



An Overview of Groundwater Supply in McHenry County

Daniel Abrams



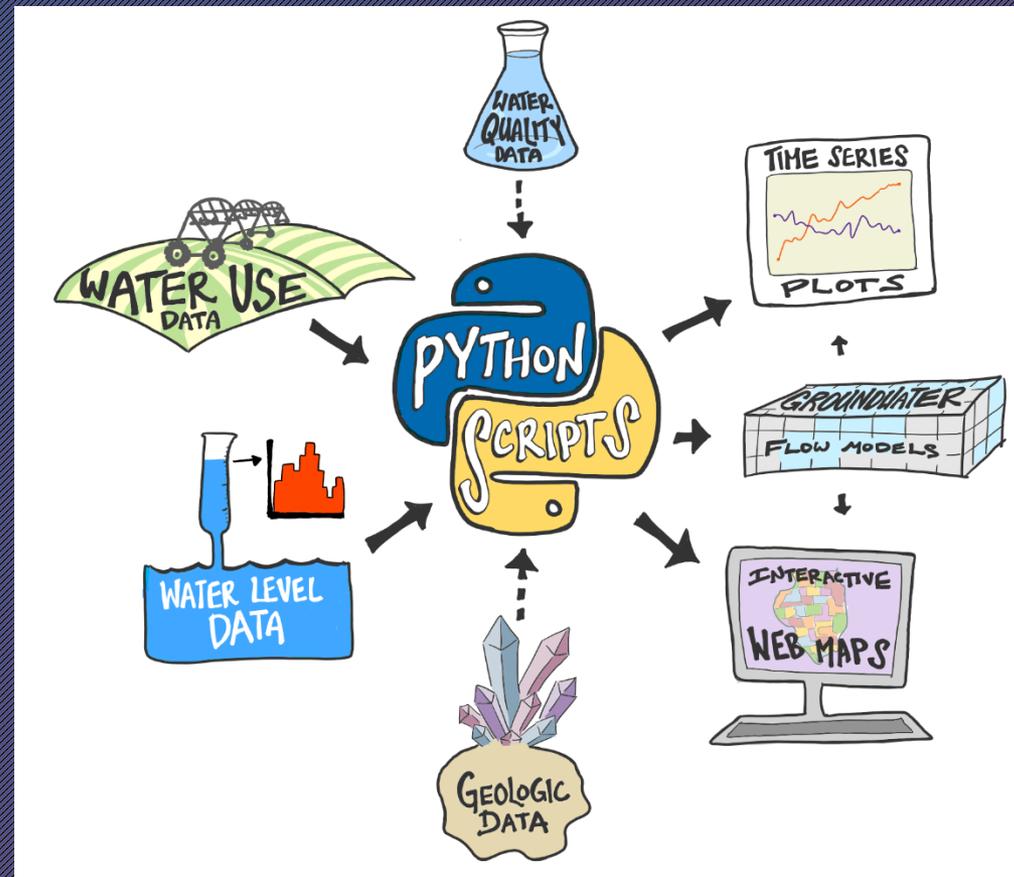
The Illinois State Water Survey is tasked with assessing groundwater flow dynamics in the state

- Head data from wells
 - Dedicated network of continuous monitoring wells
 - 5-7 year synoptic measurements of the deep sandstone
 - Community reported data (IWIP)
- Groundwater withdrawal data
 - IWIP, paper records prior to 1980
- Water quality data (IEPA)
- Well construction data
 - ISGS and ISWS databases



Water Supply Planning

- Consequently, the ISWS has heavy involvement with statewide water supply planning
- This includes analysis of data, including the development of groundwater flow models and reactive transport models (the latter to a lesser extent)



Groundwater Simulation Modeling and Potentiometric Surface Mapping, McHenry County, Illinois

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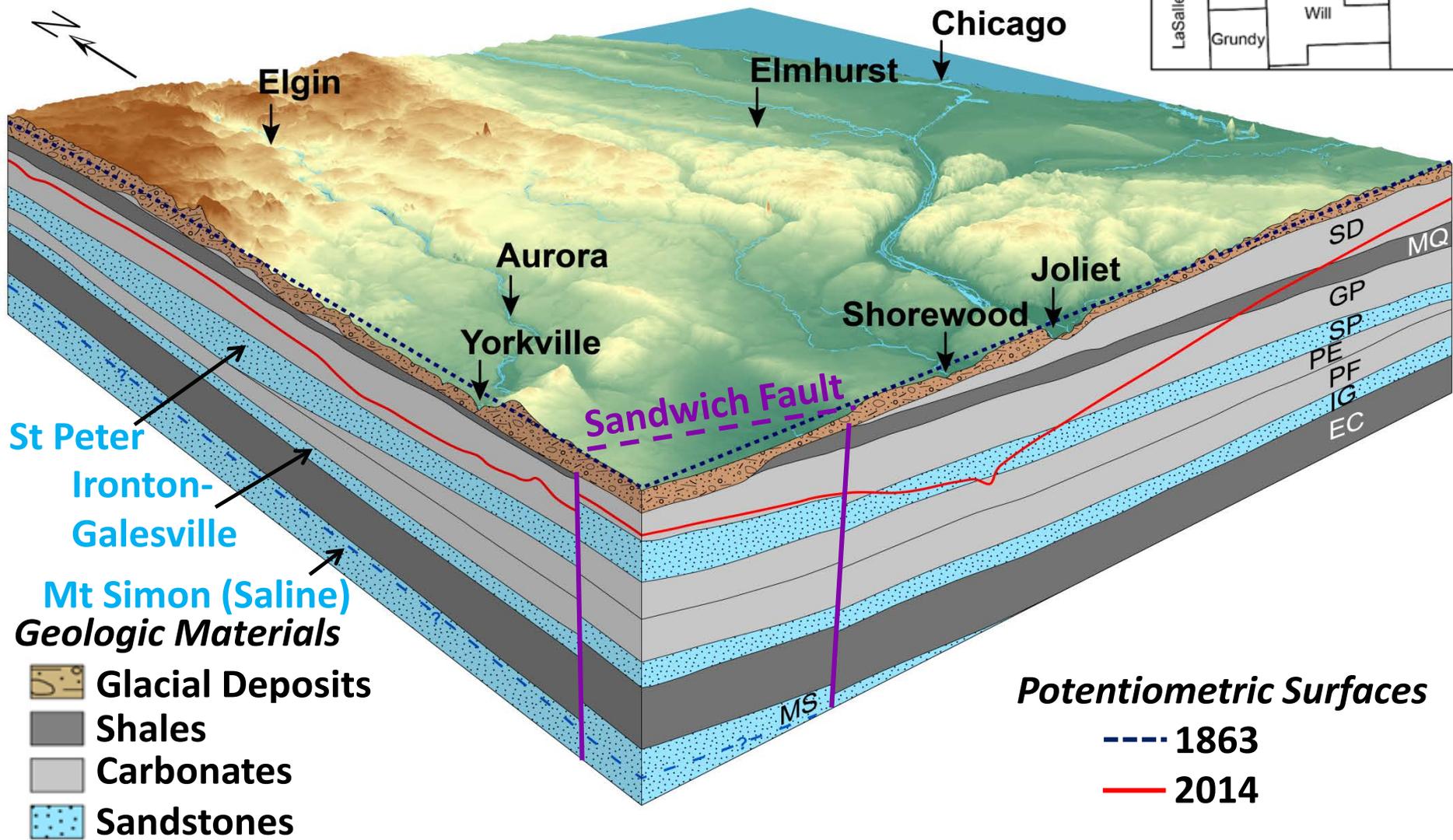


- Groundwater flow model of McHenry County, completed in 2013
- Highlights:
 - Cone of depression at Woodstock likely has reduced natural groundwater discharge to streams
 - Sandstone desaturation may occur by 2050
 - Need for deep sandstone monitoring

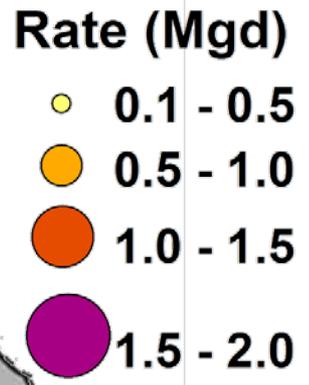
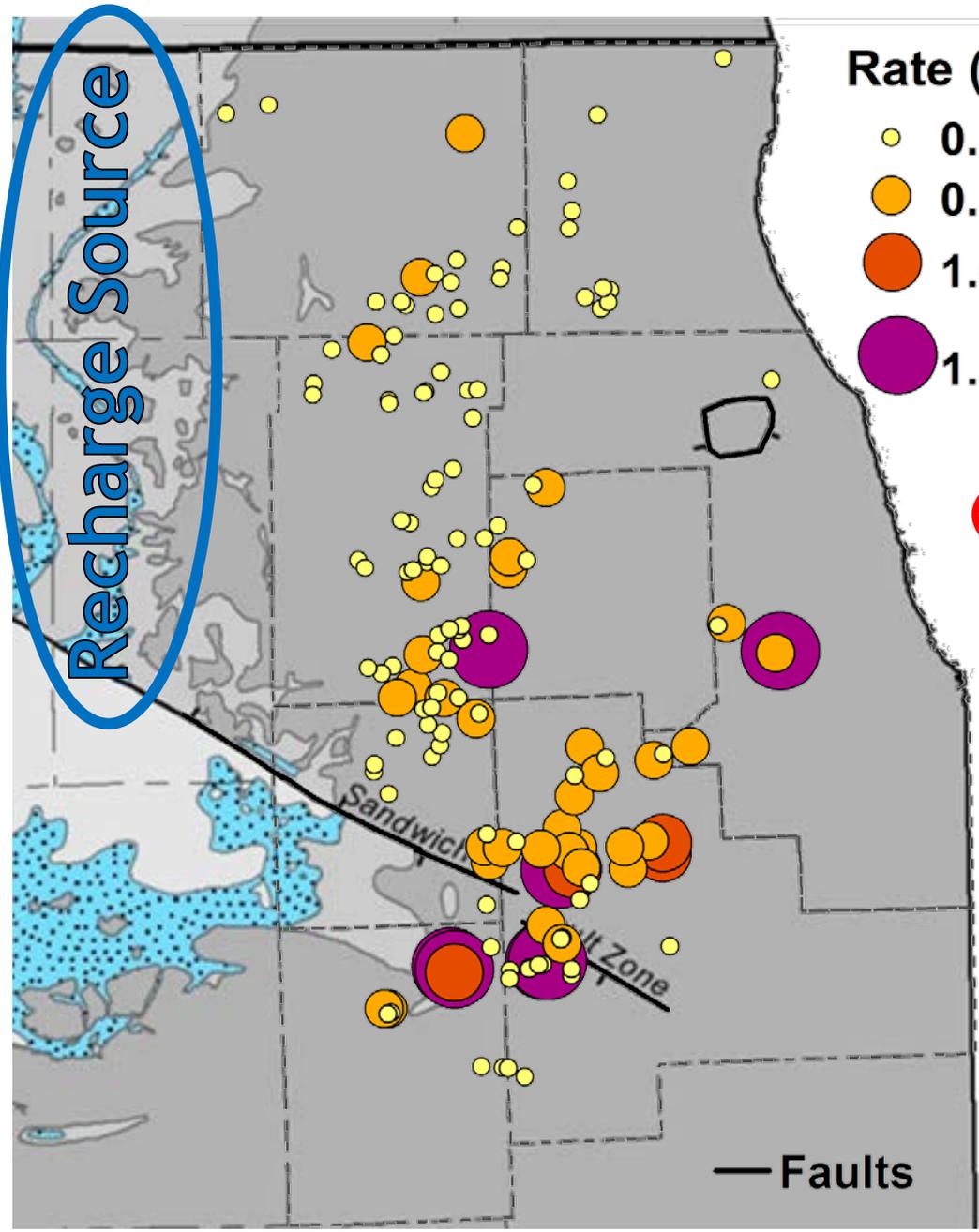
Major updates

- Sandstone aquifers
- Woodstock cone of depression
- Three Oaks Recreation Area study
- Water quality investigations
- Evolving Network of Illinois Groundwater Monitoring and Modeling Analyses

Regional Bedrock Geology



Limited Natural Recharge Sources

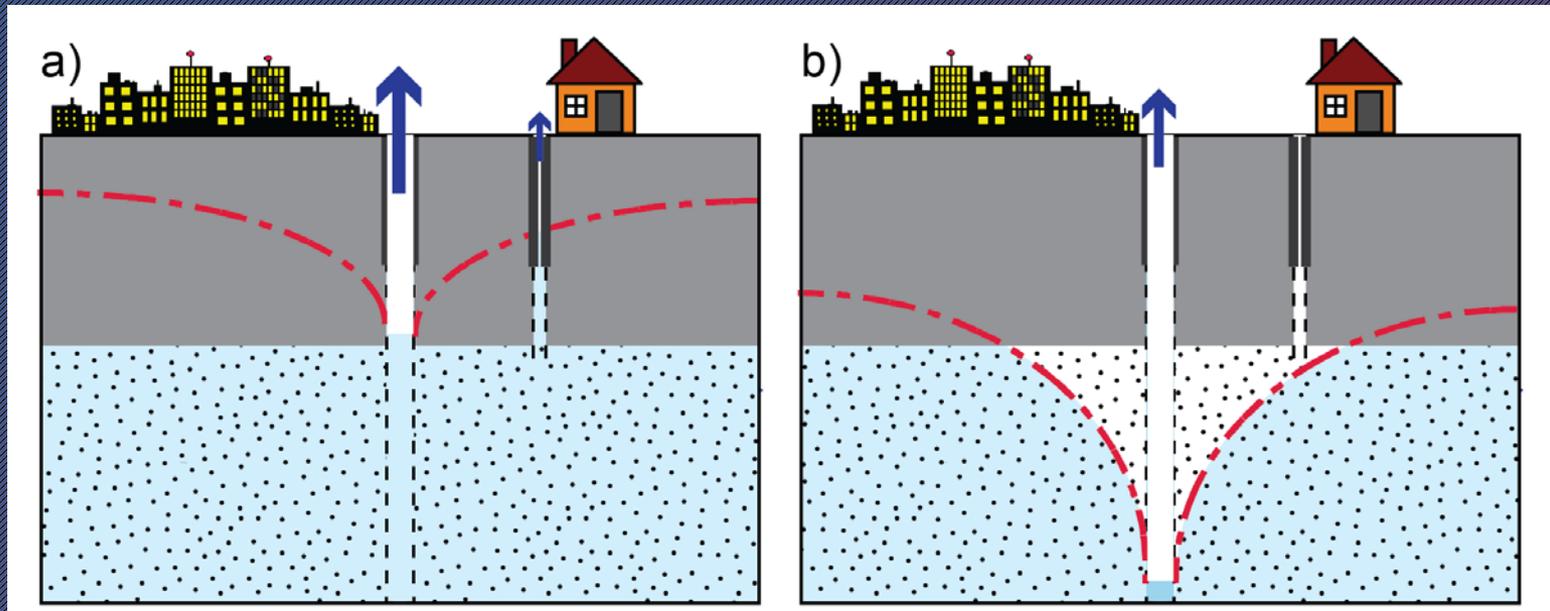


How much water is sustainable?

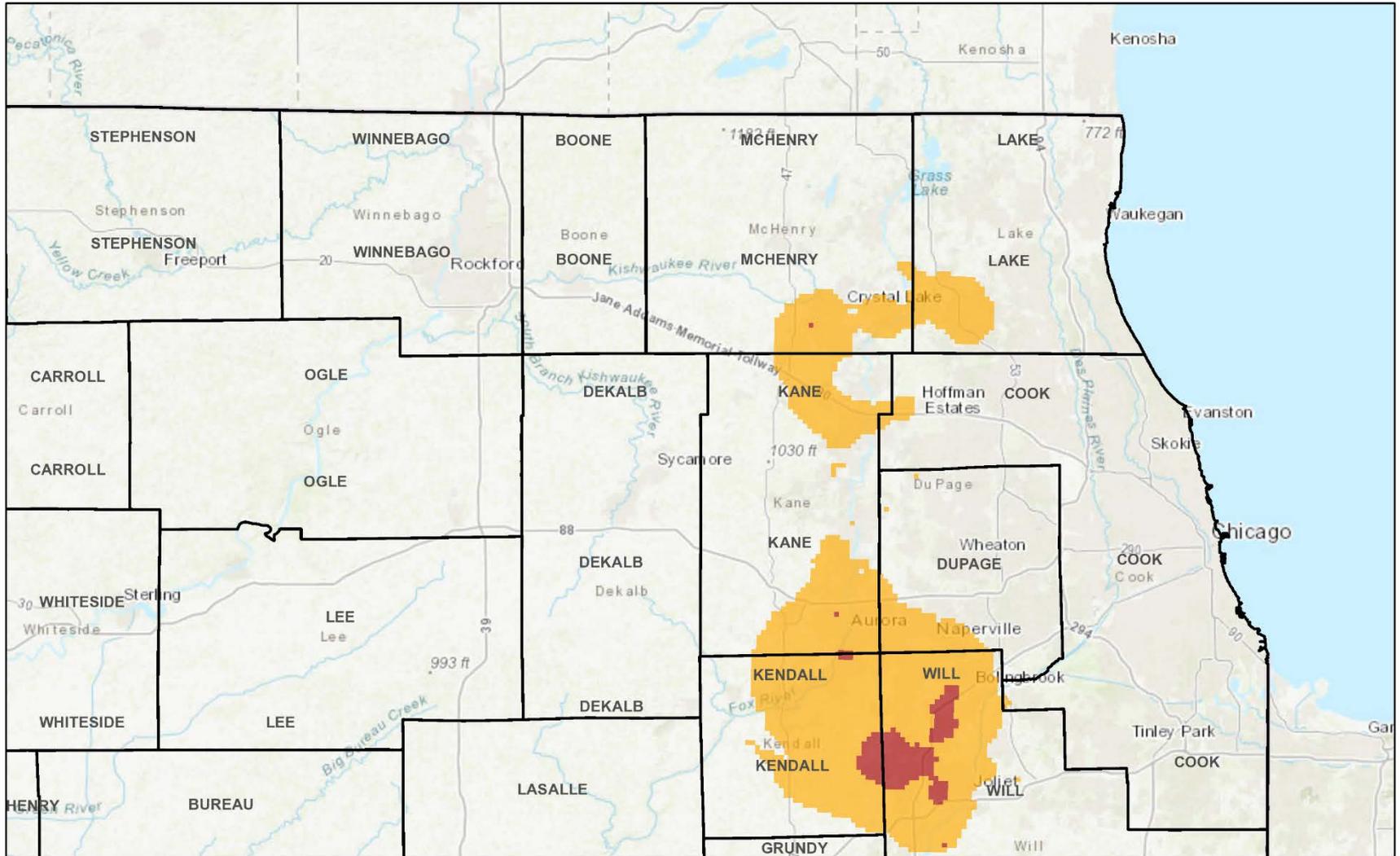
Many possible methods to calculate, but consistent results most counties are pumping unsustainably

| | MGD Withdrawals | | |
|-----------------|-----------------|-------------------|-----------------|
| County | Safe Yield | Sustainable Yield | Current Demands |
| Cook and DuPage | 35 | 9 | 10 |
| Grundy | 7 | 7 | 9 |
| Kane | 19 | 16 | 26 |
| Kendall | 7.5 | 3 | 9 |
| Lake | 7 | 5 | 5 |
| McHenry | 8 | 8 | 9 |
| Will | 17.5 | 12 | 30 |
| Total | 101 | 60 | 98 |

Removal of water from storage (desaturation)



Ironton-Galesville Risk

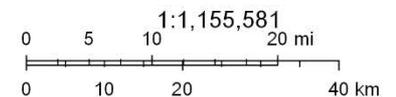


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□ Counties ■ Future

Ironton-Galesville Sandstone Risk Area

■ Current

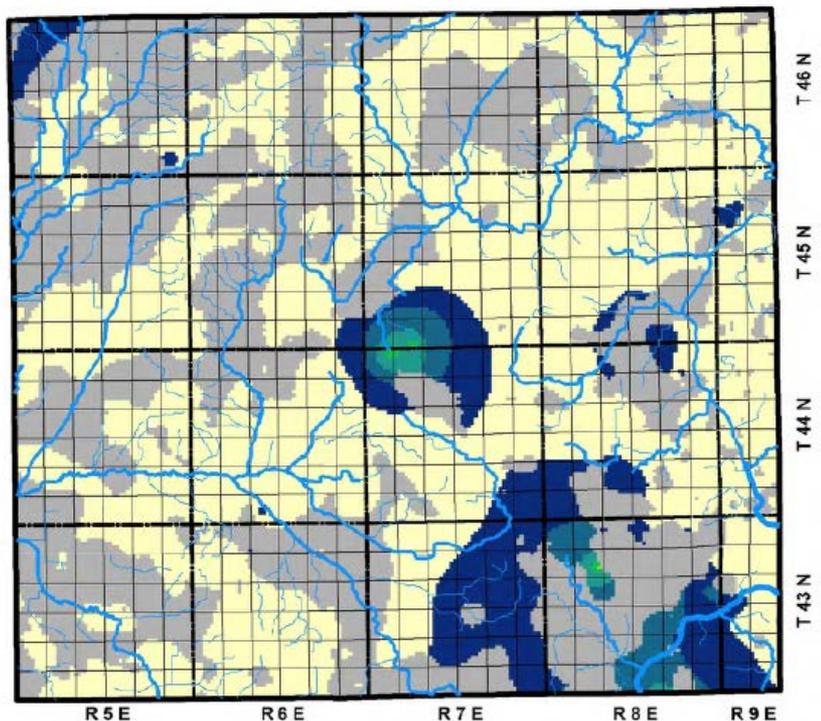


Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Web AppBuilder for ArcGIS
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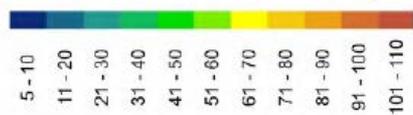
Sandstone aquifer system summary

- Joliet alone switching off the sandstone will not resolve the regional issue. However, communities and industries are moving toward a regional solution.
- As history indicates, the center of the cone of depression will likely move to a new location after communities in Will and Kendall Counties settle on a new source of water
- For the short-term, it is important to closely monitor how changes in the southern portion of the region will impact McHenry County.
- Monitoring in the sandstone aquifers of McHenry County is critical

Woodstock cone of depression

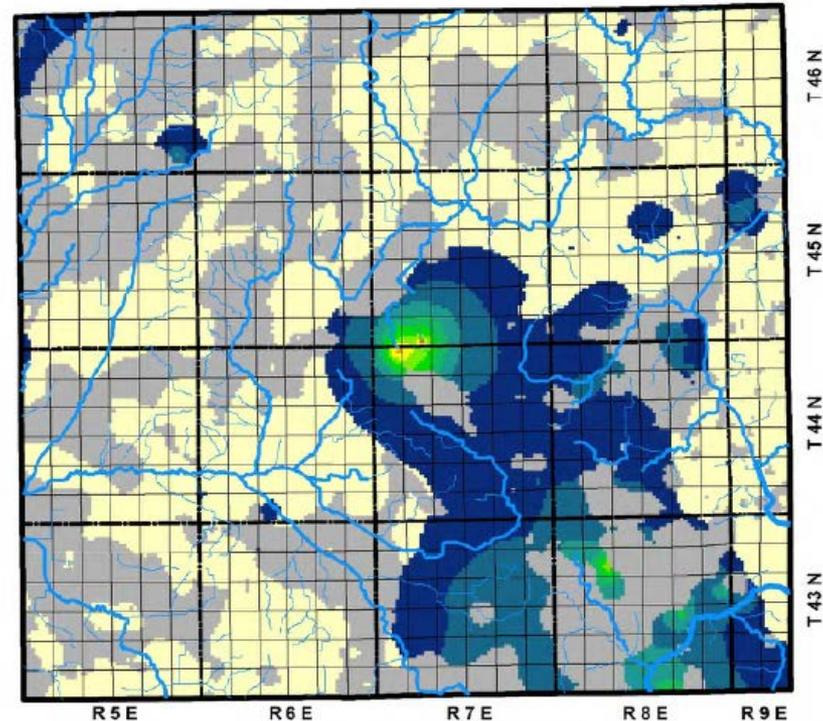


Drawdown Since Predevelopment (ft)

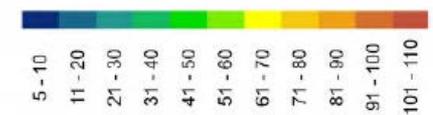


Unit absent
Stream

2009



Drawdown Since Predevelopment (ft)



Unit absent
Stream

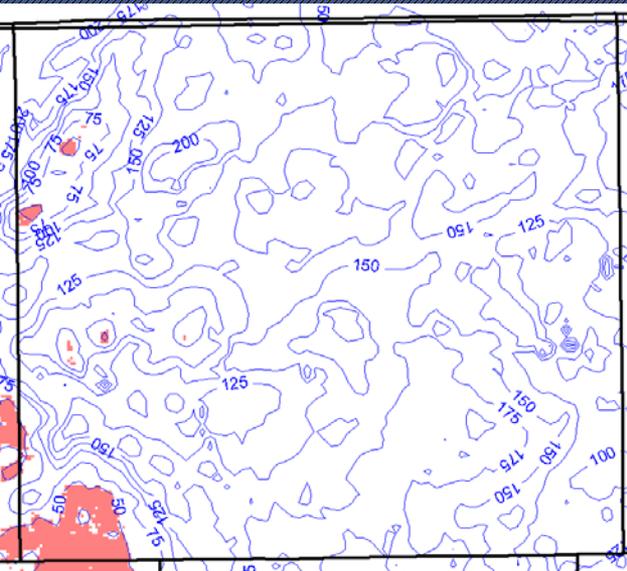
2050

Impacts of drawdown

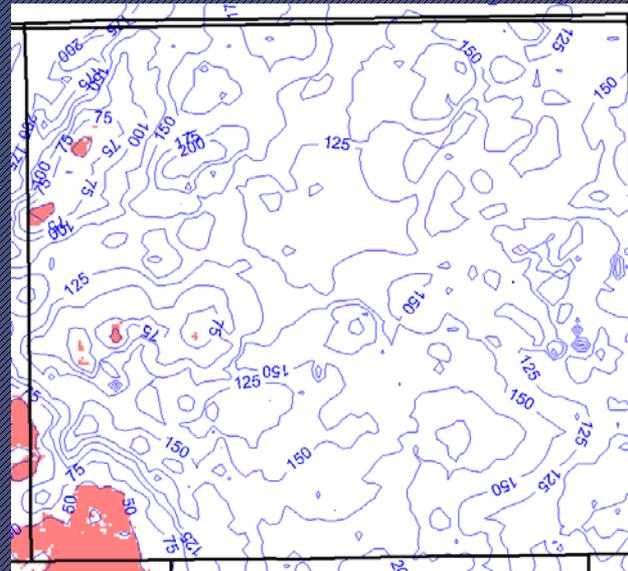
- Is the aquifer at risk of desaturation?
 - Examine both the lowermost sands (Glasford) and a middle sand layer (Ashmore) to see if sands are at-risk of desaturation
 - Note that we are primarily concerned where desaturation has increased since predevelopment conditions

Impact of Woodstock Cone of Deeper Sand (Glasford)

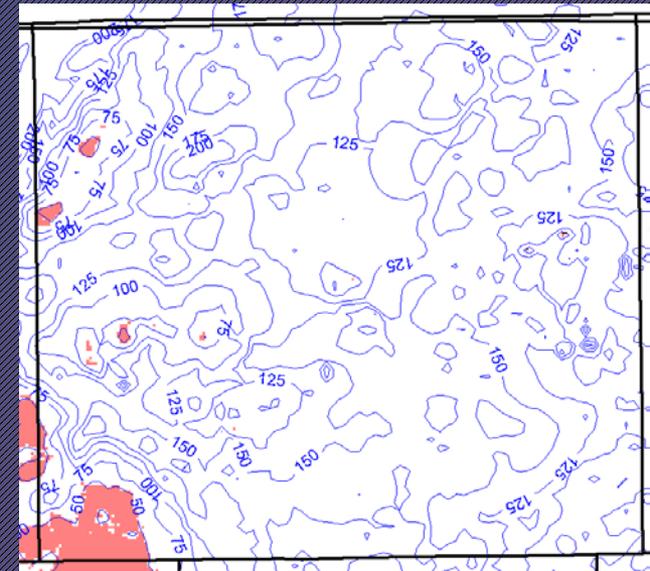
Predevelopment



2009



2050



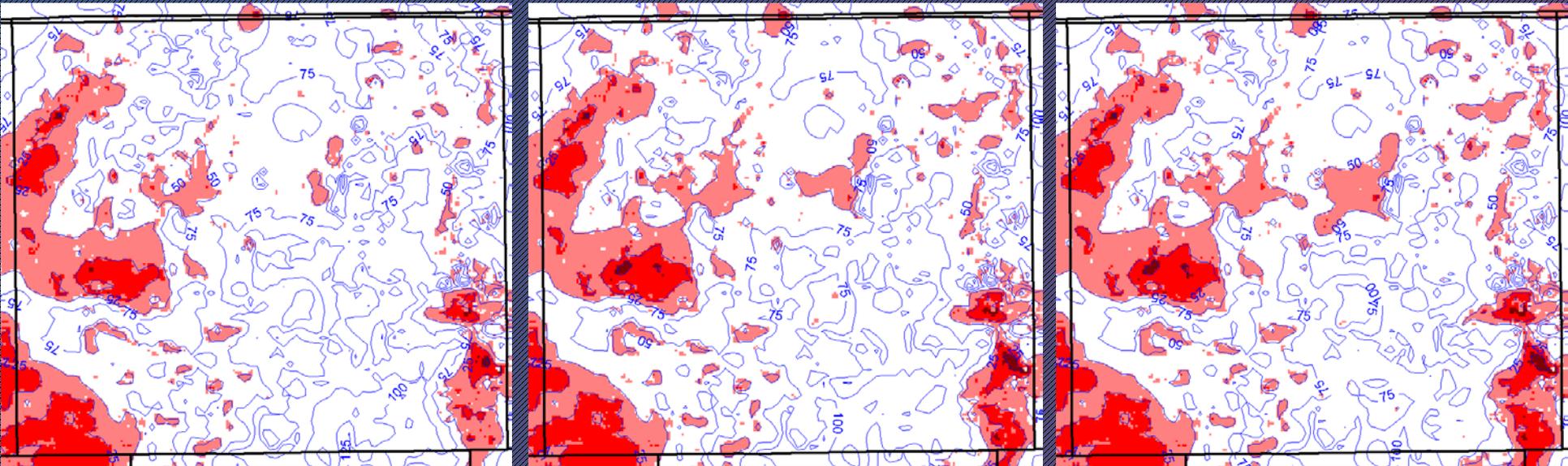
Pink: Heads are 25-50 ft above the top of the basal sand
Red: Heads are 0-25 ft above the top of the basal sand
Maroon: Basal sand is desaturated

Impact of Woodstock Cone of Shallower Sand (Ashmore)

Predevelopment

2009

2050



Pink: Heads are 25-50 ft above the top of the basal sand
Red: Heads are 0-25 ft above the top of the basal sand
Maroon: Basal sand is desaturated

Reduction in natural groundwater discharge

What is allowable? No study in the region that clearly answers this question.

A Michigan Study (Zorn 2008) indicates that reductions in natural groundwater discharge should be limited to 10% to 20% depending on the type of stream; only considers streams with limited anthropogenic impacts

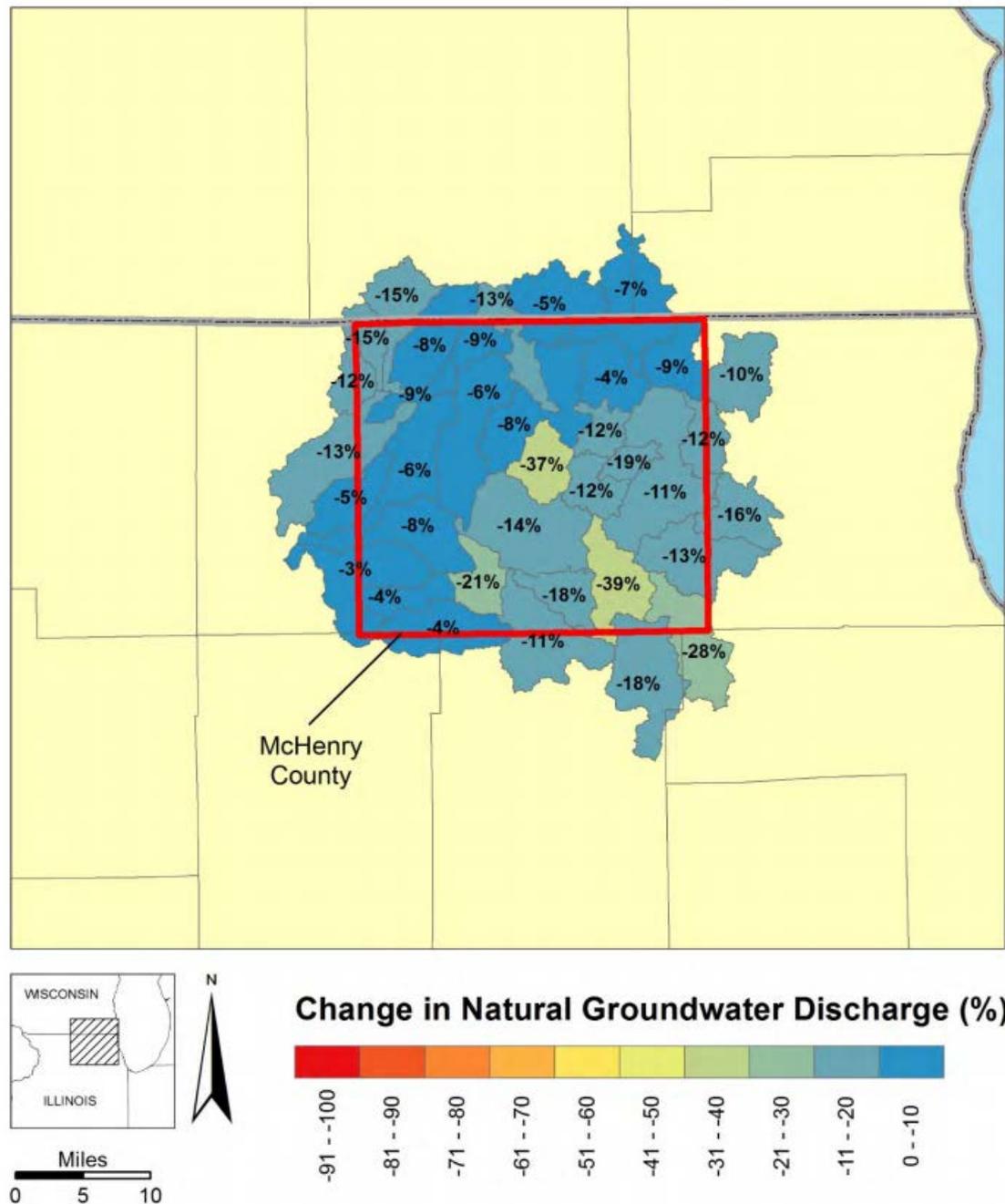
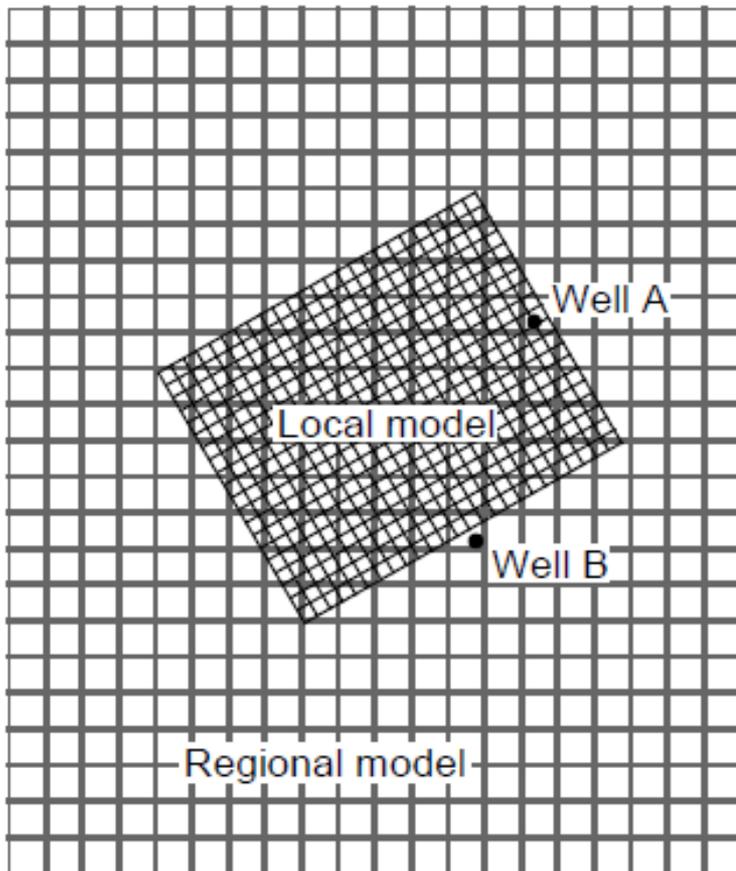
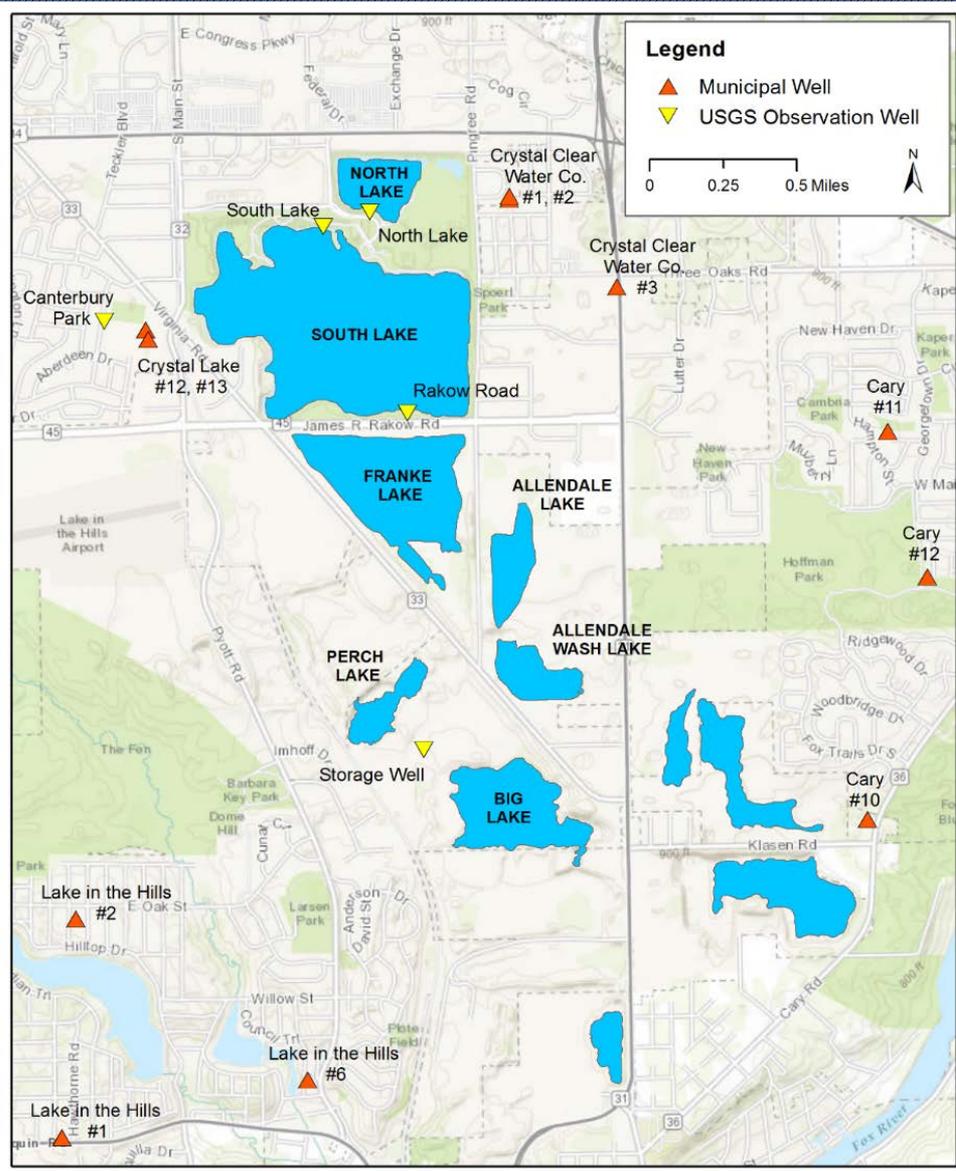


Figure 96 Change in simulated natural groundwater discharge (predevelopment to 2009) in watersheds of the McHenry County area

Local scale models



- Grid is locally refined, using boundary values from the regional model to constrain the model
- As the regional model is updated, so too are the boundaries of the local scale model
- Additional detail may be added to the local scale model to improve the solution- particularly important for local groundwater-surface water interactions



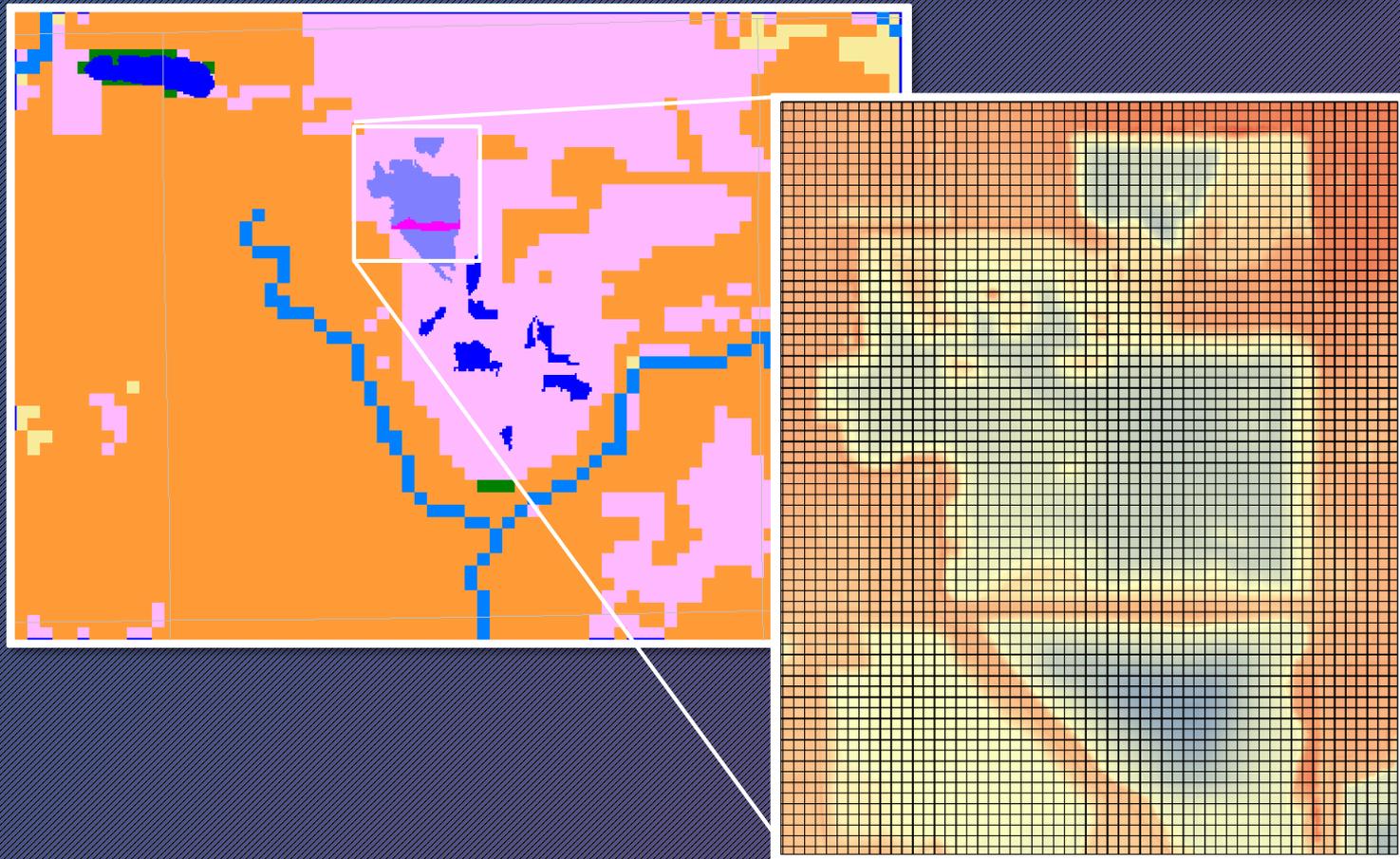
- Issue: How do local lakes interact with the aquifer?
- A local scale model was developed to calibrate to observed heads and flux measurements leaving the lake to the aquifer.

Data essential to modeling efforts

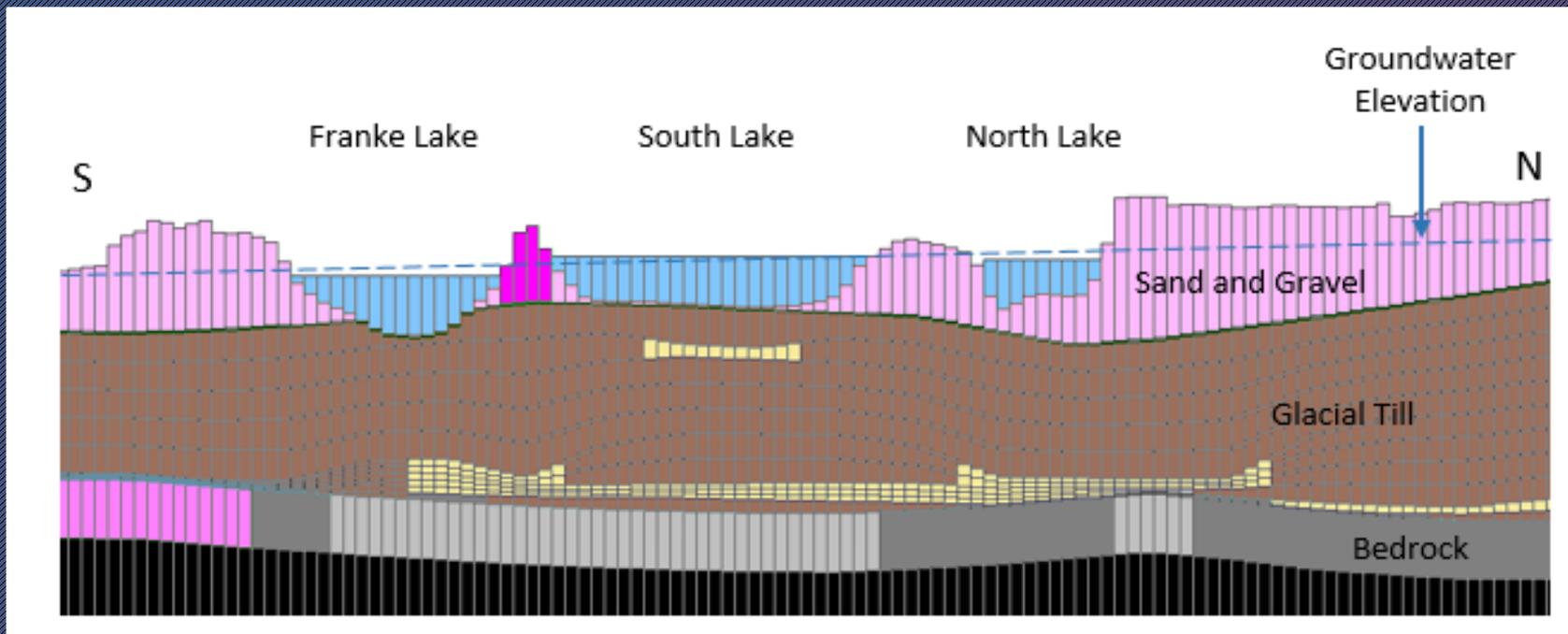
- Seepage of lake water into the subsurface is an essential metric in understanding groundwater-lake interactions
- Provided a calibration target to build confidence in the groundwater flow model



Local scale model



Local scale model: Cross-sectional view



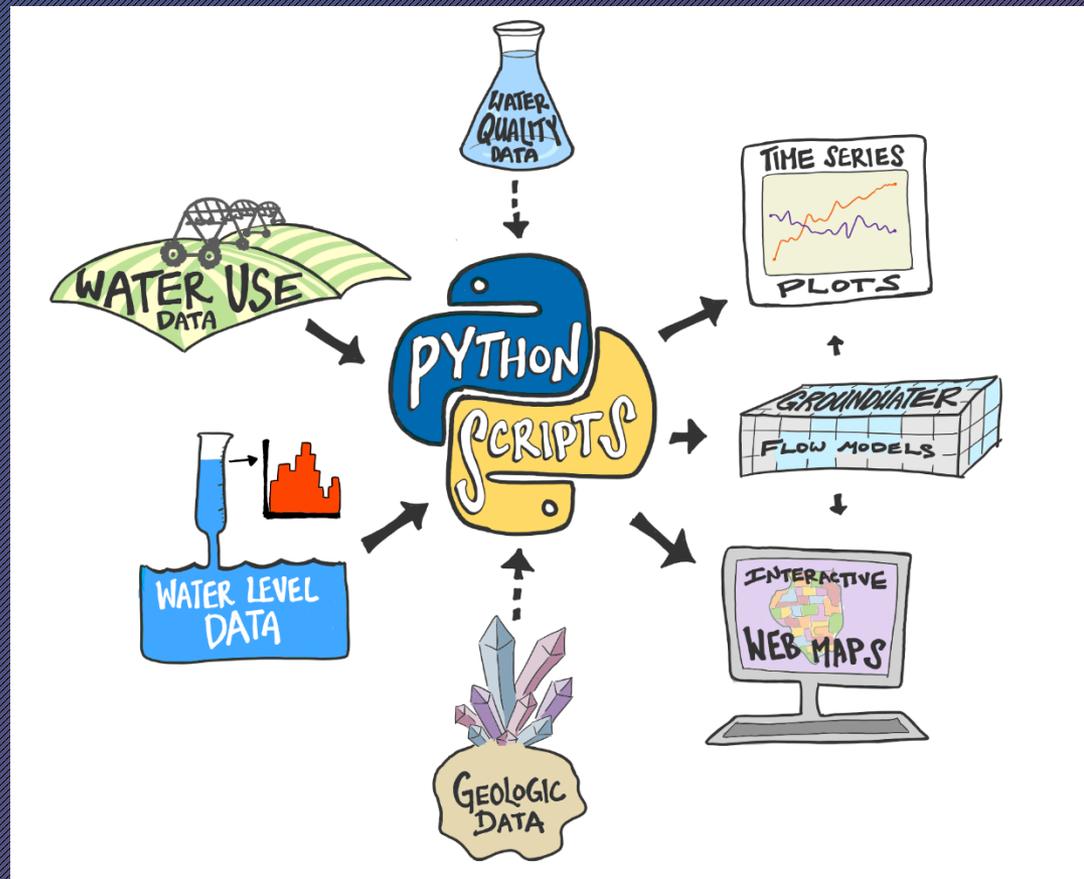
Modeled scenarios

| Scenario | Description | North Lake Level (ft AMSL) | South Lake Level (ft AMSL) | Franke Lake Level (ft AMSL) | Net Flow from South Lake into Aquifer (ft ³ /day) |
|----------|---|----------------------------|----------------------------|-----------------------------|--|
| | None (Calibrated TORA Model) | 862.8 | 861.7 | 846.9 | 6,356 |
| 1 | Downgradient Quarrying | 862.2 | 859.8 | 823.2 | 5,056 |
| 2 | Increased Precipitation by 10% | 863.2 | 863.6 | 848.8 | 16,666 |
| 3 | Increased Precipitation by 20% | 863.9 | 865.7 | 850.7 | 27,189 |
| 4 | Decreased Precipitation by 10% | 862.8 | 860.2 | 845.0 | -3,641 |
| 5 | Decreased Precipitation by 20% | 862.8 | 858.1 | 842.7 | -14,411 |
| 6 | 100 gpm input from well at TORA | 862.8 | 864.2 | 847.2 | 25,213 |
| 7 | 200 gpm input from well at TORA | 862.8 | 867.1 | 847.5 | 44,687 |
| 8 | 100 gpm input from Crystal Lake wellfield | 863.1 | 864.1 | 847.1 | 25,342 |
| 9 | 200 gpm input from Crystal Lake wellfield | 864.3 | 868.6 | 847.8 | 44,782 |

- Result: all model scenarios yielded minimal flow exchange between the lake and the aquifer

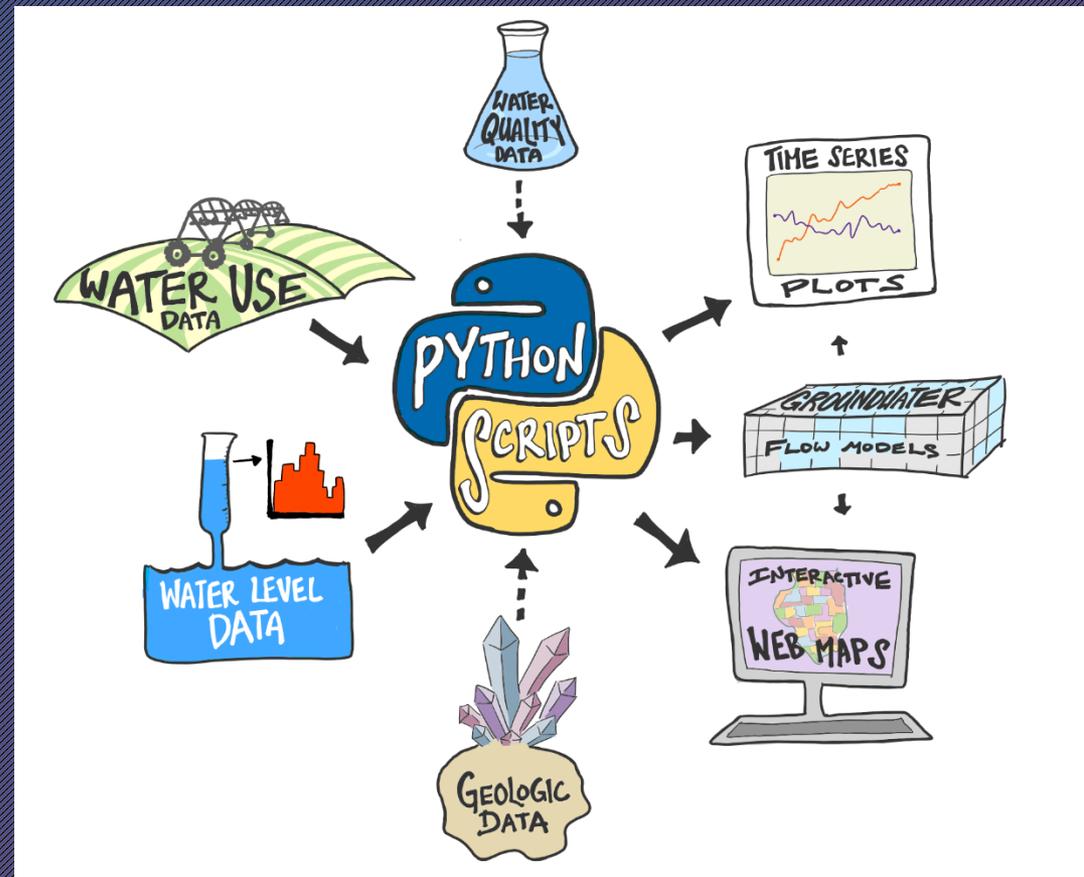
Next steps: Move McHenry County model into regional modeling framework

- The McHenry County model was developed for a specific project
 - Not created with further thoughts of keeping the model updated with new geology and pumpage
- As a result, the model is not maintained as up-to-date like the regional models of the state



Next steps: Participatory Modeling Framework

- Active stakeholder involvement in the development of model inputs and communication of model outputs
- Illinois Indiana SeaGrant proposal in development which would focus on the McHenry County region



Contact Information

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