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Agenda and Abstracts

2008 Fall Meeting

Starved Rock Lodge, Utica, Illinois
October 22, 2008

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Illinois Groundwater Association
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Starved Rock Lodge, Utica, Illinois

8:30–9:00 Registration

9:00–9:30 Opening Remarks, **Dan Horvath**, IGA Chair
Presentation of Award to Kane County
25th Anniversary commemoration

9:30- 10:00 **Bill Dey,** *Illinois State Geological Survey,* Hydrogeologic mapping for groundwater resource investigations in Kane County, IL

10:00-10:15 **BREAK**

10:15-10:30Annoucements/Updates

10:30-11:00 **Sam Panno**, *Illinois State Geological Survey,* Mega-Dairy Sites in Jo Daviess County: An Island in a Sea of Karst?

11:00-11:30 **Joyce Harris**, *Illinois State University*, Recovery of hyporheic function in modified agricultural streams over time, Headwaters of the Mackinaw River, Illinois, USA

11:30-1:00 **Lunch/Executive Committee Meeting**

1:00-1:30 **Paulo De Sa'Rego,** *CH2M Hill*, Digital Soil Logging: Using PDA's for Field Data Collection

1:30-2:00 **Tom Holm and Steve Wilson**, *Illinois State Water Survey*, Spatial Variability of Arsenic in Glacial Aquifers

2:00-2:05 Closing Remarks: **Dan Horvath**, IGA Chair

2:05-4:00 Fieldtrip to Matthiessen State Park, **Bill Shields** *Illinois State University* and Mike Phillips *Illinois Valley Community College*

ABSTRACTS

(In order of presentation)

Hydrogeologic mapping for groundwater resource investigations in Kane County, IL

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The population of Kane County was 317,471 in 1990, and 404,119 in 2000, an increase of about 27%. The Kane County population is projected to grow to 710,000 by 2030. In anticipation of the need for reliable information on available water resources, the County has contracted with the Illinois State Water Survey (ISWS) and Illinois State Geological Survey (ISGS) to assess these resources. The overall goal of this assessment is to provide Kane County with the scientific basis for developing policies and management strategies for its water resources. Staff at the ISGS compiled a database for Kane County and nearby vicinity of 40,138 water-well and boring records and other point data. Each record was individually assessed for the quality of the geological information and the reliability of the reported location. Records from 4,830 wells and borings were selected and used in generating a three-dimensional, geologic model of the county. Emphasis in the modeling was placed on Quaternary deposits and shallow bedrock geology. The main purpose of the model is to provide a reliable representation of the geology and hydrogeology of Kane County that can be used for county-scale planning. The geologic model data have been used to produce maps of the county depicting major Quaternary aquifers, bedrock geology, aquifer sensitivity and, and geologic cross sections. The ISWS have used the model for input for groundwater flow modeling. Results from that modeling are due out later this year.

Mega-Dairy Sites in Jo Daviess County: An Island in a Sea of Karst?

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In February 2008, the ISGS was asked to prepare a report on the state of karst terrane in northeastern Jo Daviess County by the Jo Daviess County Board. This action was precipitated by an application for the siting of two Mega-dairies in the county by a California firm. The company proposed constructing two large dairies that would house 6,850 animals at each site. The next month the ISGS was asked to update the report for the Illinois Attorney General's Office. Subsequent to those reports, the dairies have proven to be highly controversial and local landowners are concerned about potential contamination of their groundwater supplies.

Jo Daviess County lies within the Driftless Area of northwestern Illinois, so-called because of the lack of glacial drift overlying bedrock in the area. Bedrock underlying the proposed dairy sites consists of Middle and Upper Ordovician carbonate-dominated Galena-Platteville Group and the shale-dominated Maquoketa Group. Carbonate rocks of the Galena Group overlie those of the Platteville Group and are composed of fine-grained limestone and dolomite. Thin remnants of Maquoketa shale overlie these carbonate rocks in many places. Most of Jo Davies County has been characterized as karst based on the dominance of creviced carbonate bedrock (Weibel and Panno, 1997). This creviced carbonate bedrock is an important aquifer for municipal and private wells throughout the county. The dairy sites are underlain by this carbonate bedrock that is overlain by 5 to 20 feet of unconsolidated materials (some of which includes Maquoketa shale). Aerial photographs of the sites taken in 1947 revealed sinkholes in an undeveloped section of land immediately adjacent to one of the proposed sites. Subsequent agricultural activities on this land have totally obscured those features. Further, contamination of the aquifer (probably from road salt, private septic systems, and N-fertilizers) at depths of hundreds of feet suggest that the karst aquifer is highly susceptible to surface-borne pollutants, contains a well-connected fracture system, and has rapid groundwater travel times. Given that the planned waste lagoons containing over 100 million gallons of waste will be sitting above the karst aquifer, the potential for groundwater contamination from spills and/or seeps of animal waste would be very high.

The position of the California firm is that the area is not karst, based on roughly 5 boreholes drilled into bedrock at each site. Because the boreholes did not intersect any karst features, they maintain that there are no karst features beneath the dairy sites. They made this statement in spite of the fact that bedrock exposures literally surrounding the sites contain abundant solution-enlarged crevices. Engineers and a geologist working for the California firm contend that the crevices are due to blast damage from quarry operations, and backhoe marks, and that the sinkholes are actually hog wallows, tile blowouts, or unmapped "dogholes" from early mining efforts. Based on their site characterization efforts, the IL Department of Agriculture has granted permission for construction of a dairy on one of the sites; a ruling on the other site is pending. Local residents are attempting to stop construction through litigation; hearings are scheduled through October 20 of this year. This presentation will chronicle the efforts to resolve this issue and describe the role played by the Illinois State Geological Survey in the field and in the courtroom.

Recovery of hyporheic function in modified agricultural streams over time, Headwaters of the Mackinaw River, Illinois, USA

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We are comparing the denitrification potential of hyporheic sediments in three agriculturally modified streams that have last experienced channel maintenance at various times over the past 30 years to an unmodified stream segment. Our goal is to identify any temporal trends in the recovery of denitrification potential following a modification/maintenance event. Does the frequency of maintenance events affect or limit the recovery of denitrification in the stream? Hyporheic samplers were installed in the upwelling and downwelling zone of a selected riffle at each location and in the adjacent point bar. Sampling occurred between May and October in an attempt to capture seasonal influences and varying flow conditions. Samples were analyzed for nitrate, ammonium, sulfate, chloride, and DOC. Field parameters include dissolved oxygen and temperature. Bromide tracer tests were conducted at each site to characterize subsurface travel times beneath the riffles. Finally, detailed cross sections and measurements of thickness of coarse-grained sediments overlying low permeability glacial till have provided detailed information on the hyporheic zone. Current results indicate that under low to moderately high flow conditions little to no observable loss of nitrate is occurring across the riffle at each location including the unmodified section. Occasional decreases in nitrate concentrations in the hyporheic samplers were observed but I could not identify a trend between discharge and nitrate loss. It is likely that denitrification is limited in the 3 modified segments by residence time. Tracer test results indicate travel times on the order of minutes in all three modified segments. The flow regime at the unmodified segment is much more complex. The unmodified segment underwent the tracer test during very low conditions; therefore, bromide was only observed in the shallowest samplers. Breakthrough of bromide in the tail sampler occurred approximately 2 hours after injection. Tracer test data also suggests the presence of longer hyporheic flow paths evidenced by dilution of the bromide signal in the upwelling zones of the three modified segments. Water quality analyses do not support groundwater as a contributor to this dilution. The unmodified segment also experienced dilution in the upwelling zone as well as in the downwelling zone. However, water chemistry indicates groundwater input in both cases. Ultimately, no temporal trends in denitrification were identified between the sites. Adjusting maintenance schedules to frequencies of 30 years or less would not allow for greater denitrification rates to occur in these streams.

Digital Soil Logging: Using PDA's for Field Data Collection

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Geological field work requires observation, the collection of various data, and -- perhaps most importantly -- the rigorous recording of this information in a concise and systematic way. Intensive field studies generate large volumes of data, and the utility of this data for further analysis is largely dependent on its ability to be interpreted, standardized, and communicated to others. As we are firmly in the "digital age", the utility and power of technologies such as GIS mapping, 3D visualization, and computer modeling cannot be ignored. However, integrating traditional "pen and paper" soil logs with the databases required for any digital publishing or analysis requires the digitization of soil logs and related field data. Directly collecting field data in a digital format is desirable in order to bypass the time-consuming process of manual "data-entry" and minimize human error in collecting, verifying, and transcribing the information. Using "personal digital assistants" (PDA's) in conjunction with industry-standard software (PLog) offers a fairly low cost, flexible, and user-friendly solution for both geotechnical and environmental soil logging. Ruggedized PDA's are used in the field for direct digital data collection of soil descriptions as well as various environmental and geotechnical measurements and well construction information. The PDA's are then synchronized to a database compatible with established geological software (gINT). This software generates customizable reports including boring logs, well completion diagrams, and cross sections. The database can also used with GIS and visualization software such as EVS/MVS. An overview of the PLog digital soil logging software will be presented along with examples of logs and diagrams created with gINT. A brief "virtual" demonstration of the field logging procedure will follow. Finally, examples of GIS, data visualization, and 3D models created using digitally collected soil data will be shown.

Spatial Variability of Arsenic in Glacial Aquifers

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Recent research by the Illinois State Water Survey and others found that arsenic levels in private wells can be difficult to predict, even in areas where elevated arsenic levels are known to occur. Sampling to date has generally been over large areas, with sample points a kilometer or more apart, evaluated at a county or township scale. However, there was one cluster in which a well with 190 µg/L As was located 200-400m from wells with 2 and <0.5 µg/L As (the detection limit). In another cluster, two wells with <0.5 and 44.0 µg/L were on adjoining properties ~100m apart. In the present work, three sets of private wells were selected, in glacial aquifers where previous sampling has shown elevated arsenic in close proximity. In each area, the wells are all within a radius of 1-2 kilometers. The distance between wells is on the order of 10s to 100s of meters. Between 10 and 20 wells in each area are being sampled. Even on this smaller scale, arsenic concentrations ranged from undetectable to ~100 µg/L. The sampling results and their implications will be discussed.