Prepared by: EOR

For the Green Lake Association, Green Lake Conservancy, and Green Lake Sanitary District

Hydrologic Evaluation of the Proposed Skunk Hollow Mine, Green Lake County, Wisconsin

December 8. 2022

water
ecology
community

Cover Images

Mitchell Glen

TABLE OF CONTENTS

1. PURPOSE AND SCOPE

Emmons and Olivier Resources, Inc. (EOR) conducted this review of the proposed Skunk Hollow Mine under contract with the Green Lake Association. We were asked to address concerns about potential water resource impacts of the proposed mine. These include acid mine drainage and related metals contamination, sediment impacts on surface water and groundwater, and the supply of groundwater to springs and streams.

EOR's lead investigator for this report was Water Resources Engineer Steve Gaffield, PE, PhD (resume included in Attachment A). This report has been peer reviewed within EOR, and its conclusions and recommendations represent the collective experience of the firm.

Steve Gaffield of EOR visited the area on November 18, 2022 to observe conditions. In addition, we reviewed the Conditional Use Permit (CUP) application materials, information on the mine site provided by the Wisconsin Department of Natural Resources (DNR; Attachment B), and literature on the area including the mine site, nearby natural resources including Powell Spring and Mitchell Glen, the local bedrock geology, and risks related to mining. Many of these references are cited in footnotes throughout this report.

2. GROUNDWATER QUANTITY

2.1. Depth to water table

The proposed mining plan described in the CUP application materials is to terminate the pit above the water table, which is important to avoid aerating the aquifer and potentially mobilizing arsenic and other metals, as described in more detail later in this report. Kopplin & Kinas' Drawing 8 shows a proposed quarry floor elevation of 928.43 ft and a static water level of 918 ft. The source of the 918 ft static water level estimate appears to be from an observation in the on-site water supply well, as discussed in more detail below.

It is unlikely that the water table at the proposed mine site is as deep as estimated in the CUP application. An elevation of 918 ft is lower than Powell Spring. Available information indicates that groundwater flows from the area including the mine site toward Powell Spring, White Creek, Mitchell Glen, and Dakin Creek, which means that the water table at the mine site would be higher than the spring. Figure 1 illustrates a typical groundwater flow system, with the water table sloping downward toward streams and lakes. A statewide water table map from the US Geological Survey[1] (Figure 2) shows that the mine site is near a groundwater divide, with a water table slope to the northwest driving groundwater flow toward Green Lake. The water table elevation at the mine site therefore must be higher than the Powell Spring elevation of 923.4 ft, listed in the spring survey report by the WGNHS.

[1] Kammerer, PA, 1995. Ground-Water Flow and Quality in Wisconsin's Shallow Aquifer System. US Geological Survey, Water-Resources Investigations Report 90-4171.

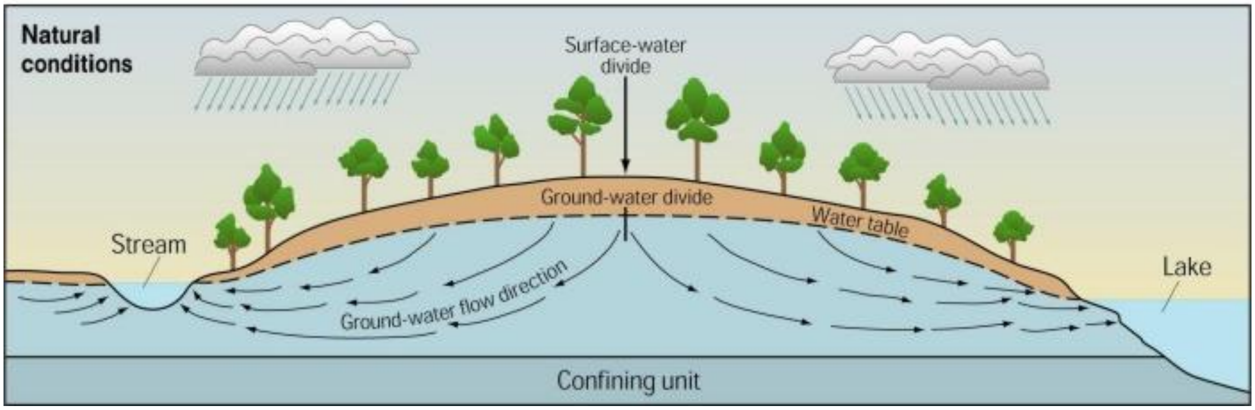


Figure 1. [USGS Ground water in the Great Lakes Basin: the case of southeastern Wisconsin]

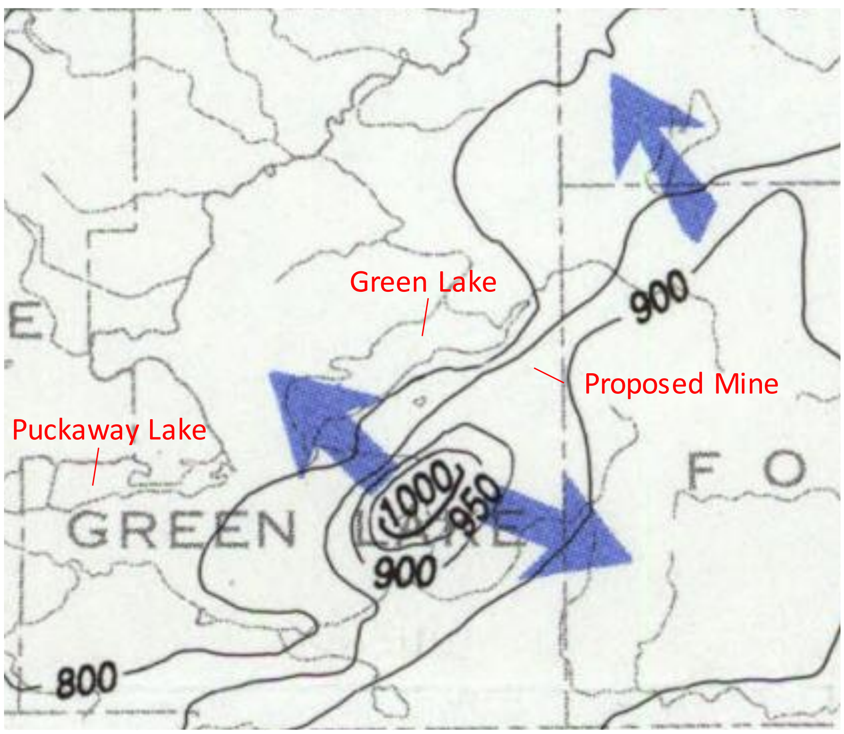


Figure 2. Water table elevation contours and generalized groundwater flow direction. From [USGS, 1995]. Location notation added by EOR. Note drop in water table from mine site toward Green Lake.

Additional information on groundwater levels in the area can be obtained from Well Construction Reports available on the DNR website. These reports include well drillers' measurement of the depth to the static water level at the time of drilling. EOR estimated the static water level elevation by locating the house associated with each well record, where possible, and determining the ground surface elevation from topographic maps. Estimated water levels near the mine site (Figure 3) show that groundwater drops from the mine site to the north and west, toward Dakin Creek, White Creek, and Green Lake. Static water elevations estimated for the three WCRs closest to the mine site, south and east of Brooklyn G Rd. and north of CTH K, are 935 ft, 942 ft, and 954 ft. The latter well is on the Kinas property, and the CUP application reports an observed depth to water of 60 ft in January 2022, without describing measurement methods. The static depth to water reported on the WCR in 1976 was only 26 ft. The difference in water levels between this reported water level and the deeper measurement reported by Kinas may be related to errors in either or both measurements and/or groundwater level fluctuations over time.

It is important to note that water levels in water supply wells are commonly lower than the water table. The water level in a well represents an average hydraulic head across the depth interval to which it is open to the aquifer. In upland areas, such as the proposed mine site, the groundwater gradient is commonly downward, and lower heads at depth cause the water level in the well to be below the water table. This is well known by researchers that use these wells for water table mapping and groundwater model calibration, and it is why groundwater monitoring wells are constructed with short open intervals. A local example of this effect is the WCR for well 8DI608 near Powell Spring. The reported depth to water of 50 ft in this well corresponds to an elevation of approximately 900 ft, which is 23 ft below Powell Spring where the water table intersects the ground surface.

Water table elevations naturally fluctuate in response to wet and dry periods. This can be seen in groundwater monitoring data from the U.S. Geological Survey for a well in Dodge County completed in the St. Peter Sandstone to a depth of 125 ft (Figure 4). Between 1964 and 2022, water levels in that well varied more than 12 ft. Therefore, groundwater levels in the future are likely to range above and below levels that are measured today.

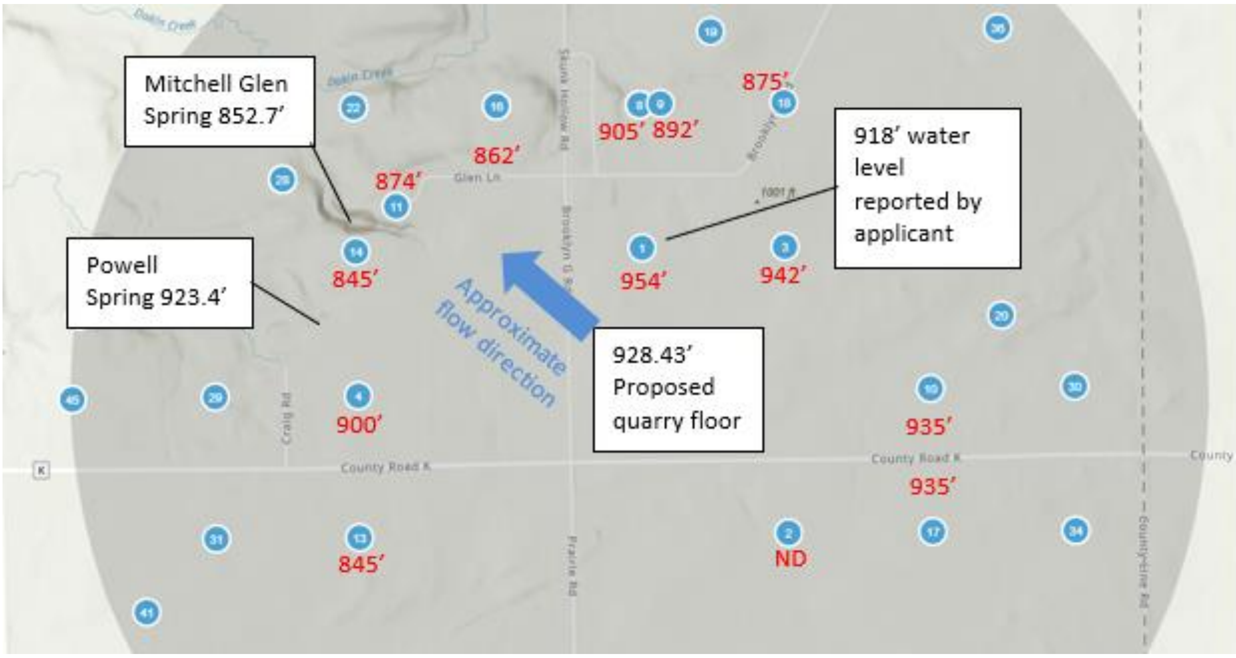


Figure 3. Comparison of water level data and proposed quarry elevation. Static water level elevations estimated from selected Well Construction Reports are labeled in red. Note drop in water levels to the north and west toward Dakin Creek and White Creek.

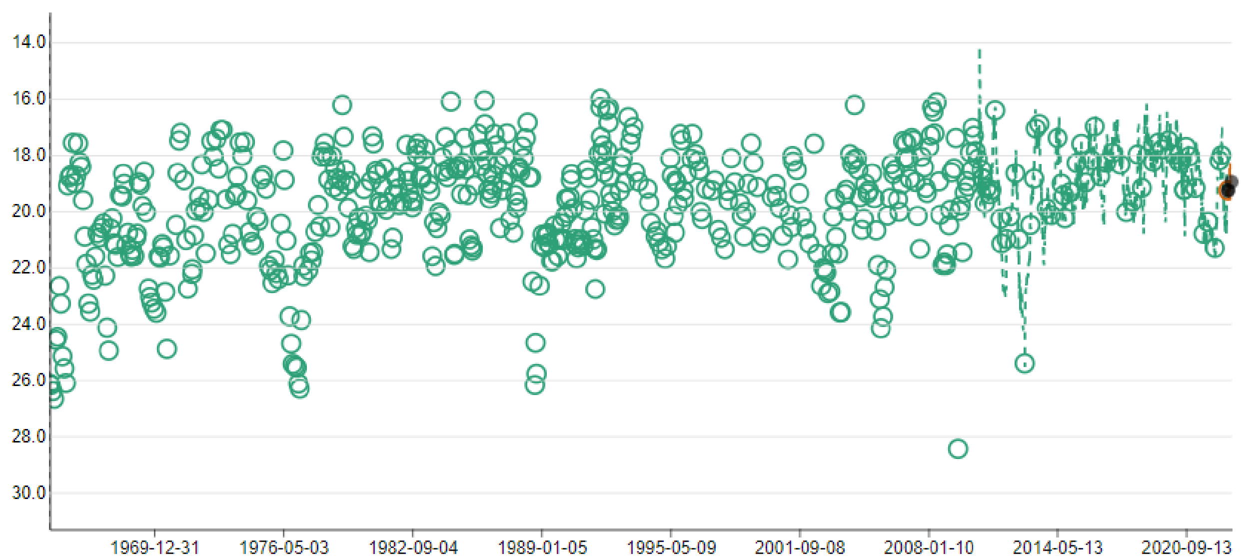


Figure 4. Variations in depth to water (in feet below ground surface) in a Dodge County well completed in the St. Peter Sandstone from 1964 to 2022 (from US Geological Survey)

Conclusions and Recommendations

1. Available information indicates that the water table at the mine site is higher than the proposed pit floor elevation.
2. Available data are not adequate to precisely determine the water table elevation at the site, and monitoring wells should be installed.
3. The water table elevation naturally fluctuates with wet and dry cycles, and it is likely that the water table elevation in the future will fluctuate above and below the level that is measured now.

2.2. Potential Groundwater Use

No groundwater dewatering is proposed, because the plan calls for the mine to be above the water table. However, the available data described above indicate that dewatering would likely be necessary to mine to the proposed depth of 928.43 ft. If ground dewatering were to be employed at the mine, this would lower the water table at the mine site and drawdown groundwater levels for some distance around the mine. This would create the potential for water availability impacts at neighboring wells and downgradient springs, as well as water quality impacts discussed in Section 3.1.

In addition, the CUP application describes the potential to install a new water well as a supply for aggregate processing, dust suppression, and portable pavement plants. No information has been provided by the applicant as to whether or not this would be a high capacity well, expected pumping rates, or the frequency of use of such a well. This makes it impossible to evaluate the potential impact of a new well on neighboring water supply wells or flow to local springs and streams. Pumping of a well would also draw down the water table with potential to affect neighboring wells and the springs.

The private water supply well at the Nehm farm is located approximately 1300 ft south-southwest of the mine site property, and DNR Well Construction Reports indicate that 13 more private water supply wells are located within 2500 ft the mine site. Potential drawdown impacts on these wells and the springs should be evaluated with a hydrologic study that includes:

a) collection/interpretation of data from monitoring wells at the mine site to estimate aquifer transmissivity (e.g. by conducting well hydraulic tests and evaluating drilling logs);
b) a drawdown analysis (e.g. the Theis method) for the proposed well to estimate drawdown at nearby wells and the springs; and
c) calculation of the expected pumping rate of the well as a percentage of the flow rates from local springs to quantify the potential reduction in spring flow that groundwater pumping at the mine could cause.

At present, no details are available on the potential pumping rate, duration, and frequency for dewatering and/or water supply pumping at the mine, so that it is not possible to evaluate potential drawdown impacts on neighboring wells and the springs.

Conclusions and Recommendations

1. If the mine is excavated to the depth proposed in the CUP application (928.43 ft), groundwater dewatering pumping is likely to be necessary.
2. No information is available on the rate, duration, or frequency of pumping from a new water supply well for the mine.
3. Before groundwater pumping at the mine is approved, a hydrologic study should be conducted to predict impacts on neighboring wells and the springs.
4. There is not sufficient information on potential groundwater pumping at the mine to evaluate these impacts.
5. It is unclear who would review this information to approve installation of a well.

3. GROUNDWATER QUALITY

3.1. Mobilization of Metals Below the Water Table

Concerns have been raised about the potential for the Skunk Hollow Mine to contaminate groundwater with arsenic and other metals. Drinking water contaminated with arsenic has been associated with cancer and other health problems, and this issue has gotten a lot of attention in eastern Wisconsin over the past 20 years or more. Arsenic is present in naturally occurring sulfide minerals in the dolomite and sandstone bedrock, and human activities that introduce oxygen into the aquifer can cause chemical reactions that release arsenic into the groundwater. Mining at or below the water table would have potential to trigger this process, as could pumping of a water supply well at the mine site. Mobilization of metals in groundwater at mines below the water table has been documented by the DNR in southwestern Wisconsin in the same rock formations as present at the mine site.[2]

Elevated arsenic concentrations occur in Green Lake County's groundwater. Wisconsin Department of Natural Resources data[3] for water supply wells in the county from 2014 – 2021 show that about 4% of samples had arsenic above the state drinking water Enforcement Standard of 10 ug/L, which is based on public health recommendations, with a maximum of 601 ug/L. An additional 29% of samples were above the state's Preventive Action Limit of 1 ug/L, which is a threshold that can trigger additional investigation

---

[2] Johnson, DM, 2009. Water supply and water quality issues in southwestern Wisconsin. In The Upper Mississippi Valley lead-zinc district revisited: mining history, geology, reclamation, and environmental issues thirty years after the last mine closed. Illinois State Geological Survey, Guidebook 38.

[3] Johnson, DM, Wisconsin Department of Natural Resources, written communication, November 18, 2022.

and corrective action. An irrigation well on the Machovich property approximately 1 mile northeast of the proposed mine site had very high concentrations of arsenic (2310 ug/L) and nickel (4310 ug/L) in 2012.

As noted in the CUP application, the bedrock that is proposed to be quarried is presumed to be the Sinnipee Group dolomite. The literature indicates that sulfide minerals can be present in the Sinnipee Group. Gotkowitz (2002) notes the source of arsenic in wells in the Fox Valleys is believed to be a sulfide-rich horizon at the base of the Platteville Formation, which is the lowest formation in the Sinnipee Group.[4] Brown and Maass (1992)[5] found that the iron sulfide mineral pyrite was abundant in rock cuttings from the Sinnipee Group in 53 water wells examined in Dodge, Fond du Lac, and Winnebago Counties. They also noted that pyrite is commonly observed in quarries in the Sinnipee dolomite, including a quarry in Dodge County, and that it occurs as coatings along joints and replacing fossils.

The CUP application notes that a water supply well could be installed at the site as a source of water for washing and processing aggregate materials and for dust suppression. A new supply well at the site would presumably be drilled into the bedrock units underlying the Sinnipee Group, which include the St. Peter Sandstone, Prairie du Chien Group dolomites, and the Cambrian Sandstone units. The Machovich well with the high arsenic and nickel concentrations noted above was also open to these rock units. Use of well water with elevated metal concentrations in the mine would result in exposure risks to groundwater (through infiltration to the water table) and surface water (through pumping out of the pit). If a new well were to be installed, it should be constructed based on DNR recommendations for the Arsenic Advisory Area of northeastern Wisconsin and tested for metals annually. Re-using stormwater from the pit would be preferable to a new water supply well for quarry operations to reduce the potential to mobilize metals.

---

[4] Gotkowitz, M, 2002. Report on the preliminary investigation of arsenic in groundwater near Lake Geneva, Wisconsin. Wisconsin Geological and Natural History Survey, Open-File Report 2000-02.

[5] Brown, BA and RS Maass, 1992. A reconnaissance survey of wells in eastern Wisconsin for indications of Mississippi Valley type mineralization. Wisconsin Geological and Natural History Survey, Open-File Report 92-3.

Conclusions and Recommendations

1. Mining should not occur below the water table due to the risk of mobilizing metals in groundwater. The current plan does not appear to meet this criterion.
2. The areas at highest risk of groundwater contamination from the mine are north and west of the mine site, including White Creek, Powell Spring and Creek, Mitchell Glen, Glen Creek, and Dakin Creek.
3. The potential risk of groundwater impacts on other properties should be evaluated through installation of monitoring wells to identify the groundwater flow direction(s). Because the mine site is located near a groundwater divide on the USGS water table map (Figure 2), groundwater flow in multiple directions from the mine site is possible.

3.2. Mobilization of Metals Above the Water Table

Contamination of groundwater by metals is possible even if the mining is above the water table. Acid rock drainage (ARD) can occur where sulfide minerals are exposed to air and water, which is accelerated by excavation of rock. Oxidation of sulfide minerals is often accompanied by mobilization of metals.[6] As noted above, the Sinnipee Group dolomite that would be quarried commonly contains sulfide minerals, and these could be exposed to air and water from rainfall and runoff in the quarry walls and in rock stockpiles.

Acid rock drainage is a common problem well studied by the global mining industry. In the upper Midwest, this issue mainly gets attention in mines and road cuts in crystalline rocks in northern Minnesota and Wisconsin. Less information is available about the occurrence of acid rock drainage in dolomite and limestone bedrock areas, such as Green Lake County. Limestone and dolomite are composed of carbonate minerals that consume acid, reducing acidity of drainage and metals mobilization. The Minnesota Department of Transportation has a guidance document for acid rock drainage from road cuts which is focused on northern Minnesota, where rocks tend to have higher prevalence of sulfide minerals (acid generators) than carbonate minerals (neutralizing agents).[7] However, even mine drainage that is buffered to a neutral pH can contain elevated metal concentrations (Figure 5).[8] Abandoned roaster waste rock piles from an old zinc mine in dolomite at Mineral Point, Wisconsin created acid drainage and high

[6] Global Acid Rock Drainage Guide, 2014. The International Network for Acid Prevention. www.gardguide.com

[7] MnDOT, 2019. Guidance Manual for Potentially Acid Generating Materials in Northern Minnesota. Report 2019-40.

[8] www.gardguide.com

concentrations of heavy metals that caused Brewery Creek to become sterile until the site was reclaimed by the DNR in 1993.[9]

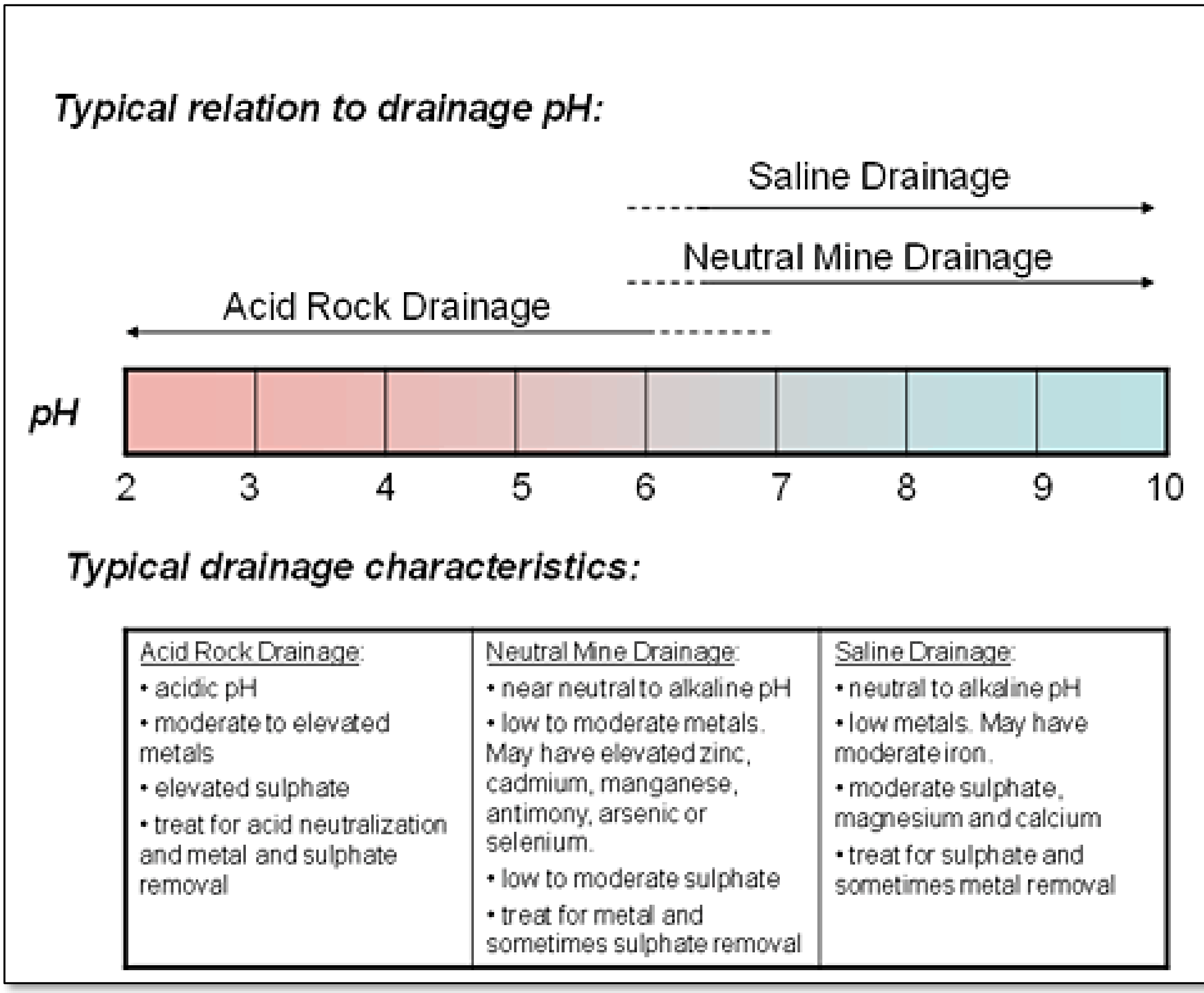


Figure 5. Types of drainage produced by sulfide oxidation (www.gardguide.com).

It takes time for sulfide minerals to oxidize enough to generate acid drainage, and EOR's experience is typically takes 5 – 10 years for acid mine drainage to be detected. It is also possible for the rate of acid drainage development to increase over the years as different rock weathering and acid buffering mechanisms take effect.[10] The mine is proposed for operation for more than 30 years, and rock materials

[9] Hunt, TC, 2009. Reclamation of zinc roaster waste, Mineral Point, Wisconsin. In The Upper Mississippi Valley lead-zinc district revisited: mining history, geology, reclamation, and environmental issues thirty years after the last mine closed. Illinois State Geological Survey, Guidebook 38.

[10] www.gardguide.com

will be stockpiled in the mine where they will be exposed to air and water. The length of time that rock materials are stockpiled will likely depend on the demand for aggregate products. The reclamation plan is to incrementally fill the quarry throughout its life as mining is completed in different parts of the pit. This would reduce the time that quarry walls are exposed to air and water, reducing acid rock drainage risk. Details are not available about how long quarry walls would typically be exposed.

Acid drainage and metals from the quarry could infiltrate downward to the water table and migrate downgradient in the groundwater to private wells, the springs, streams, and Green Lake. Movement of an acidification front in groundwater will be slower in a well-buffered environment, but as noted above even neutralized mine drainage can contain elevated concentrations of metals.[11] Dissolution of carbonate minerals by acid drainage can increase the potential to develop sinkholes and other karst solution features; monitoring for development of these features should be conducted if the mine is approved.

Measures that can be used in mines to reduce the risk of acid drainage and metals mobilization include monitoring water draining from stockpiles and pit walls for pH and metals, and sampling groundwater in monitoring wells downgradient of a mine for metals and sulfides. Note that multiple wells are prudent in fractured rock settings, such as typically formed by the Sinnipee Group dolomite, because of the chance for preferential groundwater flow paths to bypass a well. Monitoring downstream receiving waters, such as streams and springs, for changes in temperature, metals, or other water quality parameters, such as sulfate can detect and track impacts once they have occurred. Aggregate stockpiles containing sulfide minerals can be placed on liners to collect and treat acidic water that leaches through them before it drains off-site. Finally, reclaiming areas of the pit where mining is completed as soon as practicable reduces the time that sulfide minerals are exposed to air and water.

Conclusions and Recommendations

1. The literature demonstrates that sulfide minerals are present in the Sinnipee Group dolomite that is proposed for mining.
2. Mobilization of metals through the acid rock drainage process is possible at this site, even with buffering by the carbonate minerals in the dolomite bedrock.
3. Humidity cell testing of rock samples from the proposed mine site following ASTM Method D5744-07e1 is recommended to evaluate the risk of acid rock drainage at the site. It could take multiple years for acidification to occur, so a long-term test is recommended. This is administratively challenging, and it is unclear what organizations would conduct the testing, review the results, and act upon them.

[11] www.gardguide.com

4. Because acid rock drainage can take years to develop, if the mine is approved, it could already be in operation before laboratory testing and/or field monitoring detects a problem with acid rock drainage.

3.3. Blasting

Blasting is part of the proposed quarrying operations. Blasting is regulated by Wisconsin Administrative Code Chapter SPS 307, which addresses potential physical effects on neighboring properties, including vibrations and damage to structures. Monitoring of vibrations with a seismograph is required, which would provide data on the timing of blasts and magnitude of ground vibrations.

It is uncertain how the blasting might affect water supply wells and springs in the area. Blast vibrations have potential to change the nature of fractures through which groundwater flows, which could affect the quality or quantity of flow to wells and springs. Information provided by the DNR (Attachment B) shows monitoring well sampling data for a sand mine in western Wisconsin with large nitrate increases after blasting. A mixture of ammonium nitrate and fuel oil is the most common explosive used in quarries, creating a nitrate source.[12] The petroleum compounds in the explosives are another potential contaminant of concern. The DNR information also notes that the Department commonly receives complaints about silt and rust in wells related to blasting. These impacts could occur downgradient of the mine as well as in other areas that are disturbed enough by vibrations to cause physical and chemical changes to the aquifer.

Conclusions and Recommendations

1. Blasting is a potential source of nitrates and petroleum compounds.
2. The DNR has documented contamination of groundwater with nitrates after blasting at a Wisconsin sand mine.
3. The DNR reports that they commonly receive complaints about sediment and metal staining in well water near blasting sites.
4. Powell Spring and Mitchell Glen are located downgradient of the mine site, and physical or chemical changes in the aquifer due to mining could affect the springs.
5. The risk of impacts on groundwater quality, neighboring wells, and the springs should be understood and considered in reviewing the CUP application.

[12] Illinois Department of Natural Resources, FAQ Aggregate Blasting. https://www2.illinois.gov/dnr/mines/EAD/Pages/FAQAgreggateBlasting.aspx

4. STORMWATER RUNOFF

Stormwater runoff from the mine site currently flows north across Brooklyn G Rd. through the property of Ernie Neuenfeldt at N5139 Brooklyn G Rd. and northwest across Skunk Hollow Rd. to Mitchell Glen, as indicated by topographic contours and the CUP application. Stormwater and wastewater at the mine site would be regulated by the DNR under General Permit WI-0046515-07-0 for Mineral (Nonmetallic) Mining and/or Processing. The DNR is in the process of reviewing the Erosion Control and Storm Water Management Plan for the Skunk Hollow Quarry (the Plan) and has not yet issued the permit. The permit regulates discharges to both surface water and groundwater and includes requirements for water quality sampling for common contaminants of concern. These include pH, Total Suspended Solids, nitrate, sulfate, arsenic, and other metals.

The Plan describes a containment berm around the quarry site, a sediment trap on the mill level that will discharge off-site (location not identified on drawings), a sediment trap and sump located on the pit floor, a sediment basin situated north of the site, and a drainage swale to convey water pumped from the sump in the quarry to the sediment basin. Overflow from the sediment basin would flow northwest through the Neuenfeldt property to Dakin Creek. The Plan states that water will be pumped from the sediment trap and sump in the quarry only after a 10-yr or larger rainfall, but no other details of the pumping system operation are provided to evaluate the frequency, discharge, or duration of pumping to the surface drainage swale. No information is provided to determine whether the drainage swale or downstream channel would be subjected to erosive conditions during these pumping episodes. Pumping would likely be necessary more frequently if water in the pit does not seep away to groundwater quickly enough to provide storage volume for the next rainfall. No analysis is provided on the rate at which water is expected to seep into the pit floor to back up the assertion that pumping will only be necessary after the 10-yr or larger event. Similarly, the level of detail in the Plan is insufficient to determine if the proposed sediment trap(s) and basin will provide adequate settling treatment.

Neither the Erosion Control and Storm Water Management Plan nor the Stormwater Pollution Prevention Plan address any of the chemicals contained in blasting agents or if the sediment trap and basin would provide adequate treatment for them. The contaminants of concern in blasting agents – nitrates and petroleum compounds – are typically dissolved in water, and particulate settling is not an effective treatment for them. Contamination of groundwater is therefore a concern, particularly if process water rapidly infiltrates from the pit into fractures in the bedrock.

Conclusions and Recommendations

1. The locations and characteristics of all the proposed discharges to surface water and groundwater are not adequately described in the Erosion Control and Storm Water Management Plan.
2. The timing, amount, and quality of water that would be discharged from the pit to the surface drainage system off-site is not described in enough detail to understand risks of impacts.

3. Treatment of chemicals used in blasting is not addressed in the Erosion Control and Storm Water Management Plan nor in the Storm Water Pollution Prevention Plan. The particulate settling in the proposed sediment traps and sediment basin are not effective for treating these dissolved pollutants (nitrate and petroleum compounds).
4. Infiltration of stormwater and process water in the pit poses a water quality risk to groundwater, and the downgradient springs and streams.

5. SUMMARY

Our specific conclusions and recommendations are summarized in the preceding sections of this report. Available information suggests that the Skunk Hollow Mine cannot be operated as proposed without adverse impacts on the health and welfare of nearby residents or without degradation of aquatic resources including Powell Spring and Creek, White Creek, Mitchell Glen, Glen Creek, and Dakin Creek. The CUP application materials lack important information needed to provide confidence that the public health and the environment can be protected with the mine in operation.

ATTACHMENT A

Resume for Steve Gaffield

Stephen J. Gaffield, PhD, PE, CFM

Water Resources Engineer

Steve has 28 years of experience in hydrogeology and water resources engineering. He has been project lead for many groundwater protection, floodplain, stormwater design and wetland restoration projects. He is active on research committees at the University of Wisconsin, presents frequently at technical conferences, and contributes to technical journals. Steve also has extensive experience with public participation and education.

Education

1988	Bachelor of Arts in Geology and Physics Albion College
1991	Masters of Sciences in Geology University of Wisconsin-Madison
2000	Doctor of Philosophy in Geological Engineering University of Wisconsin-Madison

Professional Registration

#39140 WI Professional Engineer: civil

US-16-09286 Certified Floodplain Mgr.

Professional Activities

2012-22	Univ. of Wisc. Groundwater Research Advisory Council
2009-22	Wisconsin Geological & Natural History Survey Geologic Mapping Committee
2011	American Water Resources Assoc. WI - former president

Areas of Expertise

- Groundwater Analysis
- Watershed Planning
- Stormwater Management
- Floodplain & Dam Hydraulics
- Non-point Source Monitoring & Analysis
- Project Management

Project Experience

Groundwater Modeling, Analysis, and Planning

Black Earth Creek Watershed Green Infrastructure Plan
Capital Area Regional Planning Commission / Project Manager
Coordinated technical analysis and engagement of farmers and other stakeholders. Developed hydrologic modeling approach to evaluate benefits of urban and rural green infrastructure for flood reduction and water quality improvement. Presented project information to stakeholder steering committee and general public. Developed green infrastructure recommendations, including funding, and implementation planning.

Little Plover River Restoration Plan
Village of Plover, WI / Project Manager
Leading analysis of streamflow and habitat restoration alternatives for trout stream heavily impacted by groundwater pumping. Performing QA/QC on MODFLOW transient groundwater modeling and other water budget analyses. Coordinating with team of local & state government, non-profits and agricultural industry group.

Cheryl Drive
City of Fitchburg, WI / Project Manager
Provided QA/QC and technical oversight for the SWMM modeling of the storm drainage system, including model design, hydraulic modeling results, diagnosis of critical infrastructure limitations, and infrastructure maintenance, and upgrade recommendations.

Middleton Floodplain Study, Scenarios, and Costing
City of Middleton, WI / Project Manager
Coordinated planning, development, and calibration of a 1D/2D PCSWMM model of the Pheasant Branch Creek watershed. Oversaw mapping of the 1% and 0.2% annual chance floodplains. Led use of model to evaluate benefits of potential flood mitigation projects and conceptual cost estimates. Presented project findings to City commission and at public meetings, and discussed the potential project mitigation with dairy farm representatives.

Cross Plains Flood Mitigation
Jewell Associates Engineers / Principal-in-Charge
Provided technical advice and QA/QC review for hydrologic and hydraulic analysis of potential flood mitigation projects in the Village of Cross Plains, WI, including green infrastructure (wetland/ floodplain restoration), and gray infrastructure (flood control dam and street crossing improvements).

Private Wetland Mitigation Bank in Dodge County, WI
Eco-Resource Consulting / Project Manager
Reviewed soil test pit and groundwater monitoring well data. Conducted groundwater modeling using analytic element code GFLOW to evaluate groundwater rise from proposed drainage disablement. Reviewed and drafted hydrologic and hydraulic sections of the draft Mitigation Bank Instrument. Oversaw development of restoration grading design and plan sheets.

Spring Harbor Watershed Study in Madison, WI
AE2S / Project Manager
Led EOR's support to AE2S' development of a SWMM watershed model for the City of Madison, WI. Participated in 3 public stakeholder meetings to gather input from break-out groups. Led development of conceptual design drawings and cost estimates for potential infrastructure improvements for flood mitigation.

McCandless Remap Feasibility
Village of Plover, WI / Project Manager
Planned and reviewed evaluation of the accuracy of Flood Insurance Study hydrologic and hydraulic models. Provided advise on actions the City could take to improve the accuracy of floodplain maps.

Evansville Wetland Mitigation Design
Heartland Ecological Group / Principal-in-Charge
Provided technical input and review for wetland mitigation site grading and drainage disablement at a Wisconsin Department of Natural Resources mitigation site. Planned and reviewed Lateral Effect modeling of the effect of breaking drain tiles.

Plover Wetland Mitigation
Village of Plover, WI / Project Manager
Leading development of wetland mitigation plan with subconsultants, Wisconsin DNR and Portage County. Coordinated wetland design and site preparation with farmer selling the land. Planned and reviewed MODFLOW groundwater modeling of restoration and developing transient spreadsheet screening model. Lead restoration design, including ditch fill and irrigation well shut-down.

Big Hollow Wetland Mitigation Bank
Black Bear Enterprises / Project Manager
Led hydrologic monitoring, modeling, and civil site design for a proposed 190-acre wetland mitigation bank near Spring Green, WI, in collaboration with a restoration ecology partner. Supported submittal of a draft Mitigation Bank Instrument to the Interagency Review Team. Coordinated 2D modeling of surface runoff with PCSWMM and performed groundwater analysis with the analytical Theis equation and MODFLOW. Coordinated design and submittal activies closely with the landowner, who has actively farmed the site.

F&A Dairy Groundwater Review
The Probst Group/ Project Manager
Led groundwater review components of a WPDES permit renewal for a Wisconsin dairy that land-applies process water to farm fields. Reviewed water quality data for groundwater monitoring wells and the irrigation water, as well as details of wastewater application locations and timing. Coordinated evaluation of regional groundwater flow system and analysis of contamination risk for local water supply wells.

Stormwater Infiltration Mounding and Design
Terravessa Plat, Fitchburg, WI / Technical Advisor
Modeled groundwater mounding below regional infiltration basins with analytical equations and MODFLOW, including interference with system performance and off-site impacts. Developed iterative approach to balance infiltration volume from WinSLAMM design model with groundwater mounding constraints.

PolyMet Mine Groundwater Review
Great Lakes Indian Fish & Wildlife Commission / Project Manager & Technical Lead
Reviewed MODFLOW groundwater model of proposed mine under closure conditions. Critiqued analysis of mining company's consultant and tested their assumptions through a model sensitivity analysis to identify substantial risk of contaminated groundwater migration off-site under the proposed plan.

Proposed Non-Metallic Mine Environmental Review
Town of Vienna, WI / Project Manager & Technical Lead
Evaluated potential groundwater impacts related to three proposed quarry sites, including two sand and gravel pits and a dolomite bedrock quarry. Evaluated water quantity and quality impacts through site inspections, review of the proposed operating plans, and analysis of available hydrogeologic data. Key issues included the depth of mines relative to the water table, management of potential contaminant sources such as fuel for equipment, washing operation details, and design of site erosion control and stormwater management plans. Presented findings to the Town planning commission.

Proposed Gravel Pit Environmental Review
Town of Milton, WI / Project Manager & Technical Lead
Evaluated potential groundwater and surface water impacts related to a proposed gravel pit on behalf of the Town, as part of their condition use permit process. Inspected the site and reviewed applicant's plans for excavation, equipment operation and reclamation. Reviewed data on soils and hydrology to identify potential impacts on a stream, wetlands and groundwater. Coordinated wetland ecological evaluation and impact analysis. Presented findings to the Town planning commission in a condition use permit hearing.

Utility Construction Dewatering
Village of Cross, WI / Project Manager
Worked with Village public works director, Village engineer, and contractor/technical advisor to scope potential dewatering system issues and designs. Constructed GFLOW analytic element groundwater model of dewatering systems to predict pumping rates and impact on adjacent trout stream flow and temperature. Led permitting with Wisconsin Dept. of Natural Resources for high capacity wells and discharge to creek.

Stevens Point Municipal Well Impact Analysis
Town of Hull, WI / Technical Lead
Provided groundwater expert support to the Town and its legal counsel in dispute with the City of Stevens Point over loss of water in dozens of private residential wells after the City started operation of a large collector well nearby. Reviewed monitoring well data trends to identify drawdown impacts of the City well and refined and calibrated an existing MODFLOW groundwater model to simulate potential future drawdown impacts. Represented the Town in numerous settlement negotiation meetings and presented at a public meeting to describe the agreement.

Richfield Dairy Groundwater Impact Expert Testimony
Pleasant Lake Management District / Project Manager & Technical Lead
Reviewed groundwater modeling and reports by proposed dairy's consultants to evaluate expected impacts on lake level and flow in a trout stream and springs. Evaluated modeling assumptions, hydrologic data and scientific literature. Inspected hydrologic conditions at the site. Testified in a State of Wisconsin contested case hearing that led to a decision that the State must consider cumulative impacts of high capacity wells.

Madison Water Utility East Side Master Plan
Black & Veatch, Inc. / Technical Lead
Analyzed PCE, Mn and Fe trends in 3 water supply wells and recommended plan to evaluate PCE reduction alternatives. Evaluated hydrogeologic, land use, and infrastructure factors for potential sites for a new well in an urban area with a long history of industrial use. Presented in a series of public meetings to gather input and provide project details.

Groundwater Susceptibility Mapping
Calumet County, WI / GIS Specialist at the Wisconsin Geological & Natural History Survey
Assisted in identifying key risk factors for glacial and dolomite aquifers. Conducted GIS analysis of geologic and hydrologic factors to map the water table and susceptibility of both aquifers to contamination by human activities. Resulted in publication of WGNHS Miscellaneous Map 56.

Wetland & Lake Restoration

Plover Wetland Mitigation
Village of Plover, WI / Project Manager
Leading development of wetland mitigation plan with subconsultants, Wisconsin DNR and Portage County. Planning and reviewing MODFLOW groundwater modeling of restoration and developing transient spreadsheet screening model. Leading restoration design, including ditch fill and irrigation well shut-down.

Leopold Memorial Reserve Treatment Wetland
Sand County Foundation / Project Manager
Planned design for 4-acre wetland enhancement demonstration project to remove nitrogen from agricultural runoff in Sauk County, WI near Aldo Leopold's famous farm. Planned and assisted hydrologic and water quality monitoring pre- and post-project, including selection, purchase and installation of flow meter, automated sampler, telemetry, monitoring wells and water level loggers. Evaluated cost, performance and permitting feasibility of several designs. Led construction drawing and specification preparation, performed construction observation, and worked with subconsultants to establish native vegetation. Directed four years of performance monitoring and data analysis. Planned and edited Journal of Soil and Water Conservation paper describing successful denitrification results.

Stormwater BMP Feasibility & Design

Warner Lagoon Water Quality Study
City of Madison, WI / Project Manager
Performed evaluation of water quality and fishery improvement options for 30-acre wetland/pond system adjacent to Lake Mendota, in collaboration with fisheries experts and graphic designer. Directed stormwater treatment design and WinSLAMM modeling and performed QC model review. Synthesized data and recommendations from biologist team members for carp control and exclusion, including a physical barrier and baited trap netting. Estimated costs for stormwater treatment, habitat dredging, and mechanical aeration. Led 3 stakeholder meetings. Planned and directed preparation of 30% drawings of stormwater treatment and dredging projects and wrote feasibility report.

UW-Madison Neighborhood Stormwater Study
UW-Madison & WI Dept. of Administration / Project Manager
Planned and directed WinSLAMM model analysis of stormwater runoff volume and sediment controls for 6 parcels on the UW-Madison campus planned for future redevelopment. Researched performance of green infrastructure / low-impact development options including green roofs and walls, permeable pavement and water harvesting and reuse. Directed installation and sampling of monitoring wells to evaluate subsurface hydraulic properties of fine-grained glacial lake sediment and performed groundwater mounding analysis to determine limitations of stormwater infiltration. Simulated green roof performance with EPA's Stormwater Calculator. Developed new technique to model tree canopy interception over impervious surfaces to evaluate quantity and quality benefits in WinSLAMM; published in the Center for Watershed Protection's Watershed Science Bulletin in collaboration with U.S. Forest Service. Developed integrated conceptual stormwater plan for campus neighborhood, including several options for future site design evaluation, and cost per gallon of runoff reduced and pounds of sediment removed.

Floodplain Modeling, Planning & Management

Steve has performed floodplain modeling and permitting analyses for nearly 20 projects over the past 15 years, and he is a Certified Floodplain Manager. His experience includes hydrologic modeling of flood discharge with HEC-HMS, NRCS methods and statistical regression, and hydraulic modeling of flood elevations and mitigation alternatives using HEC-RAS. Steve's role in floodplain projects commonly include evaluating existing Flood Insurance Study models, modifying models to simulate proposed floodplain fill and stream crossings, designing mitigation alternatives to minimize floodplain impacts, QA/QC review, and helping clients understand the opportunities and constraints of floodplain regulations.

- ***Lake Belle View Restoration*** *(for Village of Belleville, WI)*
- ***Front St. Development*** *(Clifton Corporation, Watertown, WI)*
- ***Rowan and Hinkson Creeks Letter of Map Amendment*** *(for Town of Dekorra, WI)*
- ***Cell Tower Permitting*** *(Edge Consulting, Oneida County, WI)*
- ***Clark Creek Flood Study*** *(for Sauk County, WI)*
- ***Bike Trail Floodplain Permitting*** *(for City of Jefferson, WI)*
- ***Campground Fill Permitting*** *(Riverbend RV Resort, Watertown, WI)*
- ***Blackhawk Island Floodplain Permitting*** *(Luke Purucker, Jefferson County, WI)*
- ***Tenney Avenue Crossing*** *(Smart Realty Company, Waukesha, WI)*
- ***Traynor Aggregate Pit Bridge*** *(Dodge Concrete, Rock County, WI)*
- ***Brewing Expansion Permit Scoping*** *(New Glarus Brewing, New Glarus, WI)*
- ***Drumlin Grove Floodplain Delineation*** *(Burse Surveying & Engineering, Cottage Grove, WI)*
- ***Kinnickinnic River Restoration Design*** *(Milwaukee Metropolitan Sewerage District, Milwaukee, WI)*
- ***McCoy Property Development Permitting*** *(D'Onofrio Kottke Assoc., Sun Prairie, WI)*
- ***Zander Farms Development Permitting*** *(D'Onofrio Kottke Assoc., Cross Plains, WI)*
- ***Three Waters Reserve Flood Impact Analysis*** *(Applied Ecological Services, Brodhead, WI)*
- ***After-the-Fact Floodplain Permitting*** *(Ripon Rifle & Pistol Club, Fond du Lac County, WI)*
- ***Warner Park Channel Restoration Design*** *(for City of Madison, WI)*
- ***Powerplant Floodplain Analysis*** *(SCS Engineers, WI)*

Publications and Research Activities

Steve has been an active member of the University of Wisconsin-Madison's Groundwater Research Advisory Council since 2012. Each year, he reviews approximately 15 groundwater research proposals submitted to the UW-Madison Water Resources Institute (WRI) for funding, participates in discussion of the strengths and weaknesses of the proposals with other Council members, and provides recommendations to WRI for funding priorities. This experience provides valuable insights into current groundwater research topics and methods in Wisconsin.

Gaffield, Wudel & Kuehler, Dec. 2017. *Calculating stormwater volume and Total Suspended Solids reduction under urban tree canopy in Wisconsin using available research*. Watershed Sci. Bull.

Fehling, Gaffield & Laubach, 2014. *Using enhanced wetlands for nitrogen removal in an agricultural watershed.* Jour. Soil & Water Conservation 69(5): 145A-148A.

Gotkowitz, MB and SJ Gaffield, 2006. *Water-Table and Aquifer-Susceptibility Maps of Calumet County, Wisconsin*. Wisc. Geol. & Nat. History Survey Miscellaneous Map 56.

Gaffield, SJ, KW Potter and L Wang, 2005. *Predicting the Summer Temperature of Small Streams in Southwestern Wisconsin*. Jour. Amer. Water Res. Assoc. 41(1): 25-36.

Coauthor of Ch. 7: Water Quantity and Quality, in H Frumkin, L Frank and R Jackson, 2004, *Urban Sprawl and Public Health*. Island Press.

Gaffield, SJ, RL Goo, LA Richards and RJ Jackson, 2003. *Public Health Effects of Inadequately Managed Stormwater Runoff*. Amer. Jour. of Public Health 93(9): 1527-1533

Potter, KW and SJ Gaffield, 2001. Watershed assessment with synoptic base-flow surveys. In Geomorphic Processes and Riverine Habitat, American Geophysical Union, Water Science Application Volume 4, p. 19-25.

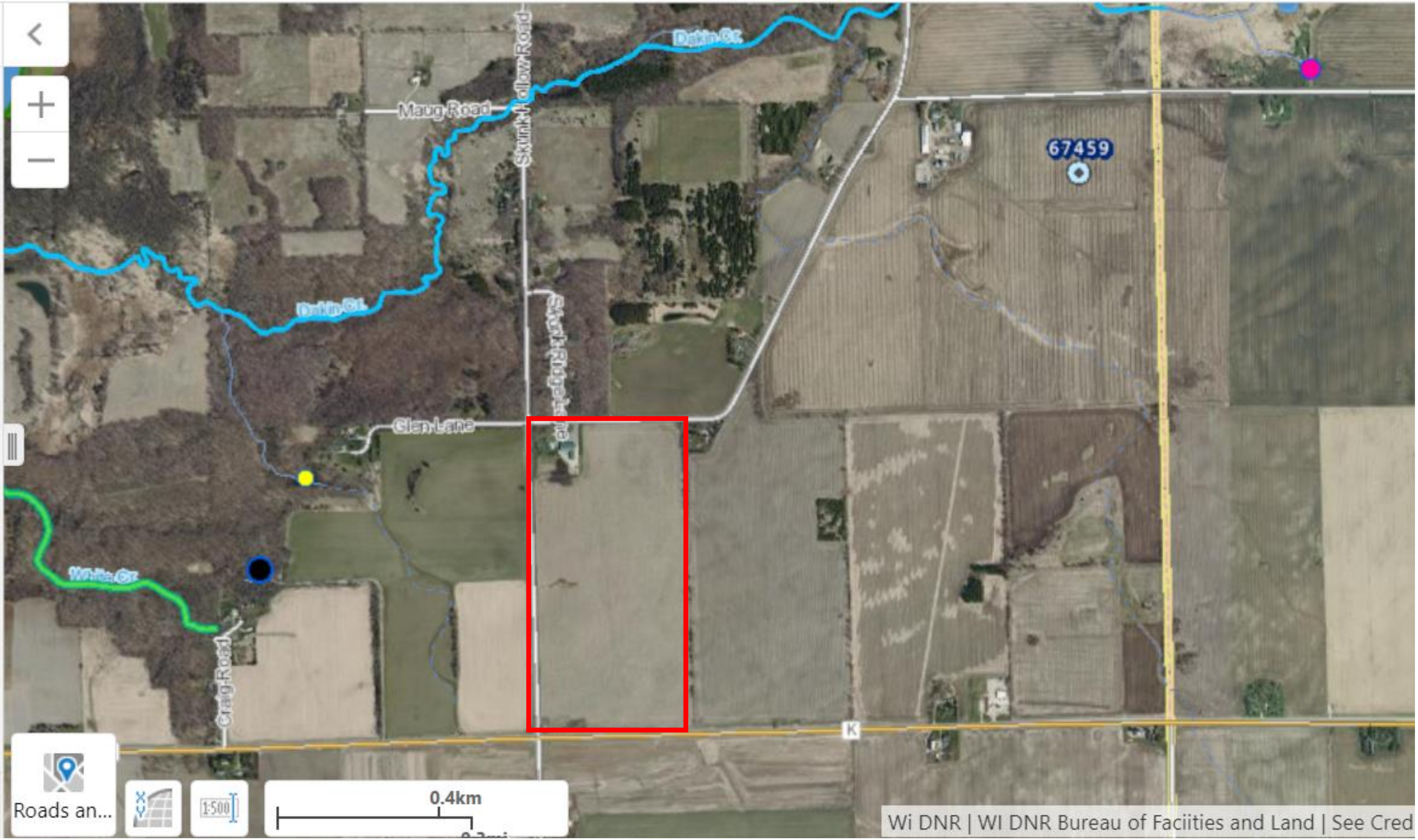
Syverson, KM, SJ Gaffield, and DM Mickelson, 1994. Comparison of esker morphology and sedimentology with former ice-surface topography, Burroughs Glacier, Alaska. Geological Society of America Bulletin, v 106, p 1130-1142.

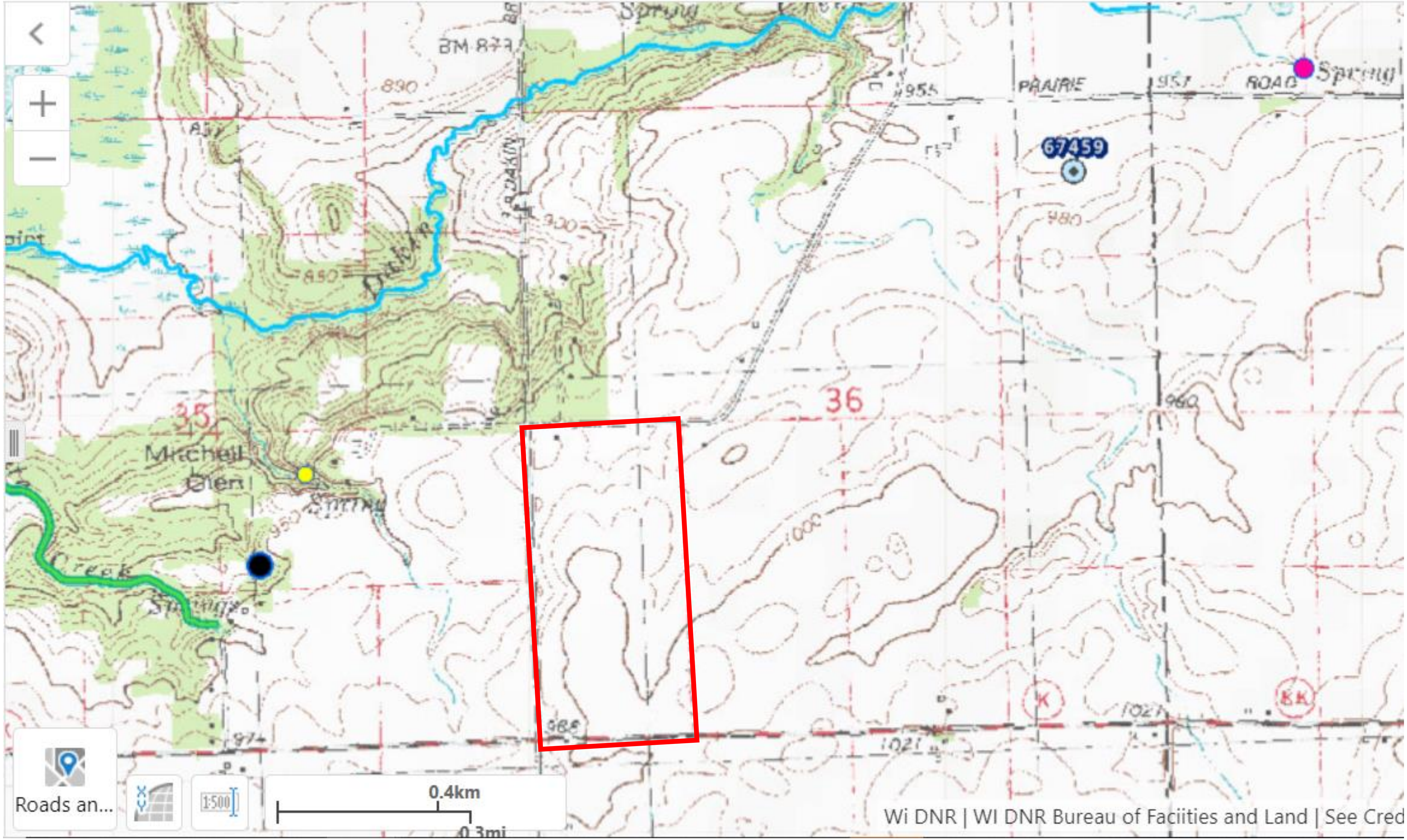
Gaffield, SJ and DM Mickelson, 1995. Driving stress, hydraulic head and landform genesis at the southeastern Burroughs Glacier. Proceedings of the Third Glacier Bay Science Symposium, 1993. DR Engstrom (Ed.), Anchorage, Alaska.

ATTACHMENT B

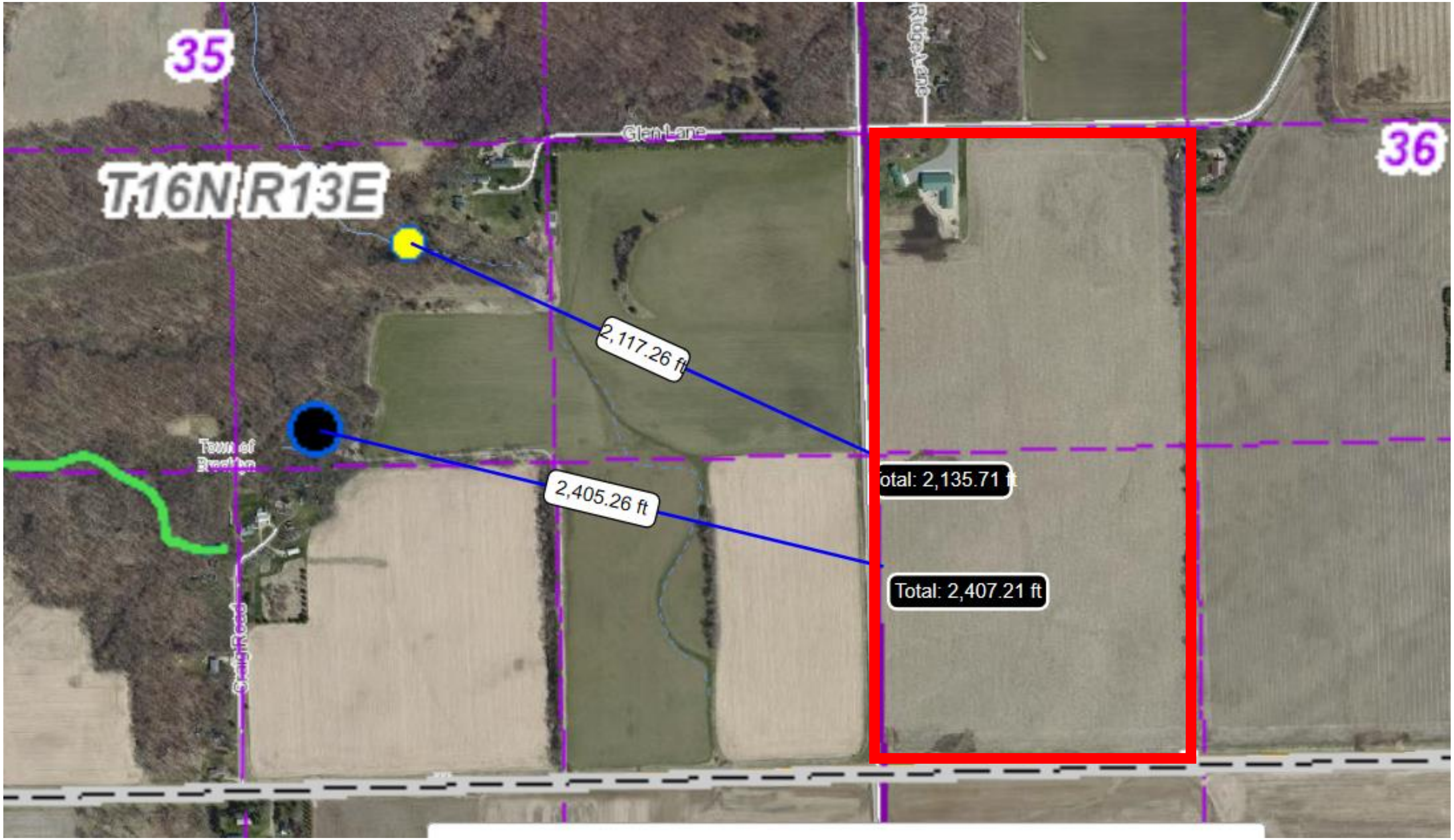
Presentation on Powell Spring and the Proposed Skunk Hollow Mine from the Wisconsin Department of Natural Resources.

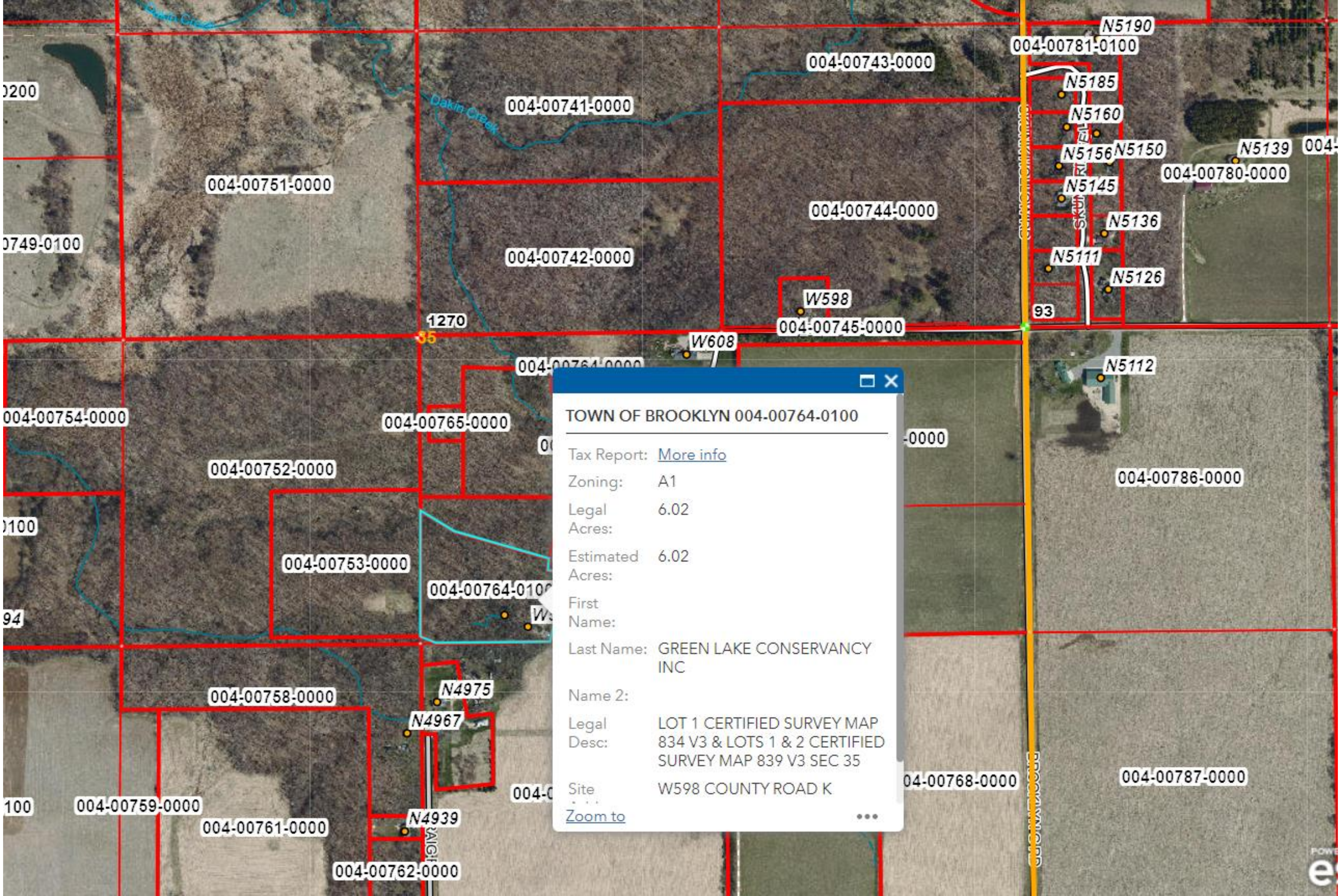
Powell Spring

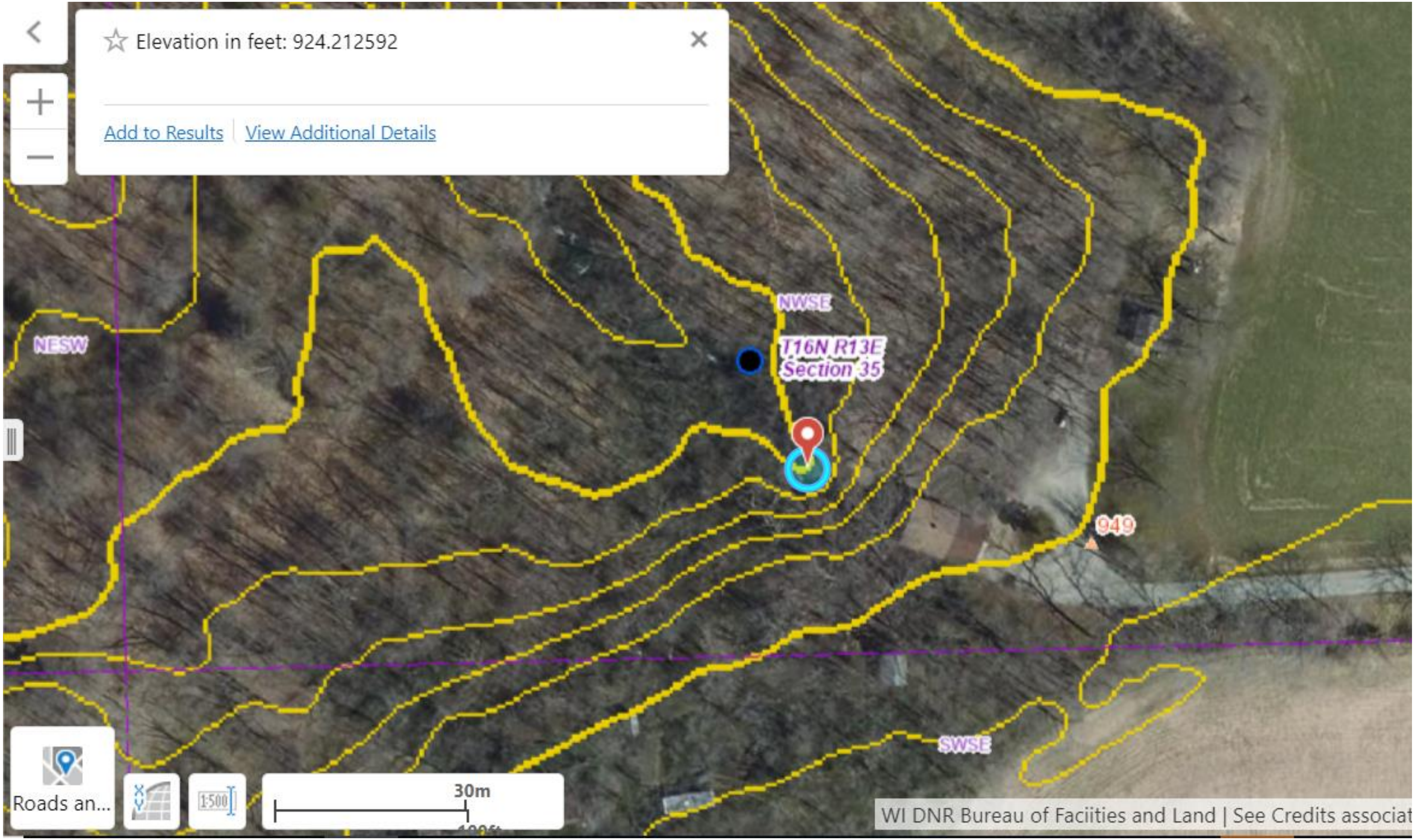

Dakin Cr.
Maug Road
Skunk Hollow Road
67459
Dakin Cr.
Skunk Ridge Lane
Glen Lane
White Cr.
Craig Road
K
Roads an...
1:500
0.4km
Wi DNR | WI DNR Bureau of Faciities and Land | See Cred

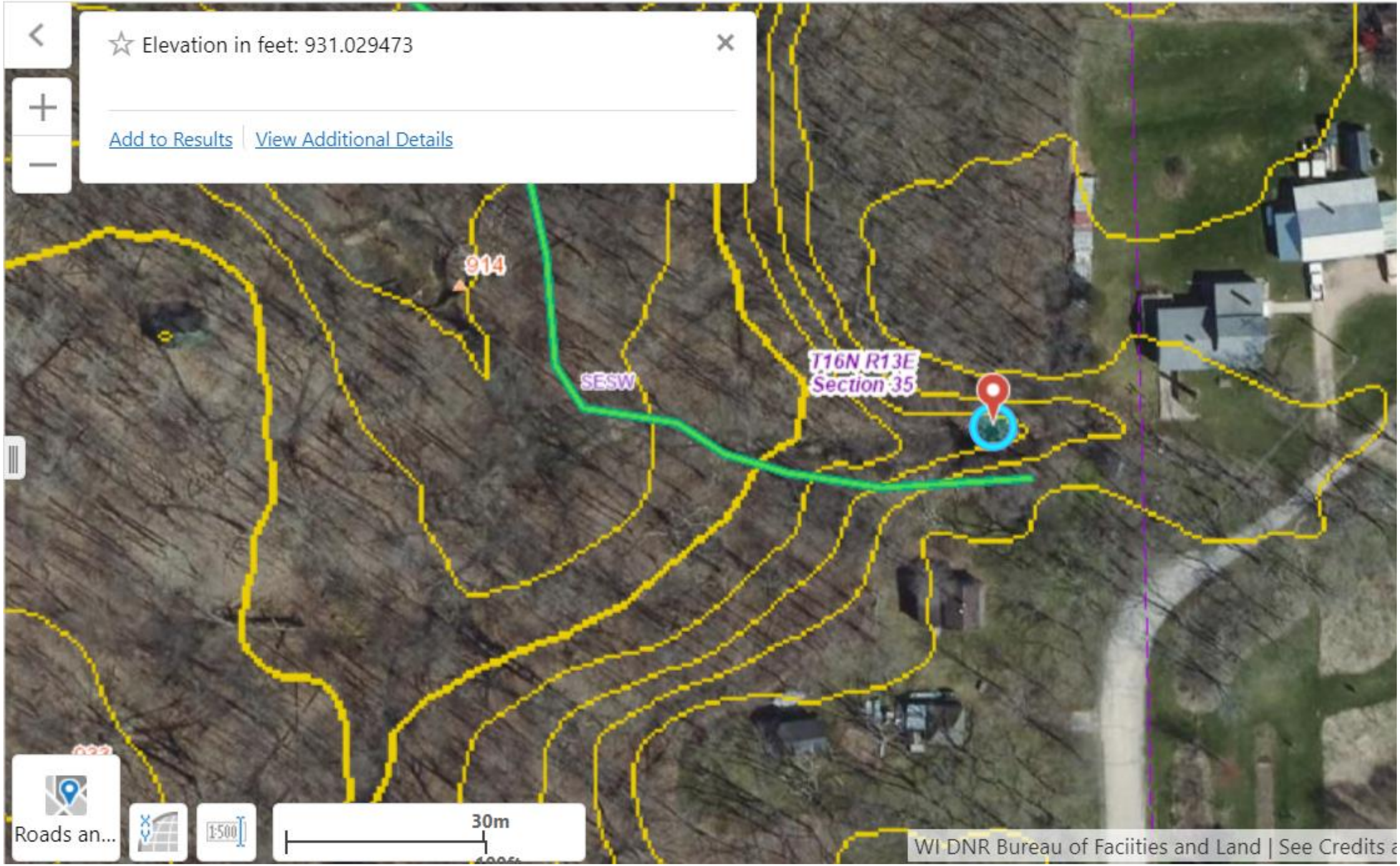


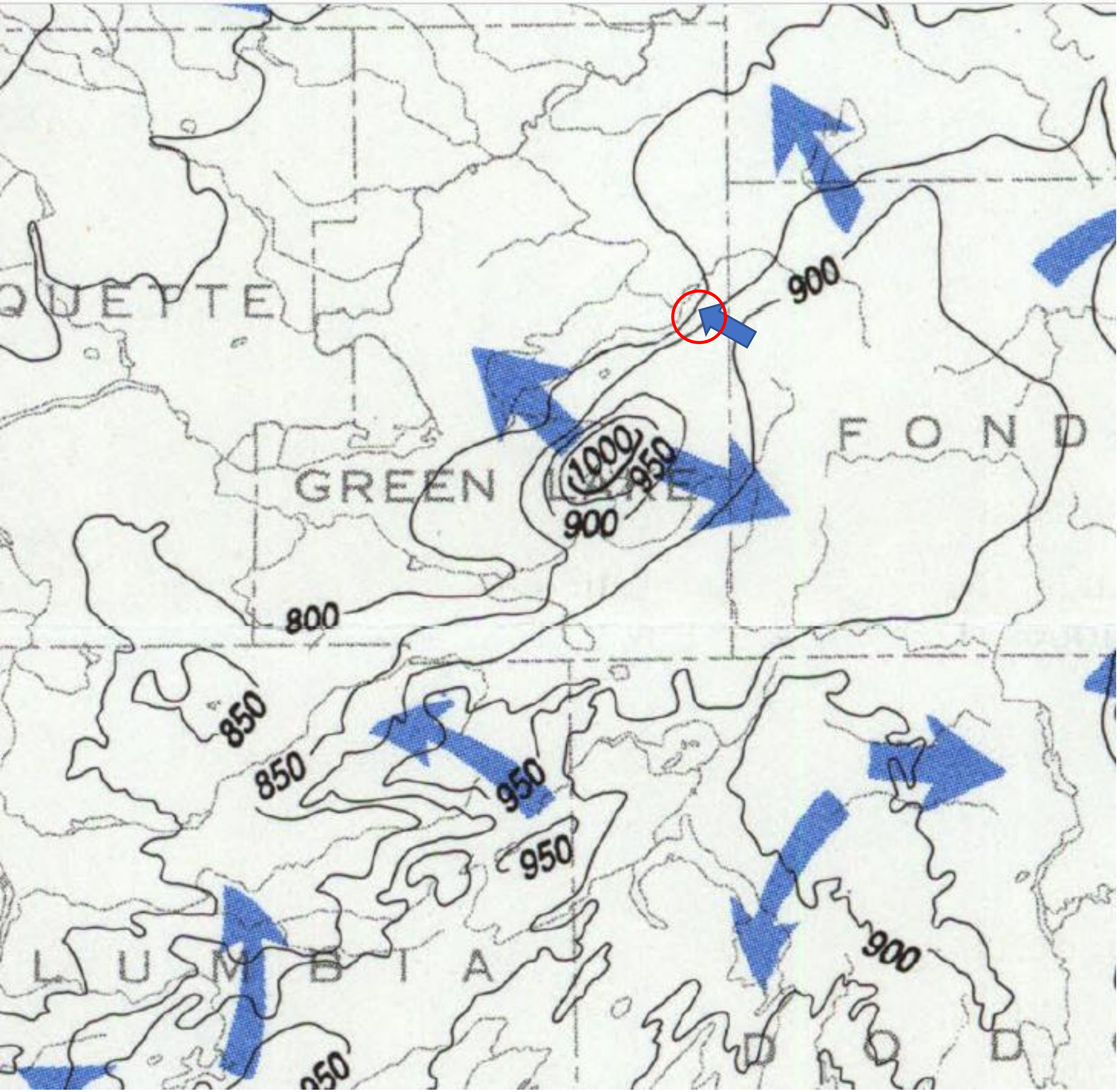
BM 873
890
955
PRAIRIE
957
ROAD
Spring
67459
980
850
35
36
Mitchell
Glen
Spring
Creek
960
1000
986
974
1021
1027
K
KK
Roads an...
1:500
0.4km
0.3mi
Wi DNR | WI DNR Bureau of Faciities and Land | See Cred


35
36
T16N R13E
Glen Lane
Ridge Lane
2,117.26 ft
2,405.26 ft
Total: 2,135.71 ft
Total: 2,407.21 ft
Town of


TOWN OF BROOKLYN 004-00764-0100
Tax Report: More info
Zoning: A1
Legal Acres: 6.02
Estimated Acres: 6.02
First Name:
Last Name: GREEN LAKE CONSERVANCY INC
Name 2:
Legal Desc: LOT 1 CERTIFIED SURVEY MAP 834 V3 & LOTS 1 & 2 CERTIFIED SURVEY MAP 839 V3 SEC 35
Site W598 COUNTY ROAD K
Zoom to
004-00741-0000
004-00742-0000
004-00743-0000
004-00744-0000
004-00745-0000
004-00751-0000
004-00752-0000
004-00753-0000
004-00754-0000
004-00758-0000
004-00759-0000
004-00761-0000
004-00762-0000
004-00764-0100
004-00765-0000
004-00768-0000
004-00780-0000
004-00781-0100
004-00786-0000
004-00787-0000
Dakin Creek
N5190
N5185
N5160
N5156
N5150
N5145
N5139
N5136
N5126
N5111
N5112
W598
W608
N4975
N4967
N4939
1270
93


Elevation in feet: 924.212592
Add to Results
View Additional Details
NWSE
NESW
T16N R13E
Section 35
949
SWSE
Roads an...
1:500
30m
WI DNR Bureau of Faciities and Land | See Credits associat


Elevation in feet: 931.029473
Add to Results
View Additional Details
914
SESW
T16N R13E
Section 35
Roads an...
30m
WI DNR Bureau of Faciities and Land | See Credits



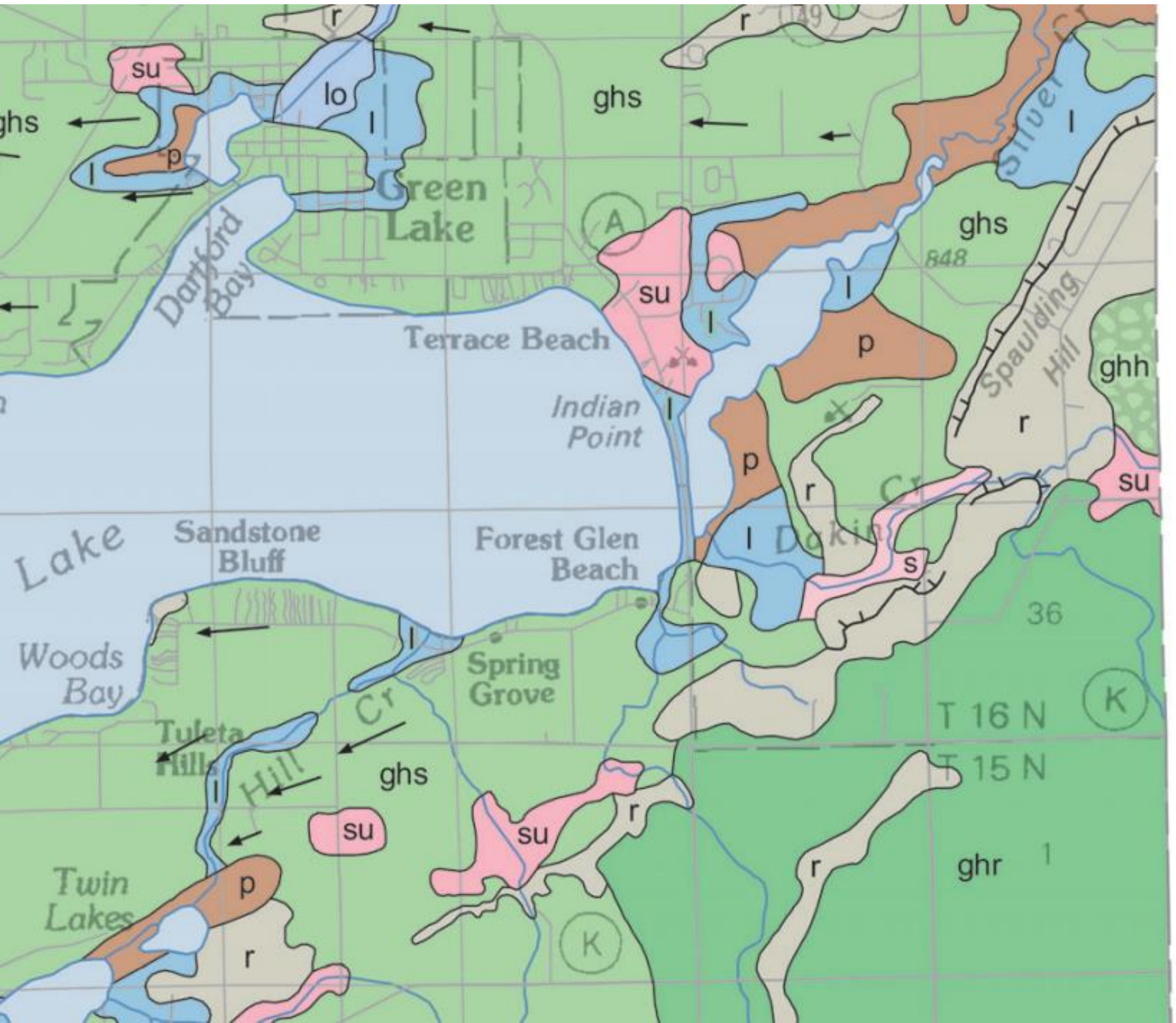
EXPLANATION

— *800* — **Water-table contour** – Shows altitude of water table. Contour interval 50 feet. Contours omitted in areas of steep slopes. Datum is sea level

Generalized horizontal direction of ground-water flow in the shallow aquifer system

This is a composite map, derived from many sources (see inset map). Contours were modified from source maps in some areas. Although the source maps cover a time span of approximately 30 years, they are suitable for preparation of a composite map with a 50-foot contour interval. There are very few places in Wisconsin where the water table has fluctuated more than 20 feet in this time span.

Groundwater flow is from the proposed quarry toward the spring(s).



Explanation

Postglacial deposits

Fill. Consists of various materials including gravel, sand, silt and clay.

Windblown sand. Well sorted, generally vegetated. Dunes between 2 and 7 m thick, generally no more than 5 m high. Active blowouts and dunes exist in some places. Deposited immediately following deglaciation. Distribution is obscure in most places and is more widespread than indicated on map.

Peat. Unit **p:** Peat occupying low-lying, flat to low-relief surfaces; thickness varies, but is typically between 1 and 5 m thick. Unit **po:** Peat over silty and clayey lake sediment (or over sandy beach sediment near margins of wetlands) of glacial Lake Oshkosh; usually occurs in areas that are less than 234 m above sea level in elevation (may be beach sediment near margins of wetland). Unit **pw:** Peat over lake sediment of glacial Lake Wisconsin; usually occurs in areas that are between 234 and 296 m above sea level in elevation. Unit **ps:** Peat overlying postglacial or meltwater stream sediment consisting of silty and sandy sediment with some channel sand and silt.

Stream sediment. Commonly consists of silty and sandy sediment with some channel sand and silt; typically between 1 and 15 m thick. Deposited in flood plains adjacent to post-glacial streams; most of this sediment was probably deposited during the recent past.

Glacial deposits, undifferentiated

Lake sediment. Unit **l:** Sand, silt, and clay. Unit **low:** Glacial Lake Oshkosh sediment covered with thin patches of windblown sand generally less than 2 m thick. Unit **lo:** Sediment deposited in glacial Lake Oshkosh, usually at elevations below 234 m above sea level; largely silt and clay where deposited in deeper water grading to sand near the shoreline; typically between 1 and 80 m thick; material deposited near the shoreline may include windblown sediment, washed hillslope sediment, and patches of peat that could not be mapped separately. Unit **lww:** Glacial Lake Wisconsin sediment covered with thin patches of windblown sand generally less than 2 m thick. Unit **lw:** Sand, silt, or clay deposited in glacial Lake Wisconsin usually at elevations above 234 m above sea level; largely silty sand where deposited in deeper water grading to sand near the shorelines.

Meltwater-stream sediment. Sand and gravel deposited directly by streams originating from the margin of the Green Bay Lobe; commonly between 1 and 30 m thick. Unit **se:** Eroded meltwater-stream sediment; gullied topography resulting from erosion in postglacial time. Unit **sc:** Collapsed (kettled) meltwater-stream sediment deposited in alluvial fans, deltas, and proglacial river channels. Unit **sg:** Subaqueous morainal bank deposited adjacent to the former margin of the Green Bay Lobe; commonly flat on top. Unit **sa:** Meltwater-stream sediment deposited in an alluvial fan or delta immediately adjacent to a moraine or ice-contact face. Unit **su:** Meltwater-stream sediment deposited in proglacial river channels or in tunnel channels beneath the margin of the Green Bay Lobe.

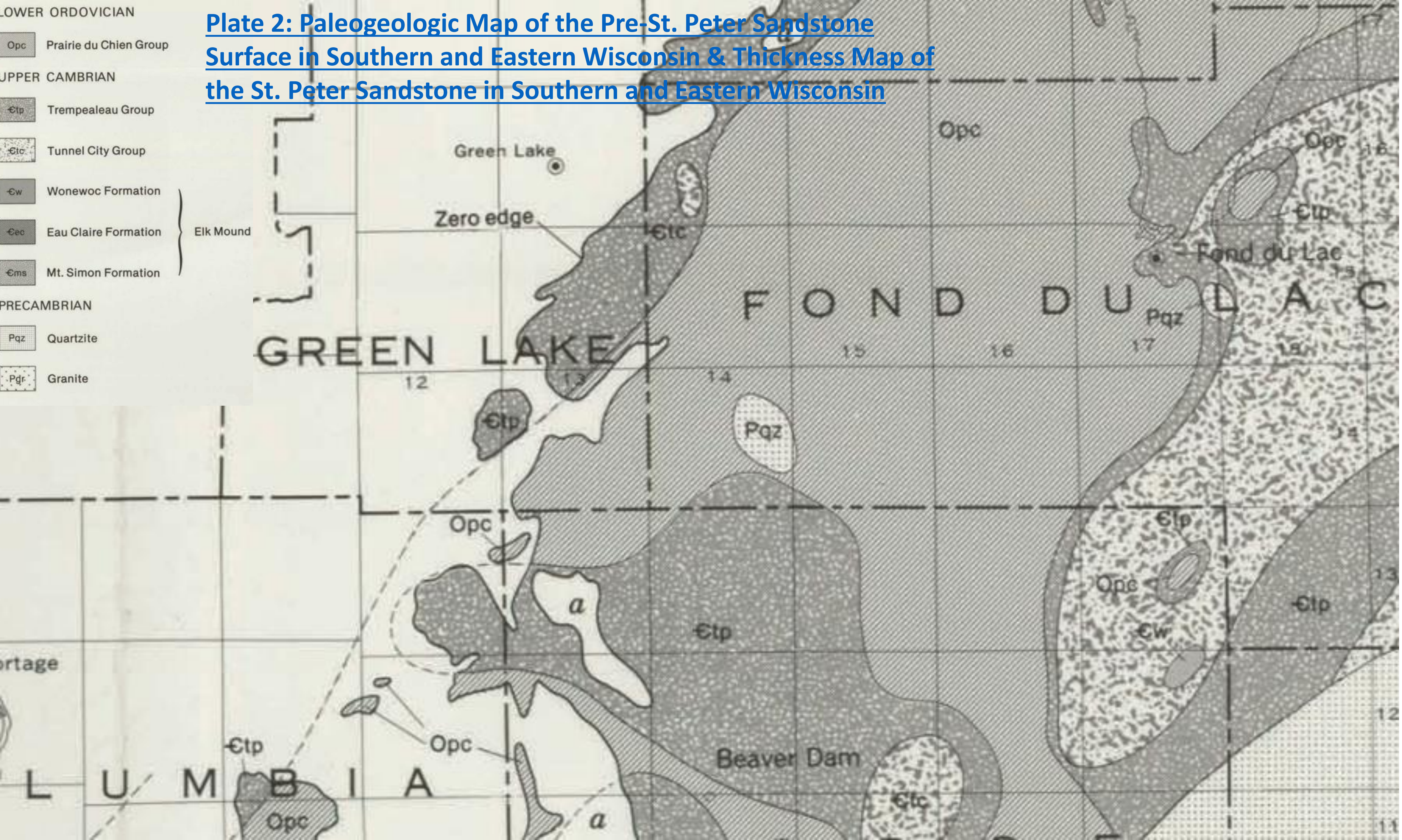
Holy Hill Formation, Horicon Member

Till. Brown to reddish-brown, gravelly, clayey, silty sand deposited by the Green Bay Lobe; generally at least 3 m thick; includes many small to large inclusions of windblown sediment, hillslope sediment, and glacial lake sediment that could not be mapped separately. In some areas, the modern surface reflects the landscape that was present before the last part of the Wisconsin glaciation. Unit **ghh:** Mostly low-relief, nondescript, hummocky topography; includes many areas of enclosed depressions. Unit **ghr:** Generally rolling topography in areas lacking drumlins. Unit **ghs:** Rolling topography that was subglacially molded; contains streamlined landforms including drumlins and flutes; many drumlins in the western part of the study area are composed of stratified sand and gravel rather than till of the Horicon Member.

Bedrock

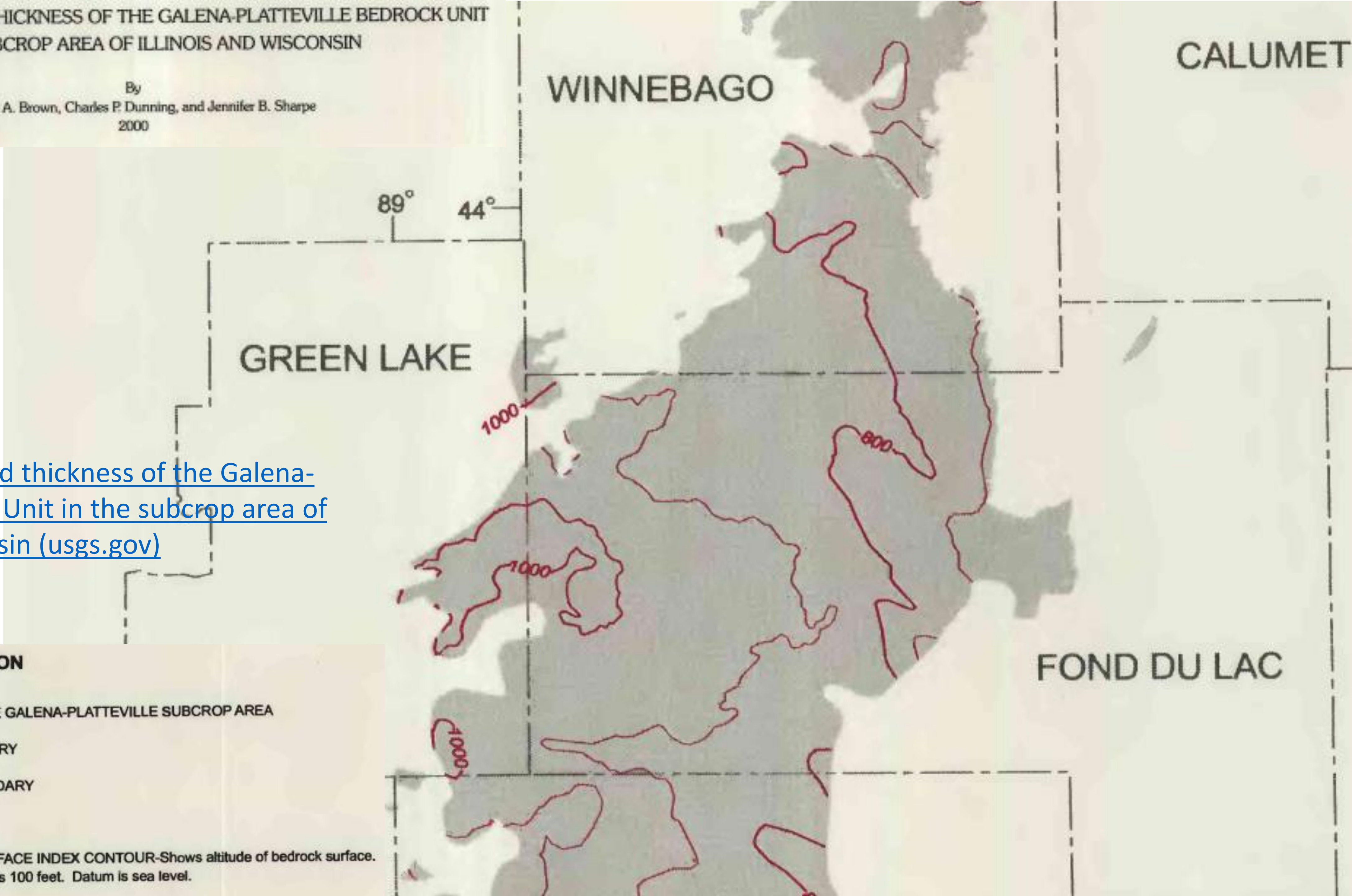
Bedrock. In glaciated areas, includes dolomite, sandstone, quartzite, rhyolite, or granite; in the Driftless Area, includes Paleozoic limestone and sandstone. Glacially scoured bedrock is covered by less than 2 m of sediment (sandy till of the Holy Hill Formation or windblown sediment), which is too thin to map.

Plate 2: Paleogeologic Map of the Pre-St. Peter Sandstone Surface in Southern and Eastern Wisconsin & Thickness Map of the St. Peter Sandstone in Southern and Eastern Wisconsin



ALTITUDE, DEPTH, AND THICKNESS OF THE GALENA-PLATTEVILLE BEDROCK UNIT IN THE SUBCROP AREA OF ILLINOIS AND WISCONSIN

By
Timothy A. Brown, Charles P. Dunning, and Jennifer B. Sharpe
2000



[Altitude, depth, and thickness of the Galena-Platteville Bedrock Unit in the subcrop area of Illinois and Wisconsin (usgs.gov)]

EXPLANATION

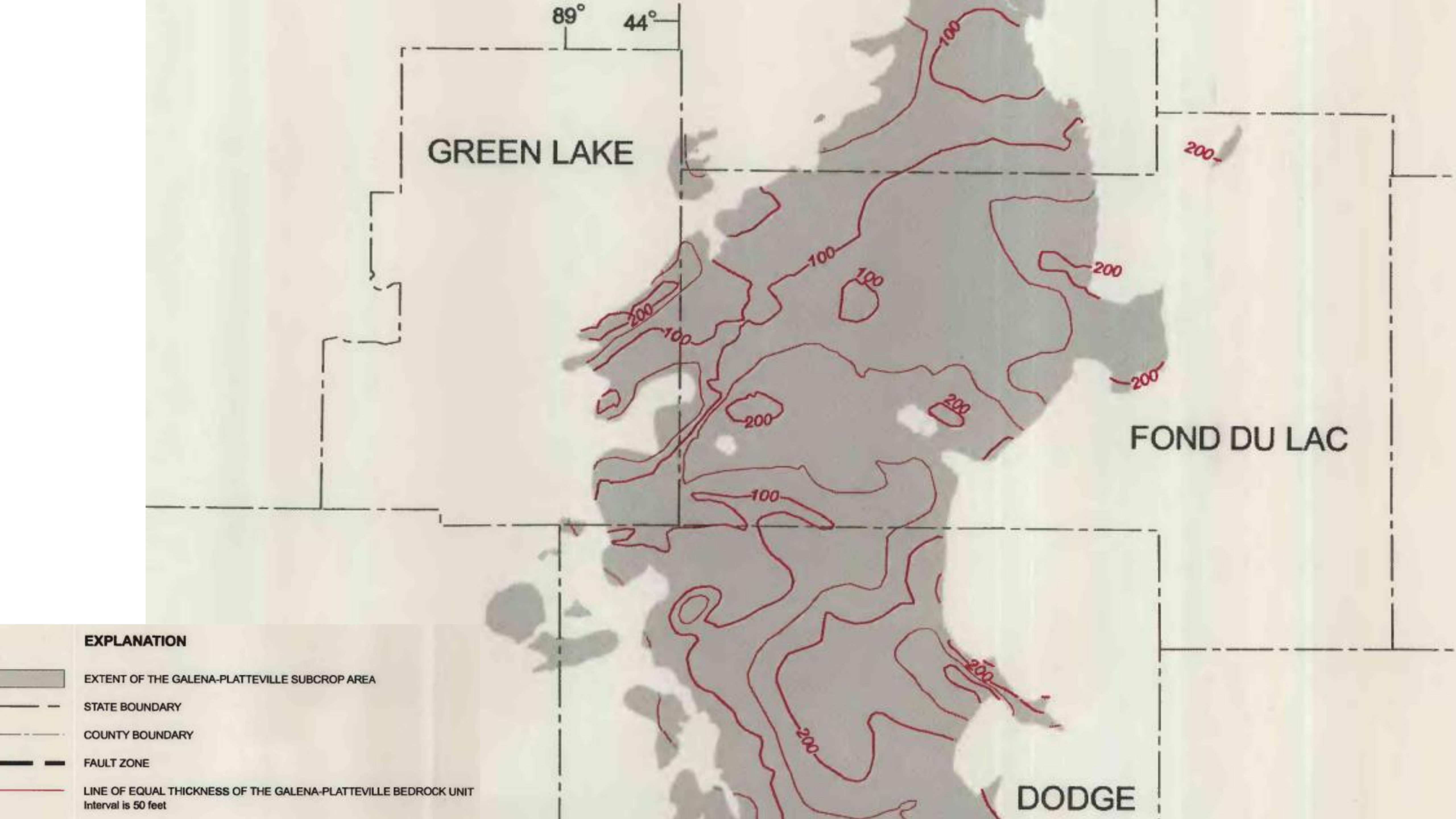
EXTENT OF THE GALENA-PLATTEVILLE SUBCROP AREA

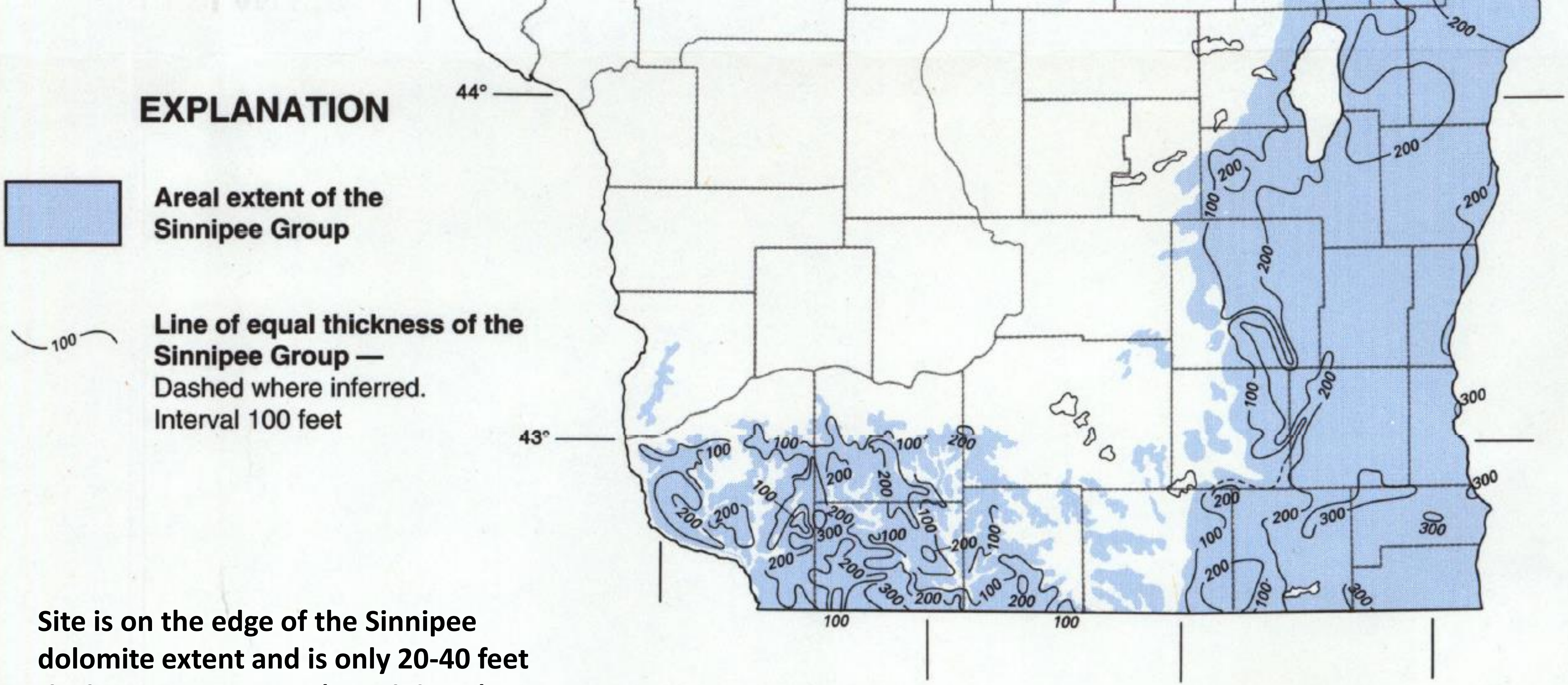
STATE BOUNDARY

COUNTY BOUNDARY

FAULT ZONE

BEDROCK-SURFACE INDEX CONTOUR-Shows altitude of bedrock surface. Contour interval is 100 feet. Datum is sea level.


89°
44°
GREEN LAKE
FOND DU LAC
DODGE
100
200
EXPLANATION
EXTENT OF THE GALENA-PLATTEVILLE SUBCROP AREA
STATE BOUNDARY
COUNTY BOUNDARY
FAULT ZONE
LINE OF EQUAL THICKNESS OF THE GALENA-PLATTEVILLE BEDROCK UNIT
Interval is 50 feet



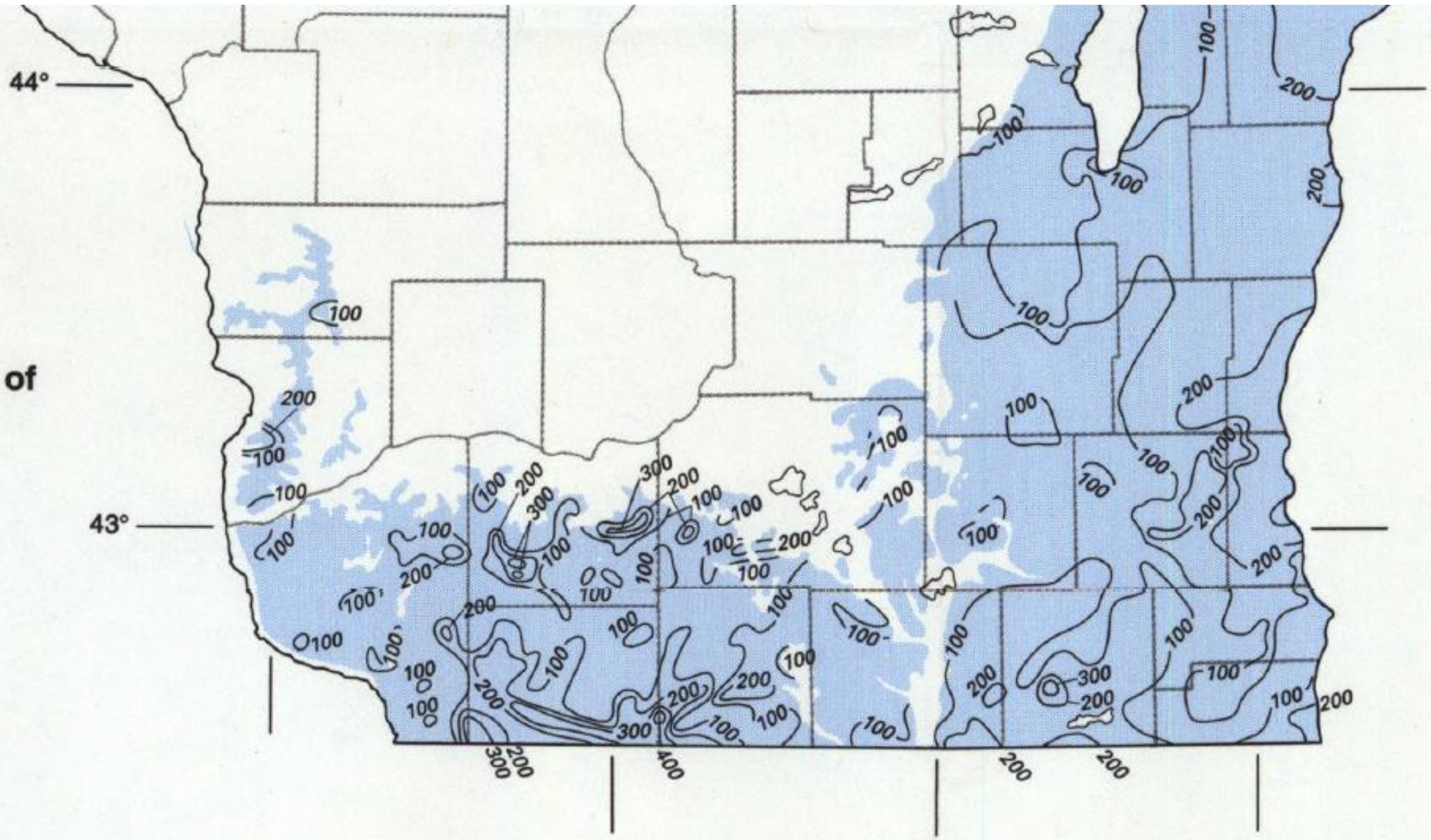
Site is on the edge of the Sinnipee dolomite extent and is only 20-40 feet thick in WCRS in area (see slide 13)

THICKNESS OF THE SINNIPEE GROUP

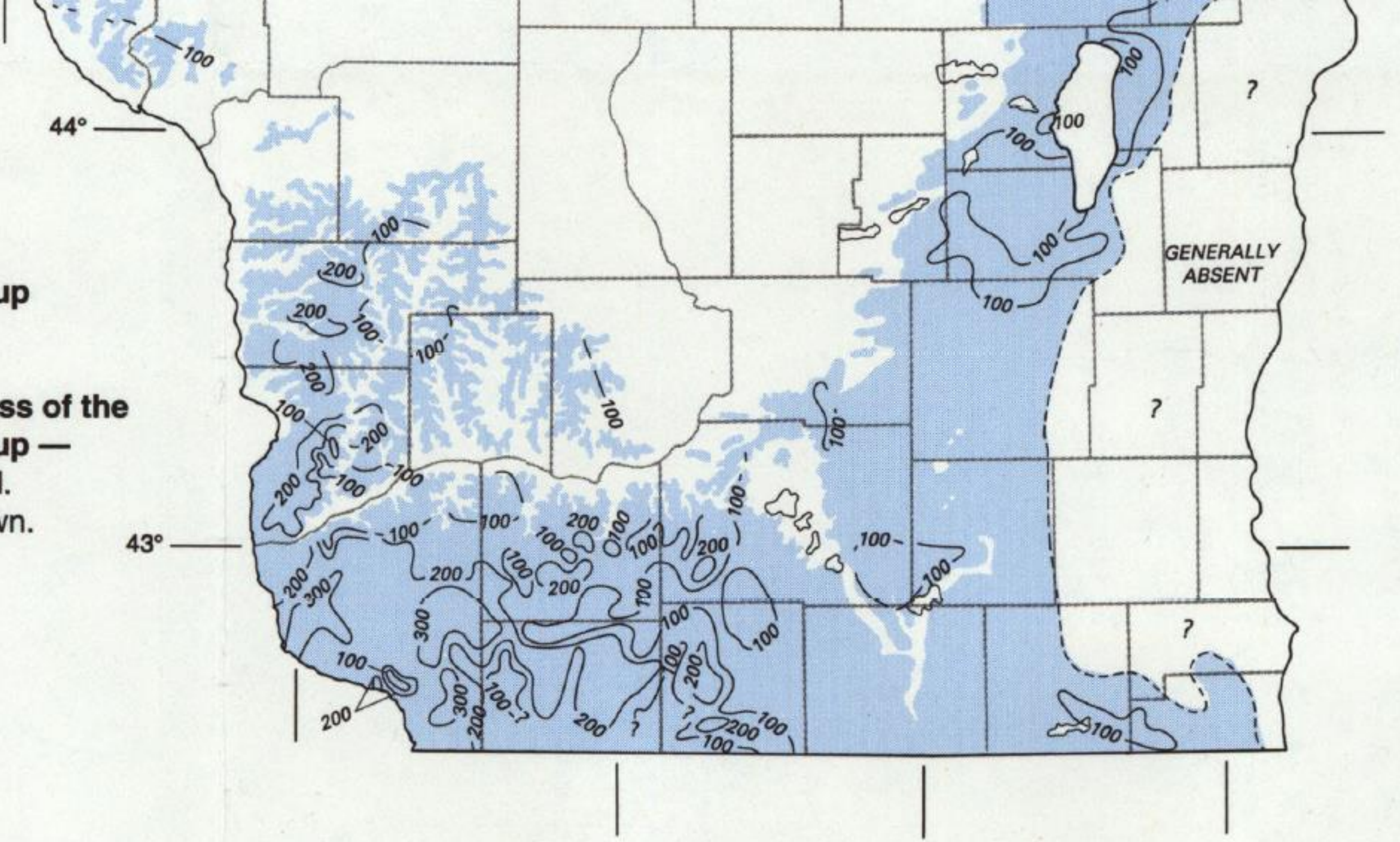
EXPLANATION

Areal extent of the Ancell Group

Line of equal thickness of the Ancell Group — Interval 100 feet



THICKNESS OF THE ANCELL GROUP

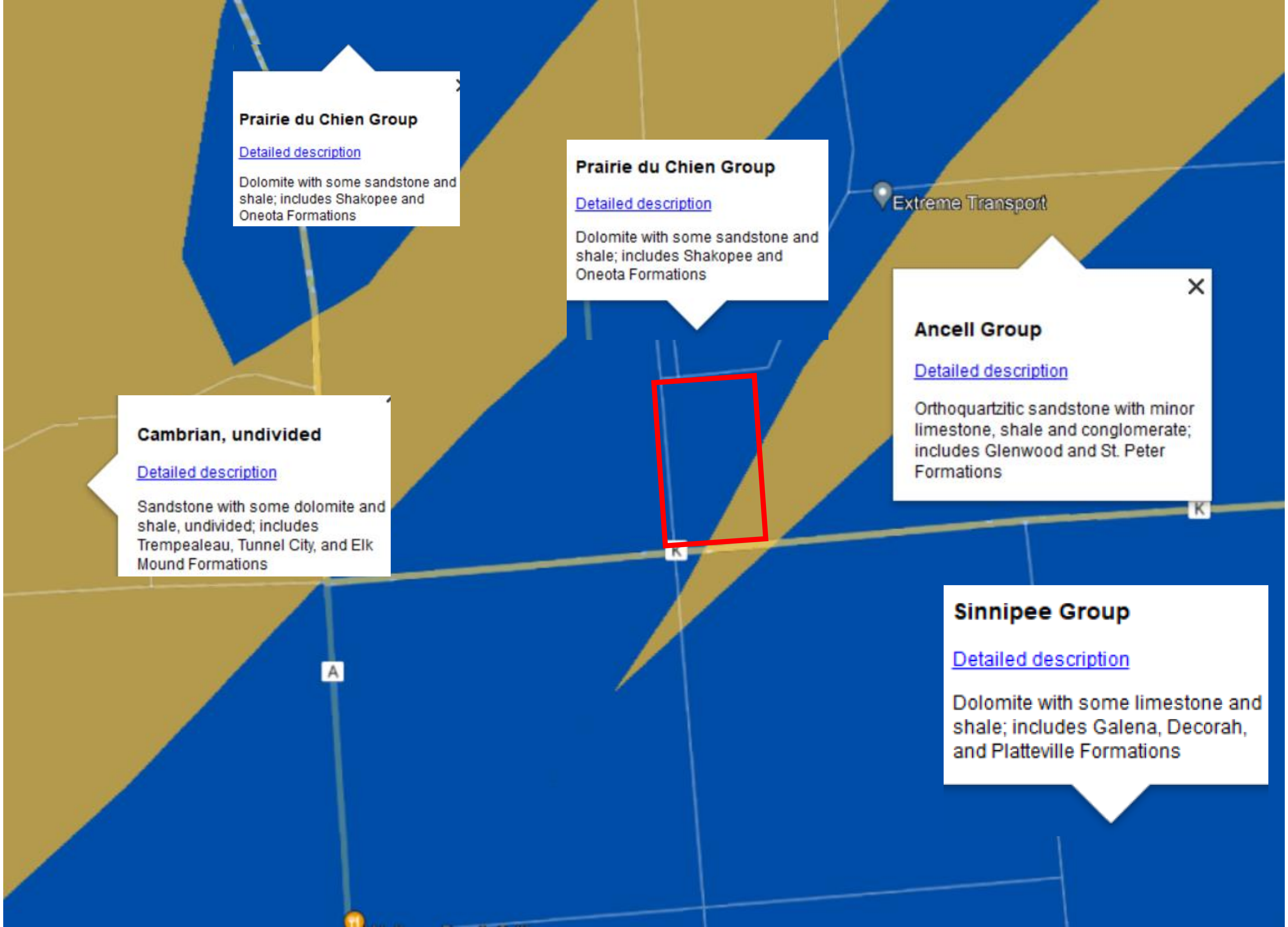


EXPLANATION

Areal extent of the Prairie du Chien Group

Line of equal thickness of the Prairie du Chien Group — Dashed where inferred. Queried where unknown. Interval 100 feet

THICKNESS OF THE PRAIRIE DU CHIEN GROUP



Prairie du Chien Group
Detailed description
Dolomite with some sandstone and shale; includes Shakopee and Oneota Formations
Prairie du Chien Group
Detailed description
Dolomite with some sandstone and shale; includes Shakopee and Oneota Formations
Extreme Transport
Ancell Group
Detailed description
Orthoquartzitic sandstone with minor limestone, shale and conglomerate; includes Glenwood and St. Peter Formations
Cambrian, undivided
Detailed description
Sandstone with some dolomite and shale, undivided; includes Trempealeau, Tunnel City, and Elk Mound Formations
Sinnipee Group
Detailed description
Dolomite with some limestone and shale; includes Galena, Decorah, and Platteville Formations

Well Construction Report For WISCONSIN UNIQUE WELL NUMBER SQ446

State of WI - Private Water Systems - DG/2
Department of Natural Resources, Box 7921
Madison, WI 53707
Please type or Print using a black Pen
Please Use Decimals Instead of Fractions.

Form 3300-77A (R 8/00)

Ele 984'

Property Owner	MACHKOVICH, STEVE
Telephone Number	–
Mailing Address	W235 PRAIRIE RD
City	RIPON
State	WI
Zip Code	54971
County of Well Location	Green Lake
County Well Permit No.	W
Well Completion Date	08/20/2004
Well Constructor (Business Name)	DANIEL J STEFFES
License #	6109
Facility ID Number (Public Wells)	
Address	BADGER WELL DRLG
Public Well Plan Approval #	W-24131
City	FOND DU LAC
State	WI
Zip Code	54935
Date of Approval (mm/dd/yyyy)	07/07/2004
Hicap Permanent well #	67459
Common Well #	2
Specific Capacity	2.7 gpm/ft

1. Well Location: [X] Town [ ] City [ ] Village of BROOKLYN
Fire # (if available)
Grid or Street Address or Road Name and Number
Subdivision Name — Lot # — Block #
Gov't Lot # or NE 1/4 of NE 1/4 of Section 36 T 16 N; R13 [X] E [ ] W
Latitude Deg. Min. Longitude Deg. Min.
Lat/Long Method GPS008

2. Well Type [X] New [ ] Replacement [ ] Reconstruction of previous unique well # constructed in
Reason for replaced or Reconstructed Well?
[X] Drilled [ ] Driven Point [ ] Jetted [ ] Other:

3. Well serves # of homes and or IRRIGATION (e.g. barn, restaurant, church, school, industry, etc.)
High capacity Well? [X] Yes [ ] No
Property? [X] Yes [ ] No

4. Is the well located upslope or sideslope and not downslope from any contamination source, including those on neighboring properties? [X] Yes [ ] No
Well located within 1,200 feet of a quarry? [ ] Yes [ ] No If yes, distance in feet from quarry:
Well located in floodplain? [ ] Yes [X] No
Distance in Feet from Well to Nearest:

1. Landfill
2. Building Overhang
3. Septic [ ] Holding Tank [ ]
4. Sewage Absorption Unit
5. Nonconforming Pit
6. Buried Home Heating Oil Tank
7. Buried Petroleum Tank
8. Shoreline [ ] Swimming Pool [ ]
9. Downspout/Yard Hydrant
10. Privy
11. Foundation Drain to Clearwater
12. Foundation Drain to Sewer
13. Building Drain [ ] Cast Iron or Plastic [ ] Other
14. Building Sewer [ ] Gravity [ ] Pressure [ ] Cast Iron or Plastic [ ] Other
15. Collector or Street Sewer: [ ] Sanitary units in. diam. [ ] Storm [ ] <=6 [ ] >6
16. Clearwater Sump
17. Wastewater Sump
18. Paved Animal Barn Pen
19. Animal Yard or Shelter
20. Silo
21. Barn Gutter
22. Manure Pipe [ ] Gravity [ ] Pressure [ ] Cast Iron or Plastic [ ] Other
23. Other Manure Storage
24. Ditch
25. Other NR 812 Waste Storage

5. Drillhole Dimensions and Construction Method

Dia (in.)	From (ft.)	To (ft.)
16	0	62
12	62	465

Upper Enlarged Drillhole / Lower Open Bedrock
[X] 1. Rotary - Mud Circulation
[ ] 2. Rotary - Air
[ ] 3. Rotary - Air and Foam
[ ] 4. Drill-Through Casing Hammer
[ ] 5. Reverse Rotary
[ ] 6. Cable-tool Bit in. dia
[ ] 7. Dual Rotary
[ ] 8. Temp. Outer Casing in. dia. depth (ft) Removed? [ ] Yes [ ] No If no, why not?

8. Geology

	Type, Caving/Noncaving, Color, Hardness, etc	From (ft.)	To (ft.)
K-I-	BLACK DIRT	0	3
–YP	HARDPAN STONES SAND	3	34
–L-	LIMESTONE	34	87
–N-	SANDSTONE	87	115
–NL	SANDSTONE LIMESTONE	115	197
–N-	SANDSTONE	197	465

6. Casing, Liner, Screen

Dia. (in.)	Material, Weight, Specification	From (ft.)	To (ft.)
12	ASTM A53B IPSCO PARAGON 12.750 X .375 EL 21 PLAIN END	0	62

Dia. (in.) Screen type, material & slot size

9. Static Water Level: ft. above ground surface; 38 ft. below ground surface

10. Pump Test: Pumping Level 225 ft. below surface; Pumping at 500 GPM for 1 hours

11. Well is: [X] Above Grade 24 in. [ ] Below Grade
Developed? [X] Yes [ ] No
Disinfected? [X] Yes [ ] No
Capped? [X] Yes [ ] No

7. Grout or Other Sealing Material. Method

Method: TREMIE PIPE PUMPED / Kind of Sealing Material	From (ft.)	To (ft.)	# Sacks Cement
NEAT CEMENT GROUT	0	62	45

12. Did you notify the owner of the need to permanently abandon and fill all unused wells on this property? [ ] Yes [ ] No If no, explain:

13. Signature of the Well Constructor or Supervisory Driller: DJS — Date signed: 08/20/2004
Signature of Drill Rig Operator (Mandatory unless same as above) — Date signed

Make additional comments on reverse side about geology, additional screens, water quality, etc.
Variance issued [ ] Yes [X] No

This well is a mile and a half NE of the spring. The water quality is on the right.

Wisconsin Department of Natural Resources
Laboratory Report

09/24/2012 Lab: 113133790 Sample: IX007160 Page 1 of 2

Laboratory: Wisconsin State Laboratory of Hygiene
2601 Agriculture Dr
Madison WI 53718
Phone: 800-442-4618 Fax Phone: 608-224-6213
DNR ID 113133790

Sample:

Field #:		Sample #:	IX007160
Collection Start:	09/12/2012 12:00 am	Collection End:	
Collected by:	PATRICK GORSKI	Waterbody/Outfall Id:	
ID #:	SQ446	ID Point #:	
County:	Green Lake	Account #:	PP010
Sample Location:	TOWN OF BROOKLYN (SEC 36 NE:1/4 NE:1/4 T16N R13E)		
Sample Description:	IRRIGATION WELL # SQ446		
Sample Source:	Private (other)	Sample Depth:	
Date Reported:		Sample Status:	PARTIAL
Project No:		Sample Reason:	Investigation

Analyses and Results:

Analysis Method: DIG, ICP, PRIVATE (SW846 3005A) — Analysis Date: 09/17/2012 — Lab Comment:

Code	Description	Result	Units	LOD	Report Limit	LOQ
99404	DIG TOTAL REC SW846 3005A	COMPLETE				

Analysis Method: METALS PANEL, TOTAL REC, ICP (EPA 200.7) — Analysis Date: 09/18/2012 — Lab Comment: NO CHARGE

Code	Description	Result	Units	LOD	Report Limit	LOQ
1104	ALUMINUM,TOTAL RECOVERABLE	16700.	UG/L	3		10
978	ARSENIC TOTAL RECOVERABLE	2310.	UG/L	5		16
1113	CADMIUM TOTAL RECOVERABLE	64.	UG/L	0.5		1.6
918	CALCIUM TOTAL RECOVERABLE	142.	MG/L	0.1		0.3
1118	CHROMIUM TOTAL RECOVERABLE	197.	UG/L	1		3
979	COBALT TOTAL RECOVERABLE	2160.	UG/L	1		3
1119	COPPER TOT REC	9830.	UG/L	2		6
899	HARDNESS TOTAL RECOVERABLE CALCULATION	534.	MG/L	1.4		4.6
980	IRON TOTAL RECOVERABLE	426.	MG/L	0.1		0.3
1114	LEAD TOTAL REC	82.	UG/L	3		10
921	MAGNESIUM TOTAL RECOVERABLE	43.7	MG/L	0.1		0.3
1123	MANGANESE ICP TOTAL RECOVERABLE	1720.	UG/L	1.0		3.0
1074	NICKEL ICP TOTAL RECOVERABLE	4310.	UG/L	1		3

With only 106 hours of pumping the water stripped all the galvanizing off the brand-new center pivot irrigation equipment. This was caused by sulfide s in the Platteville and St Peter being oxidized as acid mine drainage reaction.


Just below red line you can see where the irrigation
water had stunted the growth of the soybeans

First Water Quality Test For
WISCONSIN UNIQUE WELL NUMBER AT 573

State of Wisconsin
Department of Natural Resources
Private Water Supply — WS/2
Box 7921
Madison, WI 53707

AUG 17 1988

Property Owner: Ron Wahoske Telephone Number: (414) 748-6175
Mailing Address: Brooklyn G
City: Ripon State: Wi Zip Code: 54971
County: 24 Green Lake County Well Location Permit No.: W Well Completion Date: 7-9-88 (M M D D Y Y)

1. Location (Please type or print using a black pen.)
☒ Town ☐ City ☐ Village Fire # (if available)
of Brooklyn
Grid or Street Address or Road Name and Number (if available)
Subdivision Name Lot # Block #
Gov't Lot # ____ or SW ¼ of SE ¼ of Section 25; T 16 N; R 13 ☒ E ☐ W

Well Constructor (Business Name): Zoellner Central Well Drilling Registration #: 140
Address: P.O. Box 405
City: Brandon State: Wi Zip Code: 53919

2. Mark well location in correct 40-acre parcel of section. N W E S

3. Well Type ☒ New ☐ Replacement ☐ Reconstruction/Rehabilitation of well constructed in 19 ____.
Reason for new, reconstructed, replaced, or rehabilitated well? New Home
☒ Drilled ☐ Driven Point ☐ Jetted ☐ Other

4. Well serves 1 # of homes and/or ____ (ex: barn, restaurant, church, school, industry, etc.)
High Capacity Well? ☐ Yes ☒ No
High Capacity Property? ☐ Yes ☒ No

5. Well Located on Highest Point of Property, Consistent with the General Layout and Surroundings? ☒ Yes No
Well Located in Floodplain? ☐ Yes ☒ No
Distance In Feet From Well To Nearest:

____ 1. Landfill	____ 9. Downspout/Yard Hydrant	____ 17. Wastewater Sump
15' 2. Building Overhang	____ 10. Privy	____ 18. Paved Animal Barn Pen
____ 3. Septic or Holding Tank	____ 11. Foundation Drain to Clearwater	____ 19. Animal Yard or Shelter
____ 4. Sewage Absorption Unit	____ 12. Foundation Drain to Sewer	____ 20. Silo — Type
____ 5. Nonconforming Pit	____ 13. Building Drain ☐ Cast Iron or Plastic ☐ Other	____ 21. Barn Gutter
____ 6. Buried Home Heating Oil Tank	____ 14. Building Sewer ☐ Gravity ☐ Pressure ☐ Cast Iron or Plastic ☐ Other	____ 22. Manure Pipe ☐ Gravity ☐ Pressure ☐ Cast Iron or Plastic ☐ Other
____ 7. Buried Petroleum Tank	____ 15. Collector Sewer	____ 23. Other Manure Storage
____ 8. Shoreline/Swimming Pool	____ 16. Clearwater Sump	Other NR 112 Waste Source 24. Plumbing not Completed

6. Drillhole Dimensions

Dia. (in.)	From (ft.)	To (ft.)
8¾	surface	62
6	62	144

Method of constructing upper enlarged drillhole. (If applicable ✓ more than one.)
☒ 1. Rotary — Mud Circulation
☐ 2. Rotary — Air
☐ 3. Rotary — Foam
☐ 4. Reverse Rotary
☐ 5. Cable-tool Bit ____ in. dia.
☐ 6. Temp. Outer Casing ____ in. dia. Removed? ☐ Yes ☐ No If no, explain ____
☐ 7. Other ____

9. Geology

Type, Caving/Noncaving, Color, Hardness, Etc.	From (ft.)	To (ft.)
-C- Clay	surface	7
-L- Linerock	7	38
-N- Sandrock	38	144

7. Casing, Liner, Screen

Dia. (in.)	Material, Weight, Specification, Mfg. & Method of Assembly	From (ft.)	To (ft.)
6	New Black Steel 18.97# per ft. 1780 PSI ASTM A53 Gr. B P.E. Sumotomo	surface	62

Dia. (in.)	screen type and material	From	To

8. Grout or Other Sealing Material
Method: Pressure

Kind of Sealing Material	From (ft.)	To (ft.)	# Sacks Cement
Mud + Cuttings	surface	6	

10. Static Water Level
____ ft. above ground level
58 ft. below ground surface

11. Pump Test
Pumping Level 66 ft. below surface
Pumping at 15 GPM for 3 hours

12. Well Is: 12 in. ☒ Above ☐ Below Grade
Developed? ☒ Yes ☐ No
Disinfected? ☒ Yes ☐ No
Capped? ☒ Yes ☐ No

13. Were all unused, noncomplying, or unsafe wells properly filled with sealant? ☐ Yes ☐ No If no, explain N/A

14. Signature of Well Constructor: Larry J. Alager LJS Date Signed: 7-11-88
Signature of Drill Rig Operator Date Signed

WELL CONSTRUCTOR'S REPORT TO WISCONSIN STATE BOARD OF HEALTH
See Instructions on Reverse Side

RECEIVED JAN 31 1950 BUREAU SAN. ENG.

1. County Green Lake ☒ Town ☐ Village ☐ City Brooklyn (Check one and give name)
2. Location NE, NW N. E. of Sec. 36 Township 16 north Range 13 E
Name of street and number of premise or Section, Town and Range numbers
3. Owner ☒ or Agent ☐ August Quick
Name of individual, partnership or firm
4. Mail Address Ripon Route 2
Complete address required
5. From well to nearest: Building 35 ft; sewer 45 ft; drain 50 ft; septic tank 55 ft; dry well or filter bed 78 ft; abandoned well 200 ft.
6. Well is intended to supply water for: Home & Farm

7. DRILLHOLE:

Dia. (in.)	From (ft.)	To (ft.)	Dia. (in.)	From (ft.)	To (ft.)
8	0	75			
6	75	140			

8. CASING AND LINER PIPE OR CURBING:

Dia. (in.)	Kind	From (ft.)	To (ft.)
6	Standard Weight steel pipe	0	75

9. GROUT:

Kind	From (ft.)	To (ft.)
Drill cuttings	0	18
comment	18	75

10. FORMATIONS:

Kind	From (ft.)	To (ft.)
clay gravel	0	15
Limestone	15	55
Sand-stone	55	140

11. MISCELLANEOUS DATA:
Yield test: 1 Hrs. at 30 GPM.
Depth from surface to water-level: 52 ft.
Water-level when pumping: 55 ft.
Water sample was sent to the state laboratory at: Oshkosh (City) on Jan. 18 1950

Construction of the well was completed on: Dec. 29 1949
The well is terminated 8 inches ☒ above, below ☐ the permanent ground surface.
Was the well disinfected upon completion? Yes X No
Was the well sealed watertight upon completion? Yes X No

Signature R. J. Schafer & Sons (Registered Well Driller) Fremont Wis. (Complete Mail Address)

Please do not write in space below

Rec'd JAN 20 1950 No. 00505
Ans'd
Interpretation

	10 ml	10 ml	10 ml	10 ml	10 ml
Gas—24 hrs.					
48 hrs.					

Arsenic data from pump work samples October 2014 – 2021.

		# sample	detects	>10	>20	>50	>100	max	% Detect	% >10	%>20	% >50	% >100
Dane County	13	1139	325	52	35	12	5	737	28.5	4.6	3.1	1.1	0.4
Dodge County	14	534	277	67	44	26	19	1510	51.9	12.5	8.2	4.9	3.6
Door County	15	769	264	15	4	1		96.1	34.3	2.0	0.5	0.1	0.0
Douglas County	16	142	67					8.9	47.2				
Dunn County	17	526	104	13	7	2		95	19.8	2.5	1.3	0.4	
Eau Claire County	18	501	109	7	2			32.1	21.8	1.4	0.4		
Florence County	19	253	121	32	18	5	3	500	47.8	12.6	7.1	2.0	1.2
Fond du Lac County	20	840	355	85	59	38	19	435	42.3	10.1	7.0	4.5	2.3
Forest County	21	71	38	11	3	1		96.6	53.5	15.5	4.2	1.4	
Grant County	22	223	65	7	4	1		72.2	29.1	3.1	1.8	0.4	
Green County	23	433	212	55	33	17	7	474	49.0	12.7	7.6	3.9	1.6
Green Lake County	24	255	108	10	6	2	2	601	42.4	3.9	2.4	0.8	0.8
Iowa County	25	228	77	20	14	6	5	983	33.8	8.8	6.1	2.6	2.2
Iron County	26	35	17	1				14.4	48.6	2.9			
Jackson County	27	292	79	5	2			23.9	27.1	1.7	0.7		
Jefferson County	28	374	180	47	31	14	4	630	48.1	12.6	8.3	3.7	1.1
Juneau County	29	286	35	2	1			25	12.2	0.7	0.3		
Kenosha County	30	655	410	26	9	3	1	460	62.6	4.0	1.4	0.5	0.2
Kewaunee County	31	162	85	12	6	3		74.8	52.5	7.4	3.7	1.9	
La Crosse County	32	587	193	20	7	2		99	32.9	3.4	1.2	0.3	

A RECONNAISSANCE SURVEY OF WELLS IN EASTERN WISCONSIN FOR INDICATIONS OF MISSISSIPPI VALLEY TYPE MINERALIZATION

by

B. A. Brown and R. S. Maass

Winnebago Co.

Open File Report 92-3
31 p.

	Well #	T	R.E.	Sec	Minerals	Geol	Formation	Depth	
	1		2		3		4	5	
1	Wi-1	20	17	20	Py	Thwaites	Gal/Pv, P du C.	65-85, 175-195	1
2	Wi-9	20	17	21	Py	"	"	110-115	2
3	Wi-18	20	17	2	Py	"	Galena/Pv	45-55	3
4	Wi-25	20	16	23	"	"	"	128-135	4
5	Wi-27	20	17	27	"	"	P du C	237-260	5
6	Wi-31	18	16	24	"	"	Platteville	125-150	6
7	Wi-48	17	16	15	"	Ostrom	"	55-140	7
8	Wi-58	20	17	21	"/Chalco	Thwaites	P du C	190-210	8
9	Wi-59	20	17	28	"	"	"	175-230	9

Note: Trace amounts pyrite reported in most wells which penetrated Galena/Platteville and Prairie du Chien

Fond du Lac Co.

Well#	T	R.E.	Sec	Minerals	Geologist	Formation	depth
FL-15	15	14	21	Py	Thwaites	PduC	110-170
FL-37	15	17	9	Py	"	Galena/Pville	200-220
FL-41	15	17	15	Py	"	"	190-250
FL-56	15	14	26	"	"	"	185-190
FL-275	16	18	17	"	"	"	~~[illegible]~~-320-325
Fl 311	15	17	17	"	Stevrwald	"	25-45, 130-145
Fl 332	15	16	19	"	"	"	100-110
FL 334	14	15	3	"	"	"	70-80, 195-205
FL-342	16	14	Ripon	"	Ostrom	"	50-60
FL-343	15	17	22	"	"	"	235-280
FL-347	15	17	16	"	"	"	60-105
FL-351	16	14	21	"	"	Gal/Pville & PduC	5-60 & 130-155
FL 352	14	15	31	"	"	Galena/Pville	55-80
FL 355	16	18	32	"	"	Little from Silurian Thru PduC	
FL-373	14	16	14	"	Warren	galena/Pville	125-200
FL-369	14	15	36	"	"	"	40-50

Note most wells penetrating Niagara, Maquoketa, Galena/Pville St Peter and Prairie du Chien report trace to minor pyrite no other sulfides noted.

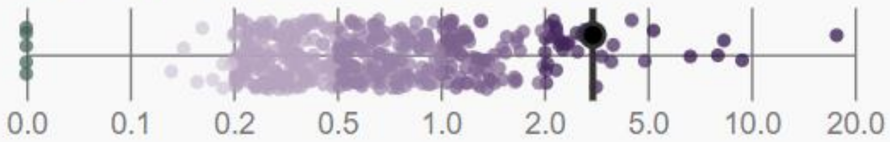
Green Lake County Spring #11

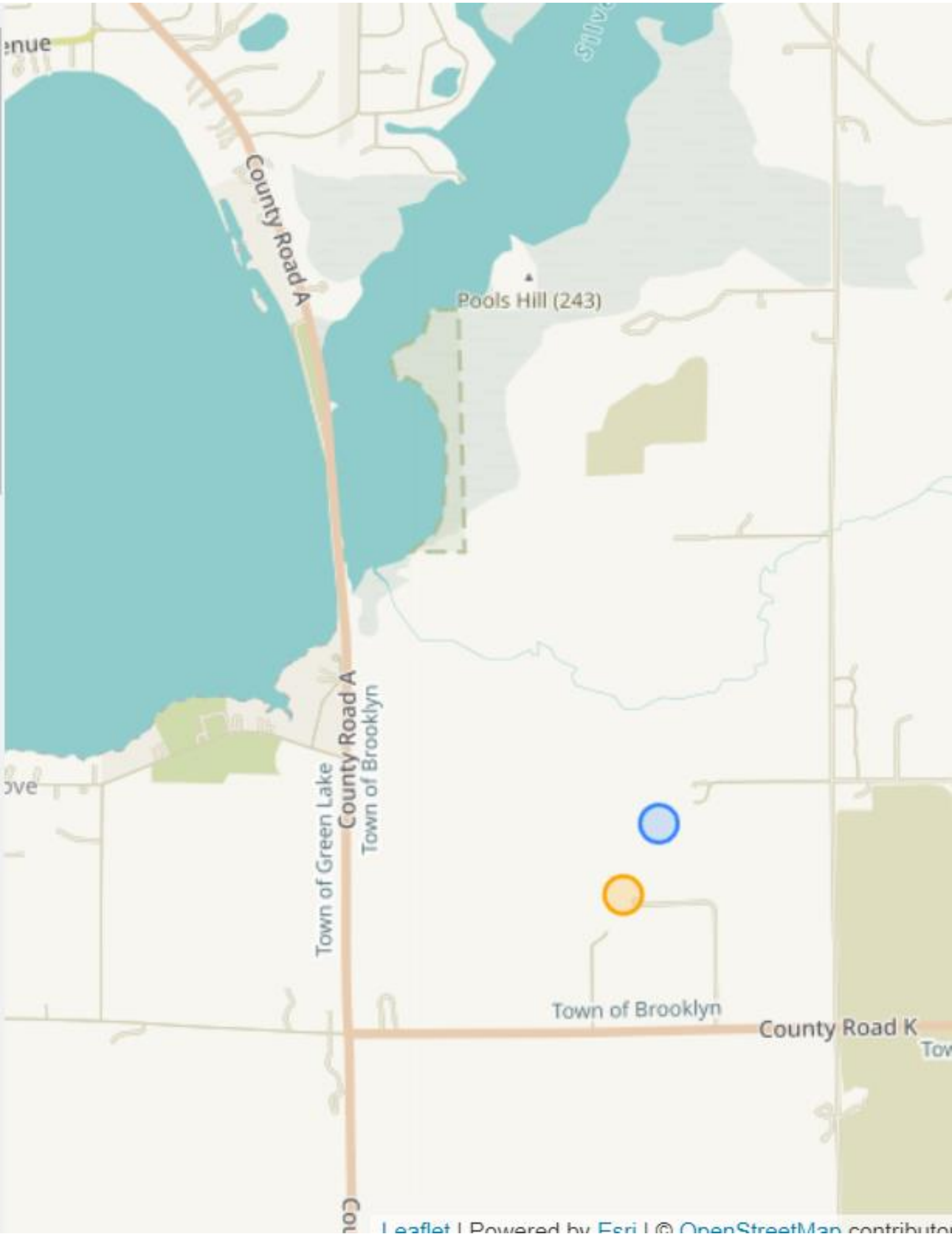
Spring orifice and back wall

Site sketch map

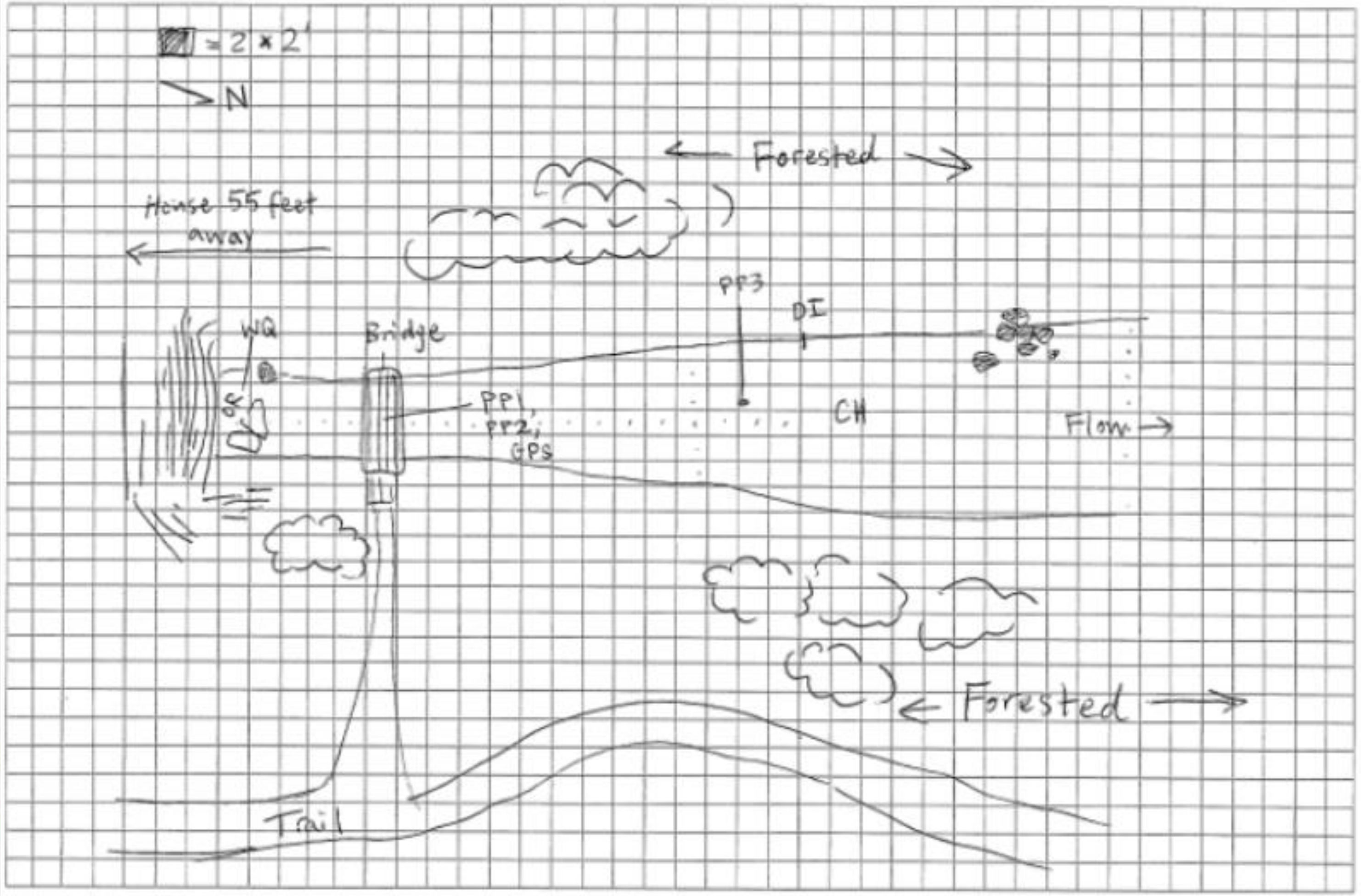
Water quality

Discharge (ft^3/s): 3.414

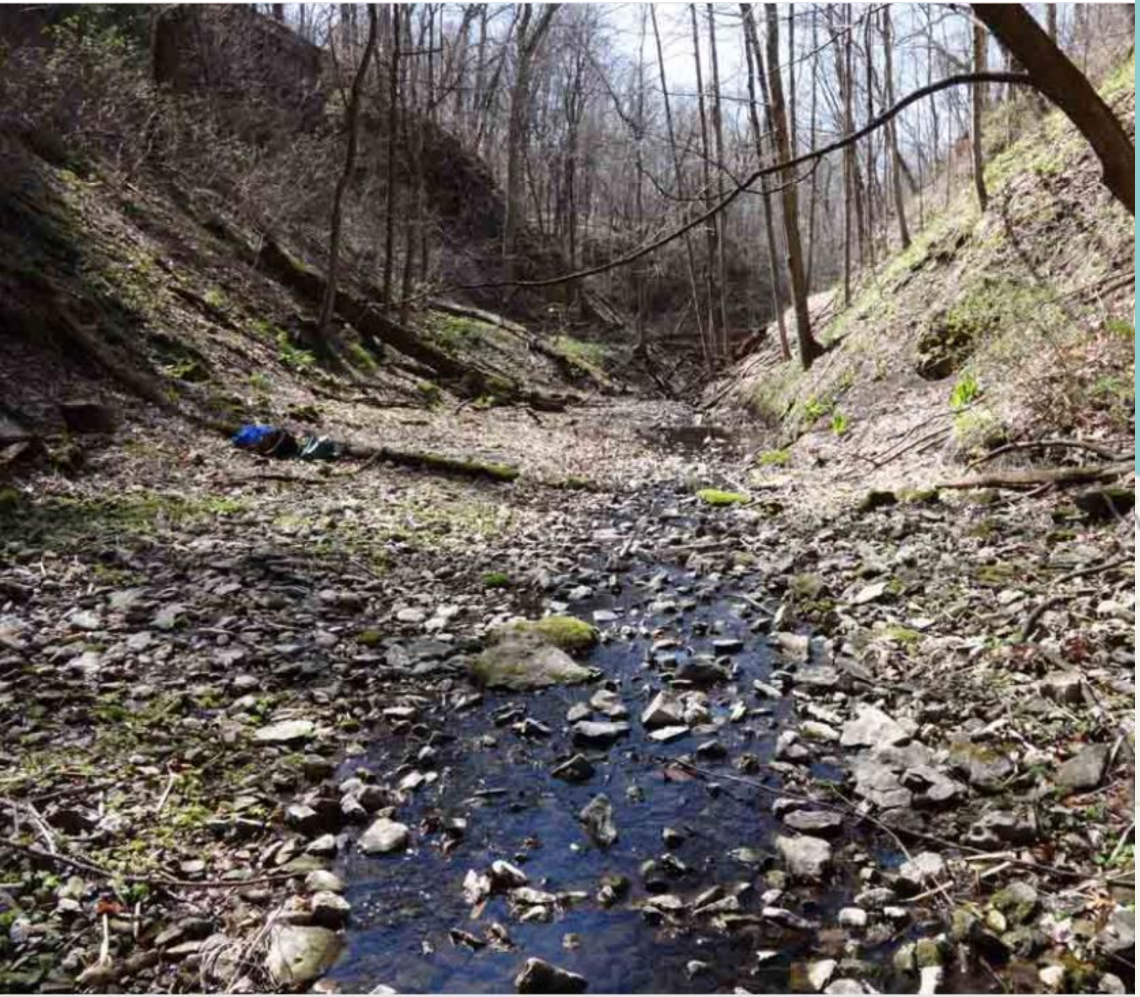


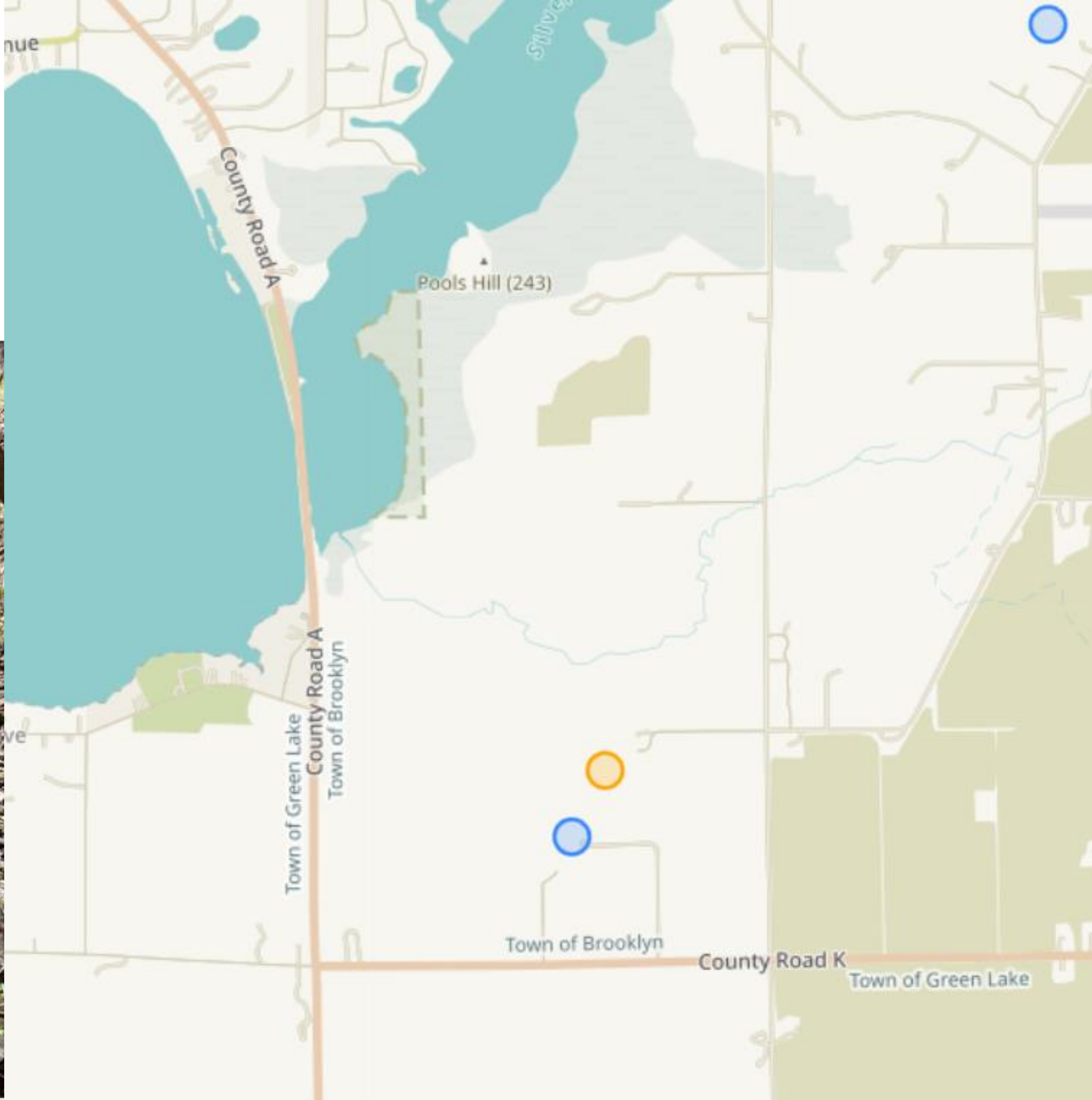


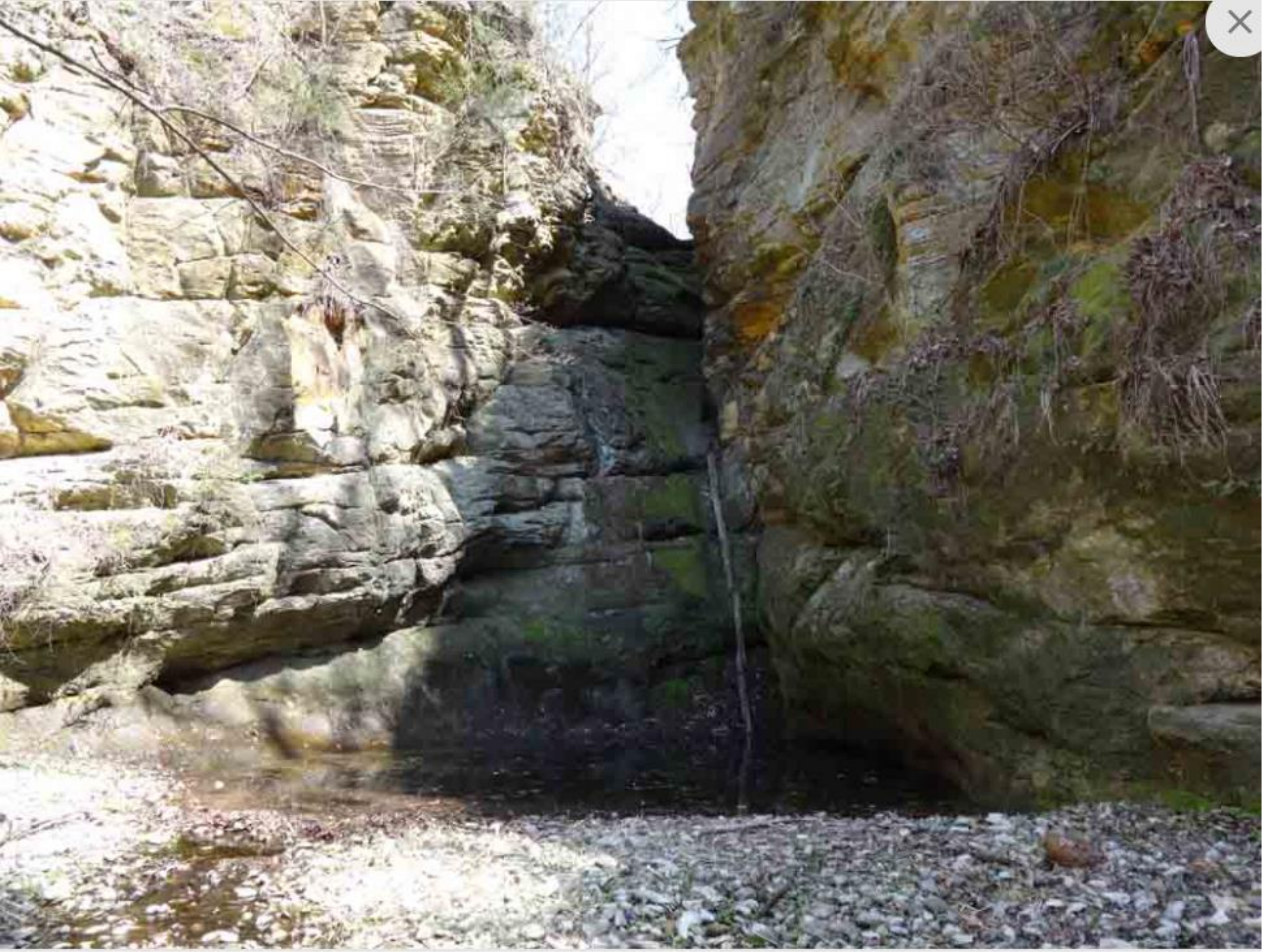
SITE SKETCH MAP Spring ID: 11 County: Green Lake

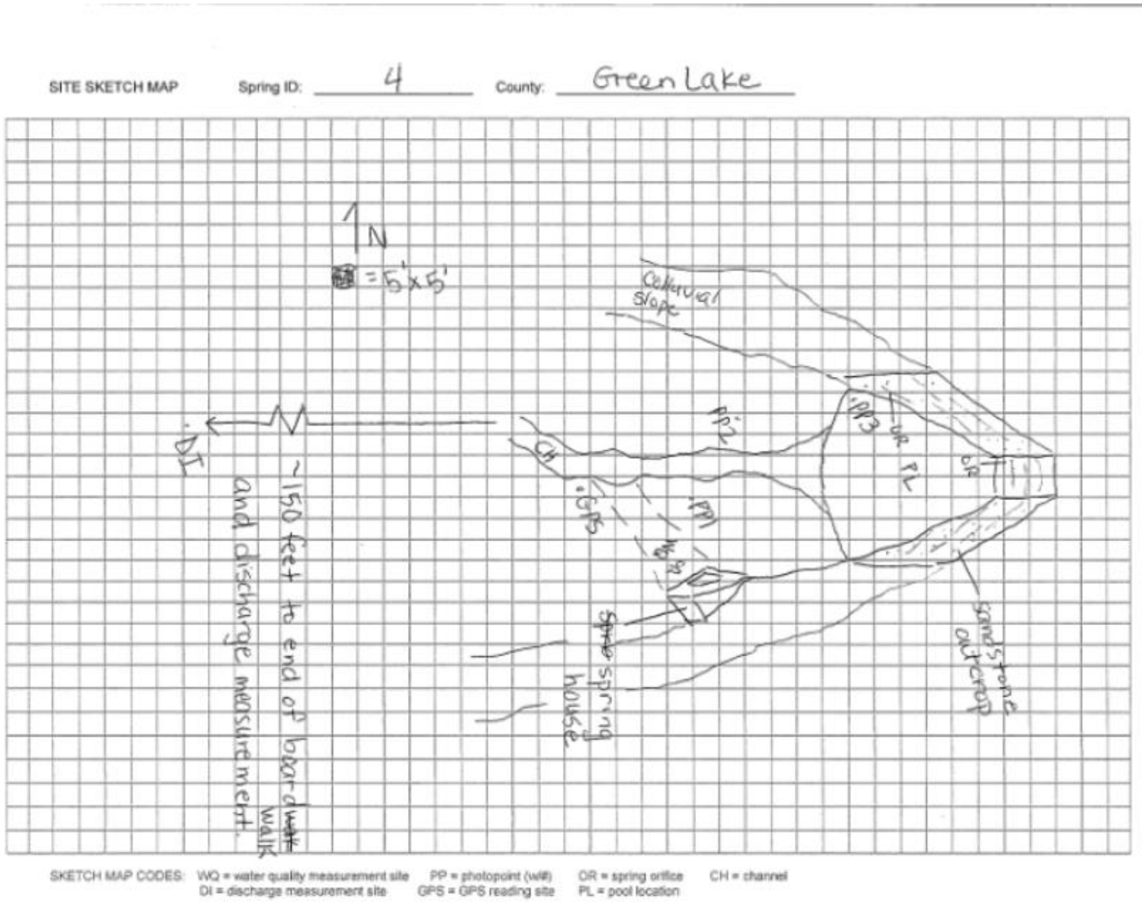


SKETCH MAP CODES: WQ = water quality measurement site PP = photopoint (w/#) OR = spring orifice CH = channel
DI = discharge measurement site GPS = GPS reading site PL = pool location




nue
County Road A
Pools Hill (243)
ve
Town of Green Lake
County Road A
Town of Brooklyn
Town of Brooklyn
County Road K
Town of Green Lake





Discharge (ft^3/s): 0.204

Download

RE: Springs, Streamflow and Proposed Mine

Reply | Reply All | Forward | ...

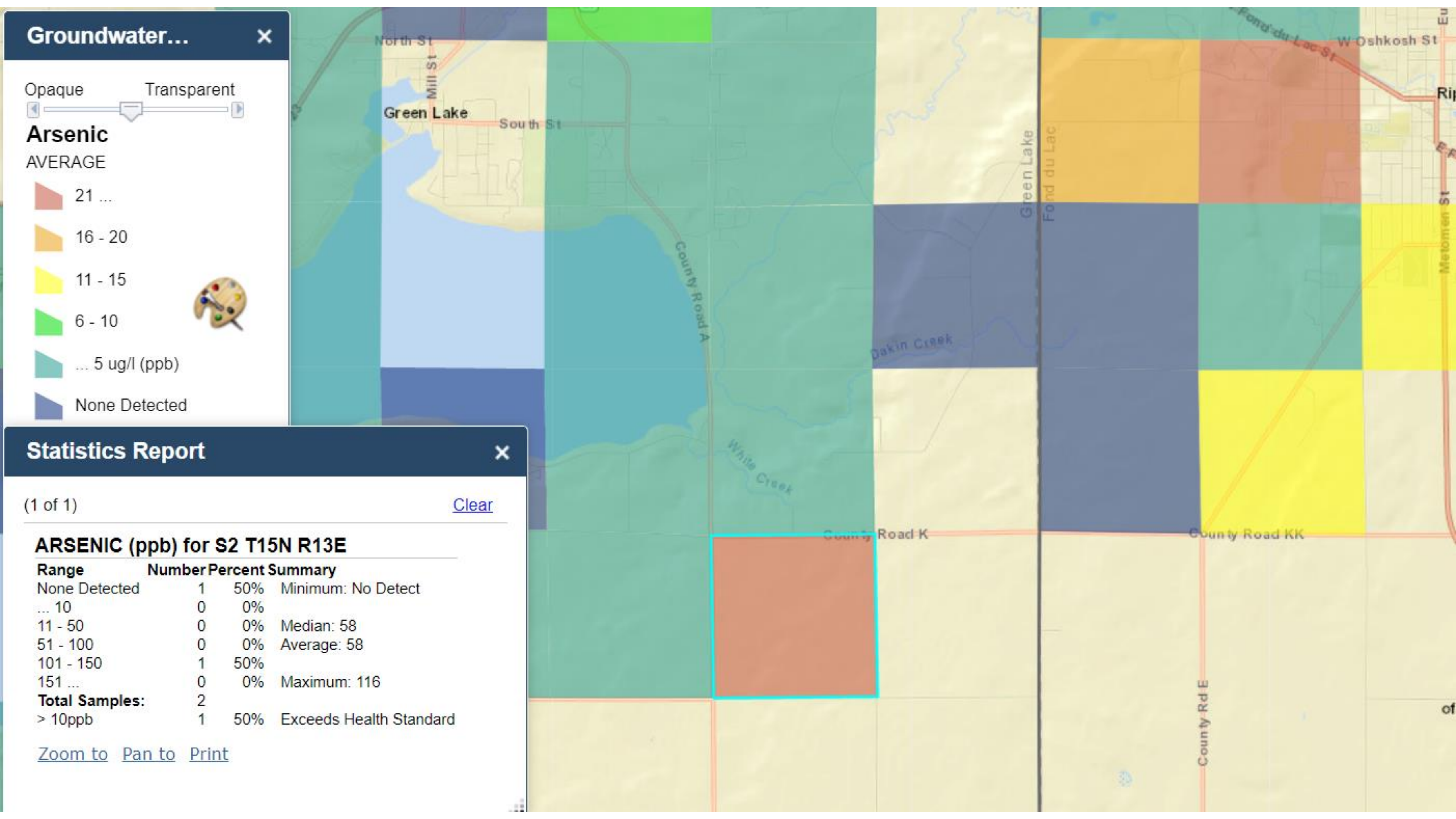
Rosnow, Joseph J - DNR
To Freihoefer, Adam T - DNR
Cc Johnson, Dave M - DNR; Clayton, Nicole L - DNR

Tue 8/2/2022 10:57 AM

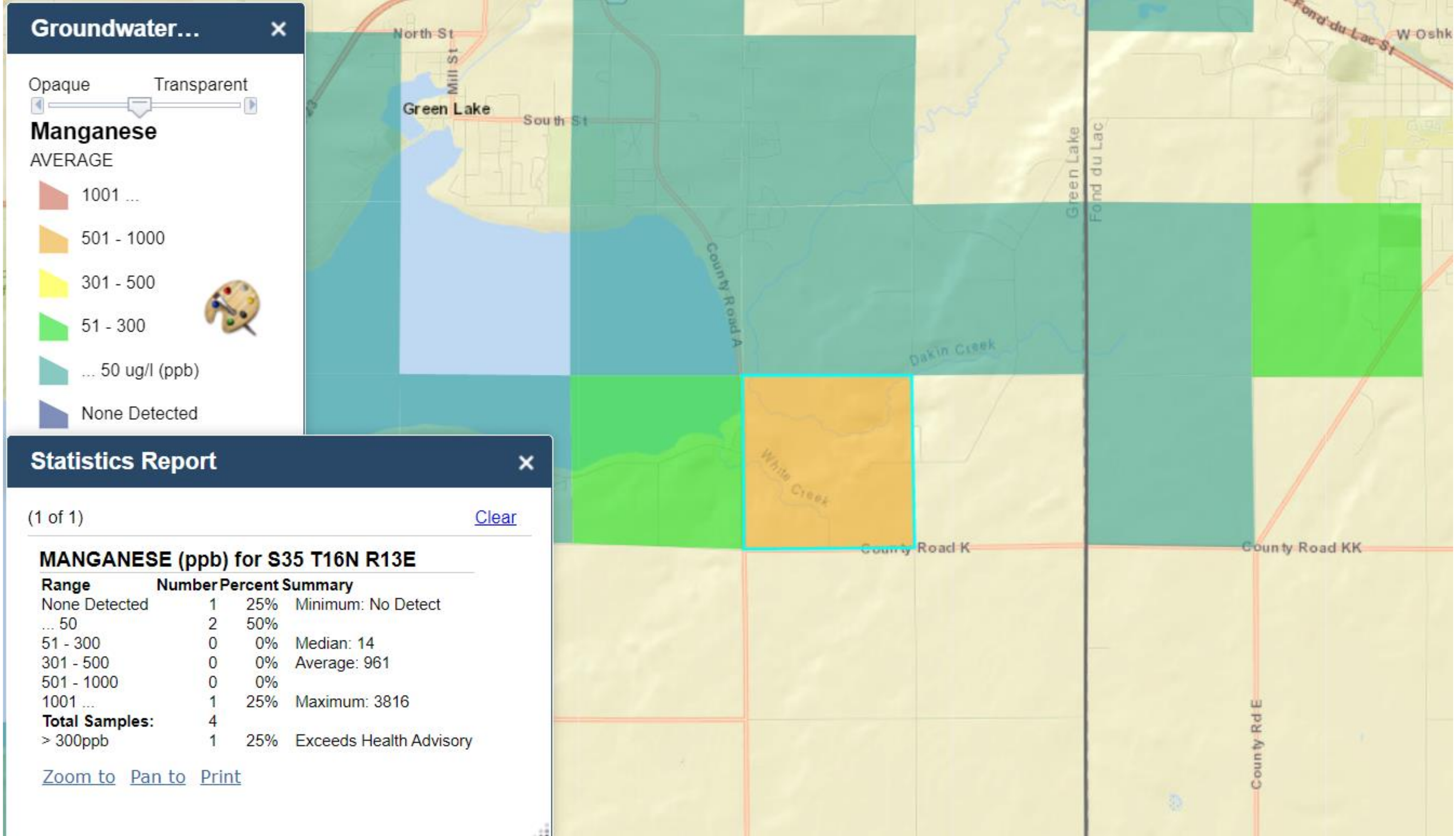
I visited all three spring in this area two years ago and two of them are quite unique in their biological, ecological and geological makeup. The headwater spring of White creek (>3 cfs) is the largest spring in the county and quite possibly all of East central Wisconsin. Please let me know what help I can be going forward, I do have the contact information for all three property owners.

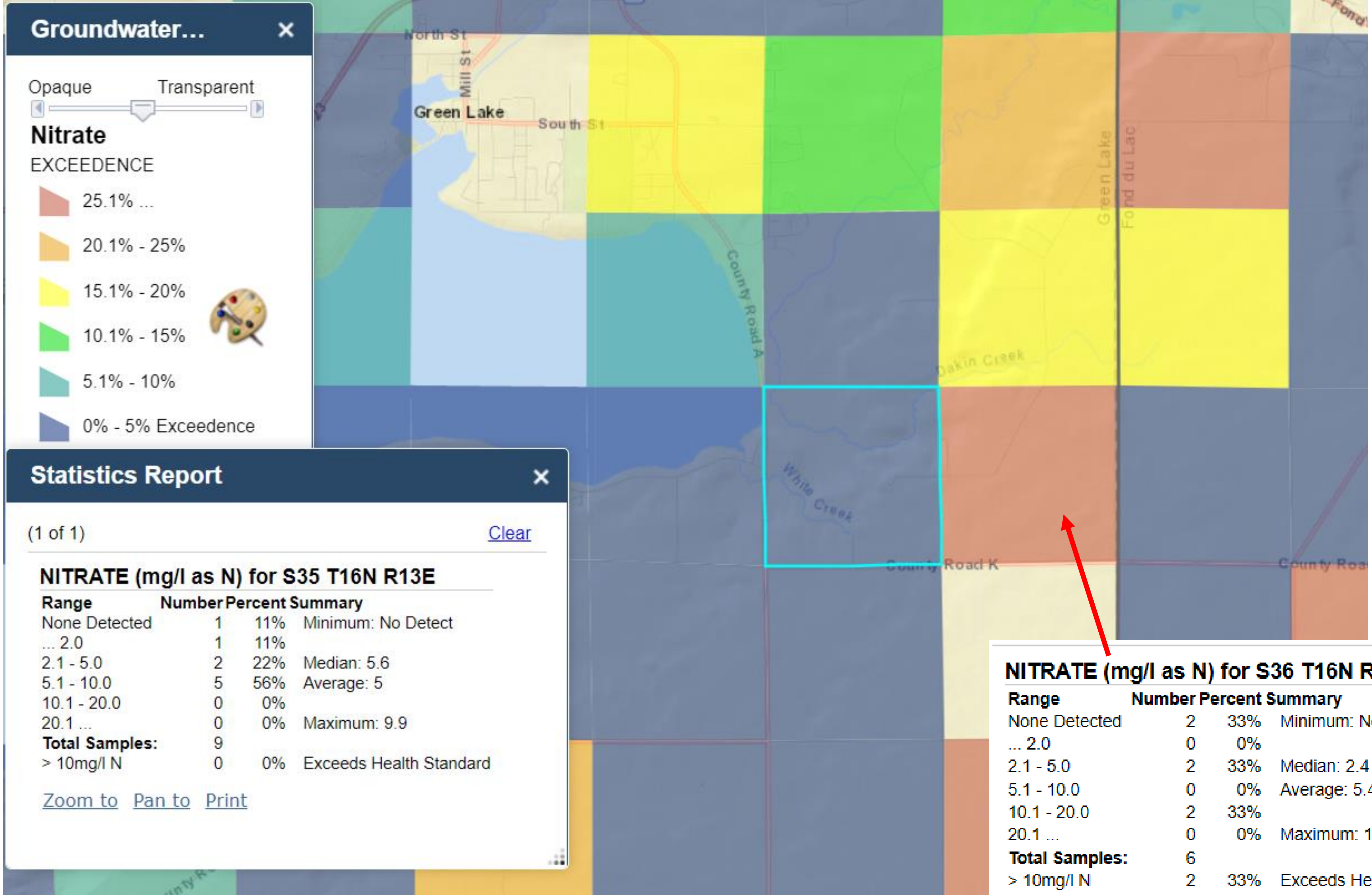
Joe

Joseph J. Rosnow
Water Supply Specialist- Bureau of Environmental Management
Cell Phone: (608) 220-1226
Email: Joseph.Rosnow@Wisconsin.gov



Groundwater...
Opaque
Transparent
Arsenic
AVERAGE
21 ...
16 - 20
11 - 15
6 - 10
... 5 ug/l (ppb)
None Detected
Statistics Report
(1 of 1)
Clear
ARSENIC (ppb) for S2 T15N R13E
Range Number Percent Summary
None Detected 1 50% Minimum: No Detect
... 10 0 0%
11 - 50 0 0% Median: 58
51 - 100 0 0% Average: 58
101 - 150 1 50%
151 ... 0 0% Maximum: 116
Total Samples: 2
> 10ppb 1 50% Exceeds Health Standard
Zoom to
Pan to
Print
North St
Mill St
Green Lake
South St
County Road A
White Creek
Oakin Creek
County Road K
Green Lake
Fond du Lac
W Oshkosh St
County Road KK
County Rd E


Groundwater...
Opaque
Transparent
Manganese
AVERAGE
1001 ...
501 - 1000
301 - 500
51 - 300
... 50 ug/l (ppb)
None Detected
Statistics Report
(1 of 1)
Clear
MANGANESE (ppb) for S35 T16N R13E
Range Number Percent Summary
None Detected 1 25% Minimum: No Detect
... 50 2 50%
51 - 300 0 0% Median: 14
301 - 500 0 0% Average: 961
501 - 1000 0 0%
1001 ... 1 25% Maximum: 3816
Total Samples: 4
> 300ppb 1 25% Exceeds Health Advisory
Zoom to
Pan to
Print
North St
Mill St
Green Lake
South St
County Road A
Oakin Creek
White Creek
County Road K
County Road KK
Green Lake
Fond du Lac
Fond du Lac St
W Oshk
County Rd E



Groundwater...

Opaque Transparent

Nitrate

EXCEEDENCE

- 25.1% ...
- 20.1% - 25%
- 15.1% - 20%
- 10.1% - 15%
- 5.1% - 10%
- 0% - 5% Exceedence

Statistics Report

(1 of 1) Clear

NITRATE (mg/l as N) for S35 T16N R13E

Range	Number	Percent	Summary
None Detected	1	11%	Minimum: No Detect
... 2.0	1	11%	
2.1 - 5.0	2	22%	Median: 5.6
5.1 - 10.0	5	56%	Average: 5
10.1 - 20.0	0	0%	
20.1 ...	0	0%	Maximum: 9.9
Total Samples:	9		
> 10mg/l N	0	0%	Exceeds Health Standard

Zoom to Pan to Print

NITRATE (mg/l as N) for S36 T16N R13E

Range	Number	Percent	Summary
None Detected	2	33%	Minimum: No Detect
... 2.0	0	0%	
2.1 - 5.0	2	33%	Median: 2.4
5.1 - 10.0	0	0%	Average: 5.4
10.1 - 20.0	2	33%	
20.1 ...	0	0%	Maximum: 16
Total Samples:	6		
> 10mg/l N	2	33%	Exceeds Health Standard

In reviewing a high capacity well application, the Department will consider on a case-by-case basis whether:

•A proposed high capacity well falls within a groundwater protection area [Wis. Stat. §§ 281.34(4)(a)1. and (5)(b); Wis. Admin. Code § NR 820.30]

•A proposed high capacity well results in > 95% water loss [Wis. Stat. §§ 281.34(4)(a)2. and (5)(c); Wis. Admin. Code § NR 820.32]

•A proposed well's construction degrades safe drinking water, degrades the groundwater resource or impacts public safety [Wis. Admin. Code § NR 812.09(4)]

•A proposed high capacity well, when combined with existing wells, will result in a significant environmental impact to a > 1 cfs spring [Wis. Stat. §§ 281.34(4)(a)3. and (5)(c); Wis. Admin. Code § NR 820.31; *See Lake Beulah*, 2011 WI 54, ¶¶ 39, 44-46, 62-63]

•A proposed high capacity well, when combined with existing wells, will result in a significant adverse environmental impact to a navigable water [Wis. Stat. §§ 281.11, 281.12, 281.34(2); *See Lake Beulah*, 2011 WI 54, ¶¶ 30-34, 39, 44-46, 62-63]

•A proposed high capacity well, when combined with existing wells, impairs a public water system. [Wis. Stat. §§ 281.11, 281.12, 281.34(5)(a); See Lake Beulah, 2011 WI 54, ¶¶ 39, 44-46, 62-63]

If any of these conditions is met in a particular case, the Department may consider adding specific conditions in the high capacity well approval, such as conditions addressing location, construction, pumping capacity, rate of flow, or amount of water that may be withdrawn. [Wis. Stat. §§ 281.11, 281.12, 281.34(2), (5)(a)-(d); Wis. Adm. Code § NR 812.09(4) and ch. NR 820; *Lake Beulah*, 2011 WI 54, ¶¶ 4, 39, 63]. If the Department conditions or denies a well approval, it will provide the applicant with a technical analysis of the scientific evidence it considered when it issued its decision on the application.

A description [PDF] of the Department's high capacity well application review process is available.

1. High Capacity Well Application Received by DNR

2. Potential Environmental Impacts

Does the Proposed High Capacity Well:

- ✓ fall within a Groundwater Protection Area ?
  (Within 1,200 feet to trout stream, outstanding or exceptional resource water body)
- ✓ result in 95% Water Loss?
- ✓ impact groundwater quality?

Do the Proposed High Capacity Well & Existing Wells :

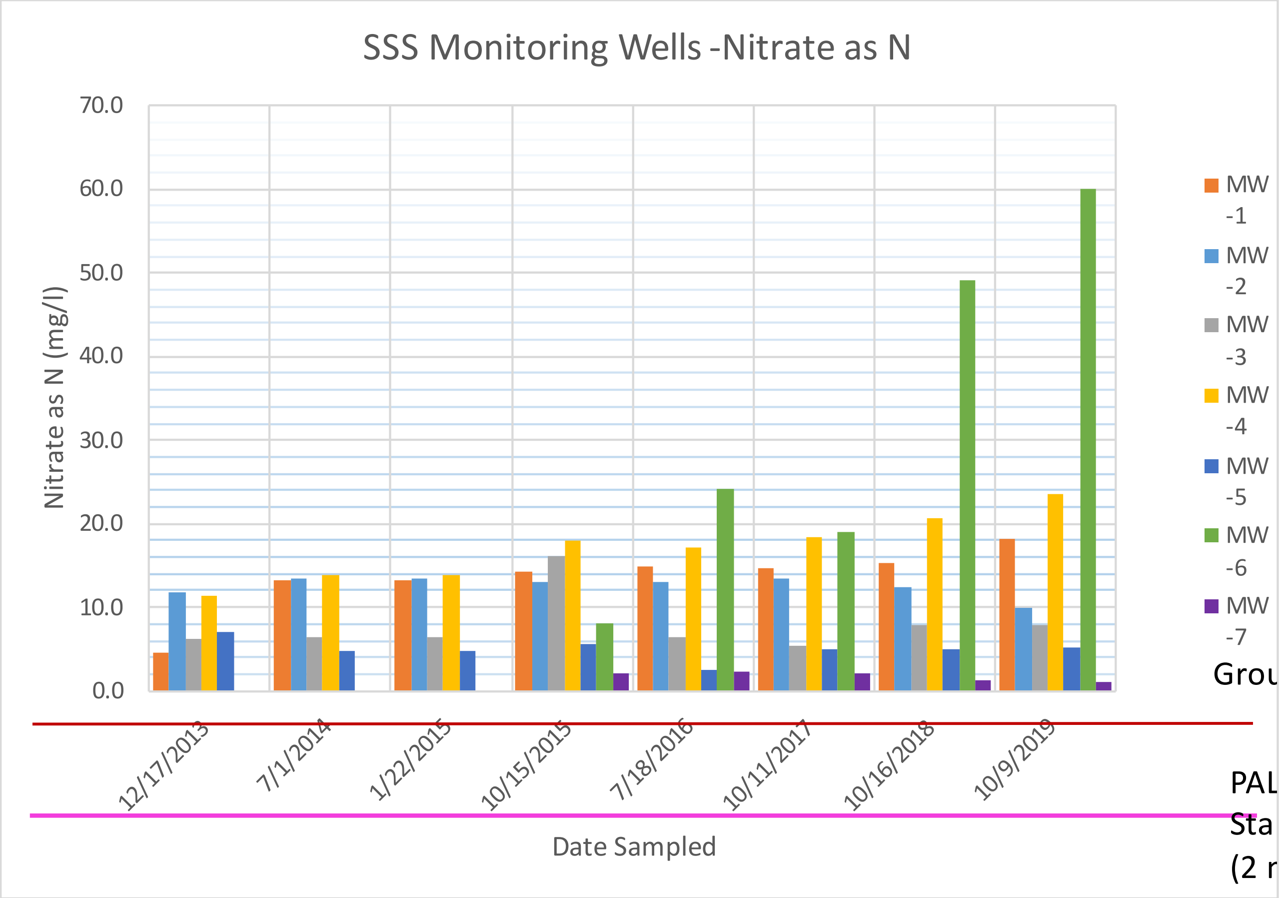
- ✓ impact a spring (> 1 cfs)?
- ✓ impact a navigable lake or stream?
- ✓ impact a municipal well?

Wis. Stat. 281.34, Admin. Code NR 812.09 & ch. NR 820

3. Potential Outcomes

- ✓ Approved as Submitted
- ✓ Approved with Conditions – Technical Support Document Provided to Applicant
- ✓ Denied-Technical Support Document Provided to Applicant

Nitrate is normally present in waters associated with mining as a result of blasting activities using ammonium nitrate or dynamite. [Remove Nitrogen in Mining Effluent Water (911metallurgist.com)]`



The graph on the left is from a Sand mine in western Wisconsin. The nitrate increased due to left over ammonium nitrate used in blasting. There are about 30 private wells downgradient of the site too. Blasting can also result in silt and rust in wells after the shot, as this is a common compliant, we receive.

State of Wisconsin
Department of Natural Resources
Box 450
Madison, Wisconsin 53701

DEC 30 1976

NOTE:
White Copy – Division's Copy
Green Copy – Driller's Copy
Yellow Copy – Owner's Copy

WELL CONSTRUCTOR'S REPORT
Form 3300–15
Rev. 10–75

1. COUNTY Green Lake
CHECK (✓) ONE: ☒ Town ☐ Village ☐ City — Name Brooklyn

2. LOCATION NW, NW ¼ Section SW Section 34 Township 16 N Range 13 E
OR – Grid or Street No. Street Name Brooklyn
AND – If available subdivision name, lot & block No.

3. NAME ☒ OWNER ☐ AGENT AT TIME OF DRILLING CHECK (✓) ONE
Elmer Lefke
ADDRESS Green Lake
POST OFFICE Green Lake

4. Distance in feet from well to nearest: (Record answer in appropriate block)

Building	Sanitary Bldg. Drain C.I.	Sanitary Bldg. Drain Other	Sanitary Bldg. Sewer C.I.	Sanitary Bldg. Sewer Other	Floor Drain Connected To: C.I. Sewer	Floor Drain Connected To: Other Sewer	Storm Bldg. Drain C.I.	Storm Bldg. Drain Other	Storm Bldg. Sewer C.I.	Storm Bldg. Sewer Other
10										

Street Sewer San.	Street Sewer Storm	Other Sewers C.I.	Other Sewers Other	Foundation Drain Connected to: Sewer	Sewage Sump	Clearwater Dr.	Clearwater Sump	Sewage Sump C.I.	Sewage Sump Other	Clearwater Sump	Septic Tank	Holding Tank	Sewage Absorption Unit
											40		Seepage Pit: ; Seepage Bed: 60 ; Seepage Trench:

Privy | Pet Waste Pit | Pit: Nonconforming Existing — Well, Pump, Tank | Subsurface Pumproom Nonconforming Existing | Barn Gutter | Animal Barn Pen | Animal Yard | Silo With Pit | Glass Lined Storage Facility | Silo w/o Pit | Earthen Silage Storage Trench Or Pit

Temporary Manure Stack | Watertight Liquid Manure Tank | Solid Manure Storage Structure | Subsurface Gasoline or Oil Tank | Waste Pond or Land Disposal Unit (Specify Type) | Other (Give Description)

5. Well is intended to supply water for: Home

6. DRILLHOLE

Dia. (in.)	From (ft.)	To (ft.)	Dia. (in.)	From (ft.)	To (ft.)
16	Surface	48			
6	48	142			

7. CASING, LINER, CURBING AND SCREEN

Dia. (in.)	Material, Weight, Specification & Method of Assembly	From (ft.)	To (ft.)
6	New Black P.E. Steel 18.97 - A53 A53M VSP	Surface	48

8. GROUT OR OTHER SEALING MATERIAL

Kind	From (ft.)	To (ft.)
Slurry Cement	Surface	48

9. FORMATIONS

Kind	From (ft.)	To (ft.)
Sandy Clay	Surface	15
Limestone	15	100
Sandstone	100	142
Water Bearing		

10. TYPE OF DRILLING MACHINE USED
☐ Cable Tool ☐ Rotary-air w/drilling mud ☐ Rotary-w/drilling mud ☒ Rotary-hammer w/drilling mud & air ☐ Rotary-hammer & air ☐ Reverse Rotary ☐ Jetting with ☐ Air ☐ Water

Well construction completed on Nov 29 1976
Well is terminated 16 inches ☒ above ☐ below final grade
Well disinfected upon completion ☒ Yes ☐ No
Well sealed watertight upon completion ☒ Yes ☐ No

11. MISCELLANEOUS DATA
Yield Test: 8 Hrs. at 10 GPM
Depth from surface to normal water level 26 Ft.
Depth of water level when pumping 28 Ft. Stabilized ☒ Yes ☐ No
Water sample sent to Oshkosh laboratory on Dec 7 1976

Your opinion concerning other pollution hazards, information concerning difficulties encountered, and data relating to nearby wells, screens, seals, method of finishing the well, amount of cement used in grouting, blasting, etc., should be given on reverse side.

Signature Wallace Clark Registered Well Driller
Complete Mail Address 5411 Aijon Rd. Osh R 3

This is the well on the property.