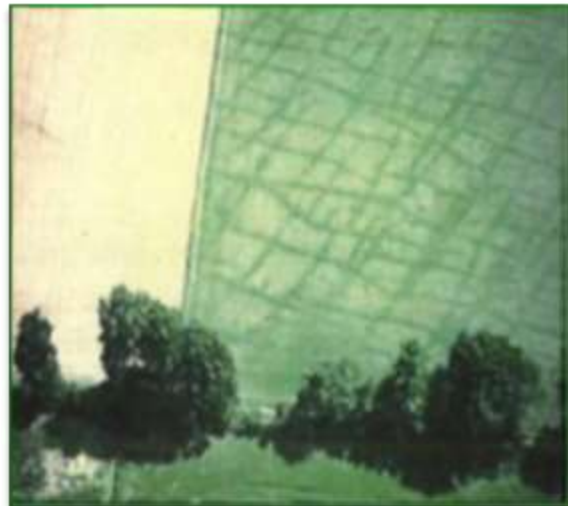
Mike Parsen, Hydrogeologist, Wisconsin Geological and Natural History Survey

Unless purchased from an outside source, every drop of water in Lincoln Township is pumped from private wells that tap groundwater from the local aquifer. Kewaunee County faces critical groundwater contamination issues, particularly in Lincoln Township with large areas of very shallow soil depths to bedrock, highly fractured bedrock, and numerous sinkholes. Dr. Mark Borchardt of United States Department of Agriculture (USDA) and Dr.

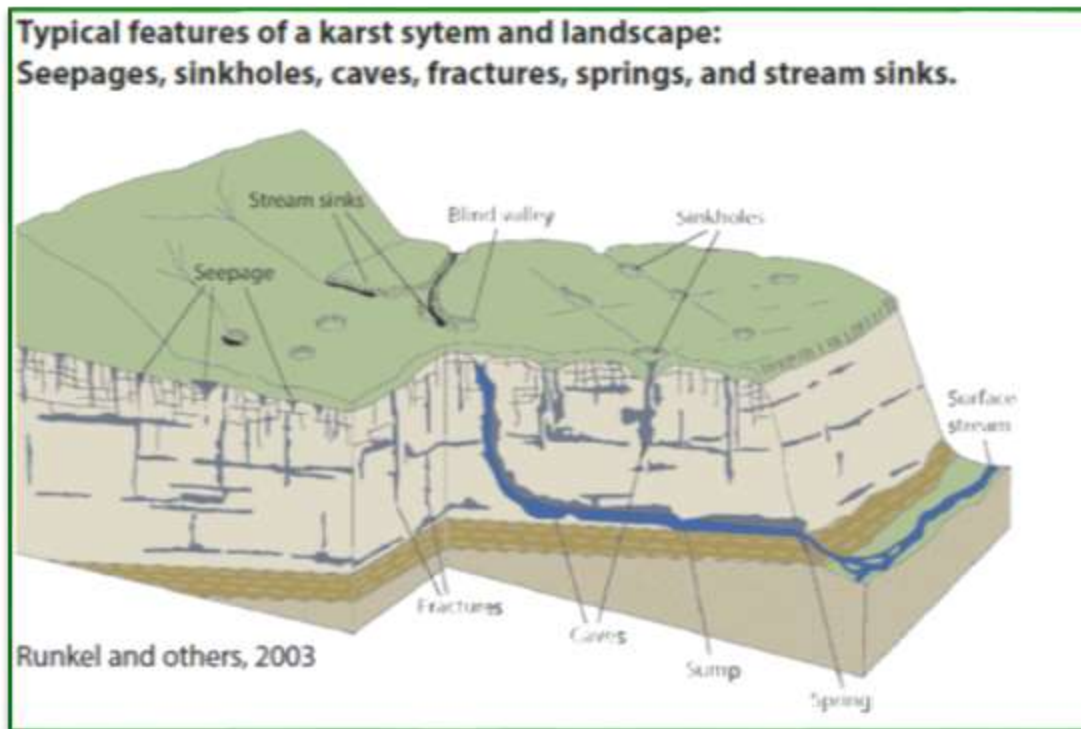
Maureen Muldoon of UW) have likened the town’s bedrock to Swiss cheese.



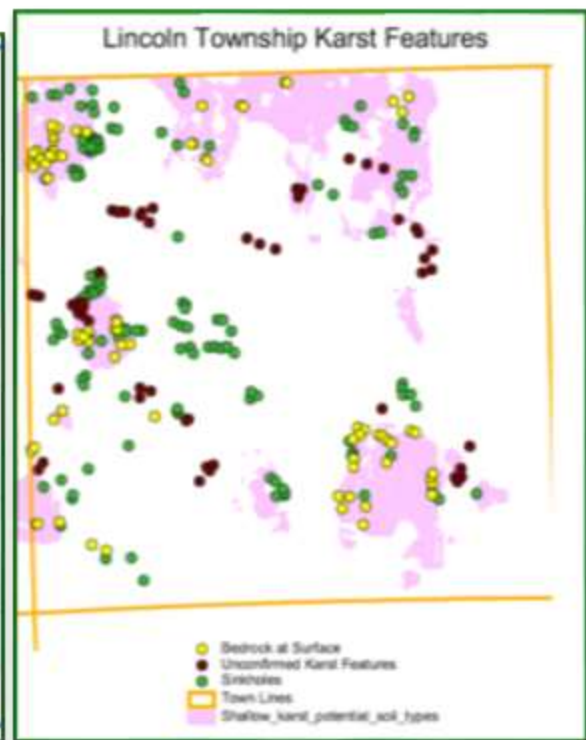
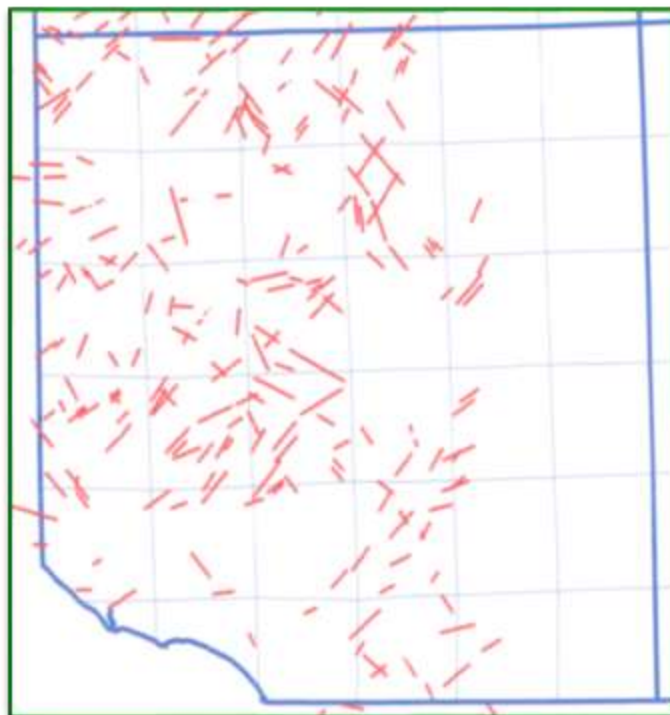
From NE WI Karst Task Force Final Report



The karst geology of Northeast Wisconsin and associated issues are well documented and should come as no surprise to anyone. Still, certain constituencies are requiring yet more science to identify the contamination source. Therefore the Township should be prepared to increase its partnership with researchers and agencies who can provide empirical evidence as to the source.



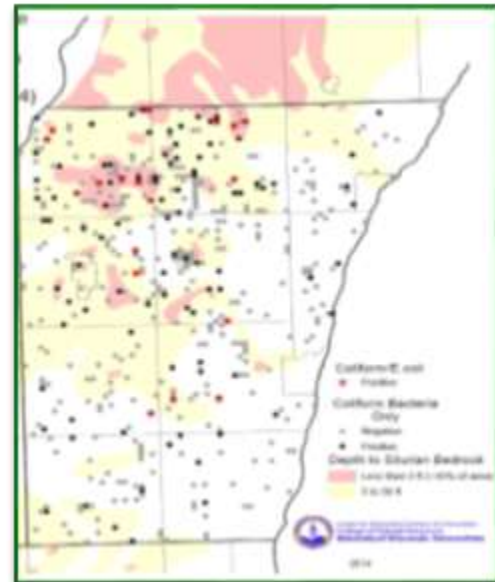
Town of Red River Karst Fractures



With increasing frequency, one or more of the local or regional media outlets has run a story about groundwater contamination problems in our county. The issue has drawn interest from the Natural Resource Conservation Service (NRCS), Environmental Protection Agency (EPA), Wisconsin Department of Natural Resources (WDNR), Department of Agriculture, Trade, and Consumer Protection (DATCP), US Fish and Wildlife Service (USFWS), and researchers from USDA, University of Wisconsin-Oshkosh (UW-O, University of Wisconsin-Green Bay (UWGB), Marquette University, the USDA and other universities and research partners.

In October of 2014, the US Environmental Protection Agency received a *Petition for Emergency Action Pursuant to the Safe Drinking Water Act, to Protect the Citizens of Kewaunee County, Wisconsin from Imminent and Substantial Endangerment to Public Health Caused By Nitrate and Bacteria Contamination of an Underground Source of Drinking Water*. The petition was submitted on behalf of Midwest Environmental Defense Center, Environmental Integrity Project, Midwest Environmental Advocates, Clean Wisconsin, Clean Water Action Council of Northeastern Wisconsin, and Kewaunee CARES.

According to the petition, “this petition is based on historic and emerging data that have been compiled by the University of Wisconsin – Stevens Point, the Kewaunee County Land and Water Conservation Department, the Wisconsin Department of Natural Resources, and other agencies and individuals showing that underground sources of drinking water in Kewaunee County consistently exceed state and federal drinking water standards for nitrate and routinely test positive for the presence of bacteria (including human pathogens), and therefore put the health of Kewaunee County residents at risk. Because state and local authorities have not acted or are precluded from acting under state law to abate this endangerment, swift and decisive action by EPA is necessary.”



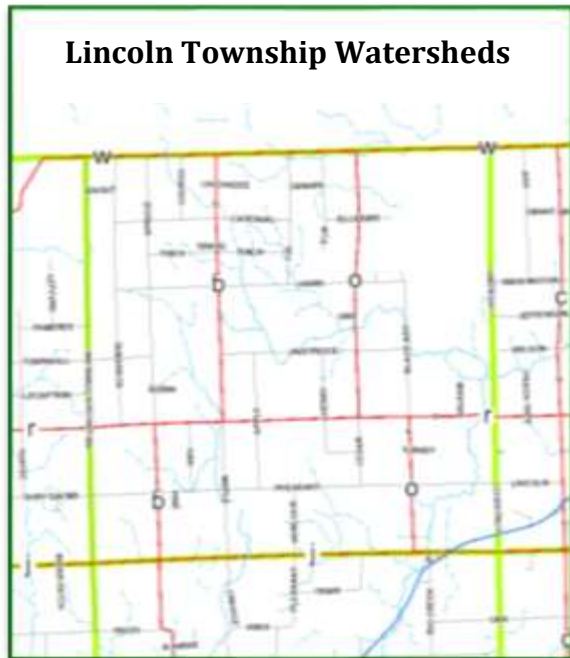
Wells tested and failed

As a result of this action, the DNR was moved to organize three Workgroups (Short Term Solutions, Compliance, and Sensitive Areas) to which the EPA had staff assigned.

As of this writing, the EPA continues to be actively engaged with stakeholders in Kewaunee County and with WDNR to identify solutions and pinpoint causes of groundwater contamination.

By 2014, all three rivers in Kewaunee County, the Ahnapee, Kewaunee, and East Twin, are listed on the EPA’s Impaired Waterways List. Tributaries to the Ahnapee and Kewaunee Rivers emanate from Lincoln Township. Silver Creek and Rio Creek contribute to the Ahnapee Watershed and Casco Creek flows into the Kewaunee River. All three were found to have

unsafe levels of e-coli in the Busse study.¹



Meanwhile, in August, 2015, Jimmy Bramblett (formerly the NRCS national Chief of Staff to the Regional Conservationists in Washington, D.C.) of the NRCS in Madison began meeting with select groups to introduce the idea of Kewaunee and Ahnapee Rivers Watershed Project in Kewaunee County. In September,

2015, the Kewaunee County Land and Water Conservation Department (LWCD) and the Natural Resources Conservation Service (NRCS) hosted a public forum to explain federal funding for the Kewaunee and Ahnapee Rivers Watersheds Project based on attendee ranking of conservation priorities.

Over 106 people attend the forum, of which 90 were Kewaunee County residents, including 10 Lincoln Township residents.



¹Crescent Beach Management and Monitoring of Non-Point Pollutants in Ahnapee River Watershed Dr. Kimberly M. Busse, University of Wisconsin Oshkosh, January, 2014.

Groundwater contamination is considered serious enough that in January, 2015, the Kewaunee County Board of Supervisors Chairperson declared groundwater the county’s number one priority, and established the Groundwater Task Force.

In March, 2015, Congressman Reid Ribble convened a “Phosphorus Summit” based on the confirmation of the existence of a dead zone in the bay of Green Bay. Researchers determined that more than 45% of the phosphorus was emanating from agricultural sources.

In May, 2015, Lincoln Township leaders were invited to participate in a round table with Congressman Ribble, Conservationists, and officials from other counties.

In April, 2015, Lincoln Township residents approved the Kewaunee County Public Health and Groundwater Protection Ordinance by a margin of four to one.

In 2016, even Wisconsin Governor Scott Walker paid the county a visit and discussed these issues with select local decision makers.

State Assembly Representatives Joel Kitchens and Scott Krug, at the request of Friends of Crescent Beach, sought funding to monitor total phosphorus and total solids in the Ahnapee River in May, 2016. Kitchens stated: “We want clean and safe resources in our area. This is especially true for the Ahnapee River and its largest tributary, Silver Creek....”

The Kewaunee County Land and Water Conservation Department has been taking samples of county wells since 2004. In the intervening years, 29% of wells tested

1	Water Quality Degradation - Excess Nutrients in Surface & Groundwaters
2	Water Quality Degradation - Excess pathogens and chemicals from manure, bio-solids or compost applications
3	Water Quality Degradation - Excessive Sediment in Surface Waters
4	Soil Erosion - Concentrated Flow
5	Soil Erosion - Sheet, Rill & Wind
6	Inadequate Habitat for Fish & Wildlife - Habitat Degradation
7	Soil Quality Degradation - Compaction
8	Soil Quality Degradation - Organic Matter Depletion
9	Air Quality - Objectional Odors
10	Excess Water - Flooding, Ponding & Seasonal High Water Table

NRCS Stakeholders and Technical Assistance Group (TAG) Resource Ranking

Table 8: Depth of Bedrock by Percent of Land Area In Kewaunee County Townships

Township	5' or Less	20' or Less
T. Ahnapee	<1%	7%
T. Carlton	<1%	0%
T. Casco	5%	15%
T. Franklin	0%	2%
T. Lincoln	15%	31%
T. Luxemburg	7%	31%
T. Montpelier	<1%	11%
T. Pierce	0%	0%
T. Red River	22%	49%
T. West Kewaunee	<1%	1%
Kewaunee County	5%	15%

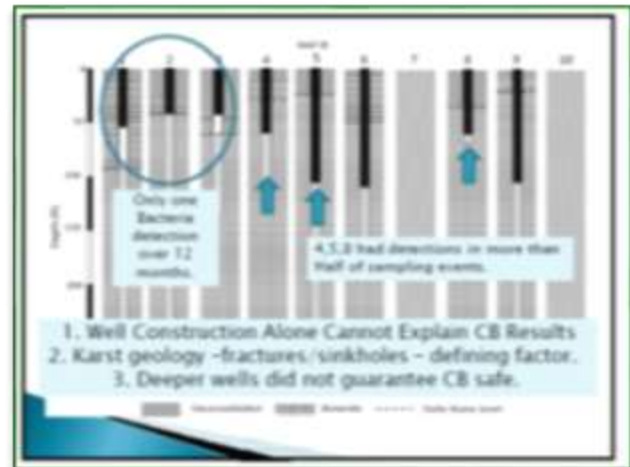
Source: Devina Boush, Kewaunee County Conservationist, KCLWCD

have been shown to be contaminated with either nitrate or bacteria or both. In Lincoln Township, the contamination rate has been as high as 41.3%.²

Lincoln Township has undertaken several initiatives to understand the scope of the problem. These include:

1. Monthly well testing of ten wells for one year by the Kewaunee County Land and Water Conservation Department and UW-Stevens Point Center for Watershed Science and Education. (see below)
2. A groundwater mapping project by the Wisconsin Geological and Natural History Survey that will include a depth to bedrock evaluation, water table mapping, groundwater recharge mapping, groundwater contaminant susceptibility, and a karst landform map featuring closed depressions.
3. A commitment to test 25 wells biannually for ten years.

The first initiative, completed in 2014, was a one-year well testing program carried out by Davina Bonness of the KCLWCD and Kevin Masarik of UWSP. The final report, *Investigating Inter-annual Variability of Well Water Quality in Lincoln Township*, was presented to the public in June, 2014. For the ten wells investigated, an average of 0.8% (eight tenths of one percent) of the nitrogen in the wells was from the septic systems with the remainder from agricultural sources. Some of Bonness and Masarik's conclusions include:



- “The degree to which nutrient management has been implemented around these wells (89% of cropland acres) is extensive...The extent to which nutrient management plans are being followed could not be verified; unless information exists to show otherwise, we assume that they are an accurate representation of what is taking place on the landscape. Therefore, we conclude that the elevated concentrations of nitrate in these ten wells are not the result of gross mismanagement or negligence.”
- **“If the goal is significant long-term reduction of nitrate concentrations in groundwater of Lincoln Township, it would likely require active efforts to reduce nitrogen inputs (e.g. less nutrient intensive cropping systems, strategic reduction in**

²UWSP Center for Watershed Science and Education, NRCS presentation to Kewaunee County, September 3, 2015.



acreage, etc.) beyond the current source, rate, and timing risk management strategies outlined in existing nutrient management plans.”

The second initiative, a groundwater mapping project by the Wisconsin Geological and Natural History Survey to be completed in September, 2017, will help the township identify closed depressions (groundwater infiltration hotspots), sensitive areas on the landscape, areas of concern that need special protection, and the flow of groundwater in the aquifer. It might also help the town pinpoint potential sources of contamination that can be addressed through zoning and/or protective ordinances.



The third initiative is a long term commitment to develop a baseline for groundwater quality so that we know what, if any, impact our efforts are making to remediate the chronic groundwater contamination situation by eliminating the sources.

There has been much disagreement about the exact percentage of contaminated wells. One side has argued that those who test their wells voluntarily are a “self-selected group with an agenda”. According to the State of Wisconsin Legislative Audit Bureau, “voluntary testing of wells coordinated by the Kewaunee County’s Land and Water Conservation Department between 2004 and 2015 found that 180 (29%) of the 620 wells tested had unsafe levels of nitrates, bacteria, or both”. The report goes on to note, however, that “a random sample of 320 wells in Kewaunee County found that 110 (34.4%) were contaminated with bacteria or unsafe levels of nitrates.” The random testing found a higher

percentage of contaminated wells than previously reported by the “self-selected group with an agenda.”

A random sample of 320 wells in Kewaunee County found that 110 (34.4 percent) were contaminated with bacteria or unsafe levels of nitrates.

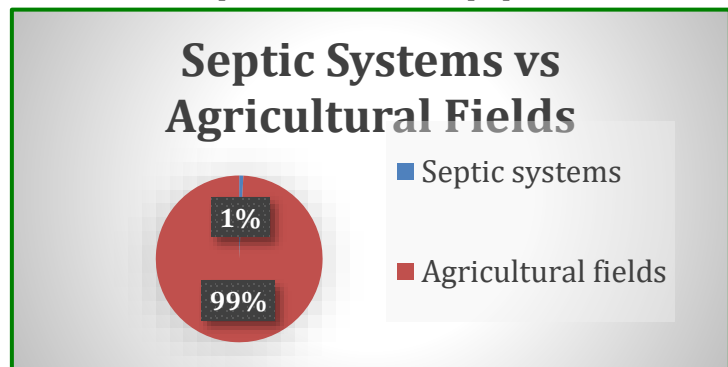
–State of Wisconsin Legislative Audit Bureau, June, 2016³



While the population of Kewaunee County is around 20,500 (20,505 in 2013), the number of Cattle (milking and dry cows, heifers, and calves) in the county exceeded 97,000 animals in 2015⁴. The amount of excrement from one dairy cow equals that of 18 people. Given this, the human-equivalent population in cattle alone in Kewaunee County is nearly 1,746,000 people, or 85 times the human population of the county. Common sense makes it clear that the bulk of the groundwater and surface water contamination is coming from animal manure and not human waste.

Lincoln Township has a population of 943 (2015). The town’s three CAFOs alone have a combined animal population (2015) of 13,773⁵. This equates to a human population of 199,137 people⁶.

The source of our groundwater contamination is a divisive issue. Many CAFO owners contend that faulty septic systems are the primary culprit, even though the Bonness and Masarik study indicated that only about 0.8% of the contamination in tested wells is from septic systems.^{7 8}



This disagreement is proving to be fertile ground for research by university and agency personnel who are now working to determine the whether the source of the groundwater contamination is human or bovine.

³ *Water Permitting and Enforcement*, Department of Natural Resources, State of Wisconsin Legislative Audit Bureau, June, 2016

⁴ NASS, USDA Statistics by State: All Cattle And Calves for 2015 and 2016.

⁵ According to the Kewaunee County Land and Water Conservation Department from 2015 Nutrient Management Plans.

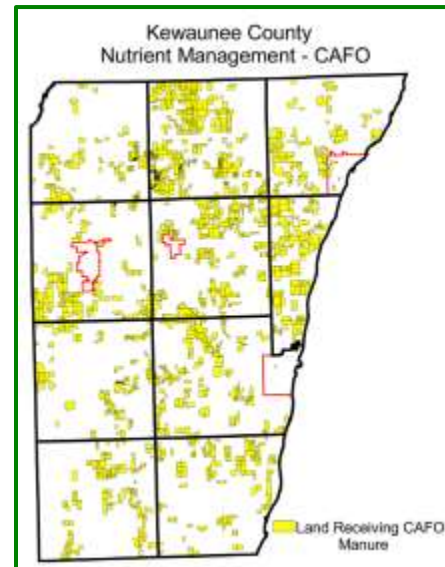
⁶ This number is weighted based on the age/size of the animals: milking dairy cows, heifers, and calves.

⁷ From *Utilities and Community Facilities*

⁸ This is corroborated by *Nitrate in Groundwater: A Continuing Issue for Wisconsin Citizens*, by the Nutrient Management Subcommittee of the Non-Point Source Pollution Abatement Program Redesign; March, 1999.

In the spring of 2016, a definitive and recent finding came as a result of the USDA's testing (funded by the DNR), where salmonella and rotavirus were found and the source was confirmed as bovine by Dr. Mark Borchardt, lead researcher on the project.

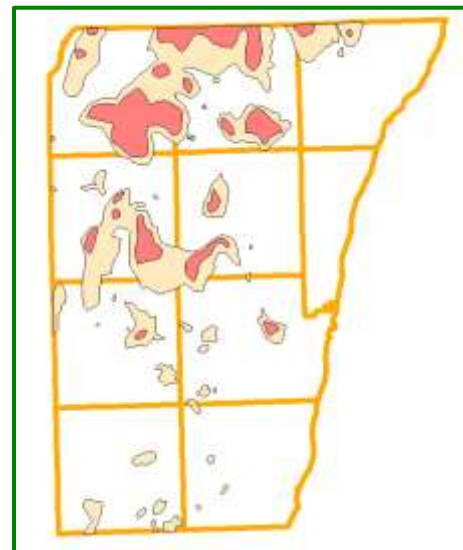
This was followed by an in depth study to assess the groundwater quality in Kewaunee County led by Drs. Mark Borchardt (USDA), Maureen Muldoon (UW-O), Randy Hunt (USGS) along with a host of others.⁹ The results indicated that the groundwater was contaminated with both bovine as well as human sources. A total of 621 households participated in the randomized study. Approximately 700,000,000 gallons of cattle manure are spread in Kewaunee County annually, while septics contribute about 200,000,000 gallons of effluent annually. (Of this, about 60% is graywater and 40% is blackwater.) The results of the study revealed contamination spikes in the spring and fall due to timing of manure applications, whereas septics contributed a lower level "baseline" of contamination year round.



Courtesy Dr. Mark Borchardt

"You don't have to be a scientist to know where the pollution is coming from"
Dr. Mark Borchardt, June 7, 2017

Dr. Maureen Muldoon explained that groundwater typically flows quite slowly, but in Kewaunee County it can flow at an astonishing "tens to hundreds of feet per day." As a result, the groundwater quality can change in a matter of hours. Dr. Mark Borchardt stated: "In your county, what you need to be concerned about is depth to bedrock, especially zero to five feet and five to 20 feet." The greater the depth of soil, the greater the protection from contamination.



"I cannot think of a hydro-geologically worse place than northeast Wisconsin to put a lot of cows,"
Dr. Maureen Muldoon, June 7, 2017

Depth to Bedrock (Borchardt)

⁹ Sources of Fecal Contamination in the Dolomite Aquifer in Northeastern Wisconsin, Mark Borchardt (USDA-Agricultural Research Service), Maureen Muldoon (UW-Oshkosh Department of Geology), and Randy Hunt (USGS Wisconsin Water Science Center), 2017.

In August, 2015, The DNR established four work groups to develop recommendations that could be used to create processes, rules and standards to improve the groundwater and surface water quality in Kewaunee County. The recommendations have yet to be implemented. However, the DNR has stated that all recommendations will be voluntary.

Arguably, the most important issues were around management practices for manure application on sensitive areas. Unfortunately, not all recommendations were discussed and were not able to be included in the final report. In addition, the DNR has insisted that all recommendations are voluntary. To quote Andy Wallander, the former Kewaunee County Conservationist, **“We have been using voluntary regulations since 1972 and they have not served us well.”**

In May, 2016, the Legislative Audit Bureau found that the DNR failed to follow their own policies on enforcement more than 94% of the time over the last decade. This harkens back to Administrative Judge Boldt’s opinion on a case involving a WPDES permit in October, 2014 in Lincoln Township: **“The proliferation of contaminated wells represents a massive failure to protect groundwater in the Town of Lincoln.”**

In a response to the Legislative Audit Bureau’s critical evaluation of the DNR’s oversight, DNR Secretary Cathy Stepp responded that “...the department has already begun work on several of the recommendations...”

Highlighted was “A number of recommendations focused on the need to identify sensitive areas and to implement best management practices in those areas, such as restricting or reducing manure spreading and providing setbacks to conduits to groundwater.”¹⁰

In order to make a tangible difference in our groundwater and surface waters, the township will need to make a number of tangible steps that go beyond best management practices and “voluntary”. To quote Wallander again, **“If you don’t change what you are doing, nothing is going to improve.”**



¹⁰ Letter from Cathy Stepp, Secretary, DNR, to Joe Chrisman, State Auditor, Legislative Audit Bureau, June 2, 2016; *Water Permitting and Enforcement*, Department of Natural Resources, State of Wisconsin Legislative Audit Bureau

In addition to implementing the “recommendations” from the WDNR Sensitive Areas Workgroup final report in June, 2016¹¹, the township should consider implementing the recommendations from the Final Report of the Northeast Wisconsin Karst Task Force, published in February, 2007. In particular, the township should consider designating areas of extreme, high, and significant vulnerability to groundwater contamination (Table 1 of the Karst Task Force Final Report), and subsequent recommendations for these areas in the report. Per the Karst Final Report: “The recommendations are primarily intended to minimize groundwater contamination from pathogens and ‘brown water’, and secondarily intended to minimize groundwater contamination from nitrate.”¹²

Table 1: Level of protection recommended based on vulnerability ranking and site specific criteria. Criteria are site specific, and multiple criteria may occur in the same agricultural field.¹³

Level of protection required	Criteria	Relative vulnerability to contamination
1	Less than 5 feet (60 inches) to carbonate bedrock, <i>and/or</i> closed depressions or any drainage areas that contribute water to sinkholes/bedrock openings	Extreme
2	5-15 feet to carbonate bedrock	High
3	>15-50 feet to carbonate bedrock	Significant
4	Greater than 50 feet to carbonate bedrock	Moderate

Mixed-Messages on Setbacks

As part of the WDNR Sensitive Areas Workgroup process, William Schuster, Land and Water Conservationist for Door County, made the compelling case that, since the required setback to private potable and public non-community water supply wells is 250 feet, that the required setback from “**all other direct conduits to groundwater (e.g. sink holes,, creviced bedrock, critical closed depressions, and fracture traces)**” should be **increased from the current 100 feet to 250 feet**. Schuster argued that the 250 foot setback to wells provides greater protection even though those conduits (wells) are cased

¹¹ Groundwater Collaboration Workgroup Final Report, June, 2016

¹² Final Report of the Northeast Wisconsin Karst Task Force, February, 2007

¹³ Final Report of the Northeast Wisconsin Karst Task Force, February, 2007

and sealed. Given this, the 100 foot setback for other conduits not only provides for lesser protection distance-wise, but these are direct conduits to groundwater which are uncased and unsealed. Schuster concluded that **“if the agricultural industry continues to apply animal waste near open conduits, the public will continue to experience animal waste in their drinking water.”**

In addition, Lincoln Township should make a concerted effort to assist the Kewaunee County Land and Water Conservation Department identify and locate abandoned wells, wells in agricultural fields, and wells with the well head below grade. The town might consider seeking grants for cost sharing the proper abandonment or upgrading of such wells since it is in the best interest of all of the town residents, all of who rely on wells as their water source, to do so.