### Hydrogeology of Ledgeview

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Dr. Maureen Muldoon, UWO Geology Dept Ledgeview Town Board May 29, 2018



- Watersheds & Water Cycle
- Groundwater Basics
- Geology
- Aquifers
- Existing Water Quality

# Water Cycle

- Processes
  - Evaporation
  - Transpiration
  - Precipitation
  - Infiltration
  - Groundwater
     flow
  - Overland flow
  - Stream runoff

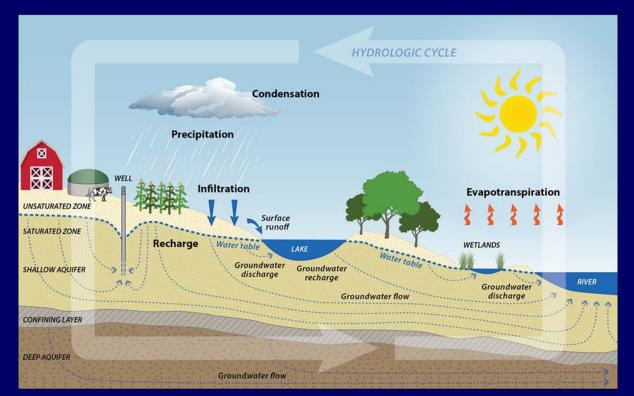
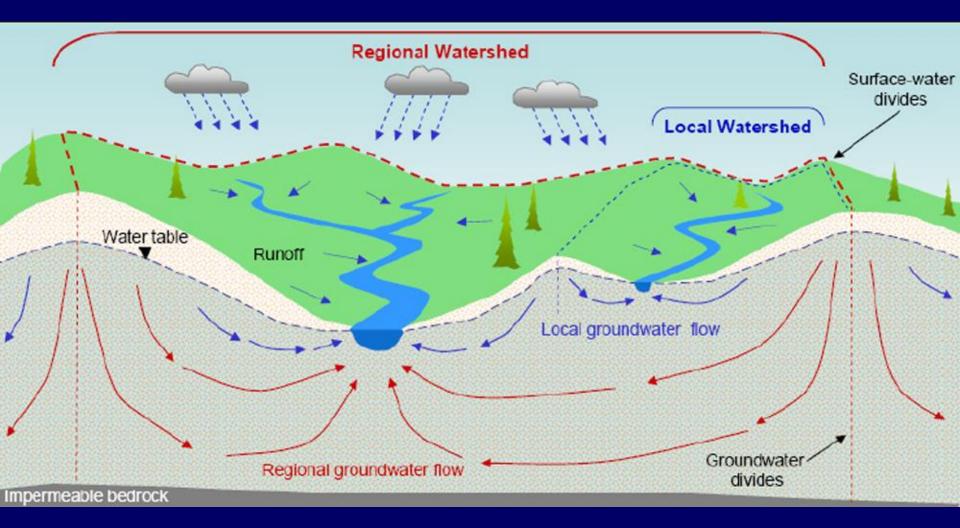


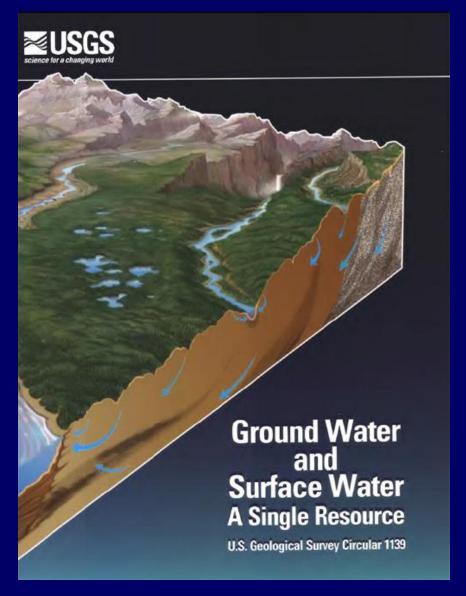
Figure from WI Geological and Natural History Survey

### Watersheds & Water Cycle



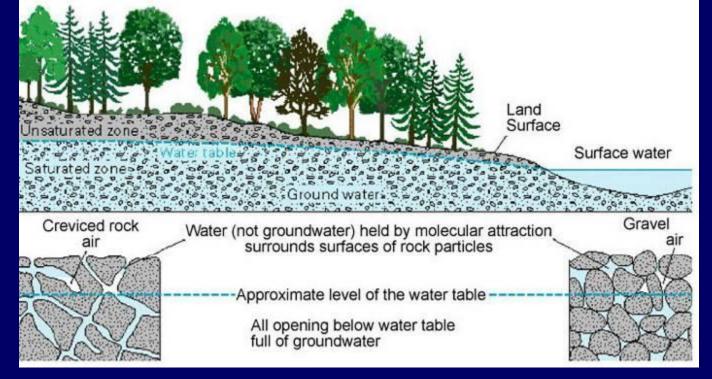
## GW & SW: A Single Resource

- USGS Circular 1139
   http://pubs.usgs.gov/circ/circ1139/
- The hydrologic cycle and interactions of ground water and surface water
- Chemical interactions of ground water and surface water
- Effects of human activities on the interaction of ground water and surface water

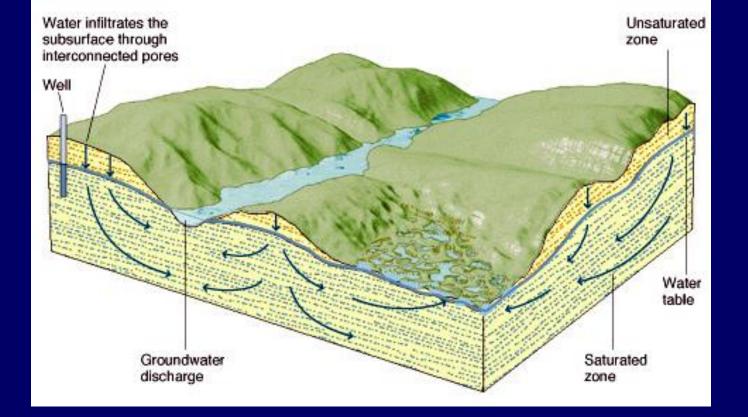




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- Groundwater Recharge -- water that seeps past the root zone and makes it to the water table (top of the saturated zone)
- Aquifer a geologic unit that can store and transmit usable quantities of water to a well
- Water table is boundary between unsaturated and saturated zones
  - Unsaturated zone pores spaces contain both air and water
  - Zone of saturation pores spaces are filled with water



- Groundwater flow is from areas of higher hydraulic head to areas of lower hydraulic head.
- Recharge area -- area where precipitation infiltrates and recharges the groundwater flow system. Groundwater flow is generally downward in these areas.
- Discharge area -- area where water exits the aquifer. In this diagram streams and lakes are the discharge areas.

## Water Elevations in the Upper Aquifer

- From Hydrogeology and Ground-water Use and Quality, Brown County, Wisconsin
- By J.T Krohelski
- WI Geological & Natural History Survey Information Circular 57, published 1986

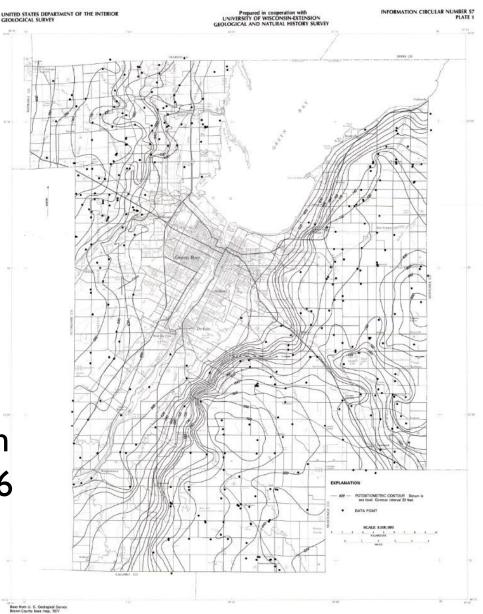
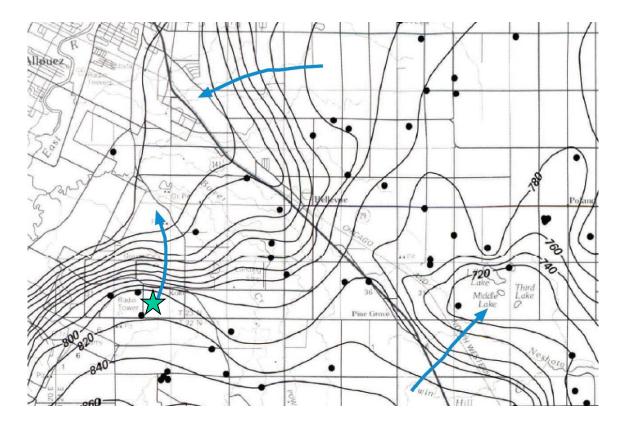


PLATE 1. POTENTIOMETRIC SURFACE OF UPPER AQUIFER, BROWN COUNTY, WISCONSIN, 1980

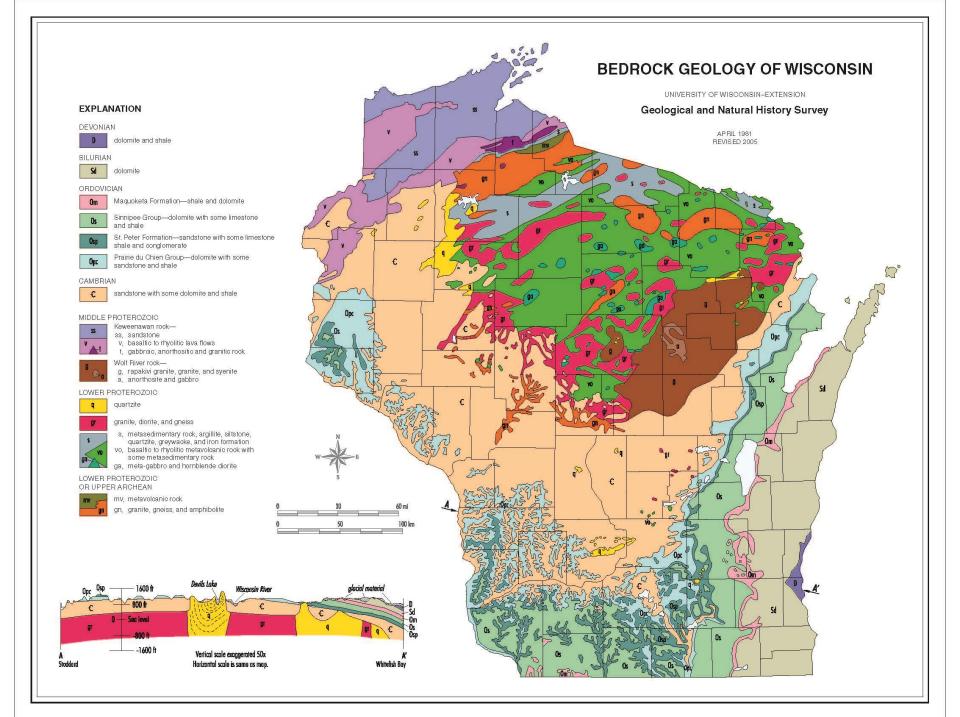
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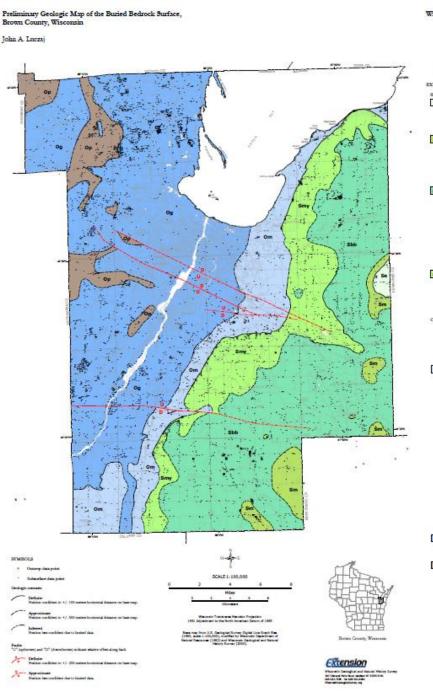


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Bedrock Geology

- by John Luczaj, UWGB
- Available from WI Geological & Natural History Survey (WGNHS)
- Open-File Report
   2011-02



### Wisconsin Geological and Natural History Survey Open-File Report 2011-02

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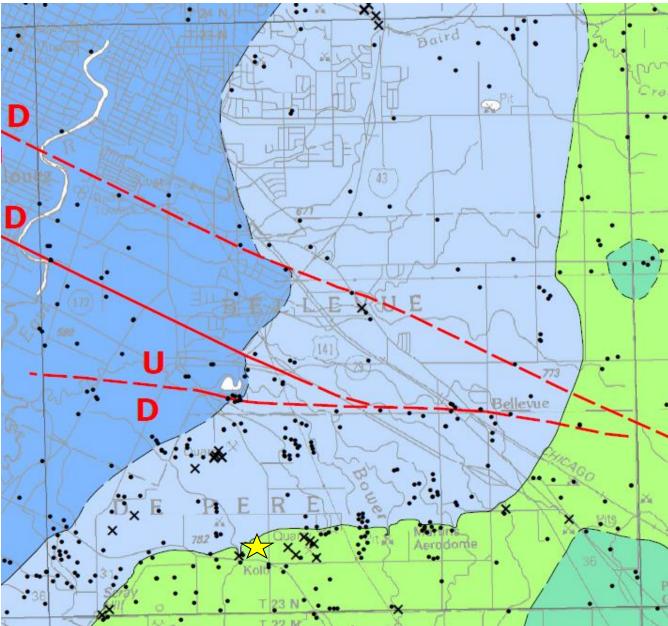
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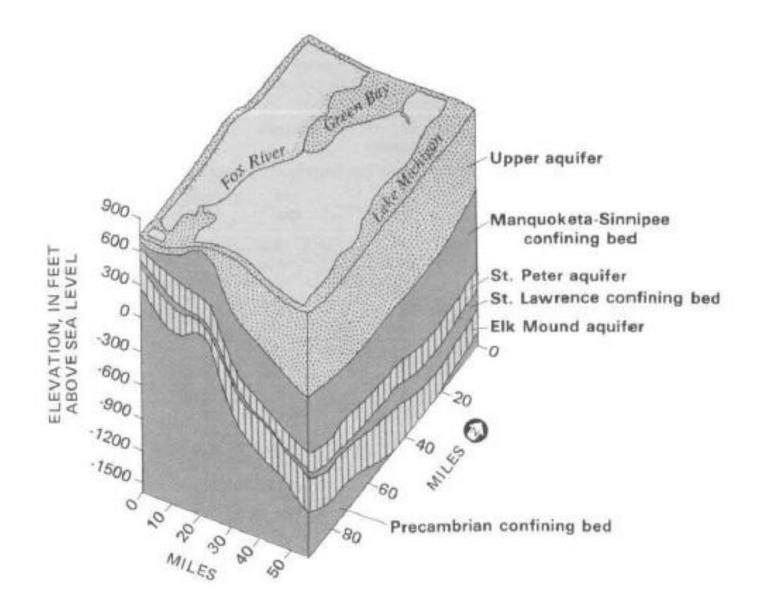
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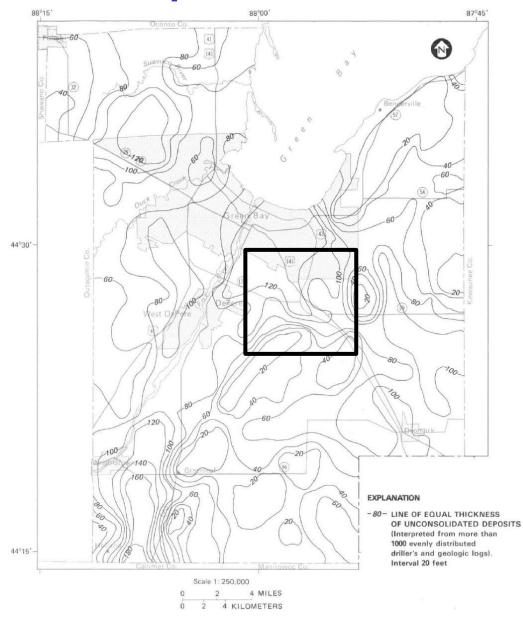
## Geology Detail





From Hydrogeology and Ground-water Use and Quality, Brown County, Wisconsin By J.T Krohelski, WGNSH Information Circular 57, published 1986

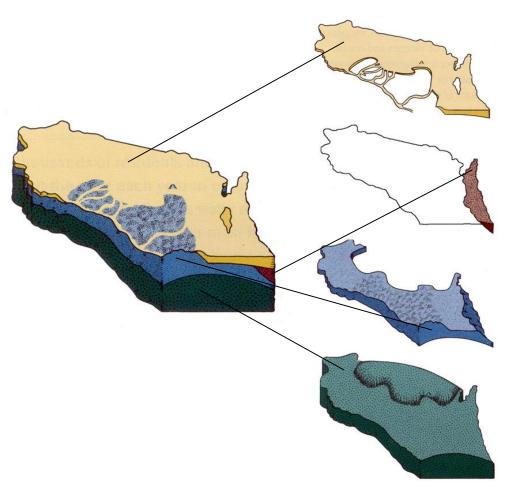
### Depth to Rock





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## Wisconsin Aquifers

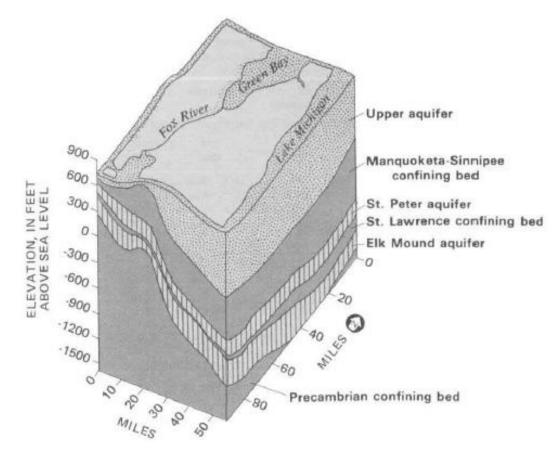


- Sand & gravel aquifer
- Silurian dolomite aquifer
- Sandstone & dolomite aquifer
- Crystalline bedrock aquifer

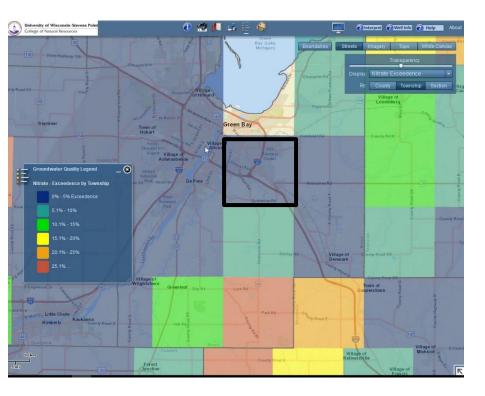
Image from DNR Magazine supplement: Groundwater Wisconsin's Buried Treasure

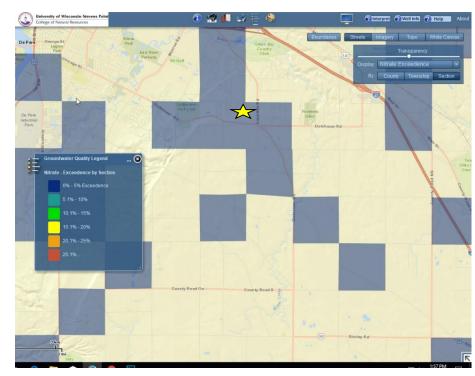
### **Domestic Wells**

- Looked at wells in section 31, where farm is located
- Shallow wells (~60 feet or less in depth)
  - Sand and gravel
  - Silurian Dolomite
- Deep wells (>500 ft)
  - Extend below the Maqouketa shale



### Existing Water Quality Data: Nitrate-N



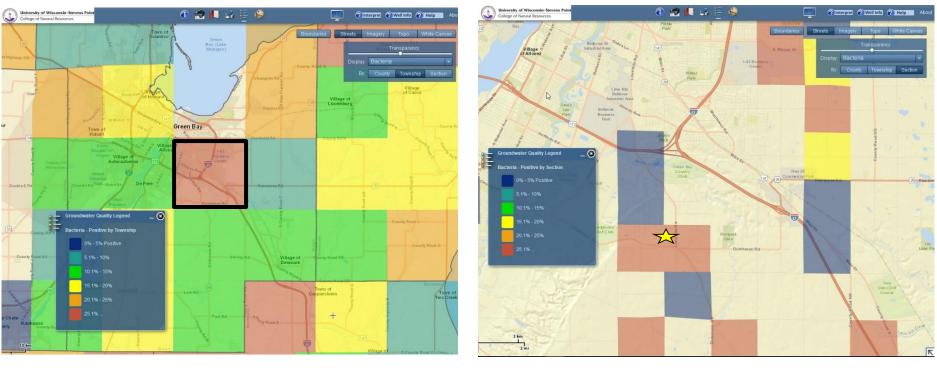


### By Township

By Section

Data from the UW Stevens Point Well Water Quality Viewer https://www.uwsp.edu/cnr-ap/watershed/Pages/WellWaterViewer.aspx

### Existing Water Quality Data: Bacteria



### By Township

By Section

Data from the UW Stevens Point Well Water Quality Viewer https://www.uwsp.edu/cnr-ap/watershed/Pages/WellWaterViewer.aspx

### Summary

### Geology

- Near the contact of the Silurian dolomite and the underlying Maquoketa shale
- Soils in the area of the farm site are generally <20 ft in thickness</li>

### Groundwater

- Domestic wells tap both the shallow aquifer (sand & gravel or Silurian dolomite) and the deeper limestone and dolomite aquifer
- Published map suggests that groundwater flow is to the north in the area of the farm site
- Existing water-quality data do not show significant impacts from nitrate, but that bacteria detections may be elevated