***Sauk County***

**Groundwater Quality Trend Data**

***Project Proposal***

**PURPOSE OF TRACKING GROUNDWATER QUALITY TREND DATA**

Sauk County has been partnering with the Center for Watershed Science and Education to monitor 300 wells annually as part of a community driven data collection effort to learn more about well water quality. Few communities have the ability to track trends in well water quality; establishing this network of private well owners has aided our understanding of how groundwater quality is changing over time and contributes to learning about potential causes of observed change.

Analysis of the nearby land use and well construction of private wells with long-term data can help identify which factors may be contributing to declining or improving groundwater quality. This information is useful for informing of conservation efforts, well construction guidelines, and well water outreach efforts in Sauk County. What is learned from monitoring this network of wells can then be applied more generally to Sauk County groundwater as a whole.

Participants were previously selected to ensure wells are representative of Sauk County geology, land cover, and rural well density. We successfully sampled more than 300 wells in each of the 5 years. Multiple years of data from the same wells increases our ability to understand whether increases or decreases represent a true trend or simply a change in concentration between two points in time. Five years was the minimum number of years recommended for this project. We propose collecting an additional two years of data to provide confidence in trend data and provide a longer record for potential correlation of trends to climatic and/or annual land cover data.

A screenshot of a computer

Description automatically generated

**Figure 1. Data on trends in the 301 wells that submitted samples for the past 5 years. Red symbols represent increasing trends (9%), blue decreasing (13%), and yellow indicate no trend (79%). The larger the symbol, the greater the rate of change.**

A graph with a dotted line

Description automatically generated

**Figure 2. Example of a well participating in the project that displays an increasing trend.**

**METHODOLOGY & TIMELINE**

***Timeline***

The proposed contract period is from July 1 2024 through June 30 2026. The project activities are as follows:

* Mail Sample Kits (September)
* Testing (November)
* Mail Results (January)
* Update Dashboard/Educational program (March)
* Annual Report (June)

***Tests***

Confidence in this trend data enables isolating areas where nitrate and/or chloride are increasing or decreasing. Additional parameters allow us to understand water quality changes are related to land use or other factors that may be influencing measurements such as weather/climate, add confidence to results, and provide important information about other water quality characteristics.

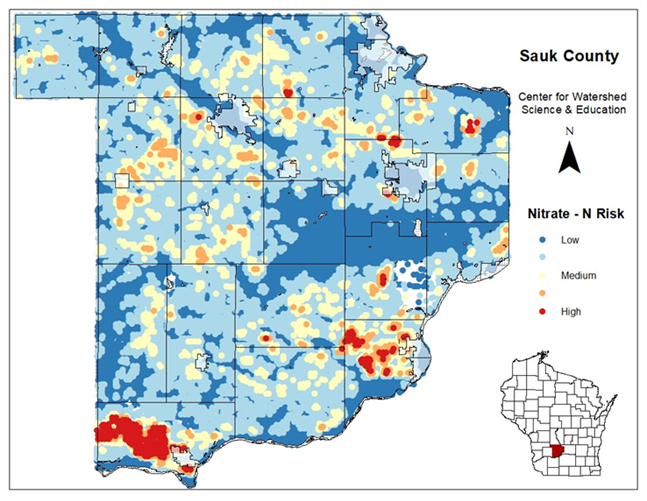
*Nitrate*

Nitrate is an important test for private well owners. Levels greater than 10 mg/L nitrate-nitrogen should not be consumed by infants, women who are or trying to become pregnant. Everyone is encouraged to avoid long-term consumption of nitrate greater than 10 mg/L.

Nitrate is a chemical commonly found in agricultural and lawn fertilizer. It is also produced when organic rich materials such as manure, bio-solids, septic system effluent, etc. decompose. Nitrate is a very soluble form of nitrogen and can easily leach past the root zone of plants into our groundwater. Levels of nitrate in groundwater are generally less than 1 mg/L in natural or areas of little human influence. Elevated levels generally occur in areas of agricultural activity or areas of dense rural development (i.e. small lot sizes with septic systems, lawn fertilizers, etc.). Soils and geology make certain areas more prone to nitrate losses to groundwater. For these reasons, nitrate is a good test to perform if trying to understanding the impacts of land use on groundwater quality as well as trends over time.

*Chloride*

Like nitrate, chloride is a useful tool for understanding the impacts of land use. Major sources of chloride to groundwater include fertilizer, road salting and septic system drainfields. Potash is used to add potassium to soil. The most common form of potash is potassium chloride; the chloride is susceptible to leaching. Road salt (usually sodium chloride) helps in deicing roads, but is then washed off roads into ditches or other pervious areas where it soaks into the soil and can eventually leach to groundwater. Septic system drain fields dispose of wastewater which contains chloride from human waste and water softener salt.

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**Figure 3. Map showing the risk of a well encountering elevated nitrate based on a statistical model that was applied to each parcel in Sauk County. Red indicates higher risk and blue lower risk. Statistical model was developed using data from first 5 years of the project.**

*Alkalinity*

Alkalinity is a measure of water’s ability to neutralize acid. It is generated by the dissolution of carbonate minerals common to Wisconsin. Groundwater alkalinity measurements are relatively stable from one year to the next. Testing for alkalinity may help in understanding whether weather variability is influencing particular water samples since alkalinity should be relatively consistent under normal conditions.

Conductivity

Conductivity is a measure of the amount of total dissolved ions in water but does not give an indication of which minerals are present. In most uncontaminated waters however, conductivity is about twice the total hardness value in an unsoftened water source. Changes in conductivity over time may indicate changes in overall water quality. There are no health concerns at levels of conductivity found in Wisconsin’s groundwater.

Hardness

Hardness measures the amount of calcium and magnesium in water. Hard water can cause scale deposits on fixtures, in pipes or water heaters. Water that is naturally low in hardness is often referred to as soft and can be corrosive. There are no health concerns associated with drinking hard water. Water less than 150 mg/L is considered soft while values greater than 200 mg/L are considered hard. *Concentrations are expressed as mg/L as CaCO3.*

pH

The pH test is a measure of acidity. The lower the pH, the more corrosive the water. There is no health standard for pH, however corrosion of metal plumbing or fixtures is more likely to occur when pH levels are less than 7. Water greater than 7 is more likely to result in scaling. Low pH water may be more likely to result in elevated levels of copper and/or lead if those elements are included in your plumbing system.

***Well Testing***

Sample kits will be mailed to all participants who have remained with the program for all 5 years. Participants will collect their sample and send back to the laboratory using a pre-paid mailer. Samples will be analyzed at the Water and Environmental Analysis Laboratory at UW-Stevens Point, which is state-certified to perform the tests of interest. Following sample analysis participants will be mailed a copy of their individual result along with interpretive information.

***Reporting & Education***

An annual summary of results will be generated for Sauk County that provides an overview, summary data, and interpretation of results. Important metrics that we would typically report on: average, median, minimum, maximum concentrations by county, towns, aquifer category, land use, and casing depth. Percentage of wells increasing/decreasing. Maps will be generated to provide understanding of water quality across Sauk County.

Our intent is not to display or share the data at a parcel level but provide a general idea of groundwater quality spatially. As a result, we plan to map display data at a county-wide scale to the centroid of a section (1 square mile area). The project dashboard will be updated annually to reflect additional years of individual parameters, trends over time, and historical data. The current dashboard can be found here: <http://68.183.123.75/wisconsinwater/County-Apps/Sauk/>

***Data & Project Deliverables***

This work will result in the following project deliverables:

1. An annual in-person update and educational session/open house event.
2. An annual report will be provided to Sauk County at the completion of each year summarizing results from the annual testing.
3. After each well test, each well owner will receive a copy of their individual test results along with interpretive information.
4. The Sauk County online interactive data visualization tool will be updated to catalogue data and make available to the public and county for outreach/educational purposes.
5. Data will be archived in the Center for Watershed Science and Education database and integrated into the WI Well Water Viewer. The viewer aggregates well water data to a 1 square mile area.
6. Any databases, raw data files, or other electronic files generated as a result of this project will be provided via preferred format to Sauk County.

***Expectations from Sauk County***

In order for the Center for Watershed Science and Education to carry out the project, the following support from Sauk County departments is anticipated:

1. Assistance arranging open houses or outreach events for participants to learn about the project and project results (Sauk County Extension).
2. Access to parcel level data and geographic information system support with names/addresses of residents for the purposes of identifying potential participants (Sauk County Land Information/GIS).
3. Communication of project results with county officials and county departments (UW-Madison Extension Sauk County, Sauk County Land Resources & Environment, Sauk County Department of Health)
4. Provide review of any recruitment materials, outreach materials, or other communication materials that result from this project (UW-Madison Extension Sauk County, Sauk County Land Resources & Environment, Sauk County Department of Health)

**BUDGET**

**Budget for July 1, 2024 – June 30, 2026**

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| **Water Testing for 300 Samples**   * Center for Watershed Science will be responsible for mailing/receiving test kits. Samples will be analyzed at the Water and Environmental Analysis Lab. * $60/sample. * This includes a follow-up mailing of individual results to participating households. | | $18,000 |
| **Mailings** | |  |
|  | Mailing cost for kits to households. | $1,500 |
| Mailing cost for samples back to the lab. | $1,800 |
| **Research Associate Staff Time**   * Academic Staff (0.075 FTE salary+fringe, $65,000+$30,225) This person will be responsible for coordinating of sampling efforts, updating dashboard, and annual report writing. | | $7,141.88 |
| **Total for FY25** | | $28,441.88 |

\*Please note: For future years, budget forecasts must include an annual fringe benefit rate increase of 5% for FY26.

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| --- | --- |
| **Year** | **Budget By Year** |
| Year 2: FY26 | $29,863.97 |

\*\*Sauk County has a policy of not paying indirect costs on outside service contracts with public institutions (documentation attached)

**F.A.Q.**

***Why can’t the data used from regularly tested dairy farms work for trend data?***

Dairy farms are only required to test for bacteria. Additionally, this would rely on farmers voluntarily sharing that information since this information is not required to be shared publicly or currently maintained in a database.

***Is this duplicating monitoring wells?***

Monitoring wells are often used to measure field scale or site specific problems. For example, if you suspected that a landfill or manure storage facility were leaking, a network of monitoring wells adjacent to the site would be the appropriate strategy to answer that question. The intent of this project is to learn about groundwater quality more generally across all of Sauk County. As a result, it is important to design a network that is representative of a broad range of factors (ex. Soils, geology, land-use, depth, etc.) that are likely to contribute to groundwater quality of rural residential wells in the area being studied.

**Would it be possible to keep weather data alongside the data and use that to help understand the data and possible implications?**

Yes. If there are quality weather stations that are providing publicly available data, we could summarize annual and/or monthly weather data in the annual report or other outreach/educational materials.

**How will this proposal be formatted in a way that makes it accessible and easy for decision-makers to use?**

It is our goal as outreach specialists to make sure information is effectively communicated and easily understood. The center has experience with online mapping platforms and other data visualization tools and techniques. We also envision using a storyboard approach which is becoming popular for communicating information of this type. Lastly, we will evaluate our products as we go to ensure that we are effectively reaching our intended audience.

**Is there any grant funding available to assist with this type of research?**

There is currently very limited funding. Some counties have used health grants from the Wisconsin Department of Health Services to fund one-time projects related to well water testing through their county health department. However, obtaining a grant is not guaranteed and sustained work beyond one year would benefit from long-term county buy-in.

**What implications will a well test in one area have for a well tested in another area of Sauk County?**

What we learn about how geology, land-use, and well construction impact water quality can then be applied to other wells that have not been tested. From this information we hope to create a statistical model that can be used to understand water quality across Sauk County.

**How will the information be used and shared?**

As part of our public outreach mission we anticipate using the information in outreach programming related to groundwater quality. Information will be used by researchers to investigate the relationship of geology, land use, and well construction on groundwater quality. Data will be summarized for annual and final reports. Data will be mapped for final reports and educational purposes, but not at a level that will allow the data to be identified to an individual parcel.