Integrating Science into Water Supply Planning

Allen Wehrmann, P.E., P.H. (GW), D.WRE

Head, Center for Groundwater Science, Illinois State Water Survey

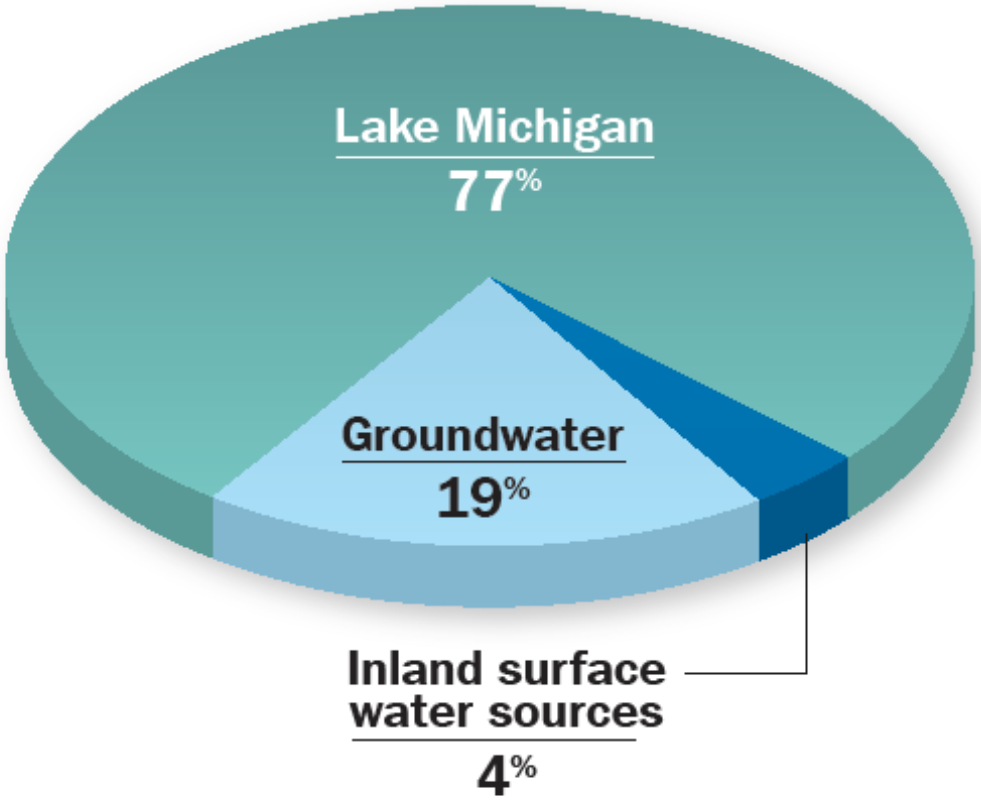
Institute of Natural Resource Sustainability, University of Illinois

Just a word about the State Surveys

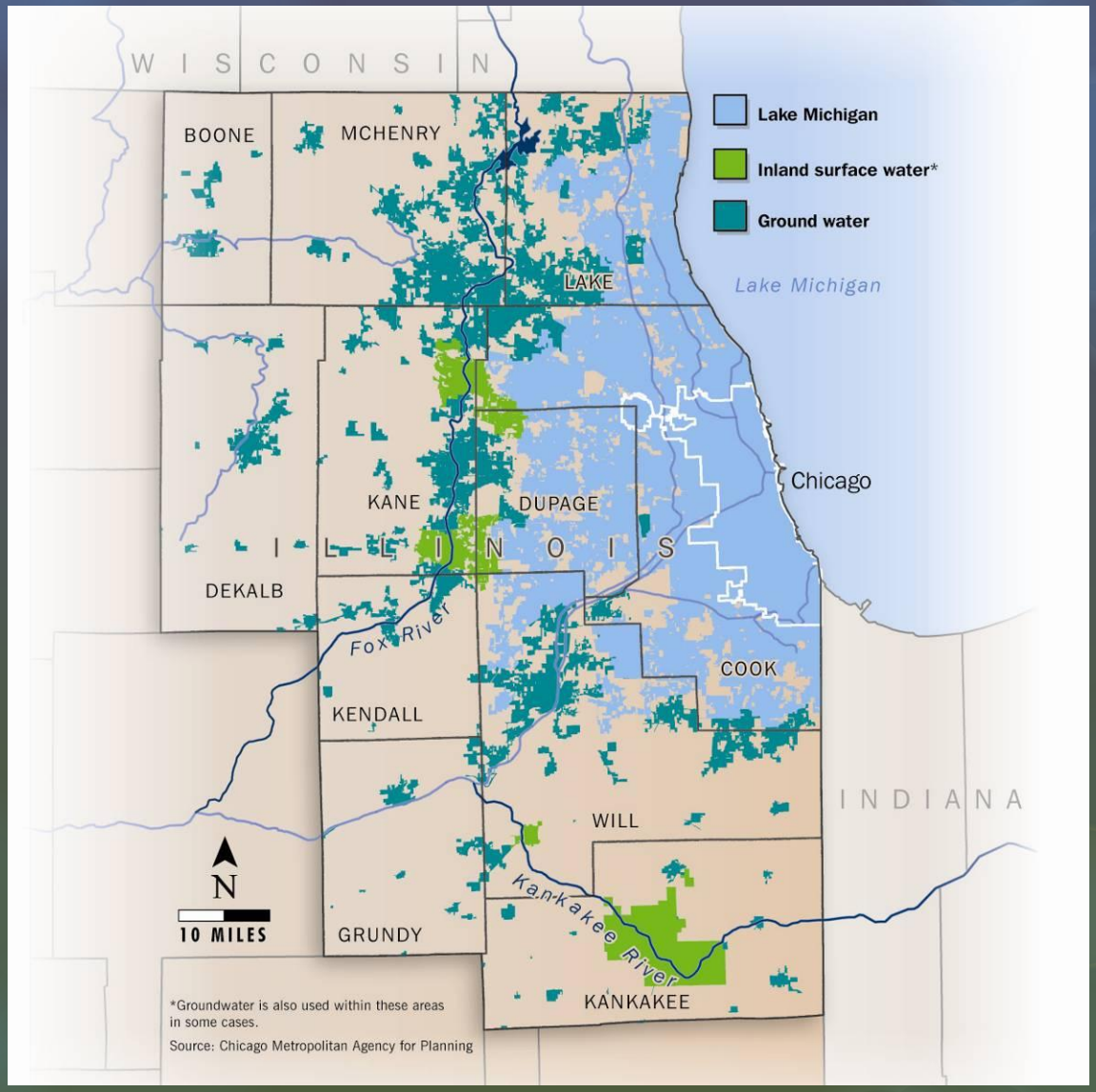
- Collectively, the five State Surveys bring a high degree of unbiased, scientific knowledge and data, from multiple disciplines, to bear on natural resource issues of significance to Illinois
- *Illinois State Water Survey* (est. 1895) is one of three "original" State Scientific Surveys in Illinois, along with the *State Natural History Survey* (est. 1858) and the *State Geological Survey* (est. 1905)
- In 1984, the *Hazardous Waste Research & Information Center* was created. Its name was changed to the *Waste Management & Research Center* (WMRC) in 1989 when it became the fourth "Survey".
- In 2008, the four Surveys became a part of the University of Illinois within a newly formed *Institute of Natural Resource Sustainability*, at which time WMRC changed its name to the *Illinois Sustainable Technology Center*
- In 2010, the *Illinois State Archaeological Survey* is established at the fifth Survey, formerly the UI's transportation archaeology program

Sources of Drinking Water for Northeastern Illinois

11-county region population, 2000



Water Supply Sources in Northeast Illinois



Data Used in Water Supply Planning

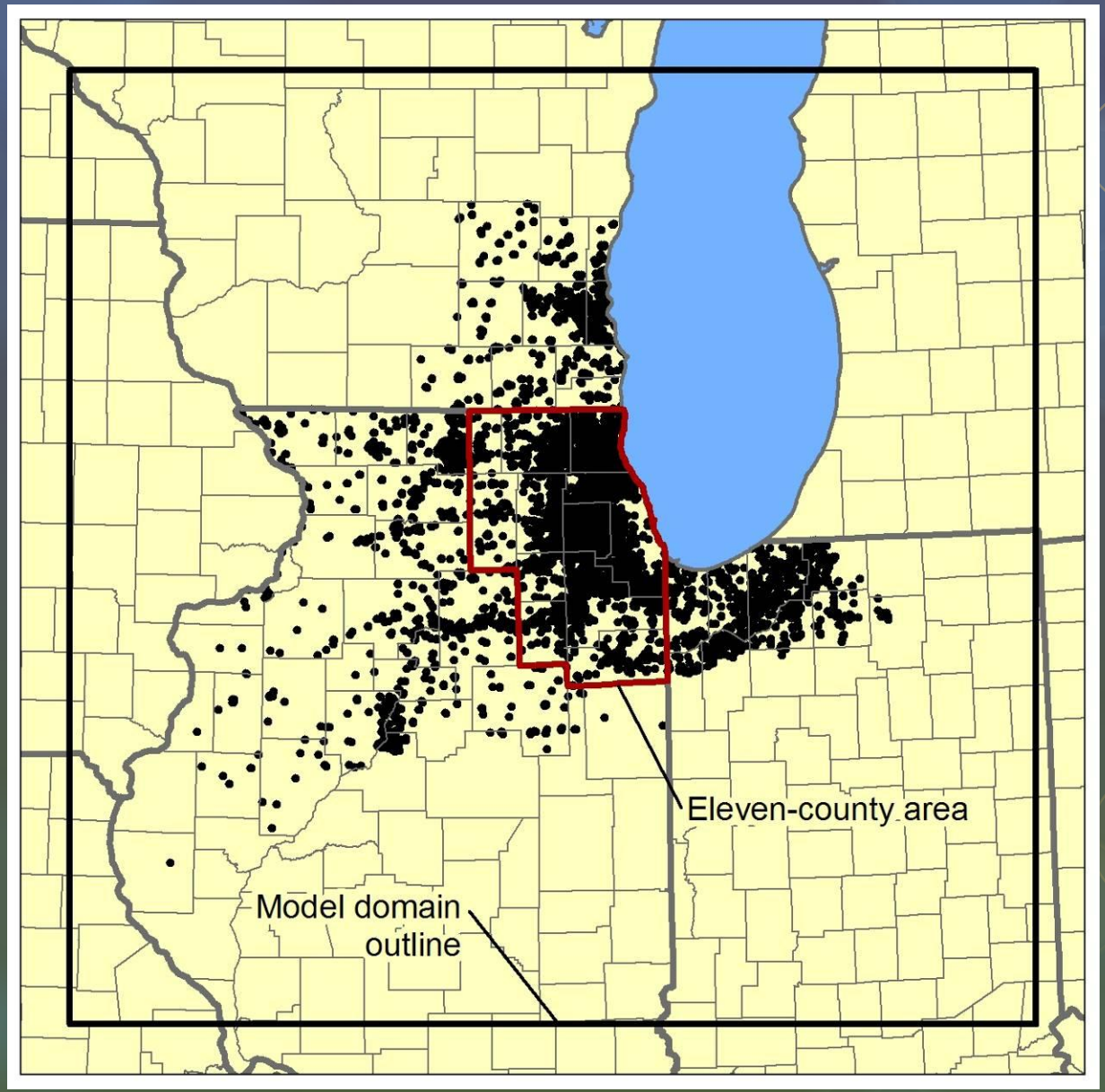
- Water withdrawals for:
  - Public water supply
  - Self-supplied industry/commerce
  - Power generation
  - Rural domestic
  - Agriculture & environment
- Streamflows and treated effluent discharges
- Groundwater data:
  - Geology
  - Wells – locations, aquifers used, pumping rates
  - Aquifer hydraulic properties (ability to transmit and store water)
  - Groundwater levels
    - Hydrographs
    - Surface maps

All of which feed into groundwater flow and transport models

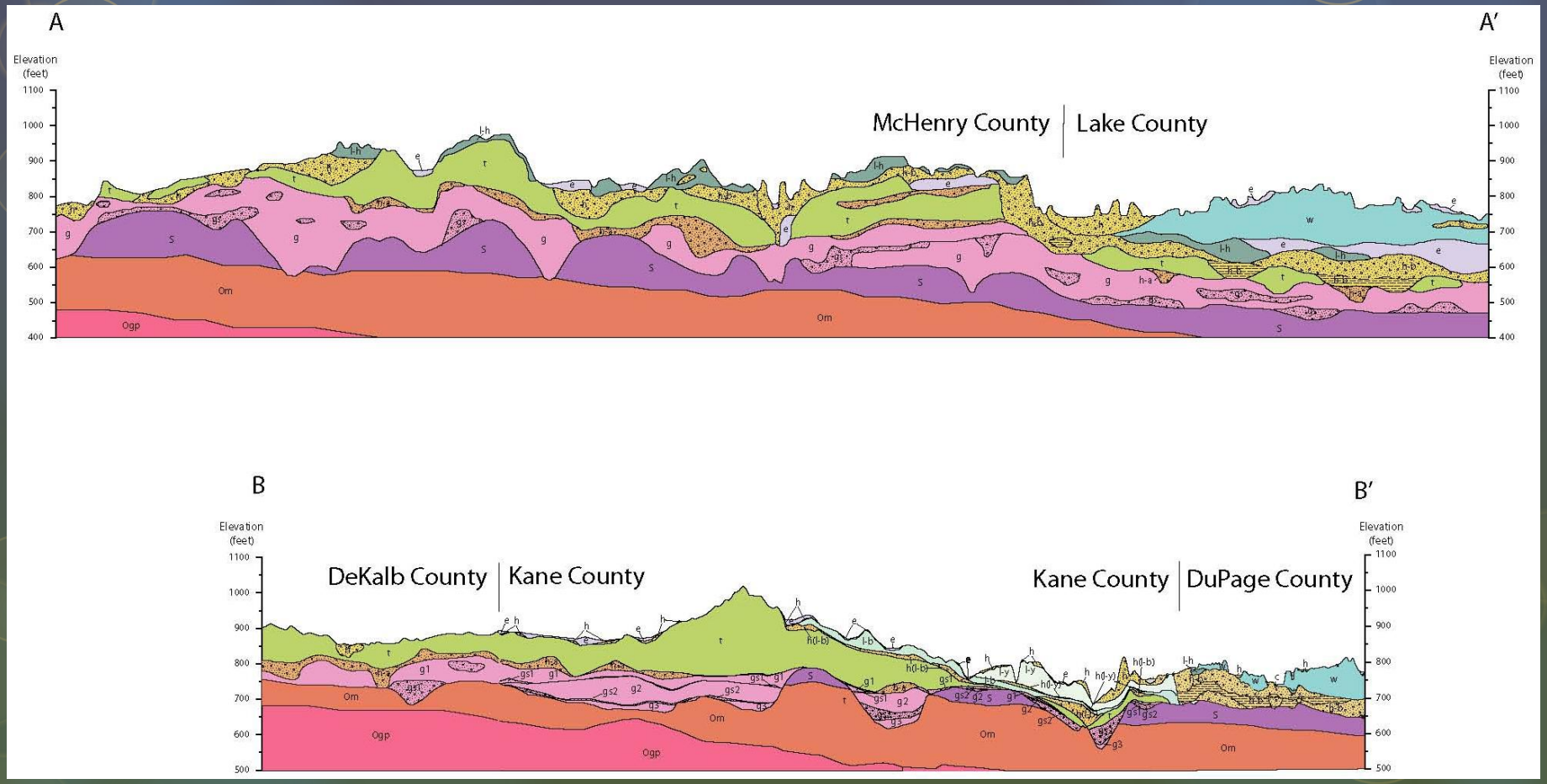
Illinois Water Inventory Program

- Statewide documentation of annual withdrawals began in 1978
- ~4,500 facilities are canvassed annually, representing over 11,000 wells and intakes: community supplies; self-supplied industry & commerce including power generation; “other” (ag-irrigation is sporadic)
- Voluntary program until 01/01/10, now mandatory based on amendments to the Illinois Water Use Act (PA99-0222)
- Annual cost was ~$125,000 before mandatory reporting
- Data is essential for any kind of water supply planning!

Existing Wells within Groundwater Flow Model Domain

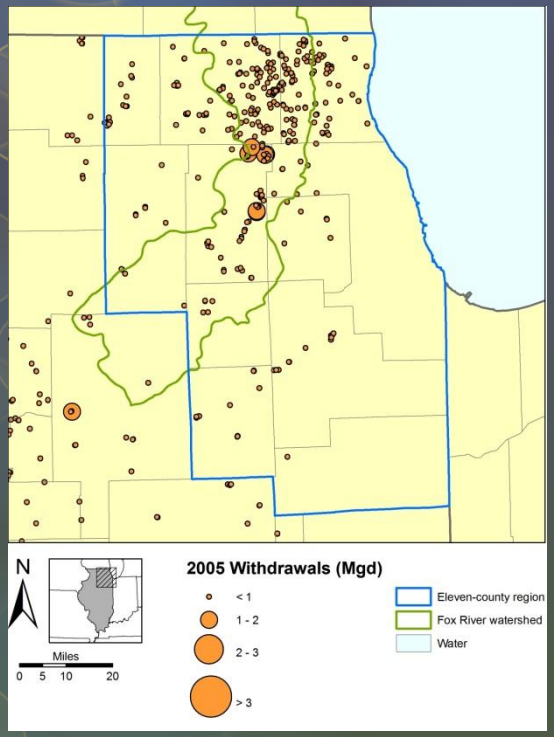


Mapping NE Illinois' Complex Glacial Geology

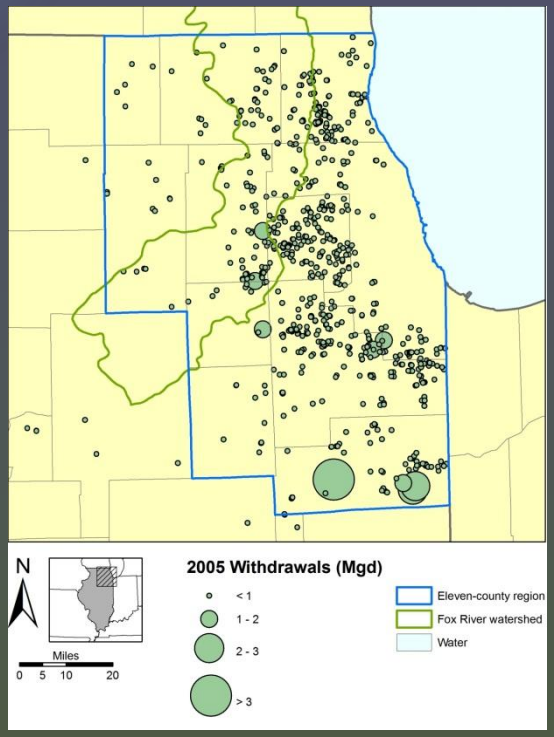


Simulated 2005 Groundwater Withdrawals

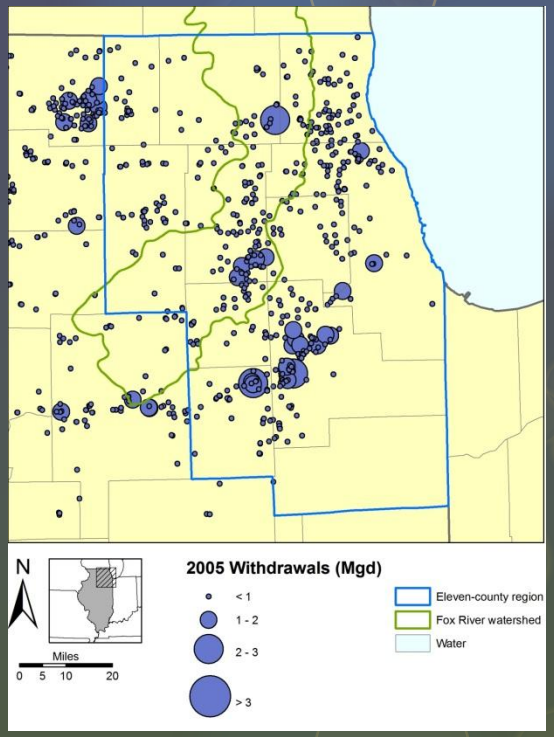
Sand and gravel aquifers



Shallow bedrock aquifers



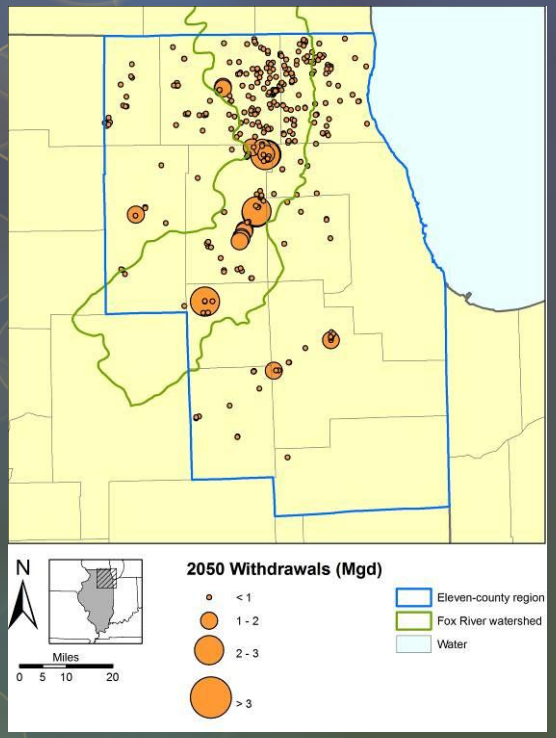
Deep bedrock aquifers



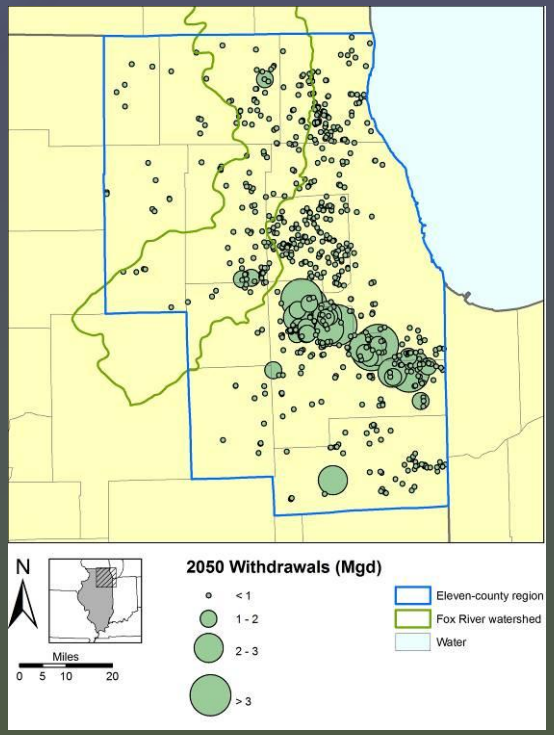
Simulated 2050 Groundwater Withdrawals

(Baseline Scenario)

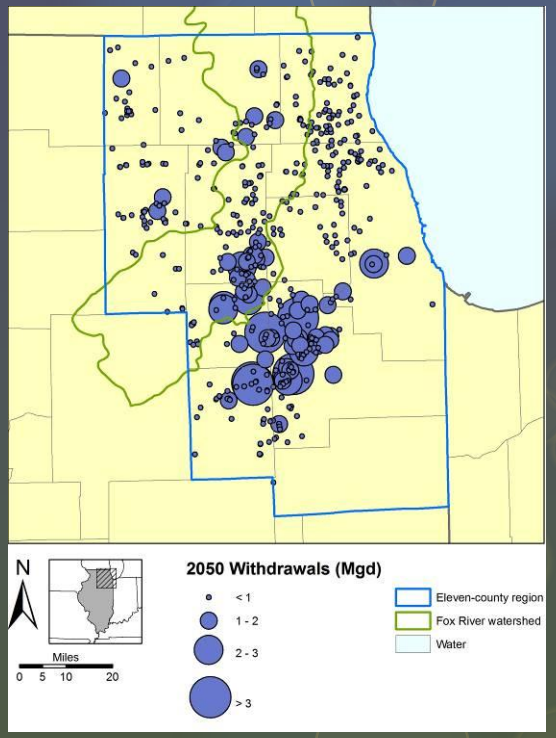
Sand and gravel aquifers



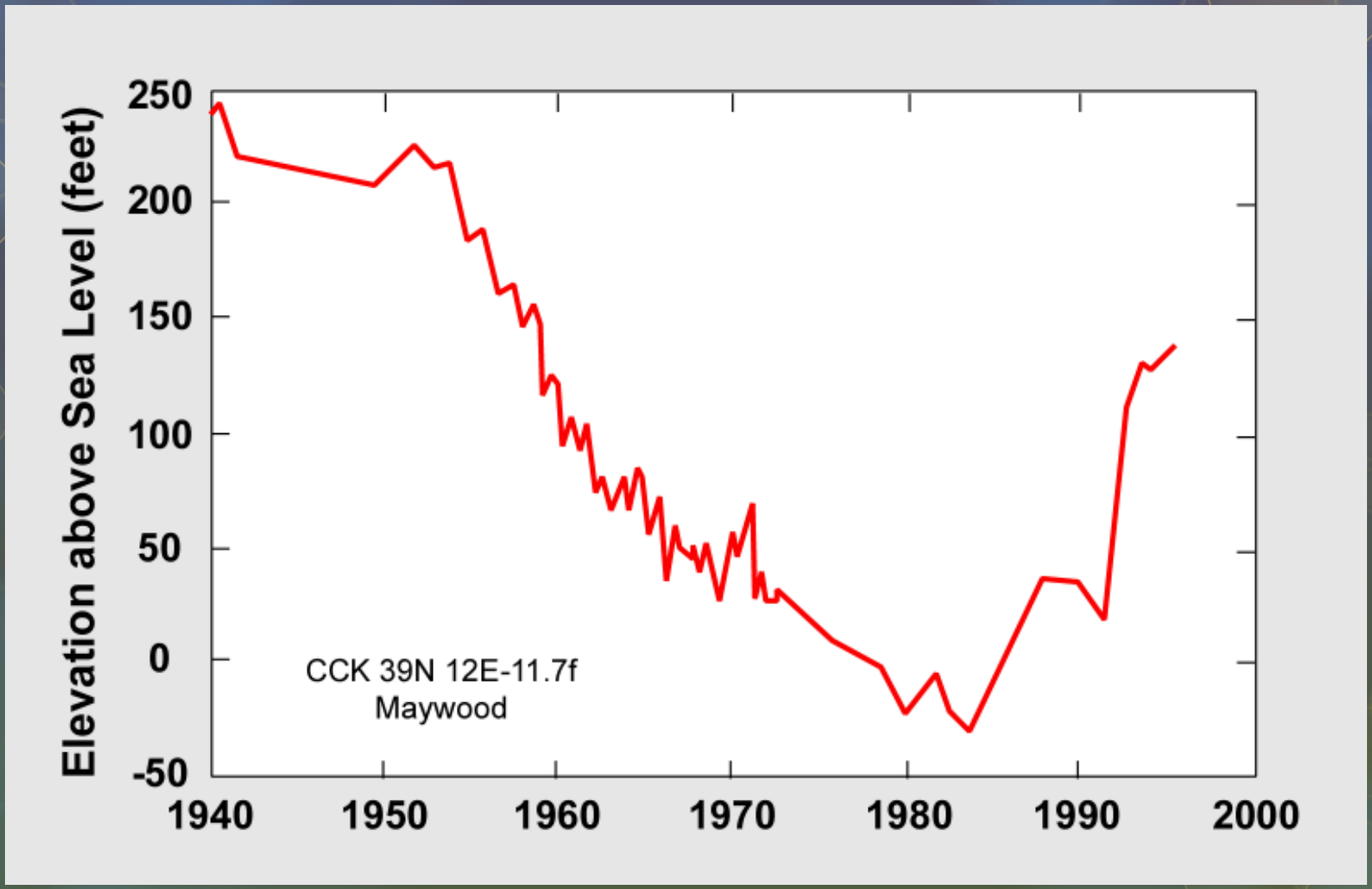
Shallow bedrock aquifers



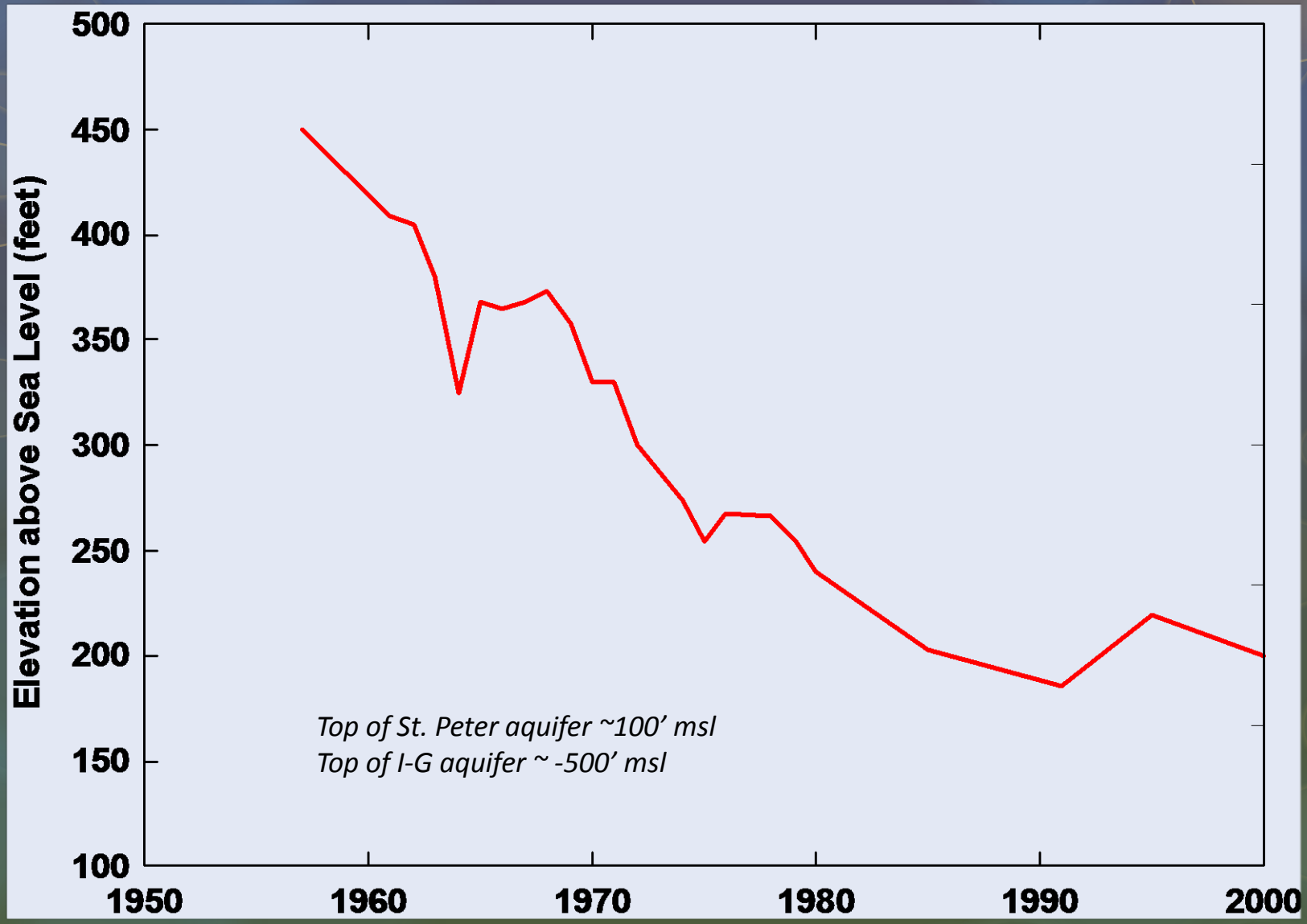
Deep bedrock aquifers



Deep Well Water Levels, Cook County



Deep well water levels, Oswego #3 (Kendall County)



Data -> Model -> Information

Hydrogeology:
- Piezometric mapping
- Aquifer testing (Conductivity, etc)

→Hydrogeologic Model

Surface Water:
- Location, Width, Depth
- Diversions/Discharge
- Stream Gauge

→Flow Accounting Model
→Streamflow Probability

Groundwater Flow Model

Assimilate / Understand

Quantify

Predict

Physics:
- Mass/Energy
- Flow in Porous Media

→Governing Equations

Other:
- Soil Type
- Land Cover
- Tile/Storm Drains

→ Supporting Data

Geology:
- Boring logs
- Geophysical Surveys
- Interpolation

→ Stratigraphic Model

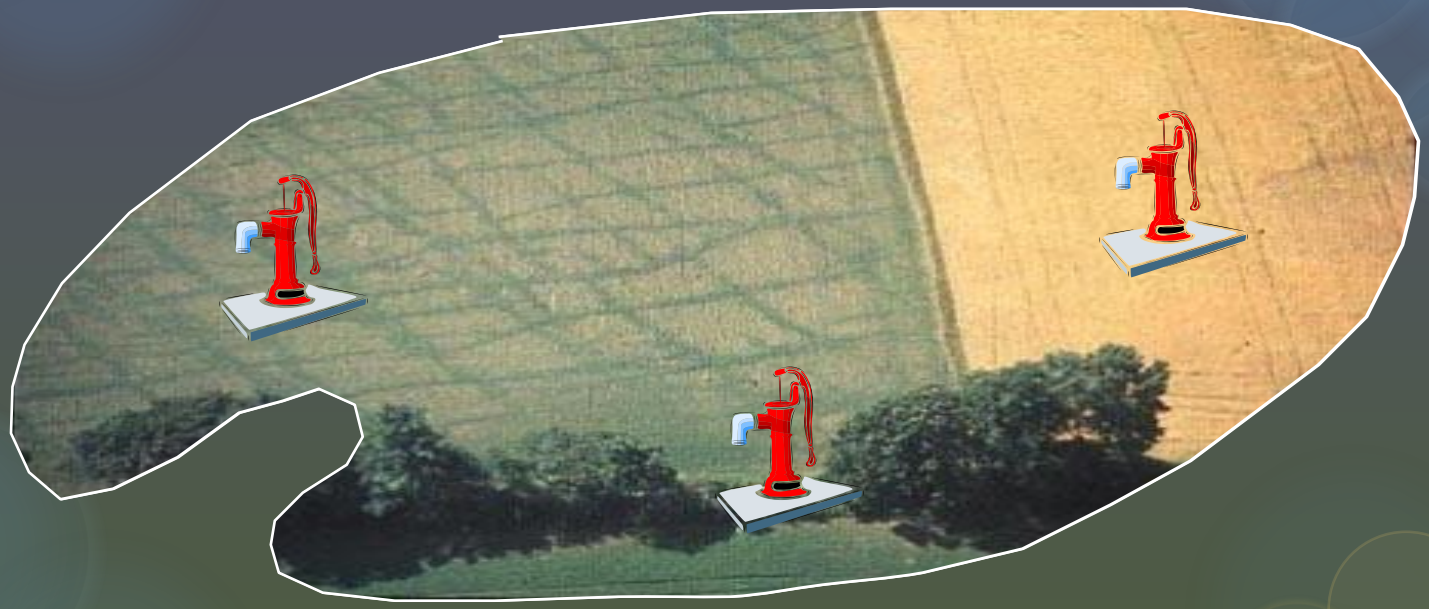
Well Data:
- Depth
- Water Levels
- Pumping Rates

→ History/Projection

Questions a Model Can Answer

Does pumping affect streamflow?

Where does the water come from? And where is it going?

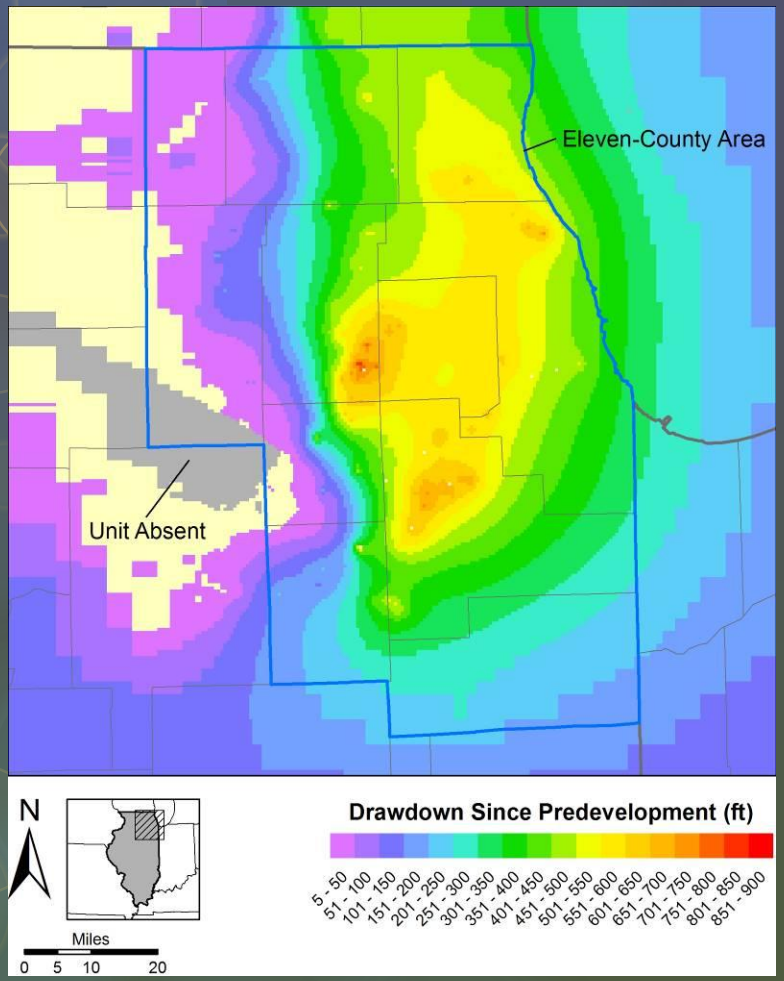


Are additional measurements needed, and where?

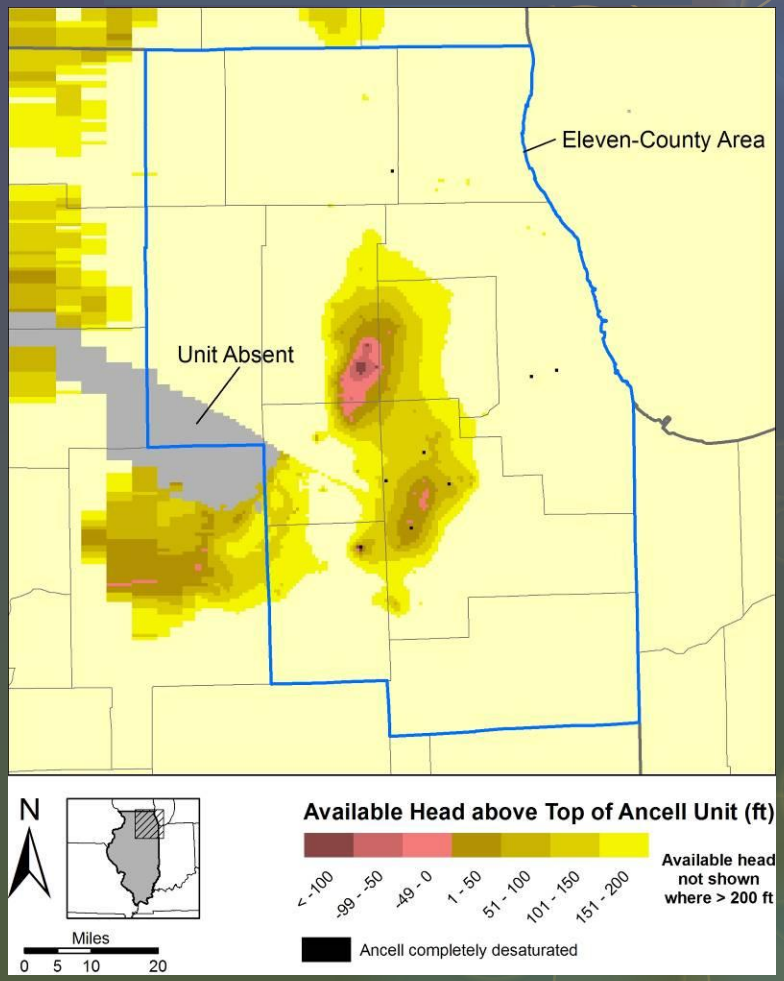
What are the long-term effects of current (and future) pumping?

2050 Simulation – Ancell Unit

Drawdown

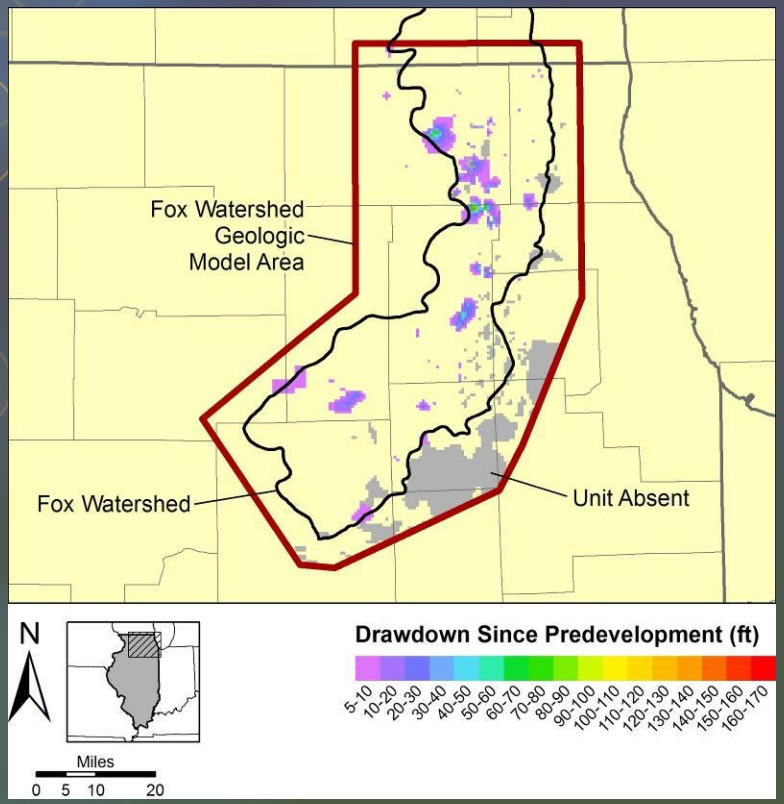


Available Head above Unit Top

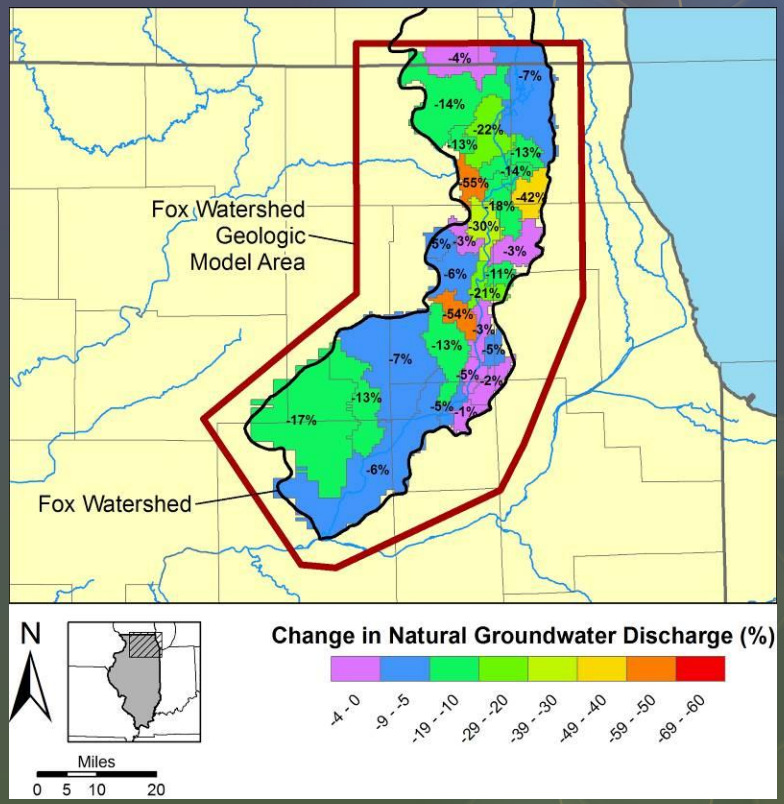


2050 Simulation – Sand & Gravel Aquifers

Drawdown



Baseflow Capture



Continuing Needs/Challenges

- Estimating availability: need for more & better data (e.g., geologic maps, groundwater levels, aquifer hydraulic properties, lake bathymetric surveys, streamflow) and analytical tools (e.g., models)
- Demand forecasting (population, economic, etc.)
- Influence of climate variability and change on precipitation, runoff, groundwater recharge & water demand
- Water quality and contamination, treatment options
- Water law
- Water resource management

Summary

- Illinois is NOT running out of water!
- But, we need to better manage our water resources so that we can continue to enjoy plentiful water. That includes protecting our groundwater resources, from water quantity and quality standpoints.
- We also need to support long-term basic data collection activities of the ISWS & others, especially the *Illinois Water Inventory Program*.