

Sauk County
Groundwater Quality Trend Data
Project Proposal

PURPOSE OF TRACKING GROUNDWATER QUALITY TREND DATA

Prior to starting a citizen-based groundwater monitoring program, the following questions are often useful in deciding whether the tracking of groundwater quality trend data would be useful to decision-makers and resource management professionals:

- Do you feel like you have enough information about groundwater quality to effectively target management decisions?
- Is there consensus around groundwater quality data as it currently exists in Sauk County?
- How does groundwater quality today compare to groundwater quality 10, 15, 30 years ago? If you had this information, would it be useful for you in making decisions today?

If these questions are relevant to your community, a county-wide groundwater quality monitoring program would, over time, provide information on where to invest time and money for the purposes of improving groundwater quality. In addition, a well-developed water quality monitoring program would potentially provide evidence whether resource management approaches are having an impact.

Residents of Sauk County have performed extensive voluntary well testing. This information is useful for understanding overall well water quality across the county, however; little information exists that allows for an understanding of how groundwater quality has changed over time. Establishing a network of private well owners to perform annual testing over an extended period of time would help inform residents and local leaders whether groundwater quality is getting better, worse, or staying the same.

The answer to that question is that there are likely areas where each of those scenarios is occurring. To what extent each occurs in Sauk County is largely unknown. Analysis of the nearby land use and well construction of private wells with long-term data could help identify what the contributing factors are to declining or improving groundwater quality. This information can inform future land use and well construction guidelines in Sauk County.

In those areas where water quality is changing, additional investigation into land use practices could provide insight into what is causing those changes (both negative/increasing pollutants and positive/decreasing pollutants). What is learned from monitoring this network of wells can then be applied more generally to Sauk County groundwater as a whole.

METHODOLOGY & TIMELINE

Timeline

If the goal is to analyze trends, multiple years of data from the same wells increases our ability to understand whether measured increases or decreases represent a true trend or simply a change in concentration between two points in time. Five years is the minimum number of years recommended for this project. Depending on what is learned from the dataset after five years, the decision could be made to continue the project beyond that timeline, discontinue, or evaluate different strategies.

The proposed contract period is from July 1 through June 30 each year. The proposed programming work is as follows:

- Recruitment (August-September)

- Testing (November)
- Mid-Year Progress Report (January)
- 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 related to land use factors relative to 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.

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 would help in understanding if a particular sampling event was influenced by rainfall or snow melt because 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 Selection & Recruitment

A minimum of 10 wells per town will be selected (n=220). To maximize what can be learned from this dataset, we will have selection preference for wells with an existing well construction report (i.e. known well depth, casing depth, depth to water, depth to rock, etc.). Additional wells will be sampled (n=80) that will allow us to account for areas of greater population density or areas of special geologic or landcover concerns. All efforts will be made to ensure wells are representative of Sauk County geology, land cover, and rural well density.

Potential participants will be contacted via mail and asked to respond within a certain time period. Expectations of and benefits to participants will be conveyed at that time. If participants decline or we do not hear back, we will continue recruiting from other wells in the area until our goal of 240 wells is reached.

Testing

Those selected will be mailed a sample bottle with instructions. 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. 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). As the dataset grows, additional data analysis will be performed and information added to help interpret trends and changes to groundwater quality that may be occurring.

Outreach materials, both written and web-based, will be generated throughout the project to communicate results.

Data & Project Deliverables

This work will result in the following project deliverables:

1. A mid-year progress report will be provided to Sauk County describing activities during the first 6 month period.
2. An annual in-person update and educational session/open house event.
3. An annual report will be provided to Sauk County at the completion of each year summarizing results from the annual testing.

4. After each well test, each well owner will receive a copy of their individual test results along with interpretive information.
5. An online interactive data visualization tool will be developed to catalogue data and make available to the public and county for outreach/educational purposes.
6. 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.
7. 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 Conservation, Planning, and Zoning).
3. Communication of project results with county officials and county departments (Sauk County Extension, Sauk County Conservation, Planning, and Zoning, Sauk County Department of Health)
4. Provide review of any recruitment materials, outreach materials, or other communication materials that result from this project (Sauk County Extension, Sauk County Conservation, Planning, and Zoning, Sauk County Department of Health)

BUDGET

Budget for the First Year

Communication with Households		\$1,200
<ul style="list-style-type: none"> Includes mailings for recruitment efforts to approximately 600 households. (estimating 50% success rate) 		
Water Testing for 300 Samples		\$13,500
<ul style="list-style-type: none"> Minimum of 10 samples per town (220 samples). Additional sampling will be done to ensure adequate weighting of various geologic concerns, land cover strata and population density (80 samples). \$45/sample. This includes a follow-up mailing of individual results to participating households. 		
Mailings		
	Mailing cost for kits to households.	\$1,200
	Mailing cost for samples back to the lab.	\$1,500
Research Associate Staff Time		\$5,946.28
<ul style="list-style-type: none"> Academic Staff (0.075 FTE salary+fringe, \$54,528+\$28,572.67) 		
Total for FY20		\$23,346.28

*Please note: For future years, budget forecasts must include an annual fringe benefit rate increase of 5% for FY21, 5% for FY22, 4% for FY23, and 3% for FY24.

Year	Budget By Year
Year 1: FY20	\$23,346.28
Year 2: FY21	\$24,543.77*
Year 3: FY22	\$25,795.79*
Year 4: FY23	\$26,868.67*
Year 5: FY24	\$27,738.34*

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

***Please note matching funds are not a requirement of the contract. It is estimated that over the course of the 5 year period, UWSP is contributing \$66,804.05 towards this project. This estimate includes 5% of Kevin Masarik's time spent on this project as well as indirect costs associated with the project which Sauk County policy does not allow reimbursement for. (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.