



Standards Oversight Council (SOC)

Developing effective technical standards that protect Wisconsin's natural resources

131 W. Wilson St., Suite #601, Madison, Wisconsin 53703
(608) 441-2677 || Fax (608) 441-2676 || socwisconsin.org

01 Verification of Land Features in Silurian Bedrock/Karst Areas Standard Team

MEETING NOTES

Monday, March 25, 2019 ▲ 9:30am – 3:00pm ▲

UW Division of Extension - 625 E. County Road Y, Meeting Room D, Oshkosh, WI

9:30 Welcome, Notes Approval (Kate, Team)

Goal: Welcome, introduce any members not present at last meeting or guests, adjust 2/28/19 draft meeting notes as necessary and approve.

- Review locations for paperwork, bathrooms, food/beverages.
- Overall meeting goal: mapping—including techniques, pitfalls, interpretations, karst issues
- Introductions of those who weren't present at last meeting (Dave Hart and Maureen Muldoon).
- **Present:** Kate Brunner, Mark Jenks, Rachel Rushmann, Joe Baeten, Travis Engels, Amy Haak, David Hart, Maureen Muldoon, Nathen Nysse, Tony Reali, Francisco Arriaga, Matt Komiskey, Jamie Patton (2nd ½), and Matt Woodrow.
Absent: Jason Nemecek,
Invited Guests: Esther Stewart from WGNHS, Bob Pearson and Dan Reid from WisDOT, John Luczaj, UW Green Bay
Public Guests: none
- Review 2/28 draft notes emailed a couple weeks ago: several questions were posed and some minor changes will be made before finalizing. If anyone has additional comments or questions, please contact Kate by Friday 3/29.
- Action items from 2/28 meeting were already completed via email or will be addressed throughout this meeting.

Bedrock Mapping Process, Resources and Components (Dave Hart and Esther Stewart, WGNHS)

Goal: Establish understanding of existing mapping processes, resources and components when completing a mapping project. Team discussion to follow.

1. What is mapping and the mapping process?
 - a. Maps are representations and simplification, not reality but skilled and experienced interpretations
 - b. Different maps offer different interpretations.
 - c. Depth to bedrock mapping update projects may use existing maps, Lidar, aerial photos, soil maps, farmer maps, DNR well logs, WGNHS logs and field confirmation
 - d. Surface topography may also tell us something about bedrock lithology.
2. Current map resources
 - a. There are depth to bedrock maps on statewide, regional, county and town scales.

- b. The county level maps of depth to bedrock in the area of Silurian dolomite have largely been updated. The scale of each varies and adjacent counties don't always match up: Door Co. maps use 4', 8', 16' and 32' depth intervals; Fond Du Lac Co. map has no shallow detail <20' (shading indicates depth to bedrock 0-20 feet); current Kewaunee Co. map uses depth to bedrock contours at 10, 50 and 100'; Waukesha Co. depth to bedrock map has no shallow detail <25' (shading for depth to bedrock 0-25').
- c. **Maps showing depth to bedrock <10 feet are unreasonable/unreliable without dense data collection.** Mapping certainty not always well communicated.
- d. Depth to bedrock maps don't necessarily show small outcrops or depressions, but depict generalizations.
- e. They reviewed some of the difficulties with interpretations for the WGNHS Town of Lincoln study. Some key points:
 - i. Built from well logs, including some outside of town boundary, geophysics, borings, visual observations, NRCS soil maps with interpretation (it's lithic soil and not depth to bedrock), farmer maps, and Lidar (high resolution, requires interpretation and verification).
 - ii. Final map has contour lines for **<10', 10-20', 20-50'**, etc.
- f. They reviewed some of the difficulties with interpretations for the WGNHS Dodge Co. depth to bedrock mapping project. Some key points:
 - i. There were complicated interpretations of features like escarpments, glacial drumlins, quarries and differing bedrock types.
 - ii. In Dodge County, depth to bedrock is not always depth to Silurian Dolomite—there are areas with no Silurian Dolomite.
 - iii. There were quality control issues with existing information—well logs may report incorrect or vague location, imprecise rock depth (+/- 2-foot accuracy for shallow rock but less accurate for deeper rock), "bedrock" is typically hard rock and not weathered rock, different drilling techniques and different boring purposes result in different results being reported. WGNHS had students reviewing well records and making corrections to database to improve that information. Student may interpret differently (and less accurately) than a geologist.
 - iv. Well logs are from biased locations—typically not on top of drumlins, clustered in specific areas.
 - v. They used NRCS soil data as a guide, but not depth data.
 - vi. They also used passive seismic data, aerial photo review, geotech and environmental boring logs (DNR), railroad information, and utility information. Field checks focused on areas along roads since gaining access to private property can be an issue. Human input was time consuming and tedious.
 - vii. This map is expected to be complete this year, with lowest contour line at **20' depth** to bedrock.
- 3. Some questions raised for future discussions:
 - a. Who is qualified to make data interpretations?
 - b. Who is managing the data?
 - c. Who owns the data?

- d. Given existing map resources, how are maps updated as more data becomes available?
With this standard, we'll have new verification points all the time. Snap maps typ. updated once a year.

GPS Accuracy (Travis Engels)

Goal: Review examples of GPS point accuracy and discuss issues.

- Kewaunee County has an ordinance adopting NR 151 targeted performance standards and a detailed methodology for field probing. The county has started performing field verification. Maps used as a starting point, but not field specific.
- Currier at UWGB has also done some depth to bedrock field verification studies as part of contract with the county.
- Kewaunee Co and UWGB probing methodologies were very similar but not identical. For example, the county reduced their probing interval for greater accuracy when investigating potential areas for manure restrictions 0-24" depth to bedrock. They would probe a radius around each shallow point.
- County has probed 1,960 points. UWGB has probed 3,206 points, some on same fields as the county. Some probe points mapped at the same location had different depth results even though data was collected in same month with similar conditions. **Discrepancies were attributed to different GPS systems** which had different levels of accuracy (though both were using the same GPS projection). County GPS locating is using a more accurate device, which ties into WISCOR system.
- The county also used GIS application on their cell phones to update the GIS map in real-time so users in the office and field are seeing the regular updates.
- Hand probing methodology will be discussed in more detail at next meeting. Some initial discussion:
 - It's hard work.
 - Team considers issues with repeatability—would results change with soil moisture or other factors?
 - If shallow refusal <24", they'll step out on 10 foot radius for confirmation.
 - Refusal on a boulder or tight sand feels different from bedrock, hand probing allows you to tell the difference.
 - If they are in a field with furrows, they flatten the area where probing so at a middle point for ground surface.

Karst/Shallow Fractured Bedrock (Robert Pearson and Dan Reid (geologists at WisDOT))

Goal: Establish better understanding of karst issues, identification methods, mapping, environmental considerations, contract specifications, field investigation methods, and construction/maintenance issues. Team discussion to follow.

- Bob emailed many resources which Kate forwarded to team. Keep these in mind as they may be helpful in the future as reference resources. They have handouts of three of these—WGNHS

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and WisDOT karst inventory forms and a sheet of karst terminology across different agencies. Consistent terminology and definitions are important.

- Team hears a summary of WisDOT experiences with karst and shallow fractured bedrock across the state. They provide information on issues with karst, identification methods, mapping, environmental considerations, contract specifications, field investigation methods, and construction/maintenance issues. Some key considerations and advice are below:
 - What are scale factor objectives?
 - Maintain consistent documenting and reporting methods in logs and field observations
 - Be aware of emerging technology
 - Consider crowdsourcing the information
 - Develop data management system – sharing data would be valuable
 - Use both old and new data sources
 - WisDOT has been creating a database of shallow boring logs, though it is not available to the public (yet?).
- WisDOT has identified and mapped fractures, caves and sinkholes in karst areas near roads and bridges—for example, along State Hwy 57 from Green Bay to Sturgeon Bay. They used a variety of existing maps, aerial photos, drones with IR or thermal cameras, boring logs, watershed reports, university researchers, local staff (DNR, ag, DOT), in-person observations.
- Detection of bedrock surface and karst voids can be done with geophysics or seismic refraction. These can be hit or miss results, especially when soil has rock fragments. Geophysics requires knowledgeable operator to interpret the data.
- Voids can be filled (cement or sand fill) though you may not be sure where the fill is headed.

Kewaunee County Depth to Bedrock Mapping (John Luczaj, UW Green Bay)

Goal: Gain basic understanding of sources and methodologies for mapping techniques being used by UW Green Bay.

- UWGB was contracted by DNR, in part to prepare an updated depth to bedrock map for Kewaunee County.
- It is anticipated that this map would go into a geodatabase, to be used as a resource to guide future field study. They had 12,029 data points and 10,781 points which intersected bedrock or probably bedrock with acceptable confidence/geologic data.
- They started with existing maps: statewide, eastern WI, and Kewaunee County. Each had differing contour intervals and some different interpretations.
- Also used well construction logs for county and 2-mile surrounding buffer zone, county LWCD data on exposed bedrock and hand probing results, UWGB and DNR information on bedrock exposures and quarries, logs from utilities (Wind turbines, DOT). Some issues:
 - Well logs are of varying quality, reliable only to +/- 1' (some only to 5')
 - Some wells don't reach bedrock or don't have geology.
 - Location of well not always accurate.
 - Hand probing may have erroneous results due to soil conditions/misinterpretation
 - Variable data density

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- Variable surface expression (glacial in southern Kewaunee Co.)
- Data points were contoured with interpretation using control points and break lines (e.g., Kewaunee River and bedrock hill flanks)
- They did not use geophysics or the Clayton data points (possible exaggeration of bedrock exposure).
- Additional calculations made with Lidar (ground surface and bedrock surface).
- Their final map will be county scale (1:100,000) and have shading for depth to bedrock at 0-5 feet and 5-20 feet. **It is not intended for field scale interpretation.**
- His research identified some areas where additional refinement is recommended via field verification. He suggests 1 acre density.
- The updated map isn't yet finalized but they are submitting it soon.

Next Meeting Topics and Plan of Action (Kate, Team)

Goal: Identify and understand the topics, concerns, and goals for next meeting. Review Action Items and agenda items for next meeting.

- We discuss some possible next steps and next topics:
What are varying field verification methodologies? Discussion will include pros and cons of the methodologies including availability, qualifications to operate, cost, variability, specifications, use by depth implications, etc.
 - Geophysics:
 - GPR, EM surveys, Resistivity, Aerial geophysics (airborne), microgravity
 - Team discusses possible presenters.
 - Hand probe
 - Direct push probe, like Geoprobe
 - Backhoe
- Though not for the next meeting, we could eventually do a field trip to observe some techniques
- Next meeting is April 25 in Oshkosh, same building
- Assignments:
 - **Kate**: finalizes 2/28 notes and post online
 - **Kate**: prepare draft meeting notes, reviewed by **Rachel and Mark**, then reviewed by full **Team**
 - **Kate, Rachel and Mark** will set agenda for next meeting and presenters.

3:00 End