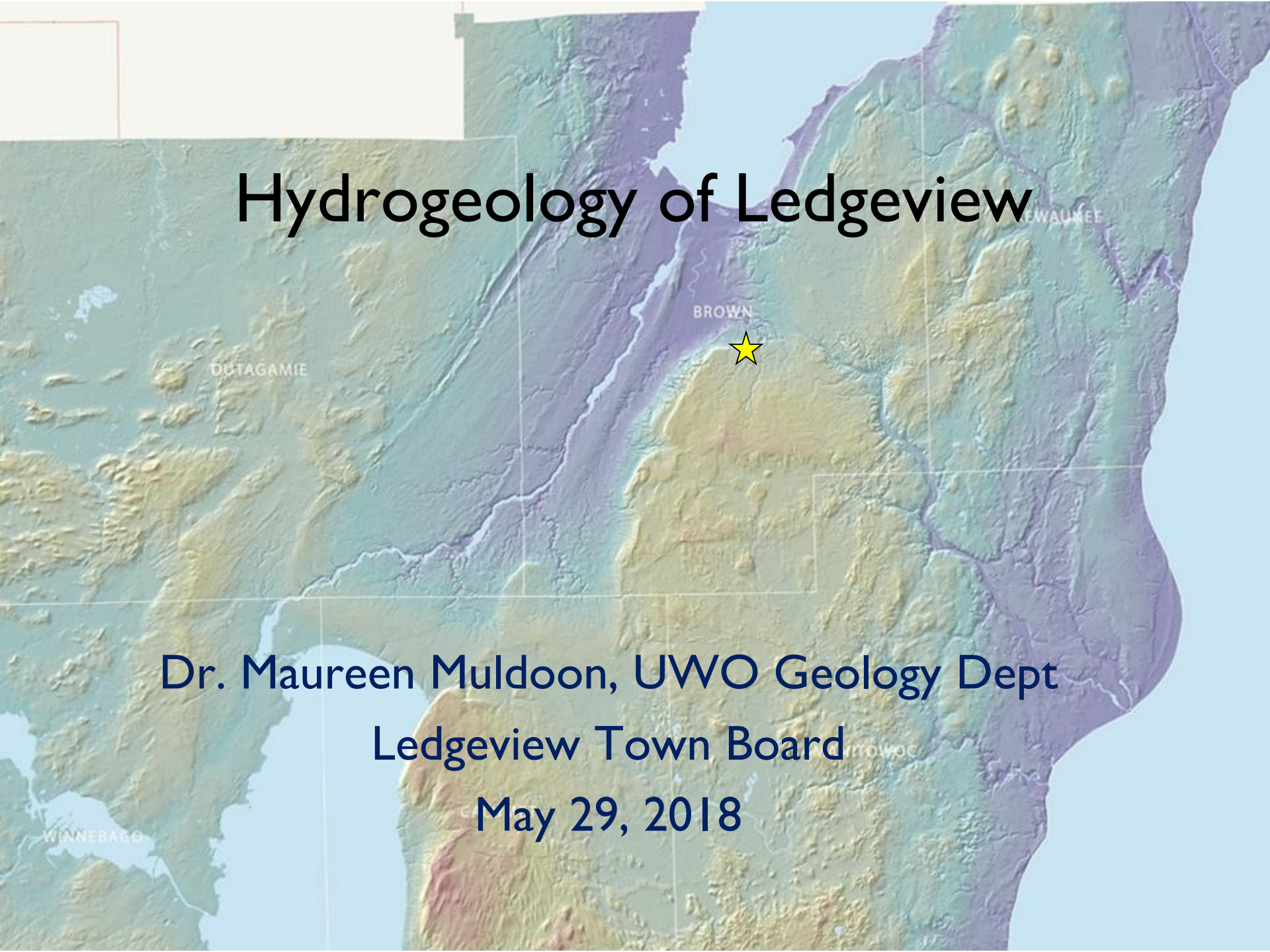


Hydrogeology of Ledgeview

Dr. Maureen Muldoon, UWO Geology Dept

Ledgeview Town Board

May 29, 2018

Outline

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

Water Cycle

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

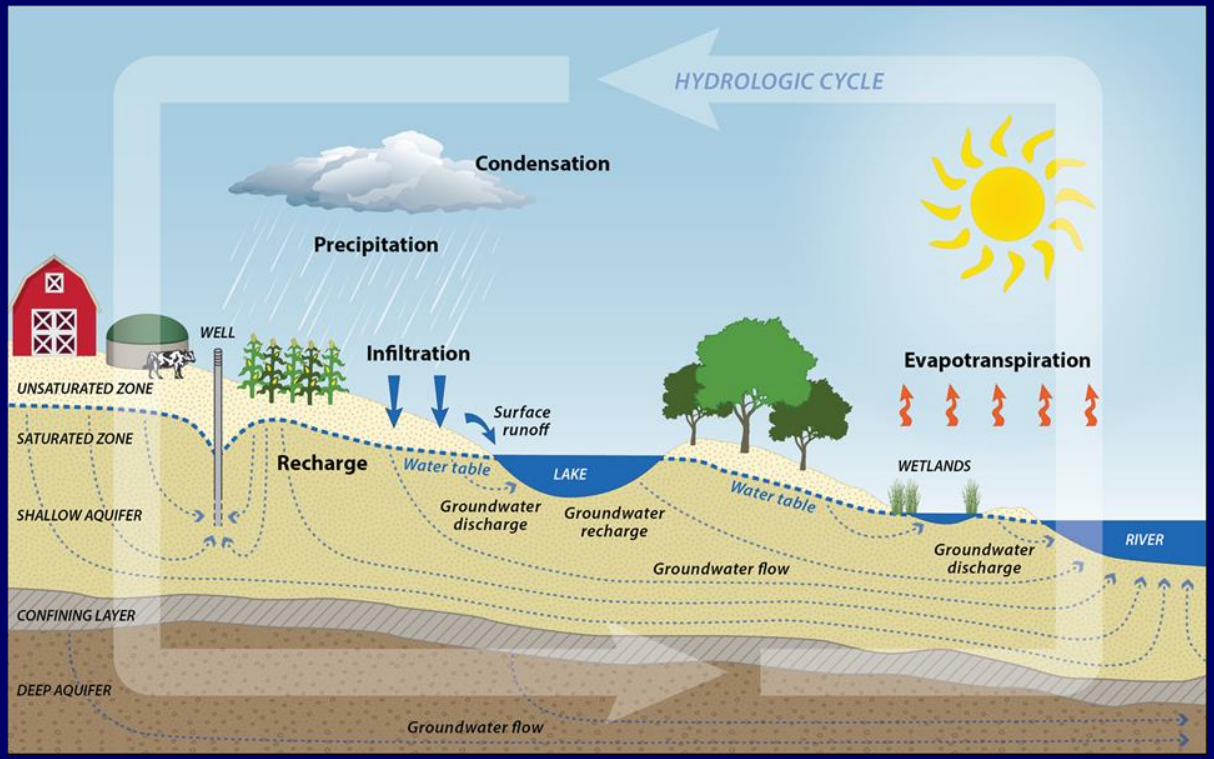
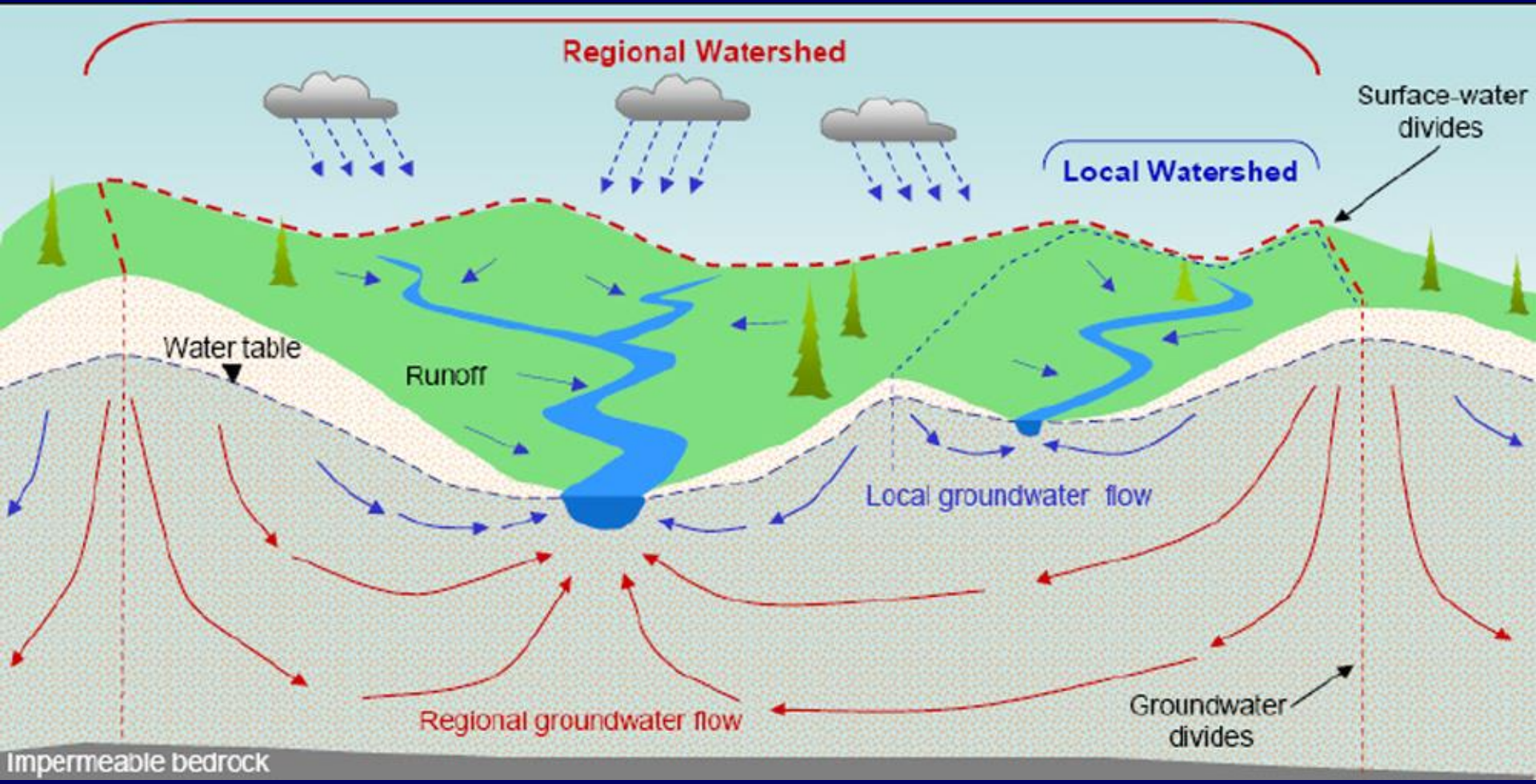


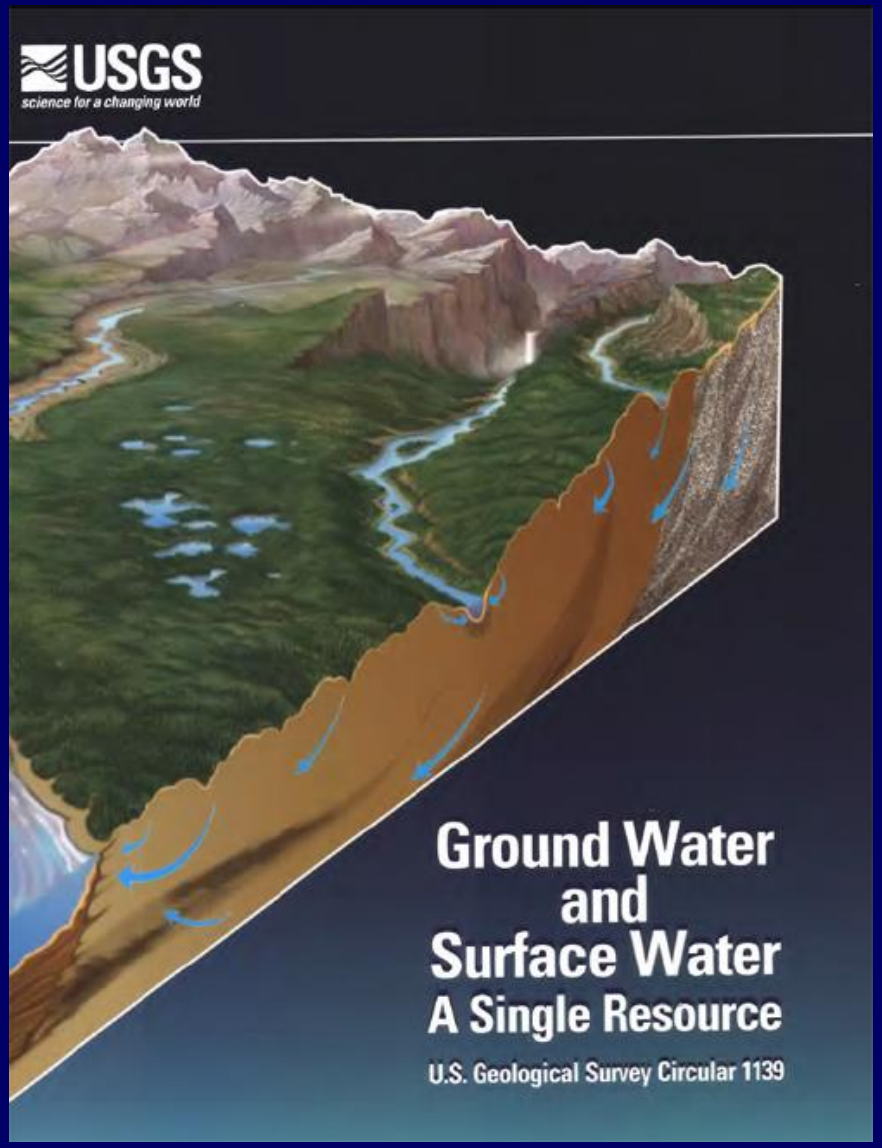
Figure from WI Geological and Natural History Survey

Watersheds & Water Cycle



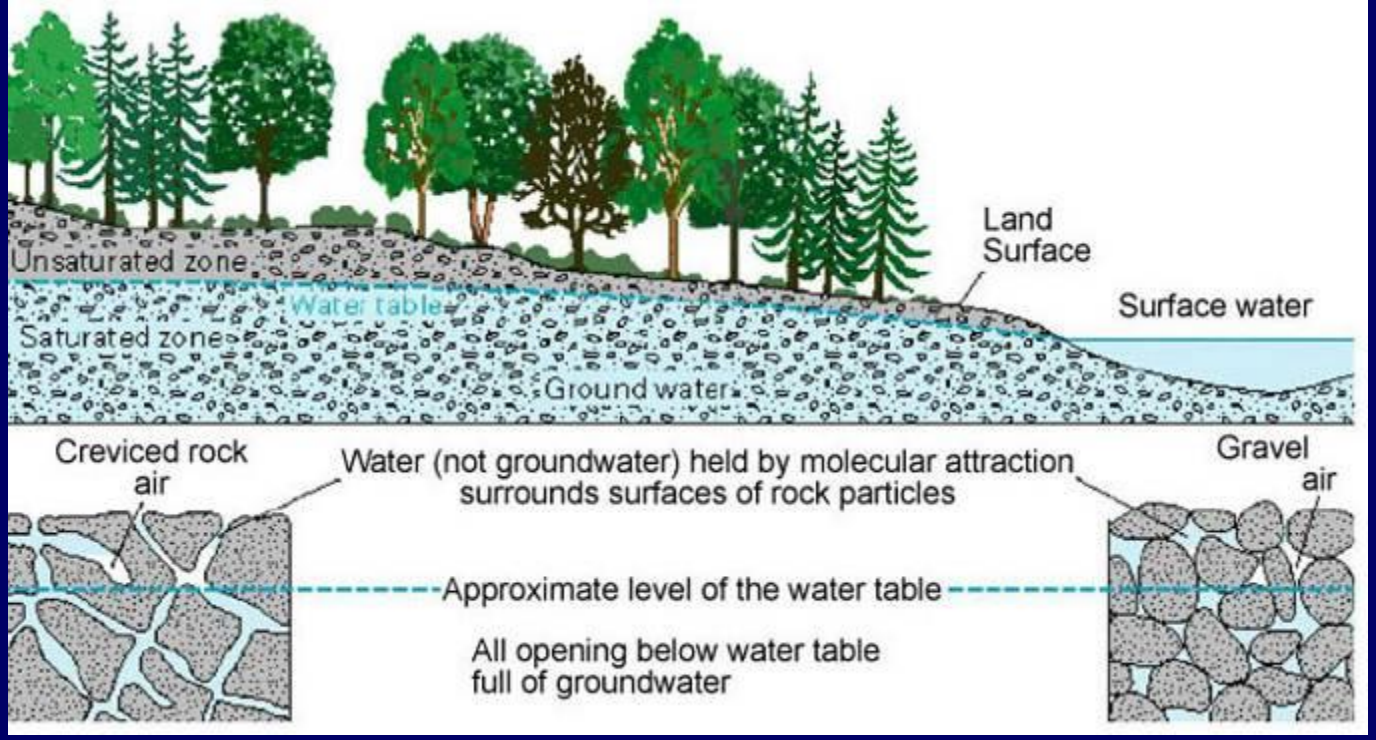
GW & SW: A Single Resource

- 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

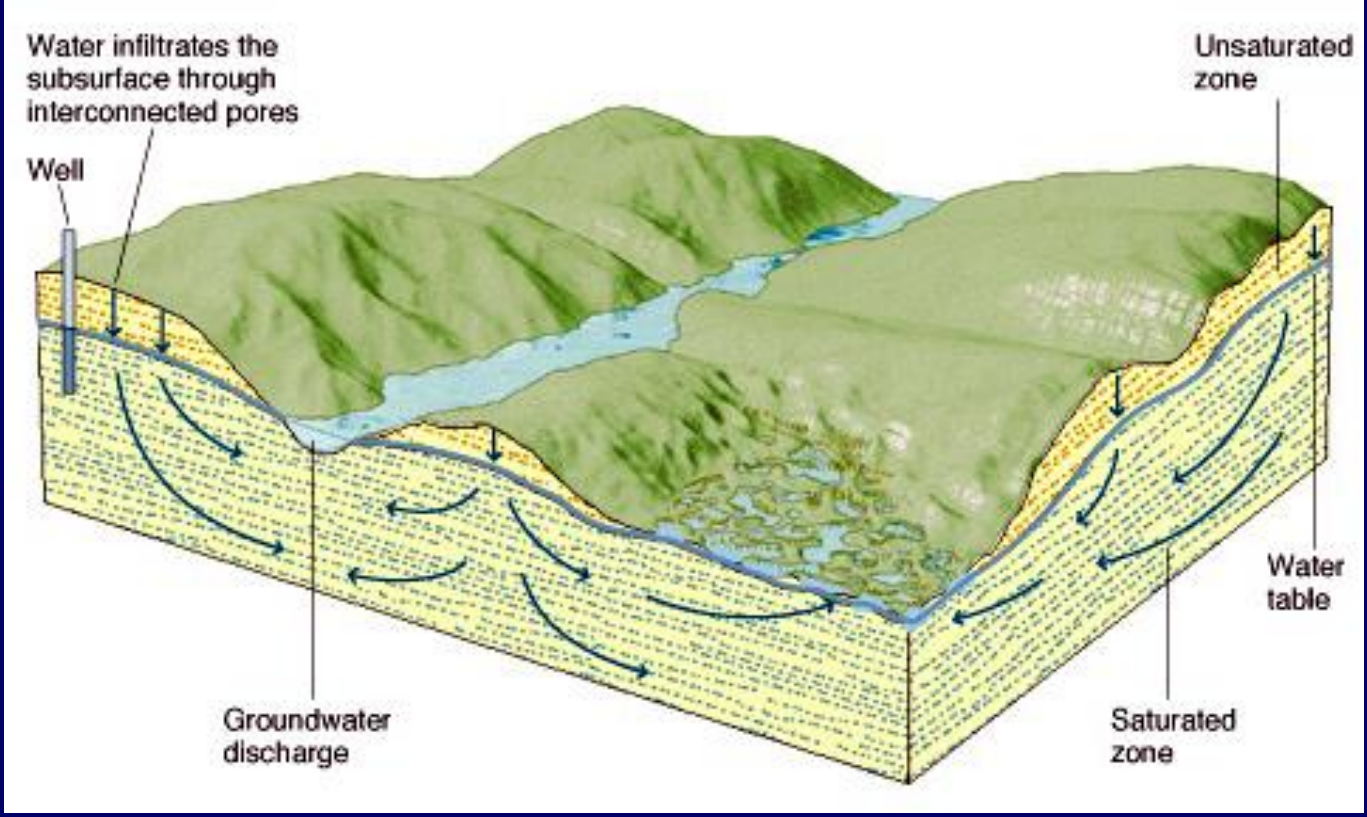


Outline

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



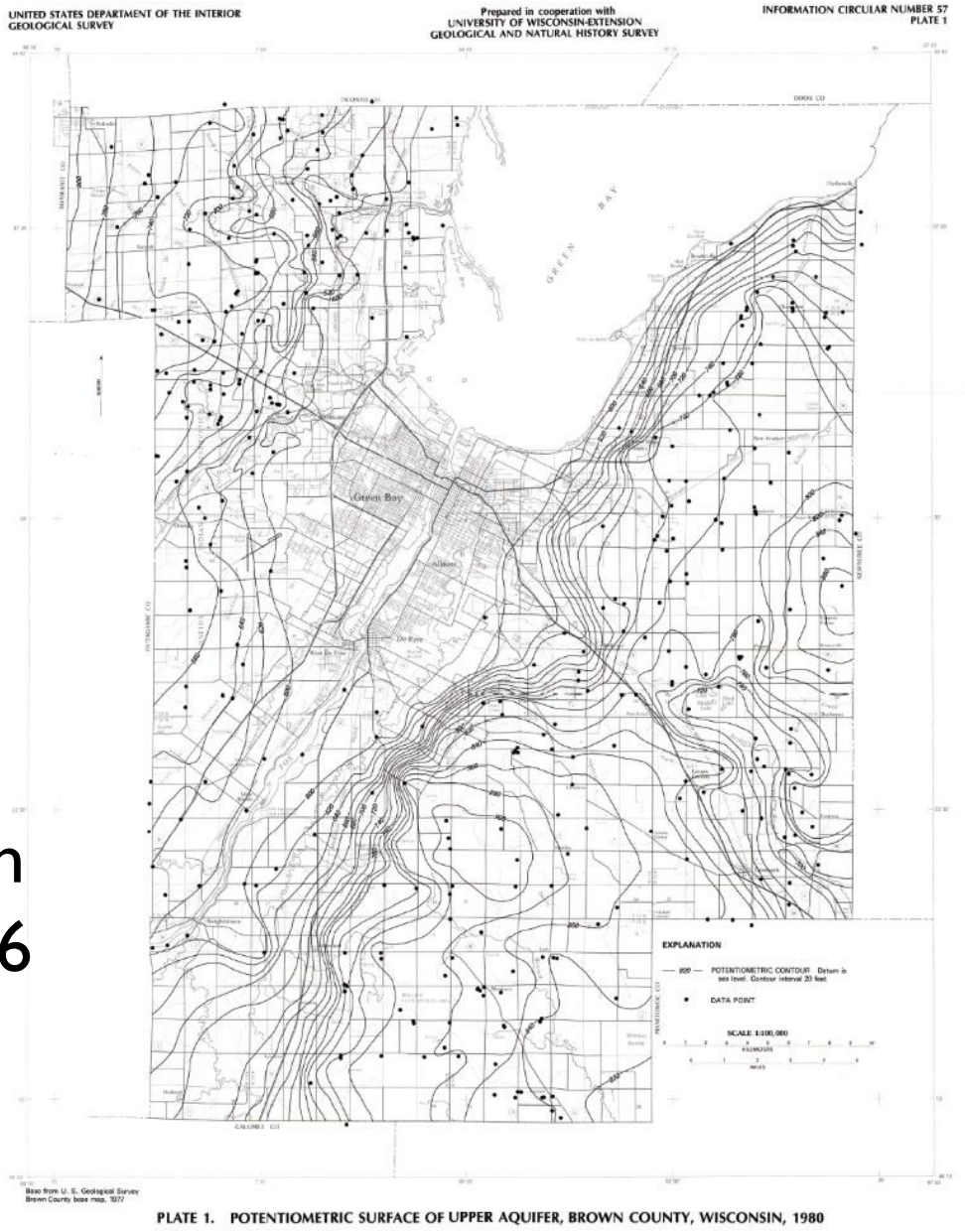
- Groundwater Recharge -- water that seeps past the root zone and makes it to the water table (top of the saturated zone)
- Aquifer – a geologic unit that can store and transmit usable quantities of water to a well
- Water table is boundary between unsaturated and saturated zones
  - Unsaturated zone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



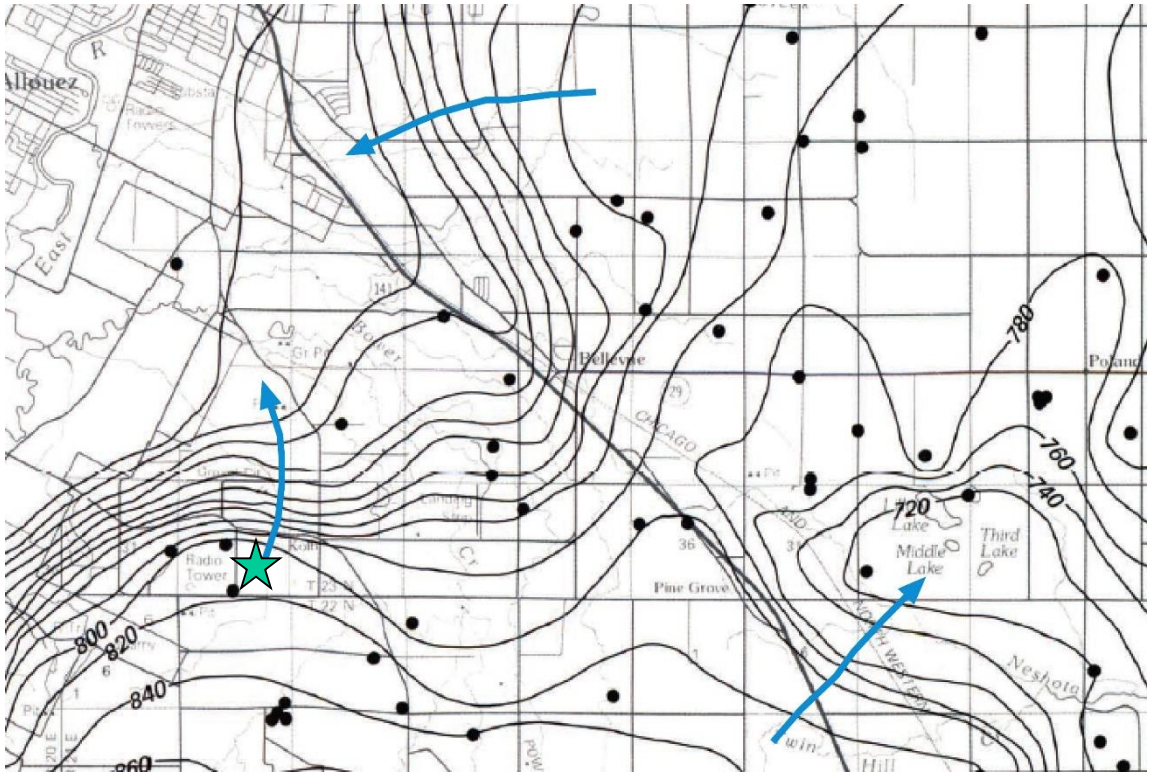
- Groundwater flow is from areas of higher hydraulic head to areas of lower hydraulic head.
- Recharge area -- area where precipitation infiltrates and recharges the groundwater flow system. Groundwater flow is generally downward in these areas.
- Discharge area -- area where water exits the aquifer.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



Water Elevations in the Upper Aquifer



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

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BEDROCK GEOLOGY OF WISCONSIN

UNIVERSITY OF WISCONSIN–EXTENSION

Geological and Natural History Survey

APRIL 1981
REVISED 2005

EXPLANATION

DEVONIAN

- D — dolomite and shale

SILURIAN

- Sd — dolomite

ORDOVICIAN

- Om — Maquoketa Formation—shale and dolomite
- Os — Sinnipee Group—dolomite with some limestone and shale
- Osp — St. Peter Formation—sandstone with some limestone shale and conglomerate
- Opc — Prairie du Chien Group—dolomite with some sandstone and shale

CAMBRIAN

- € — sandstone with some dolomite and shale

MIDDLE PROTEROZOIC

- ss, v, t — Keweenawan rock—
  - ss, sandstone
  - v, basaltic to rhyolitic lava flows
  - t, gabbroic, anorthositic and granitic rock
- g, a — Wolf River rock—
  - g, rapakivi granite, granite, and syenite
  - a, anorthosite and gabbro

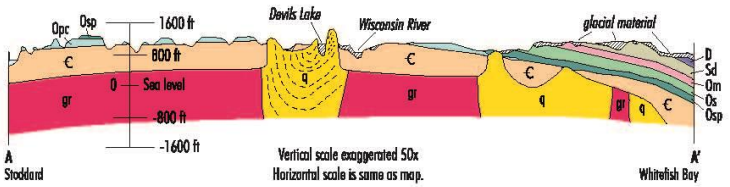
LOWER PROTEROZOIC

- q — quartzite
- gr — granite, diorite, and gneiss
- s, vo, ga — s, metasedimentary rock, argillite, siltstone, quartzite, greywacke, and iron formation
  - vo, basaltic to rhyolitic metavolcanic rock with some metasedimentary rock
  - ga, meta-gabbro and hornblende diorite

LOWER PROTEROZOIC OR UPPER ARCHEAN

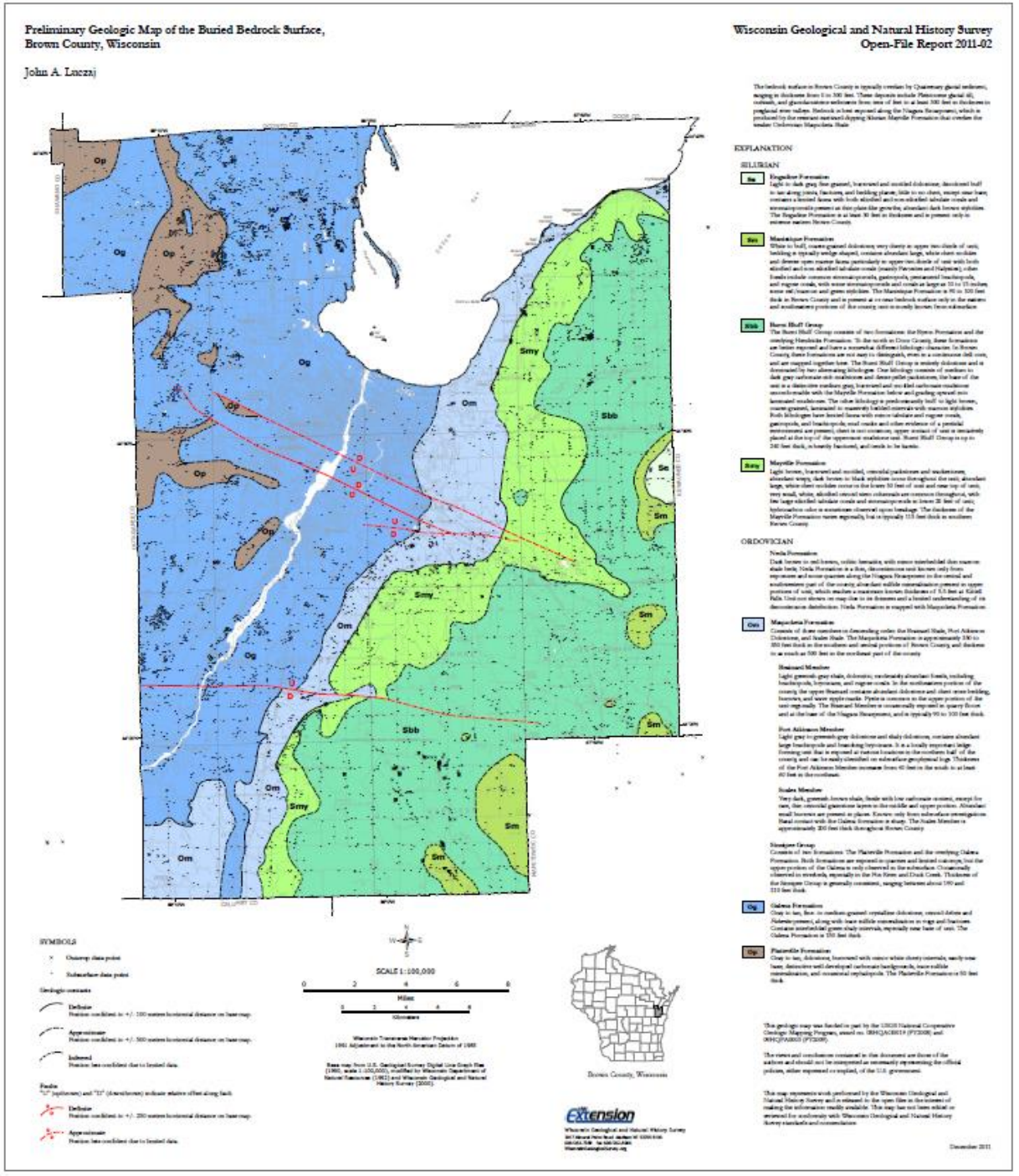
- mv, gn — mv, metavolcanic rock
  - gn, granite, gneiss, and amphibolite

0 30 60 mi
0 50 100 km

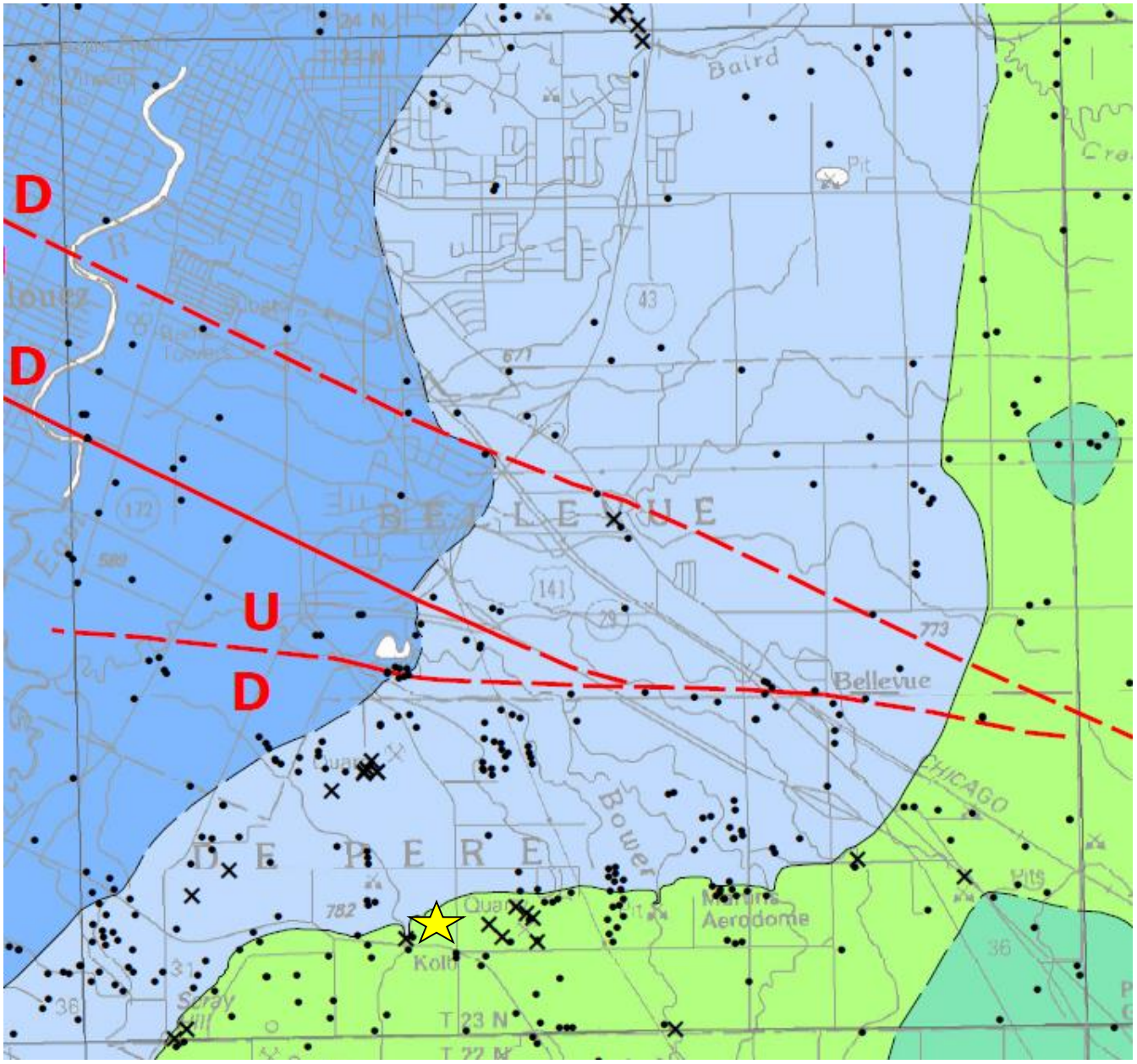


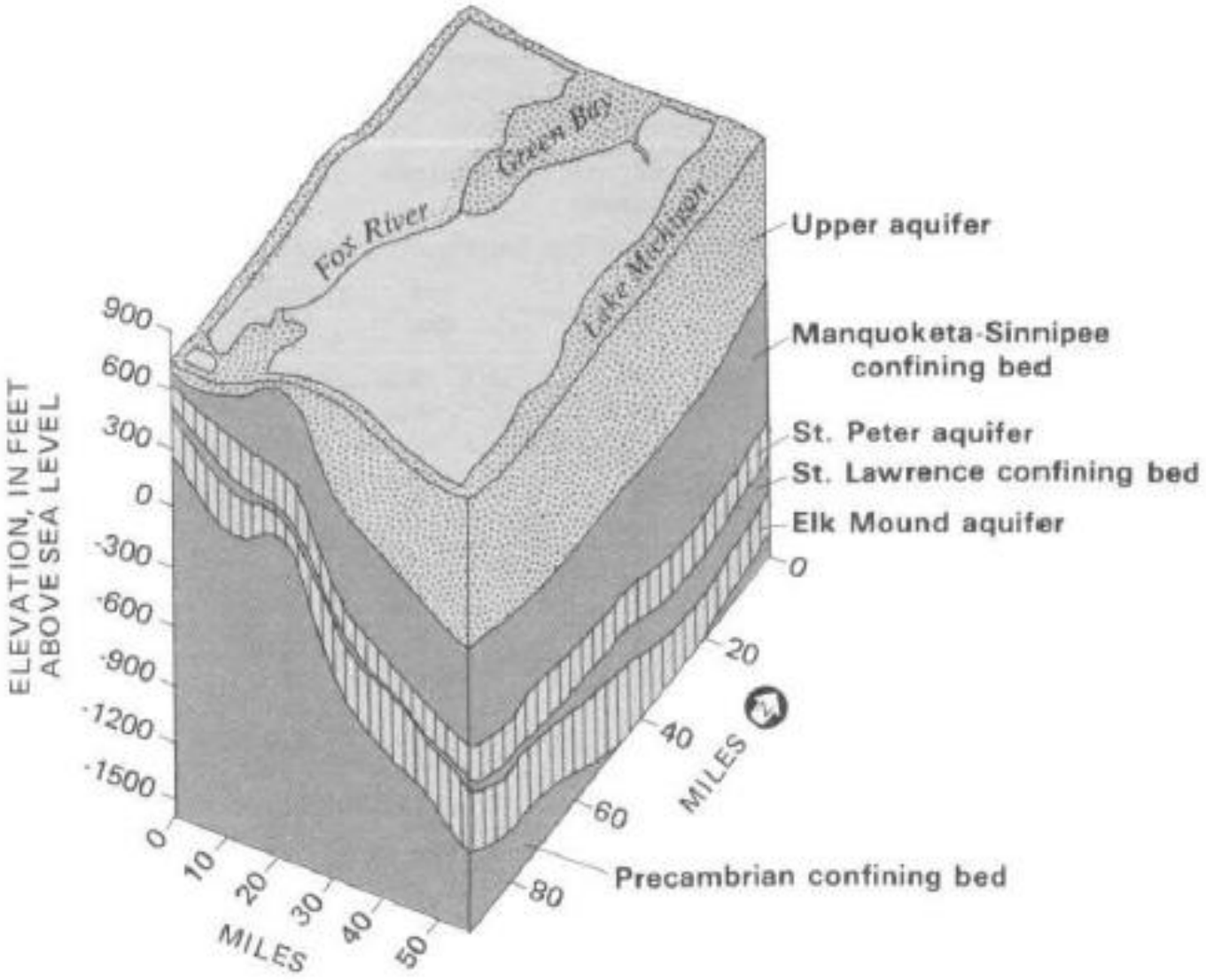
Bedrock Geology

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



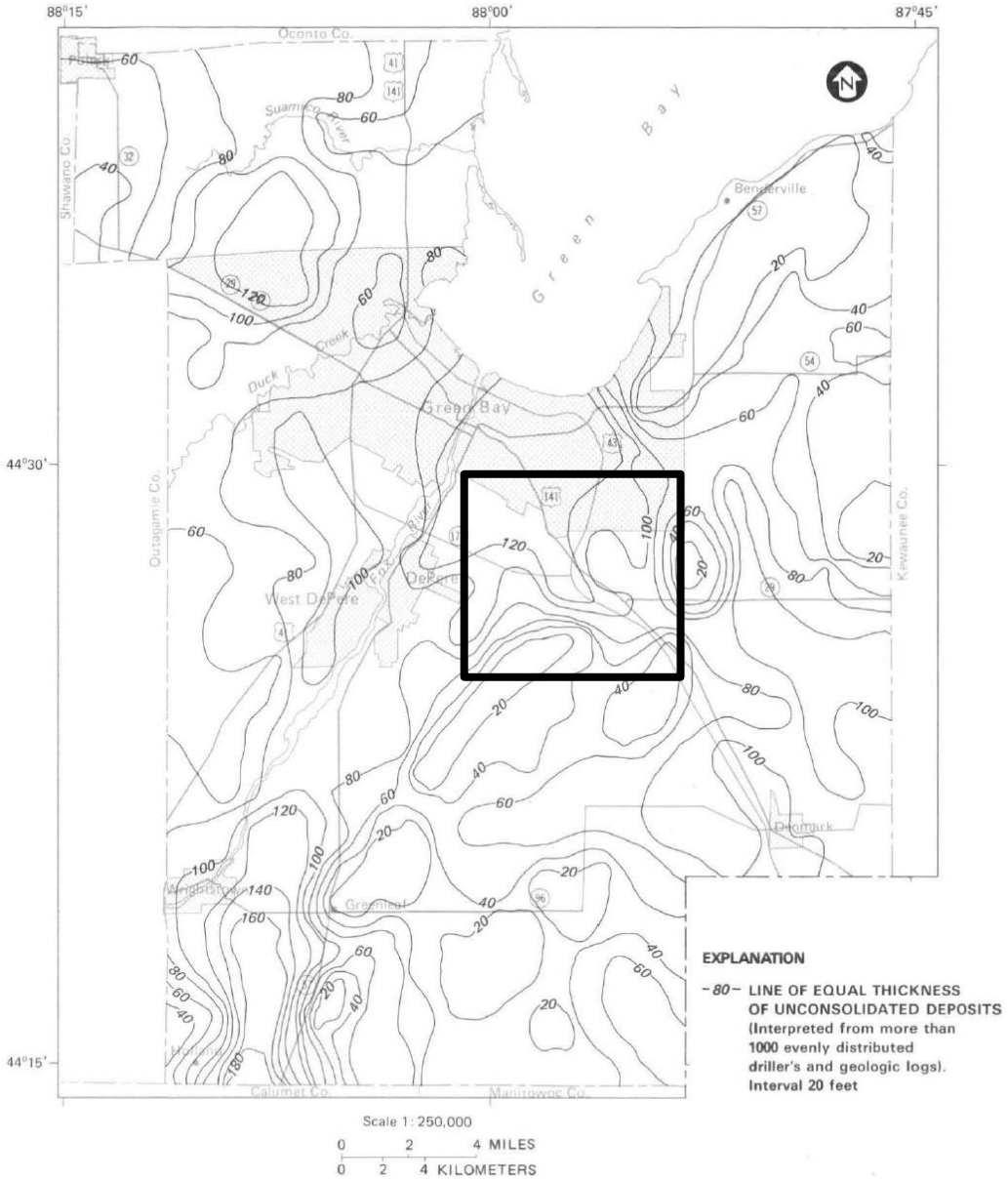
Geology Detail





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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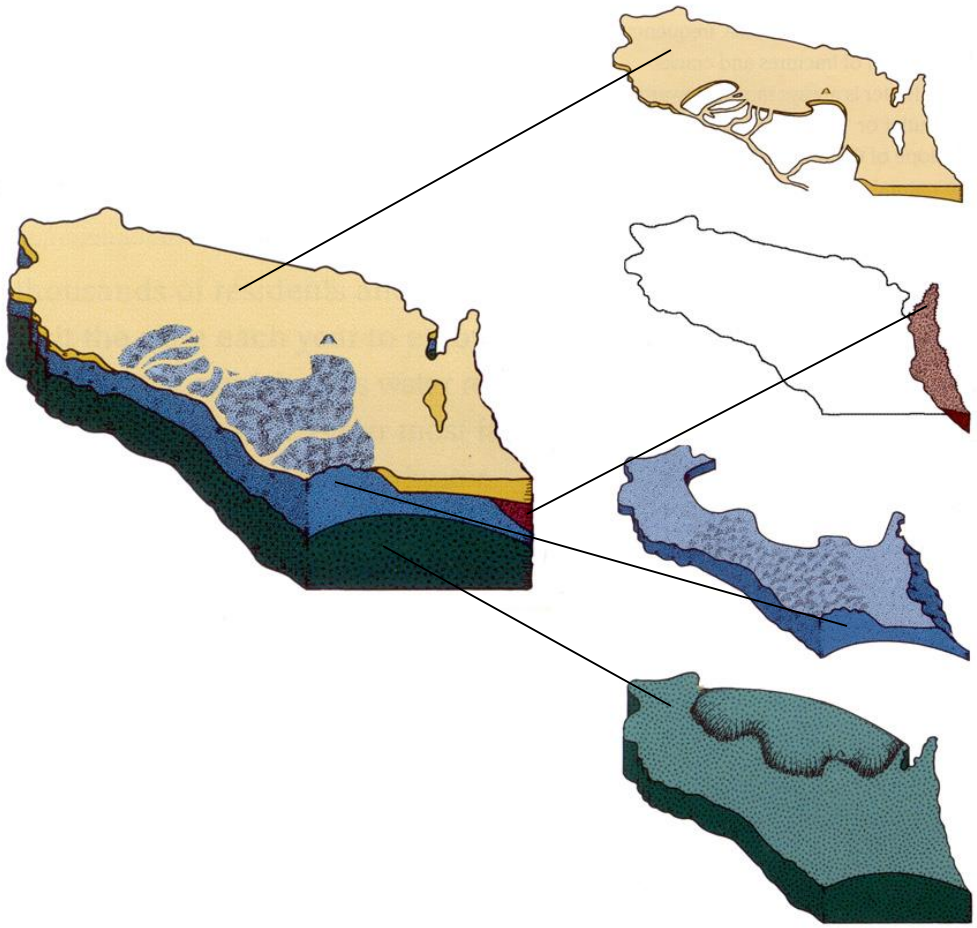
Wisconsin Aquifers

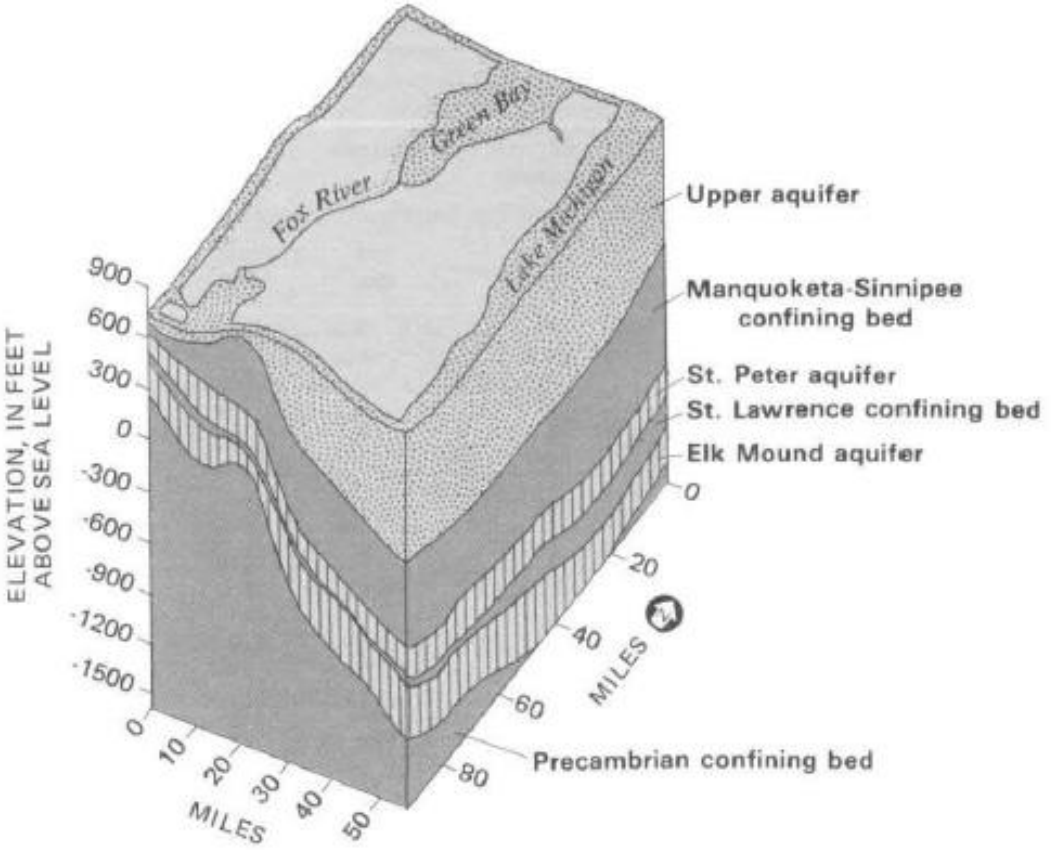


- Sand & gravel aquifer
- Silurian dolomite aquifer
- Sandstone & dolomite aquifer
- Crystalline bedrock aquifer

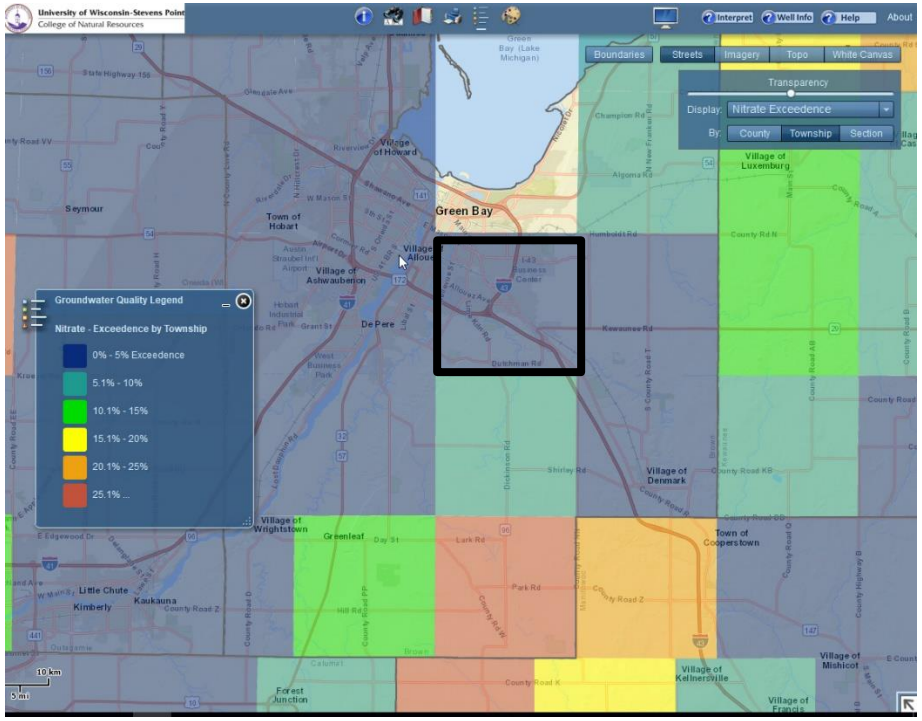
Image from DNR Magazine supplement: Groundwater Wisconsin's Buried Treasure

Domestic Wells

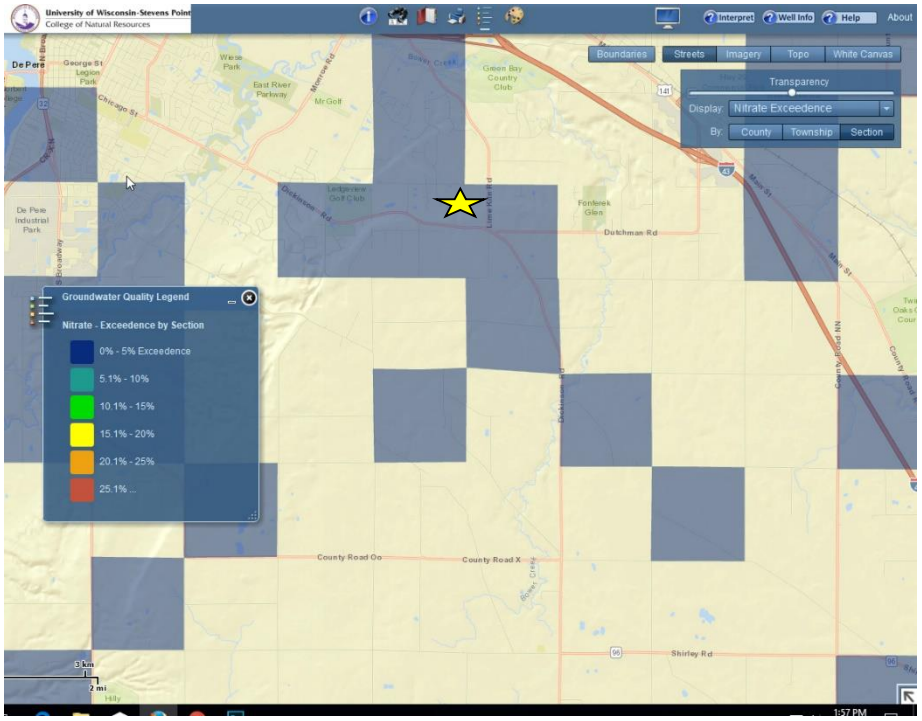
- Looked at wells in section 31, where farm is located
- Shallow wells (~60 feet or less in depth)
  - Sand and gravel
  - Silurian Dolomite
- Deep wells (>500 ft)
  - Extend below the Maqouketa shale



Existing Water Quality Data: Nitrate-N



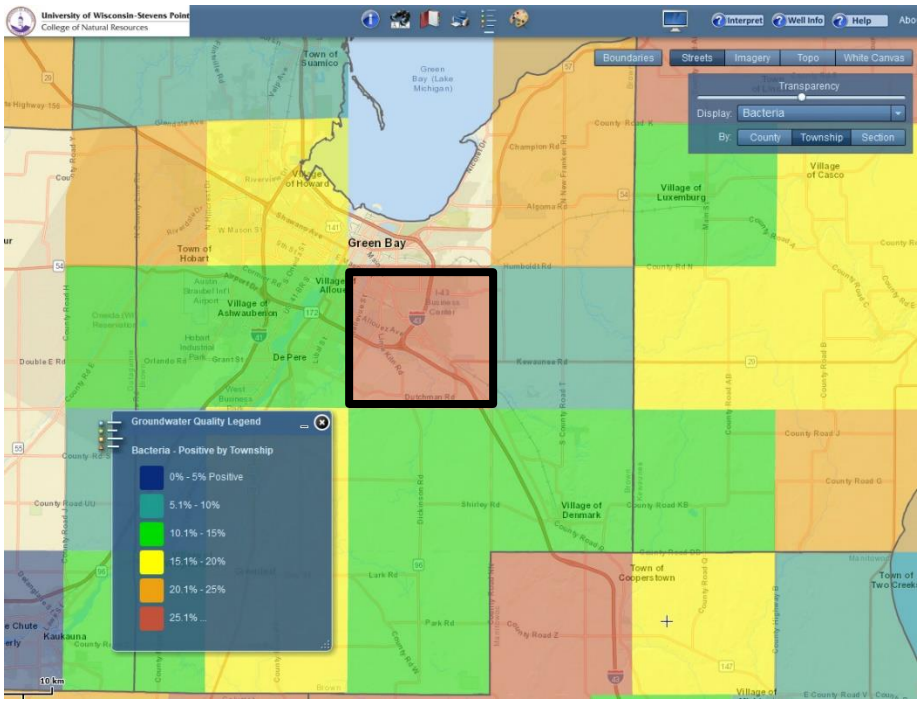
By Township



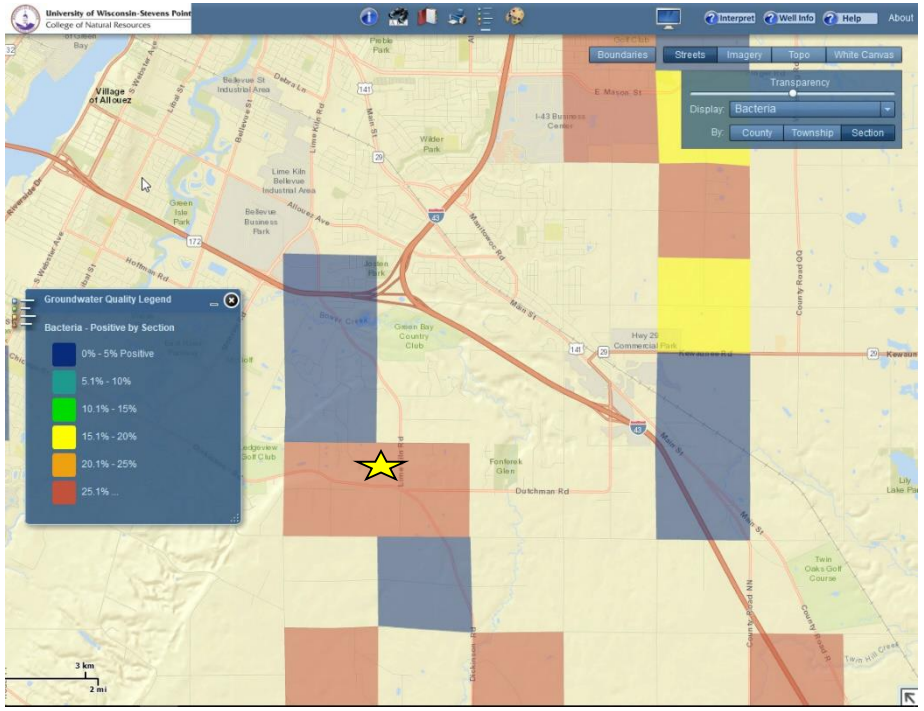
By Section

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
- 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