Water for Kane County

Highlights of the Illinois State Water Survey's Results and Application to the Northeast Illinois Water Supply Planning Process

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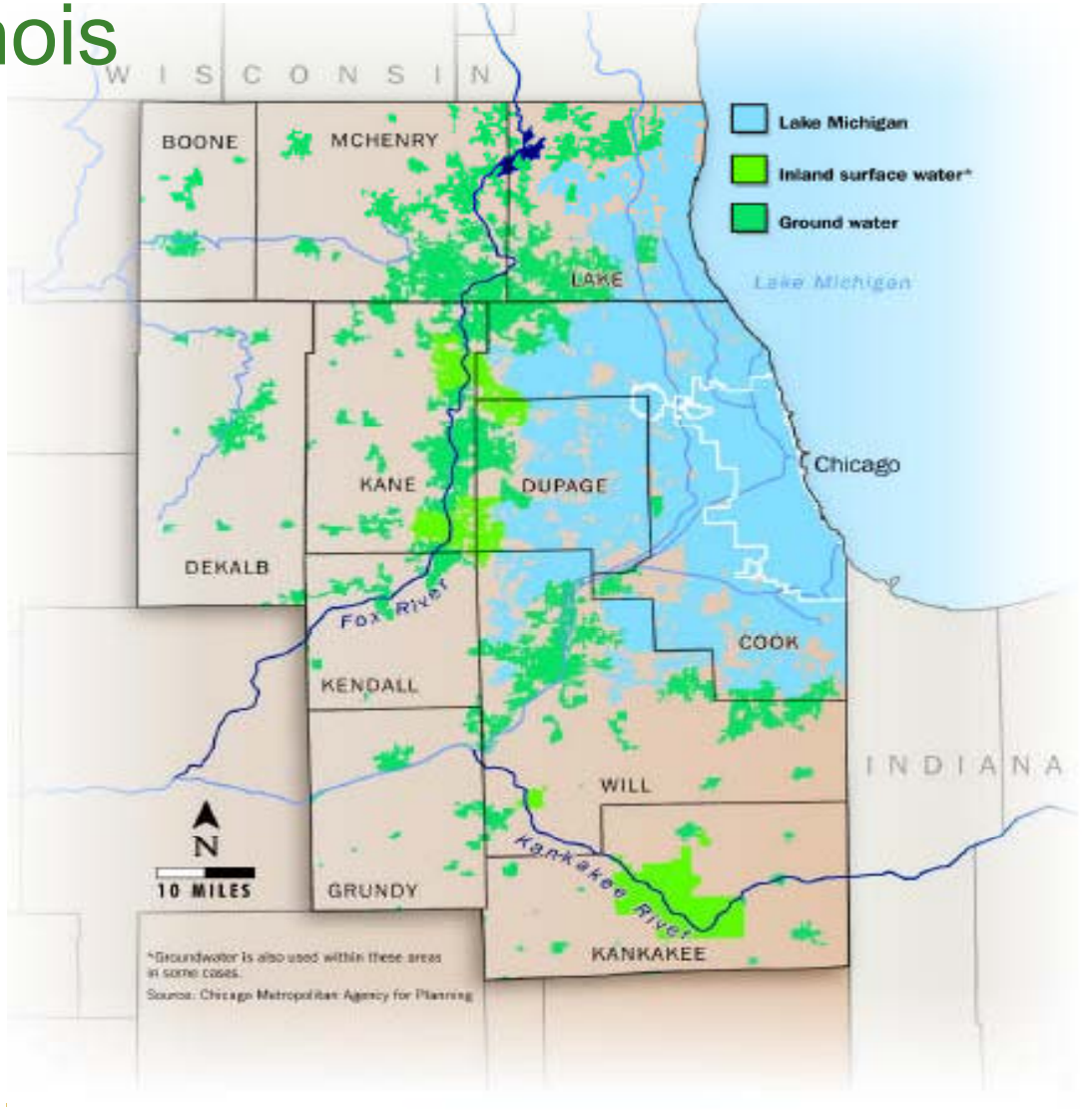
Water Sources for Public Supply in Northeast Illinois



Kane County Water Resources Assessment Project

- Defines water resources & provides a scientific basis for county water supply planning
- Identifies potential for new withdrawals and impacts of withdrawals
- Models historical gw withdrawals & scenarios to 2050; placing new withdrawals at existing well sites
- Provides tools for analyzing impacts from new wells & surface intakes/discharges on the Fox River
- Does not determine:

  a) water quality impacts,

  b) quantity/quality impact acceptability, or

  b) costs

Kane County Water Resources Assessment Project

- **Level of effort**

  5+ year project period

  $1.8M (Kane County) + ~$1M (GRF) = ~$2.8M invested

  Involved ~60 professional, technical and support staff,
  17 students, and 7 senior administrative staff

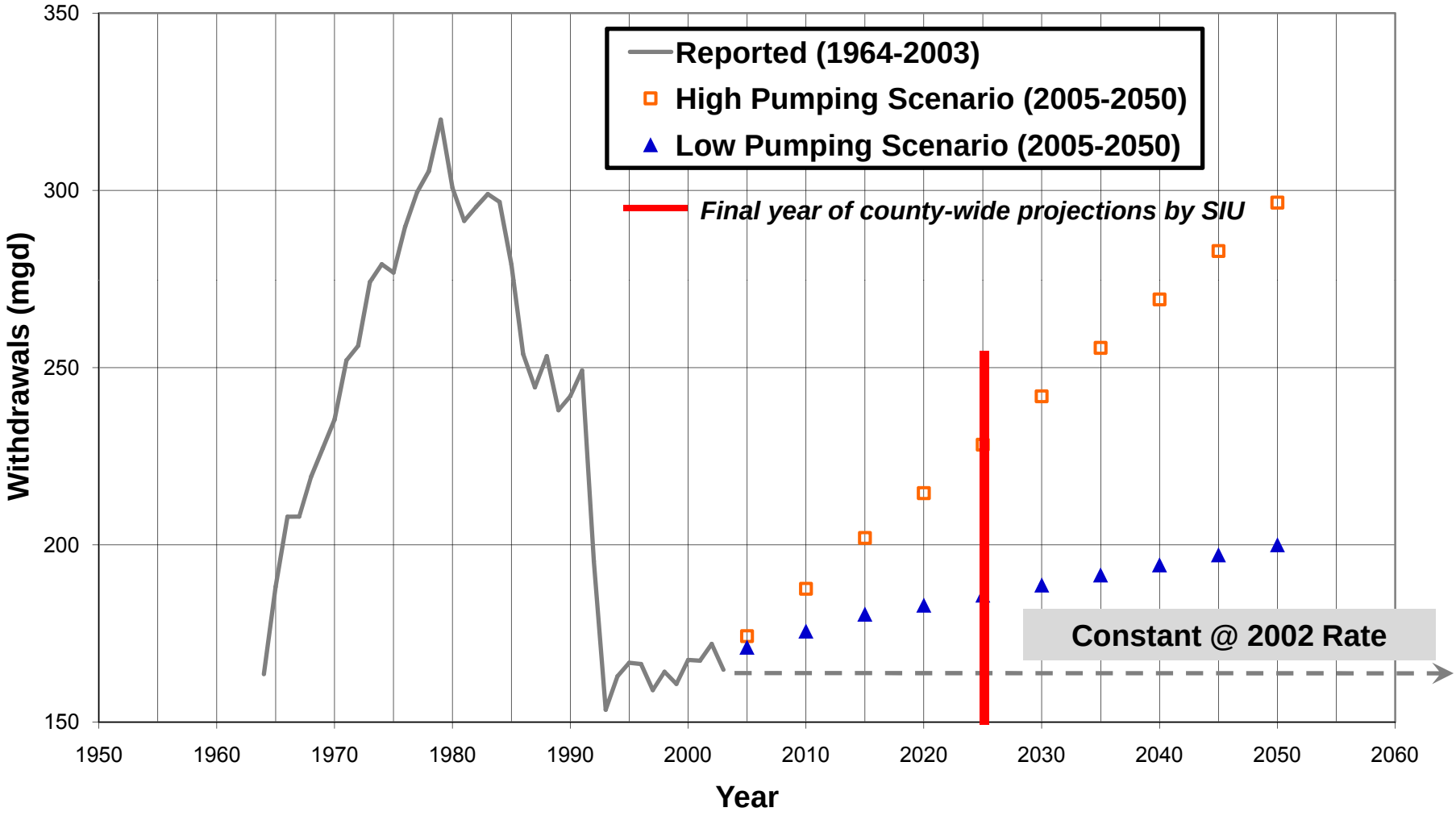
- **Products**

  Data: 2000+ water levels, miles of geophysics, hundreds of feet of new boreholes, analysis of 70+ water samples

  Maps: geologic surfaces, major aquifers, potential for contamination, potentiometric surfaces of shallow aquifers

  Tools for Kane County: 3D Geologic Model, Regional GW Flow Model, Local Shallow Aquifers GW Flow Model, Kane County Surface Water Accounting Model

Reported & Projected Groundwater Withdrawals from Public Supply, Self-Supplied Commercial & Industrial, and Irrigation Sectors in NE Illinois



Kane County Water Withdrawals

1964

25mgd (all groundwater)

2003

63 mgd

40 mgd groundwater (20 mgd shallow/20 mgd deep)

23 mgd surface water

90% for public supply

2050

+12 to +31 mgd groundwater

+ ?? surface water (not projected)

Major Conclusions

- In 2007, ~68 mgd serves 0.5M people in Kane County
- Current withdrawals of water from the aquifers have impacts and costs and will have increased long-term impacts and costs as the system adjusts to these withdrawals
- Withdrawals from the Fox River rely in part on treated waste water from Wisconsin at low flow; low flow limits withdrawals.
- In 2050 water demand in Kane County could be 100+ mgd
- Lake Michigan is not expected to be an important source of water for Kane County
- More water can be withdrawn from the Fox River and shallow and deep aquifers with inherent impacts and costs
- Many environmental impacts can be avoided or mitigated at cost
- Reducing water demand reduces or delays impacts and costs

Impacts, Risks, and Costs to 2050

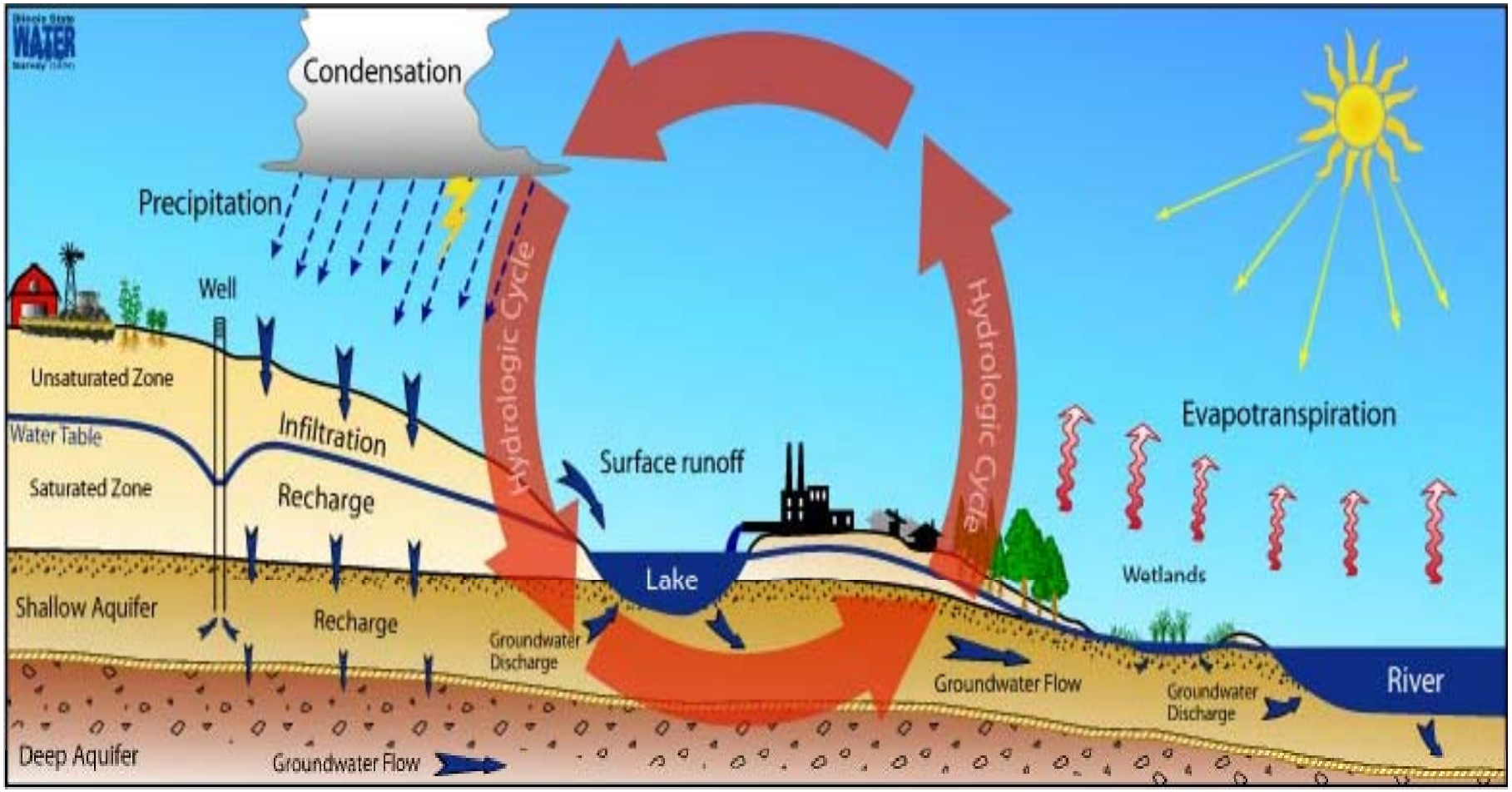
- Expanding and deepening cones of depression in aquifers – not problems *per se*
  - Some existing and new wells go dry
  - Dewater some parts of deep aquifers
  - Reduce baseflow in some streams
  - Water quality concerns and treatment costs
- Droughts and climate change?
- If Wisconsin obtains permission to divert water from Lake Michigan this could reduce low flow in the Fox River and limit future withdrawals in Kane County; may require modification of operation of Stratton Dam

The Bottom Line!

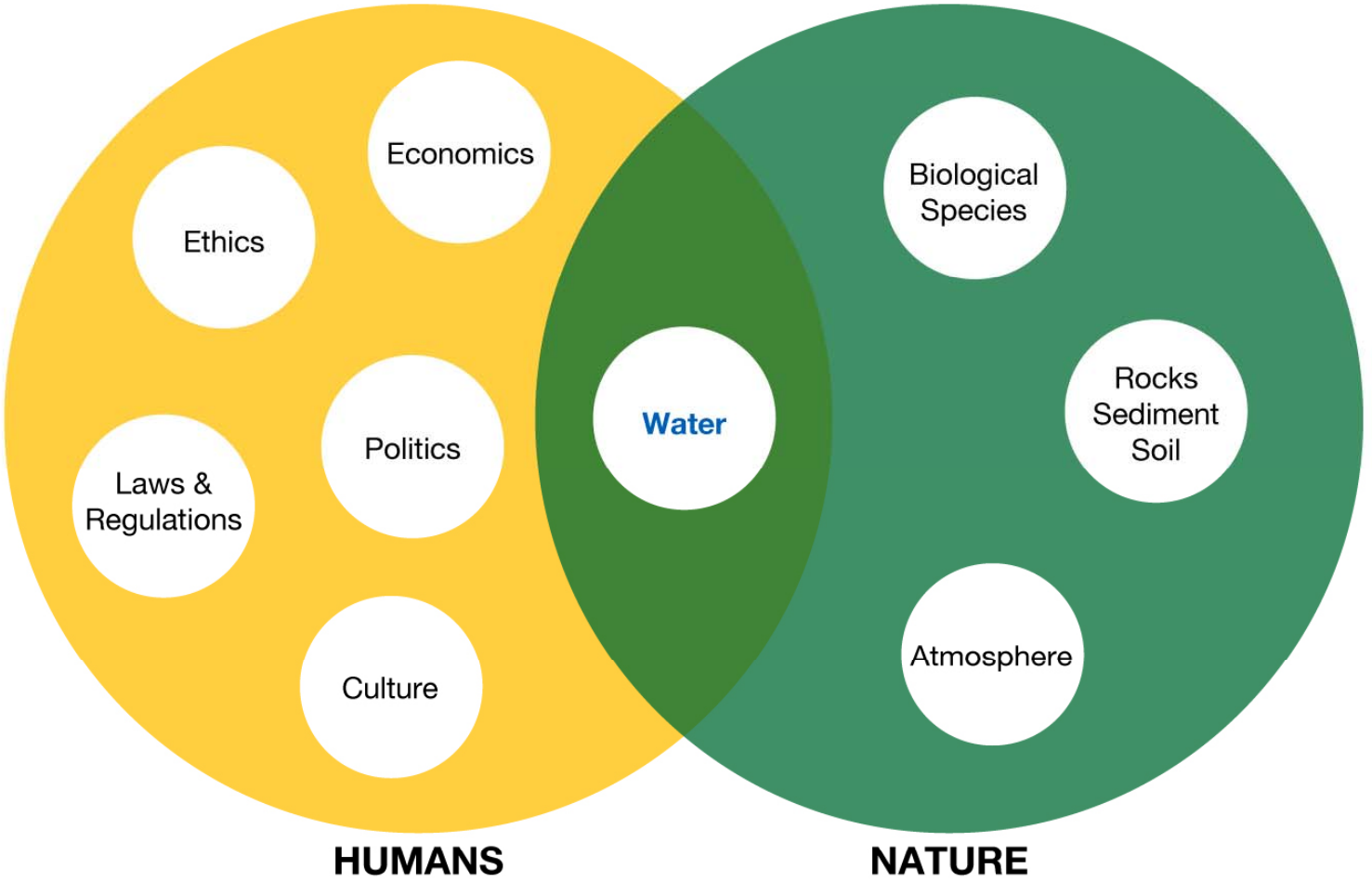
- All water withdrawals have impacts and costs.
- What environmental and financial costs are you willing to bear to provide adequate and reliable sources of clean water to meet demand?
- How much water are you prepared to conserve/reuse?
- How much risk are you willing to bear?
- It is up to you, the public and decision-makers, to ask/answer these questions and incorporate the questions/answers in management policies and strategies.

The Water Cycle

Climate, surface water, and groundwater are linked



Water Supply Planning and Management



Water Supply Planning Toolbox

- Kane County Surface Water Accounting Model (KC-SWAM)
- Local Shallow Aquifers Groundwater Flow Model
- Regional (Deep Bedrock Aquifers) Groundwater Flow Model

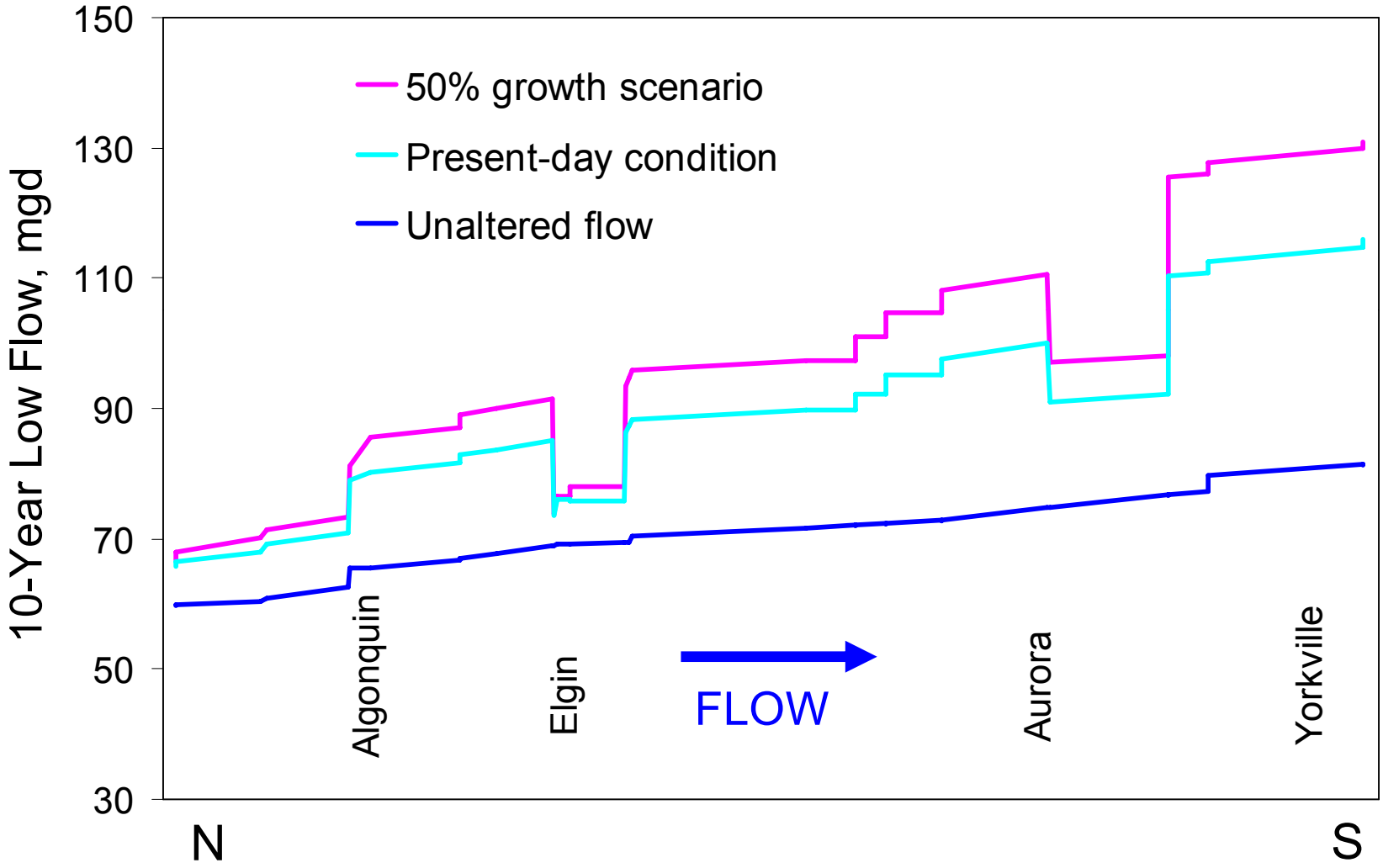
Factors Affecting Fox River Low Flows and Fox River Water Availability

1-2. Climate variability and Effluent discharges (tied)
3. Stratton Dam operation
4. Water use withdrawals

Land use/urbanization**
Groundwater use effects on baseflow**

**Variable local effects that are often difficult to detect and predict

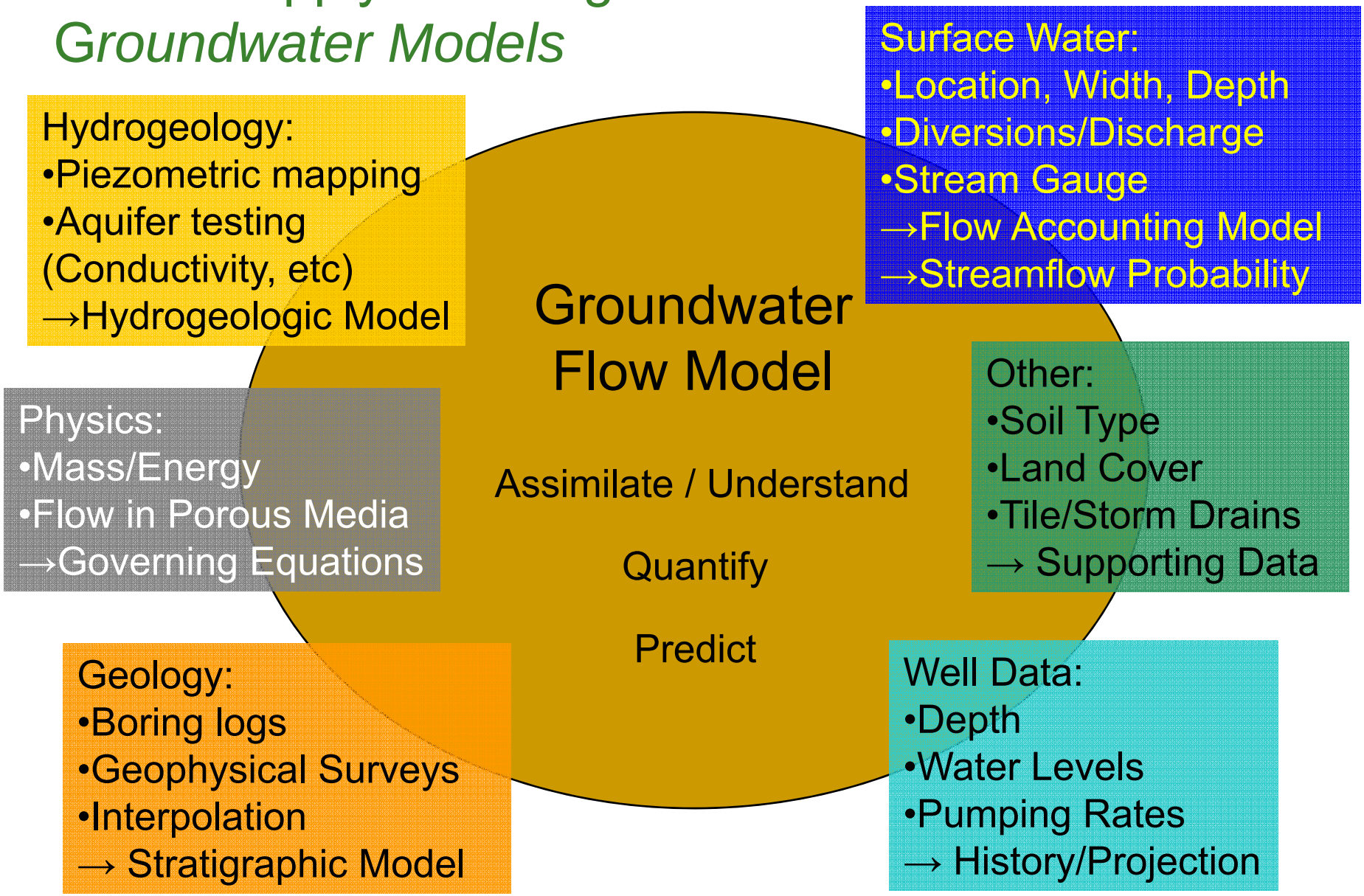
Fox River Low Flows: KC-SWAM 50% Growth Scenario



Using the Kane County-Surface Water Accounting Model (KC-SWAM) for Building Water Use Scenarios

- KC-SWAM can help identify preferred locations for siting new facilities to minimize adverse impacts on Fox River low flows.
- Once a scenario using KC-SWAM has been created, additional modifications can be built-on as alternative plans are formulated.
- KC-SWAM can be used to assess potential impacts on Fox River flows resulting from various water use growth scenarios; water use scenarios can be saved and shared…
- Leading to a better understanding of potential stream conditions, and …
- Development of more effective alternative plans.

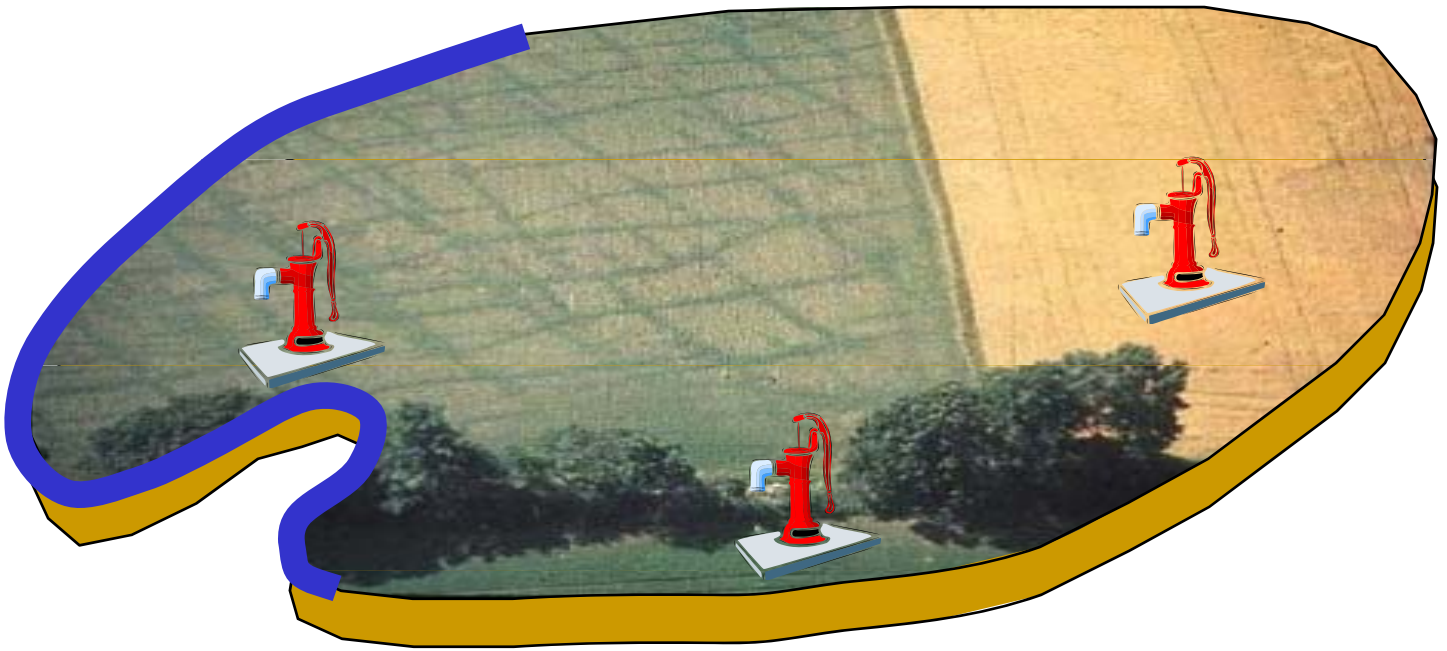
Water Supply Planning Toolbox - *Groundwater Models*



Questions the Models Can Answer

Where does the water (recharge) come from?

Does pumping affect streamflow?



Are additional measurements needed, and where?

What are the long-term effects of current pumping?

For this Study, 2 Groundwater Models Were Developed:

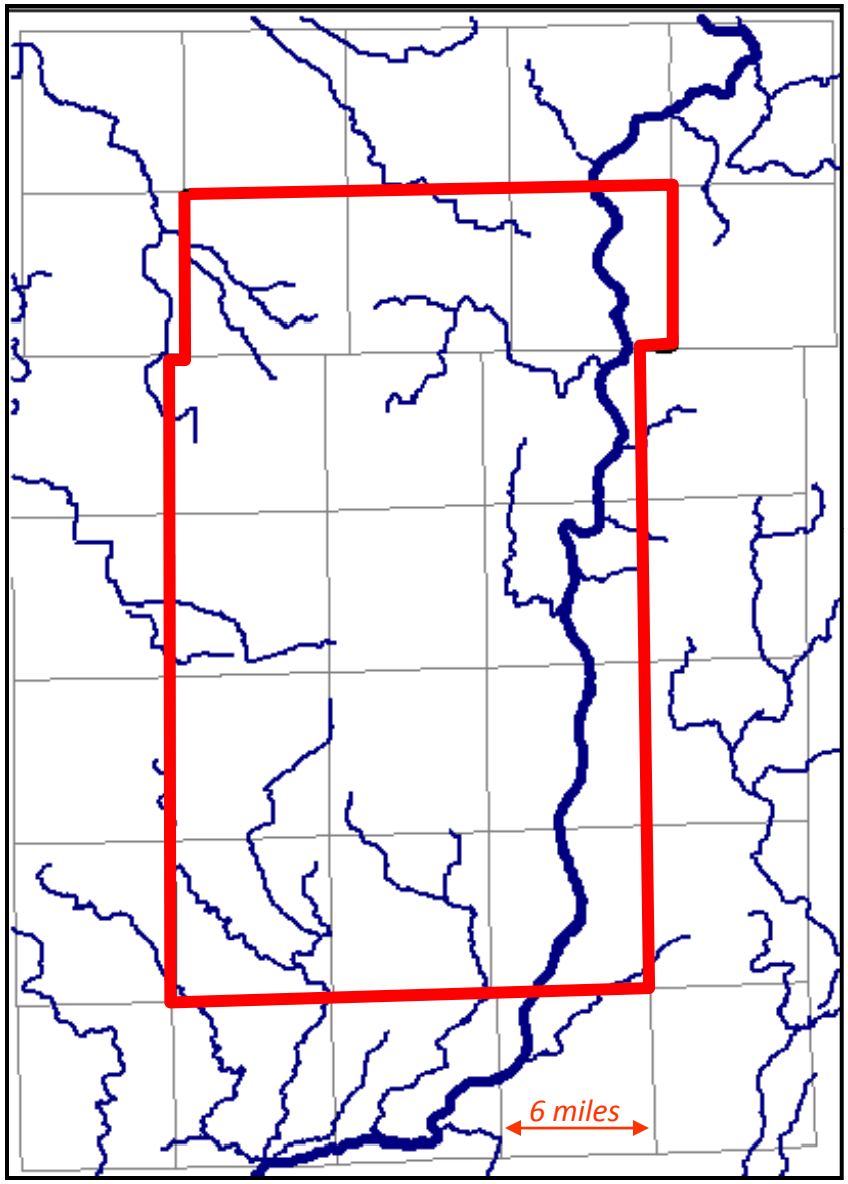
Regional (Deep) Model
Approx. 800,000 nodes
Max grid spacing 16 mi.
Min grid spacing 2,500 ft.
All aquifers

Local (Shallow) Model
Approx. 1.5 million nodes
Grid spacing 660 ft.
Shallow aquifers only

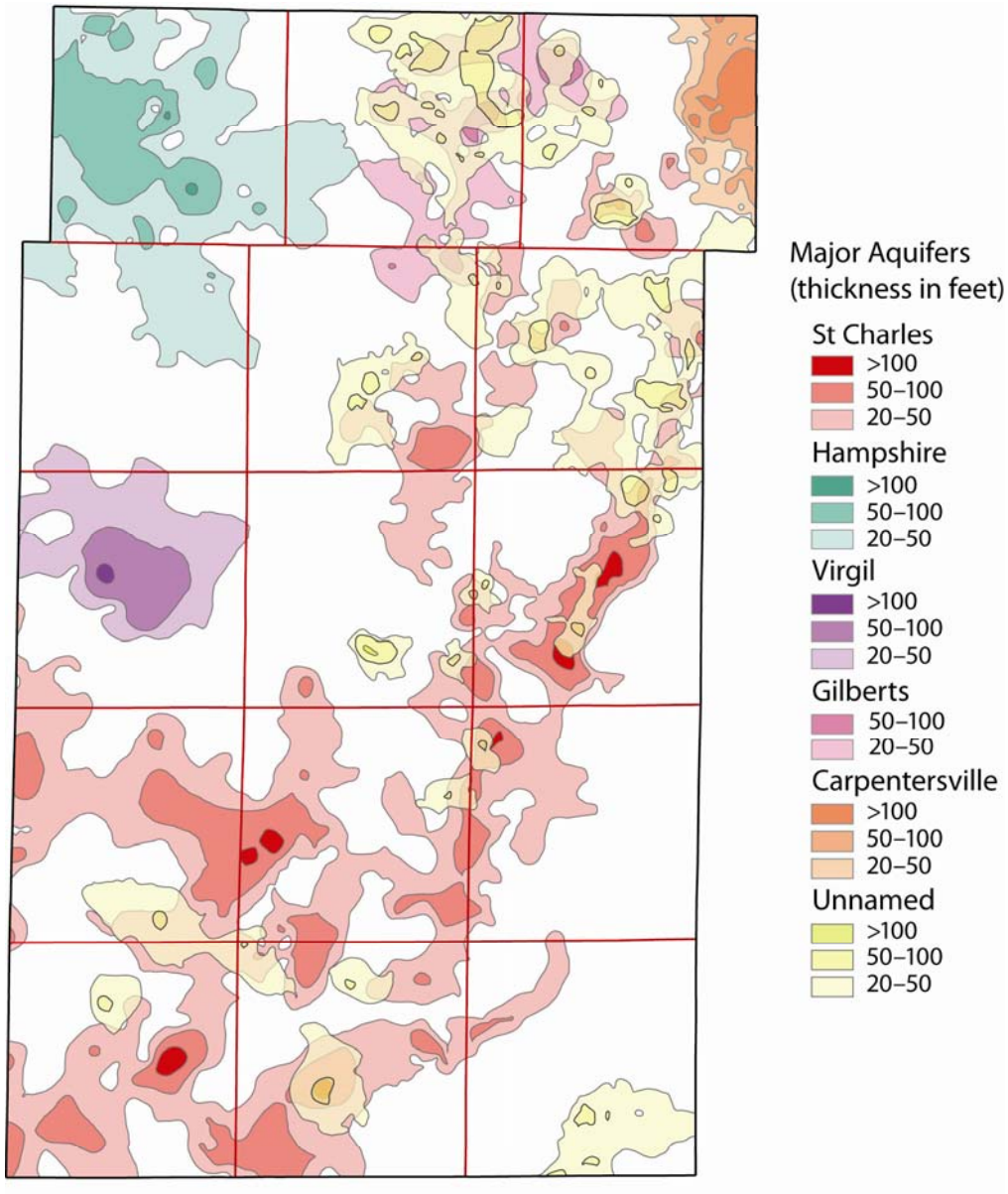
For consistency and realism, the local model takes its boundary conditions from the regional model

The Local Shallow Aquifer Model

- Kane County plus township buffer area
- 18 Layers
  - 9 aquifers
  - 9 aquitards
- 600’ x 600’ grid spacing



Major Quaternary Aquifers

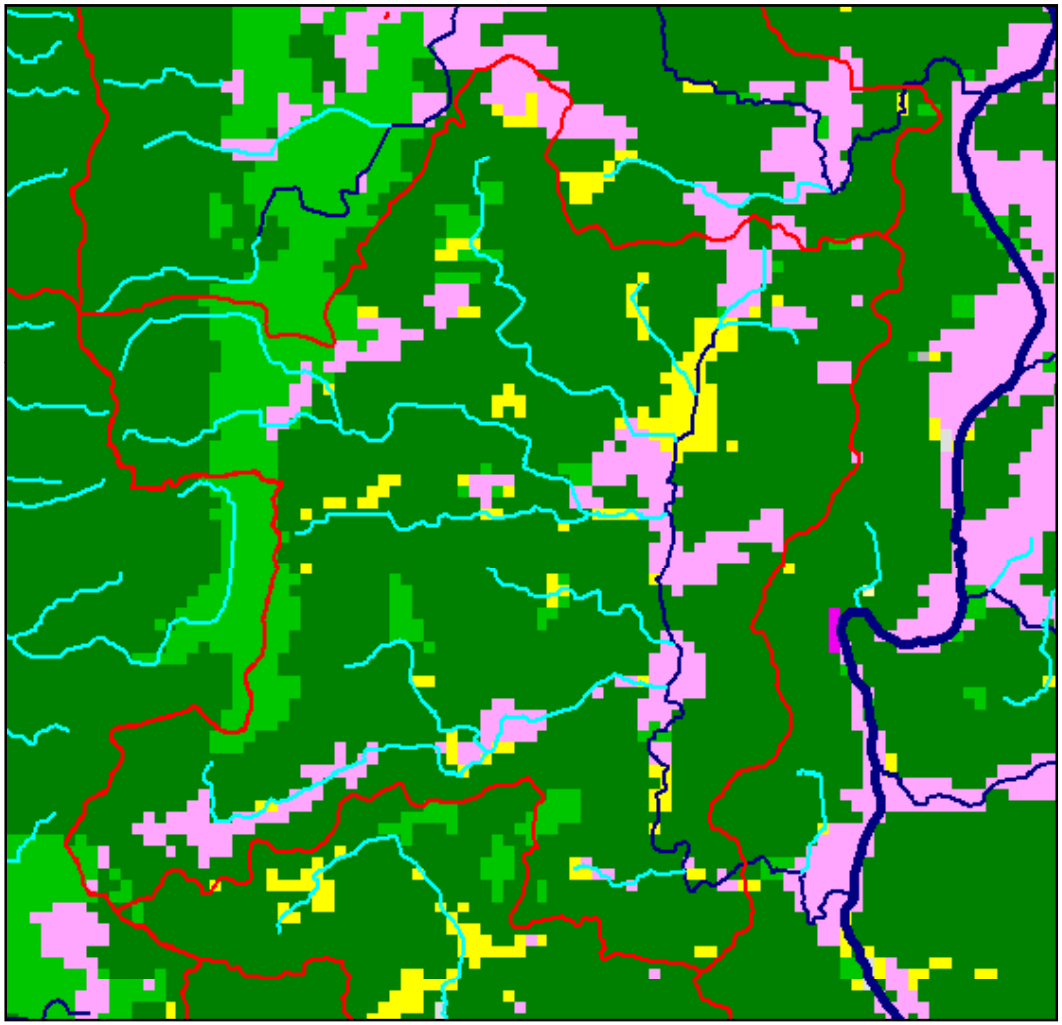


What does the top model layer look like?

Ferson-Otter Creek Watershed

Permeability & Recharge Zones

- Clay-rich diamicton
- Silts
- Shallow sands
- Intermediate sands
- Dolomite/shale

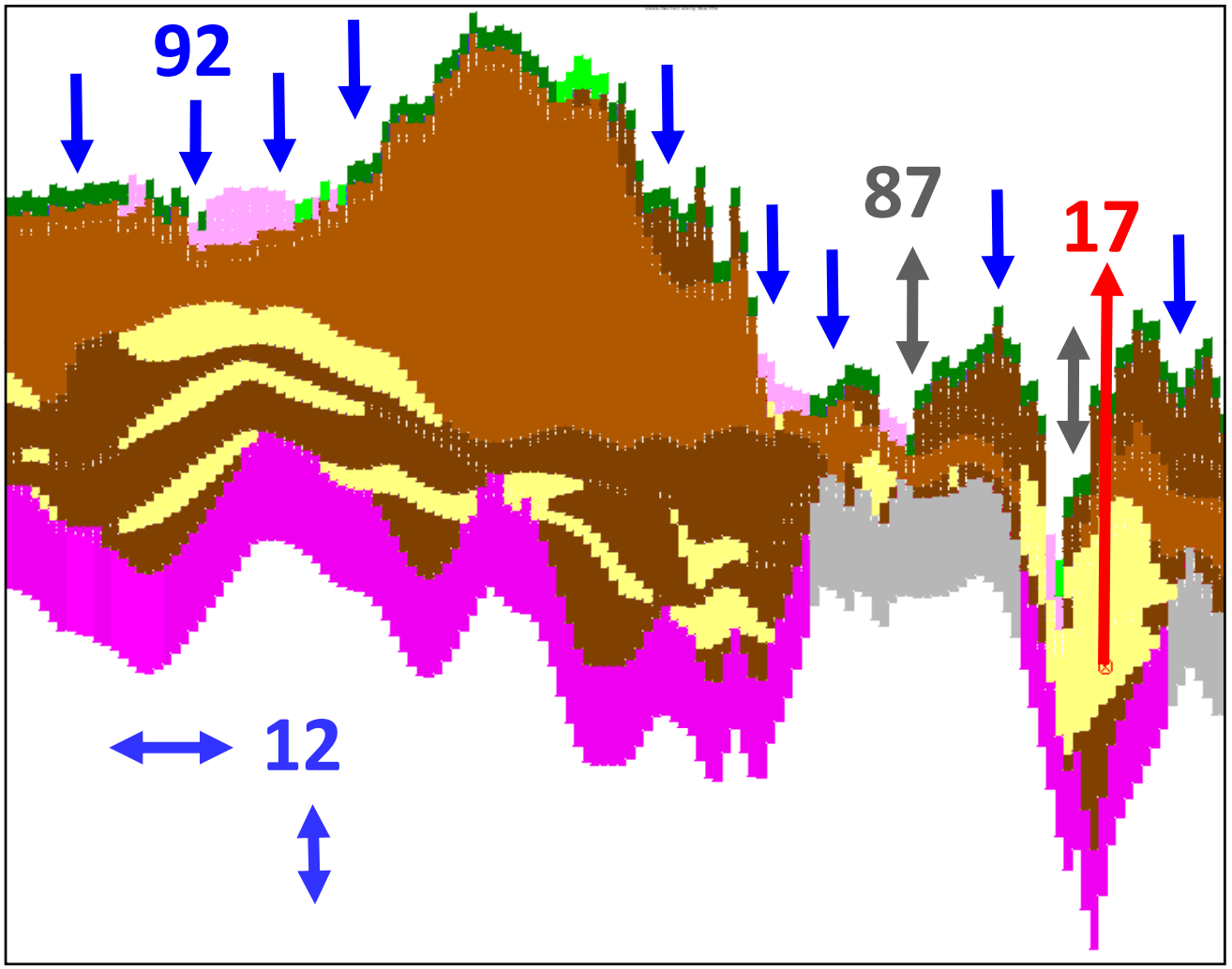


Model Results – Shallow Aquifer System

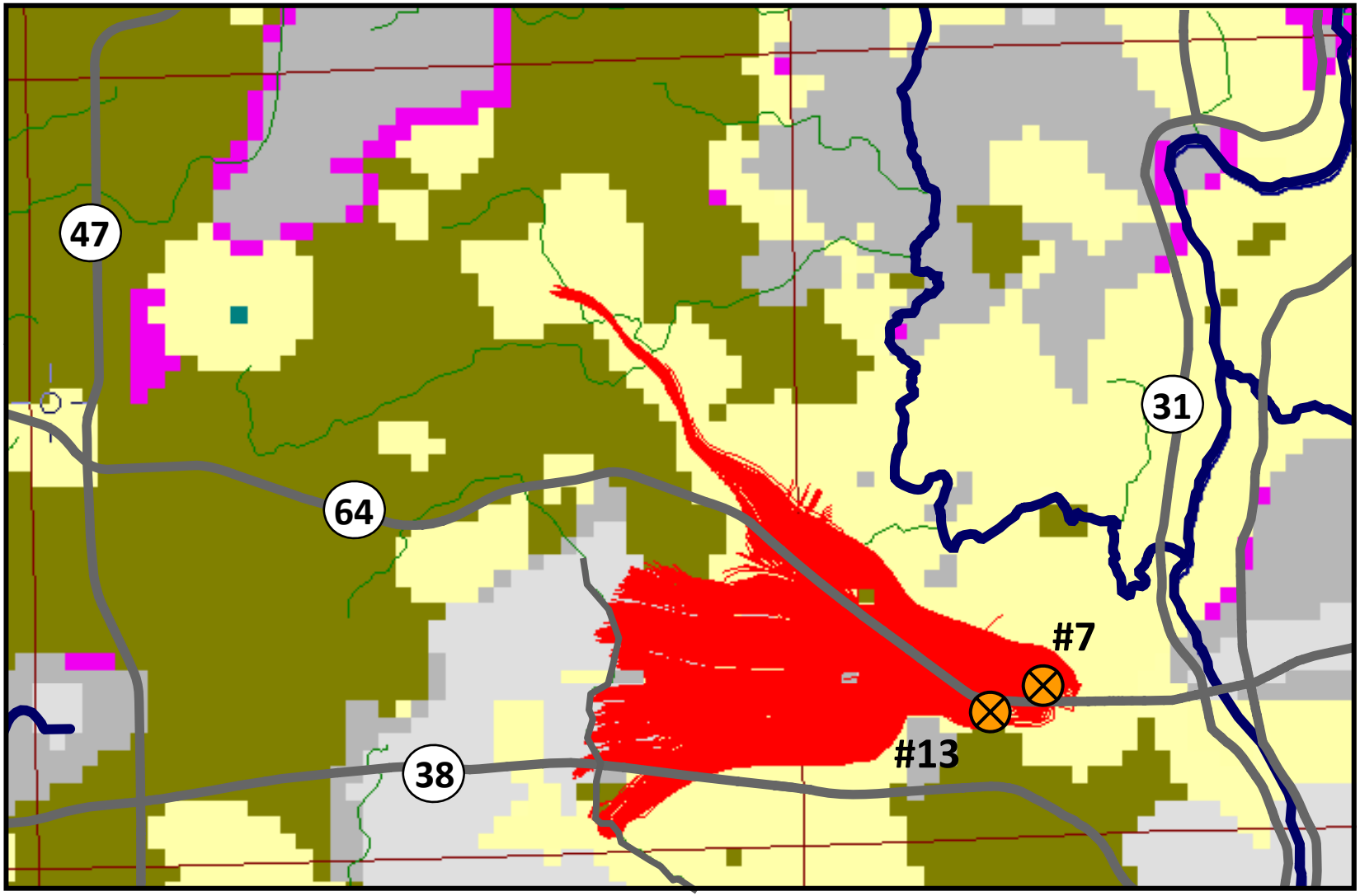
County Flow Budget

Inflows	*(MGD)*
Recharge	92
Lat/vert flow	12
Total	104

Outflows	*(MGD)*
Streams	87
Wells	17
Total	104



Capture Zone of St. Charles Wells #7 & #13



Layer 14

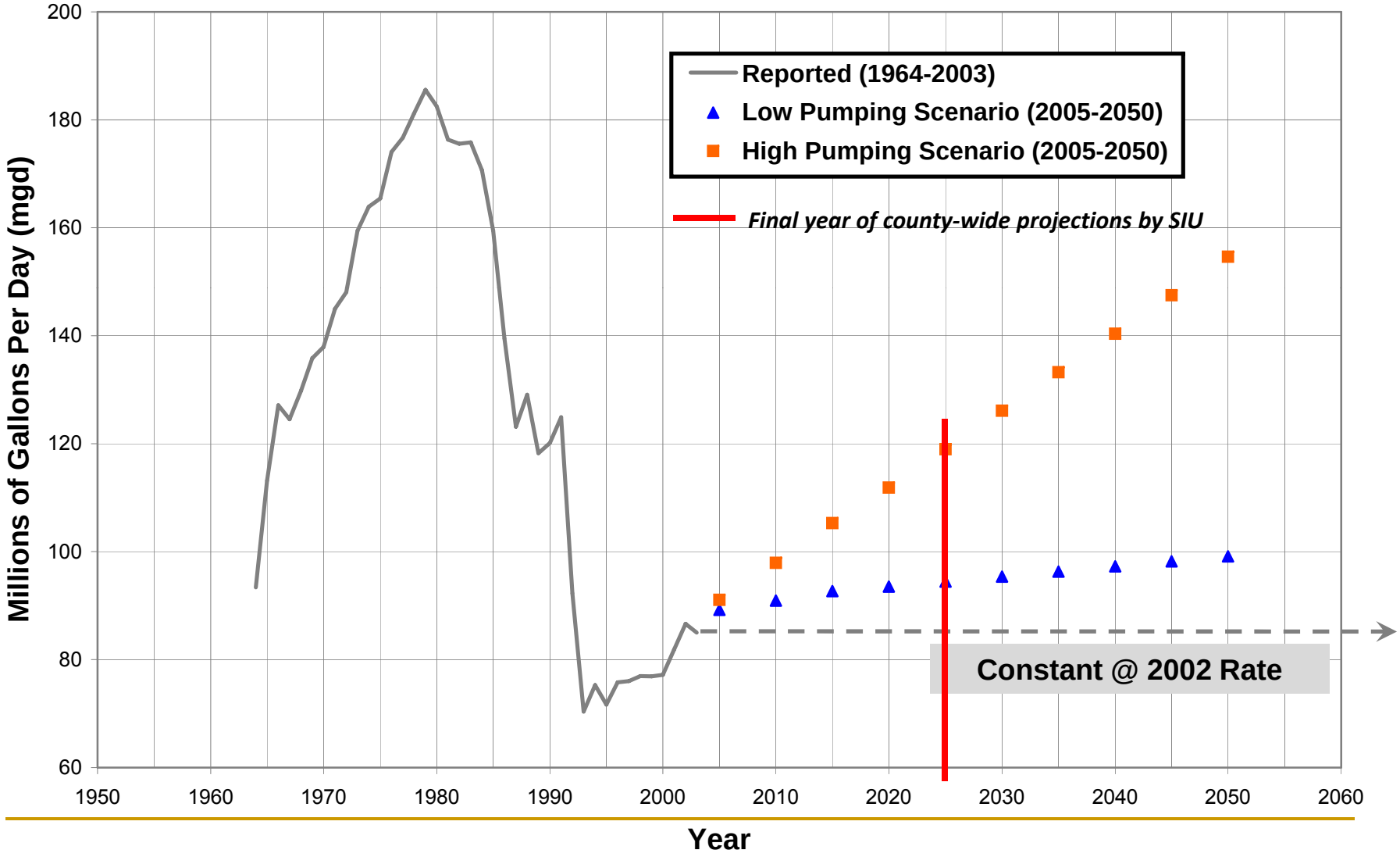
40 Years

Local Shallow Aquifer Flow Model Uses

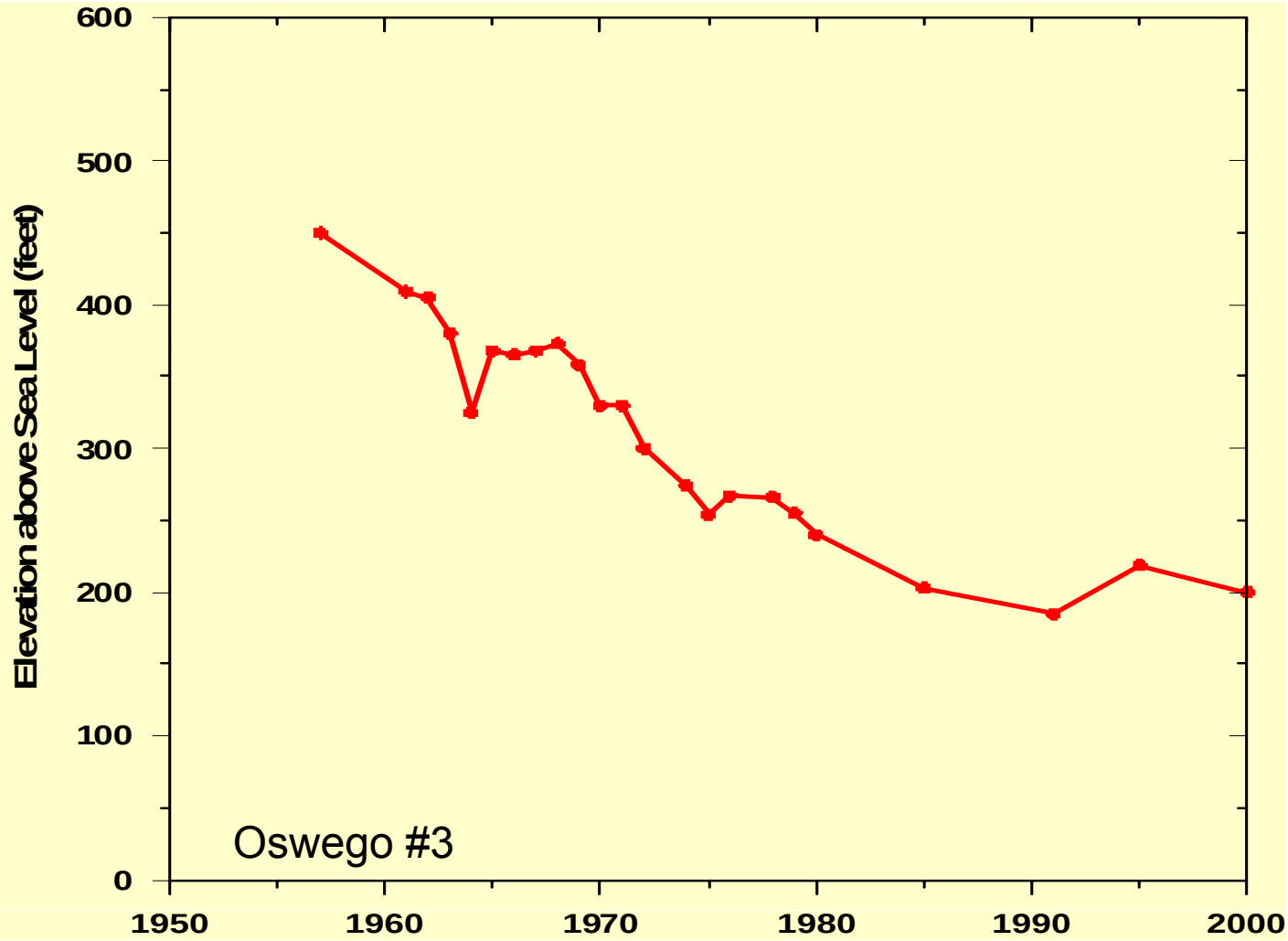
- Impacts of future pumping
- Capture zone analysis
- Interaction with streams
- Locating new well fields

Regional (Deep Bedrock)Groundwater Flow Model

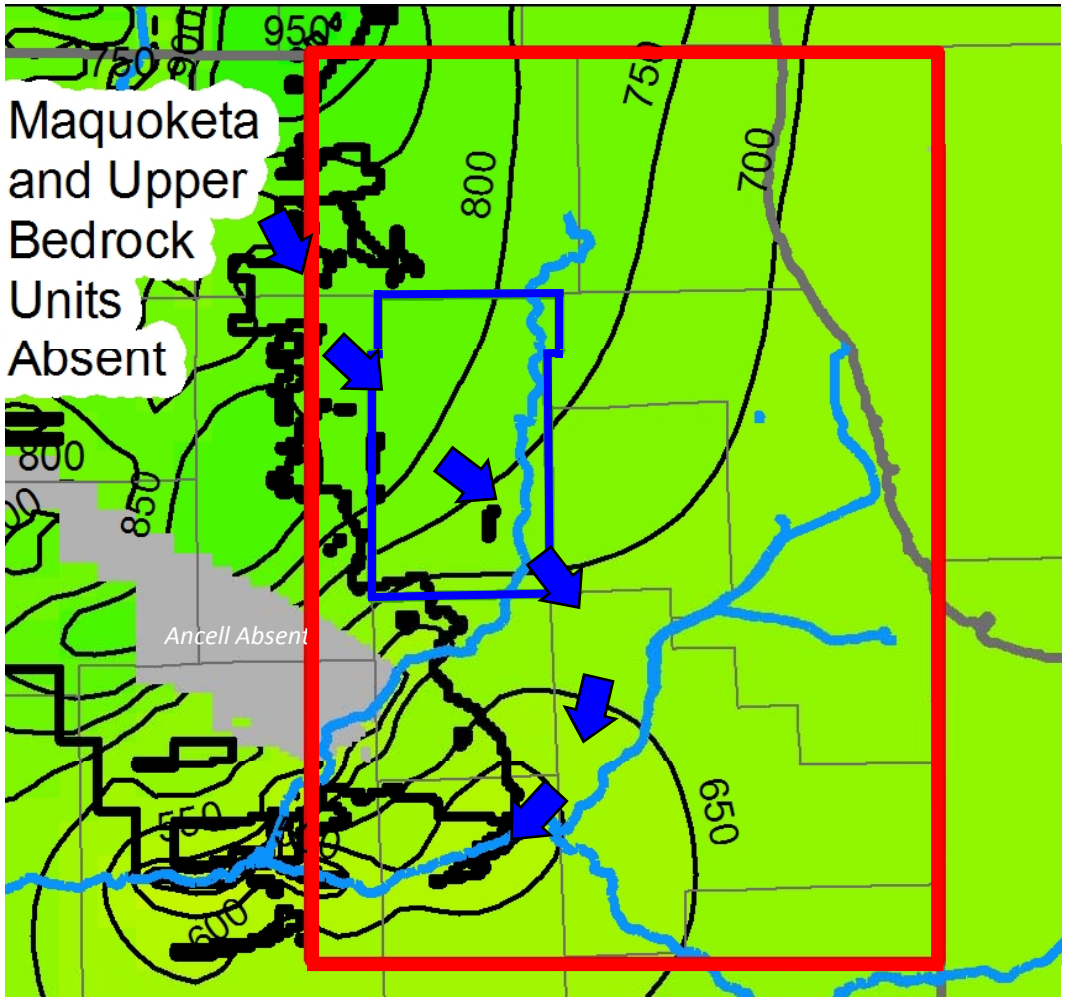
Reported and Modeled Deep Bedrock Aquifer System Withdrawals from Public Supply, Self-Supplied Commercial and Industrial, and Irrigation Sectors in northeastern Illinois



Deep Well Water Levels, Kendall County



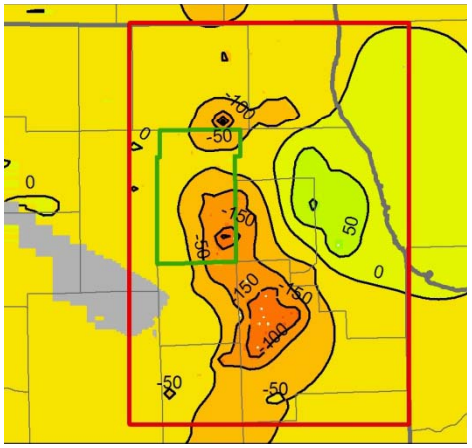
Regional Model: Ancell Aquifer Predevelopment



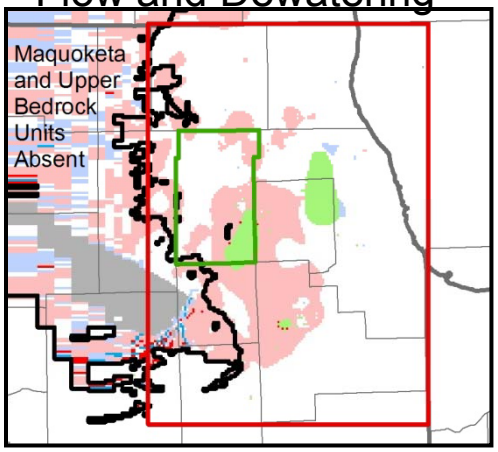
- Recharge where Maquoketa is absent
- Flow from central Wisconsin and DeKalb Co. to Illinois River
- Flowing artesian conditions in Chicago

Deep Bedrock Model Analyses

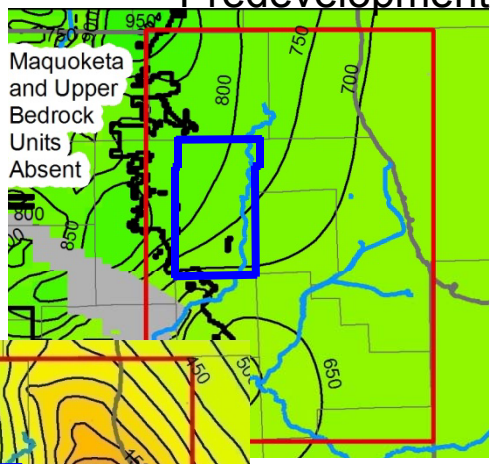
Drawdown



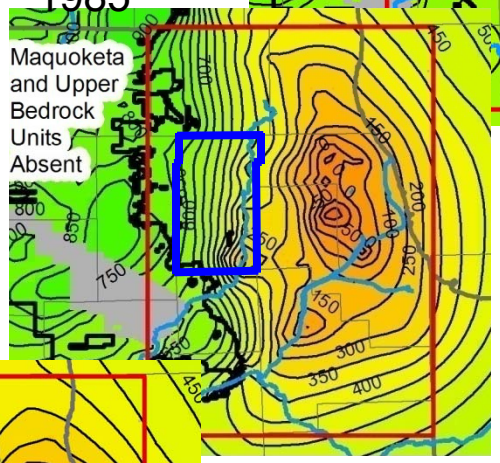
Flow and Dewatering



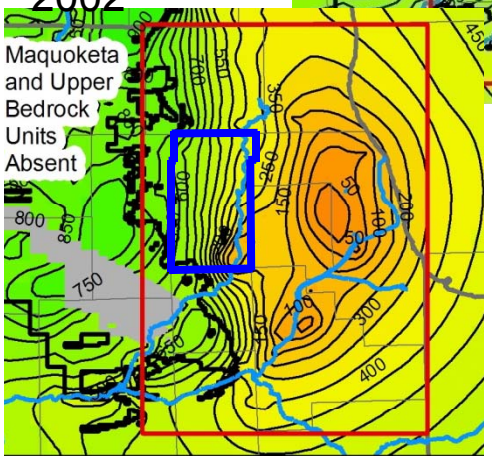
Predevelopment



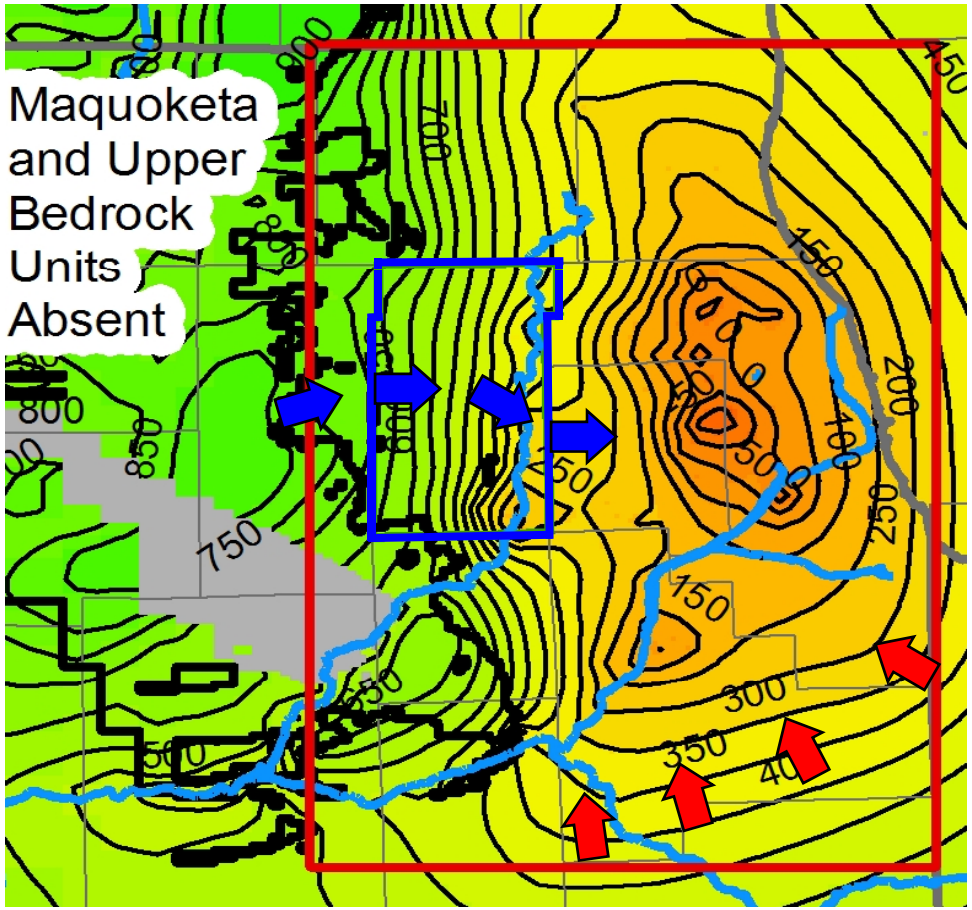
1985



2002

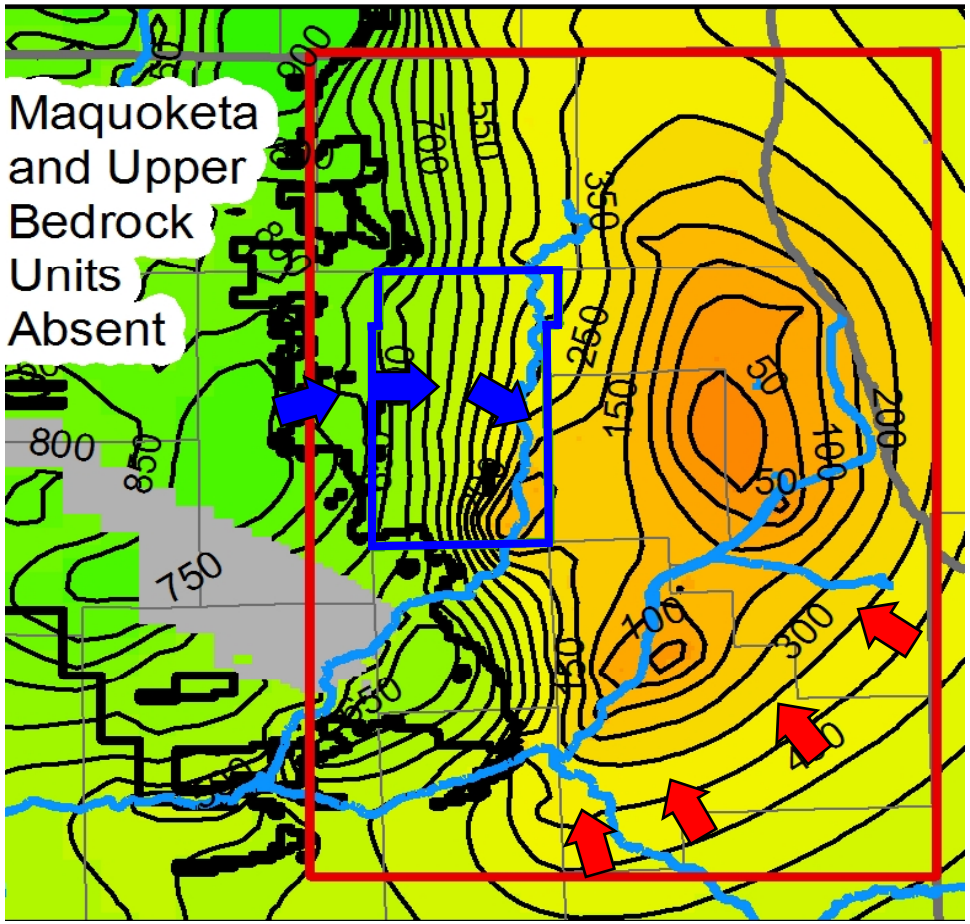


Ancell Aquifer: 1985



- Steep cone of depression
- Flow eastward to Cook and DuPage Counties
- Northward flow from saltwater regions
- Similar cone of depression surrounding Milwaukee

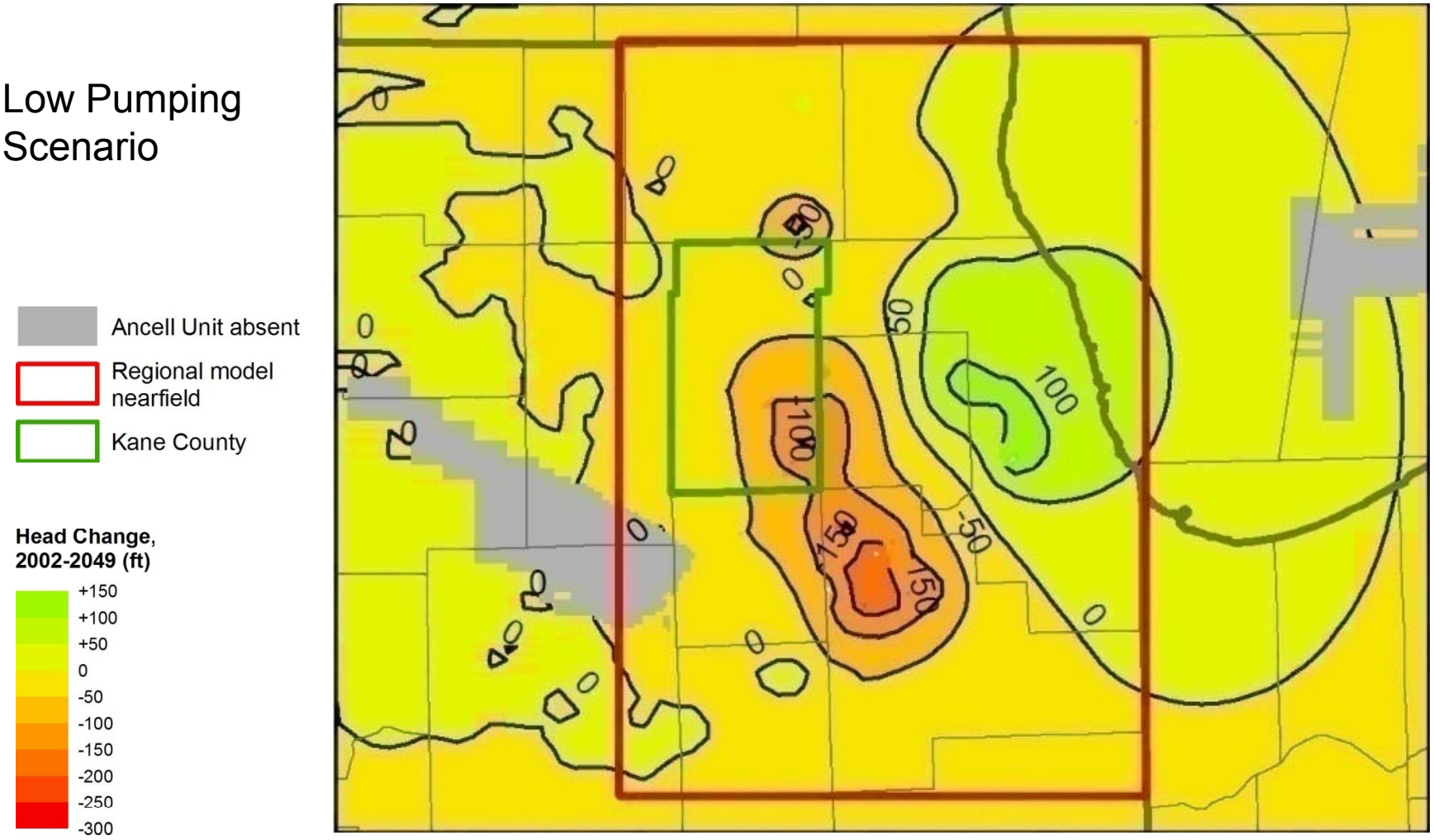
Ancell Aquifer: 2002



- Cone of depression flattens, shifts west with pumping
- Flow eastward to Cook and DuPage Counties
- Northward flow from saltwater regions
- Upper layers dewatering (Galena-Platteville overlying the Ancell)

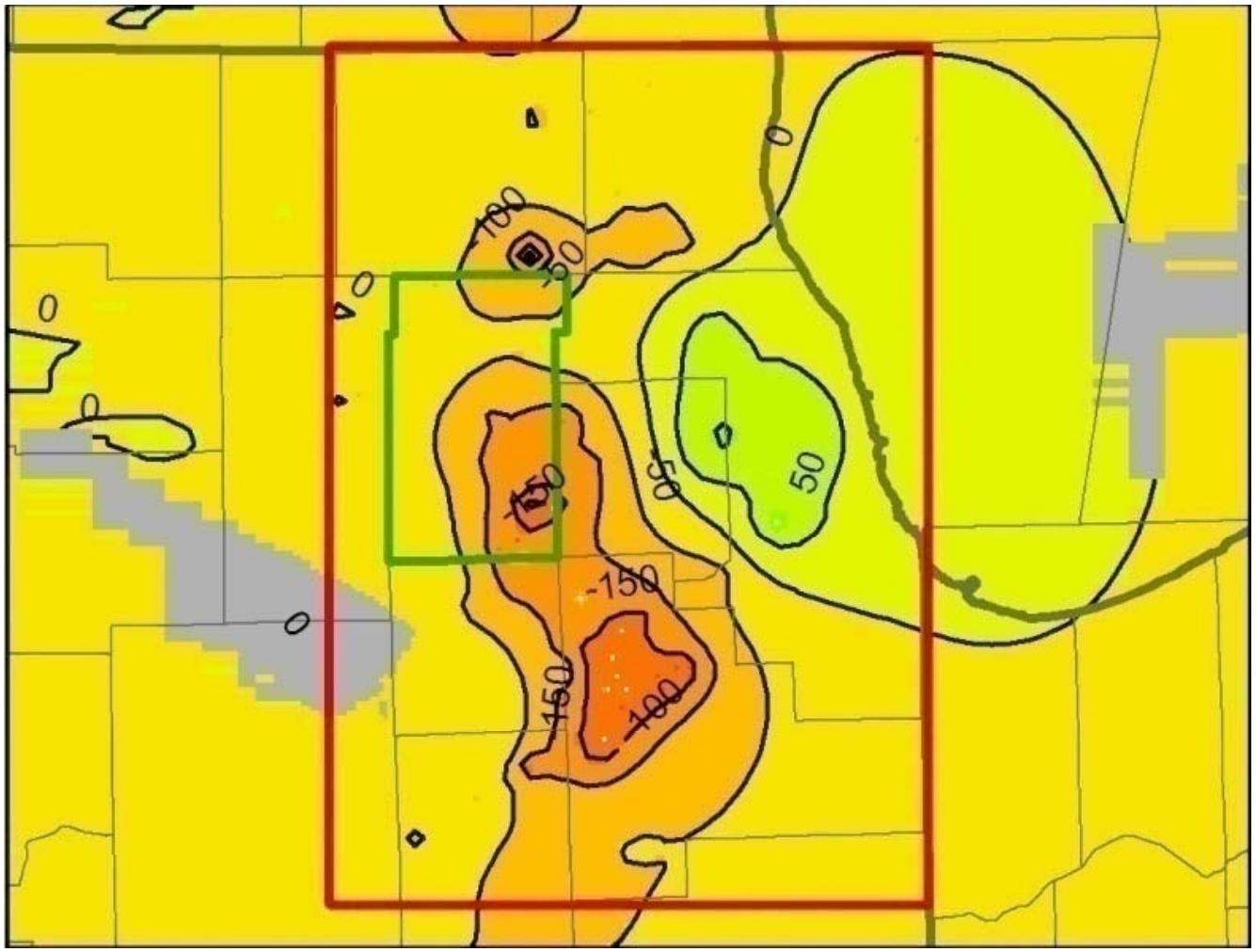
Estimated Head Change from 2002 to 2049 in Ancell Unit under Low and High Pumping Scenarios

Low Pumping Scenario

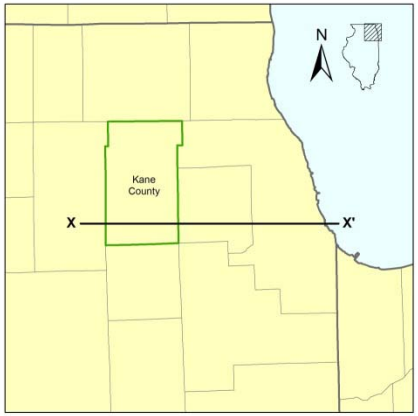


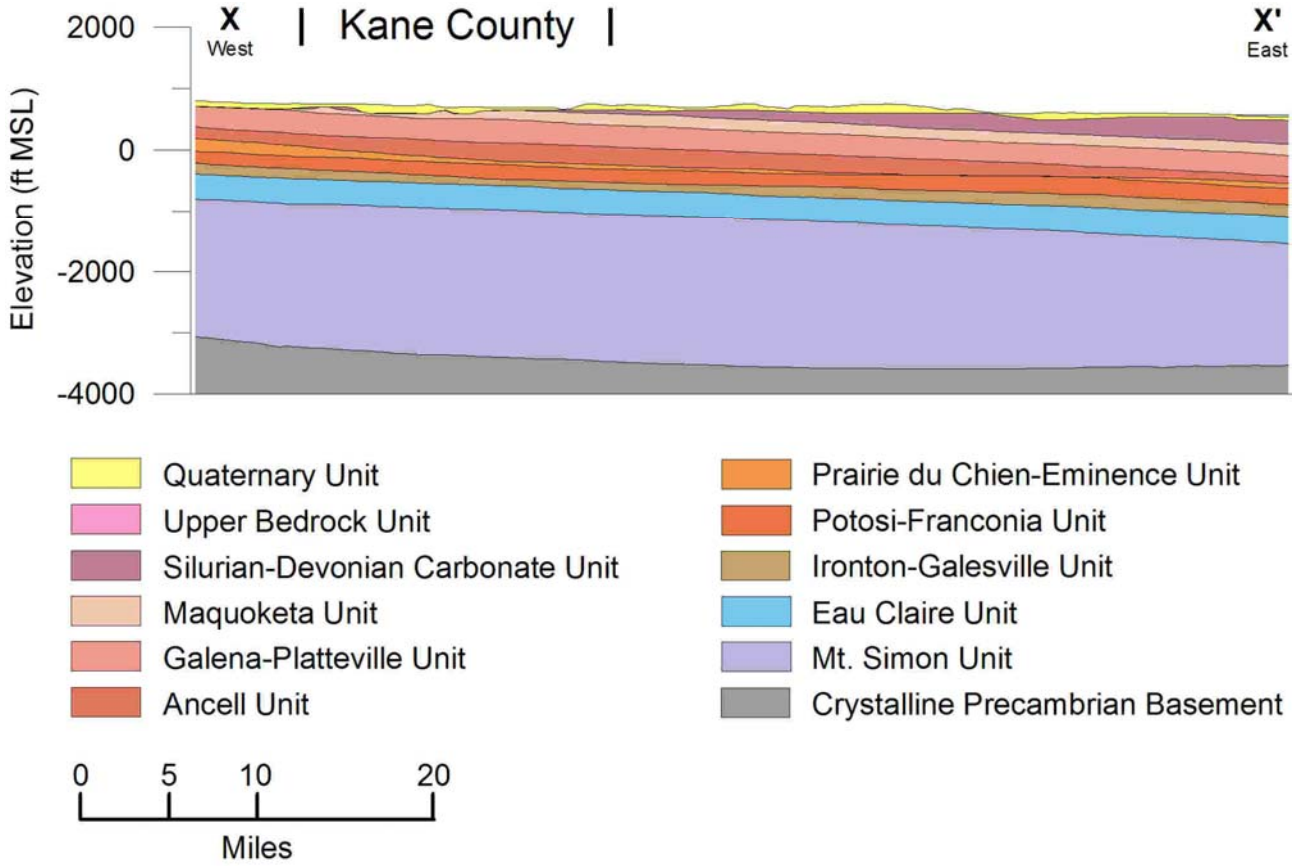
Estimated Head Change from 2002 to 2049 in Ancell Unit under Low and High Pumping Scenarios

High Pumping Scenario



Potential for Dewatering of Bedrock Units in Northeastern Illinois





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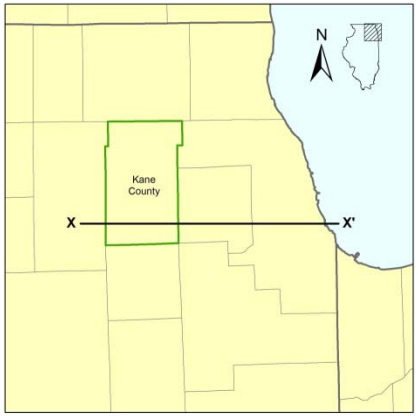

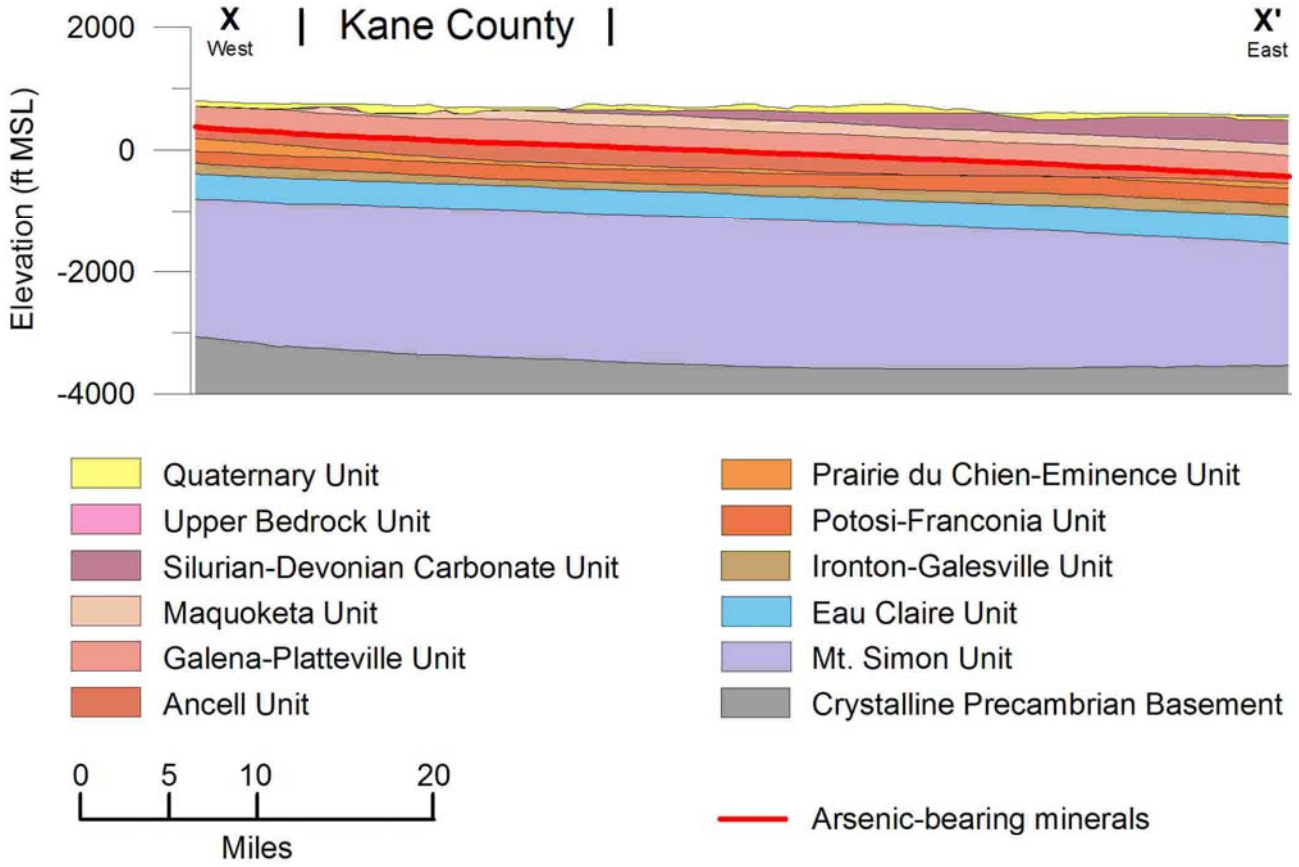

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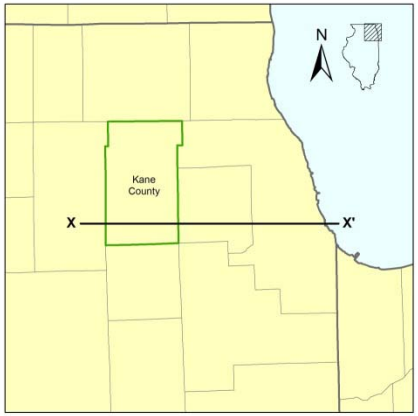

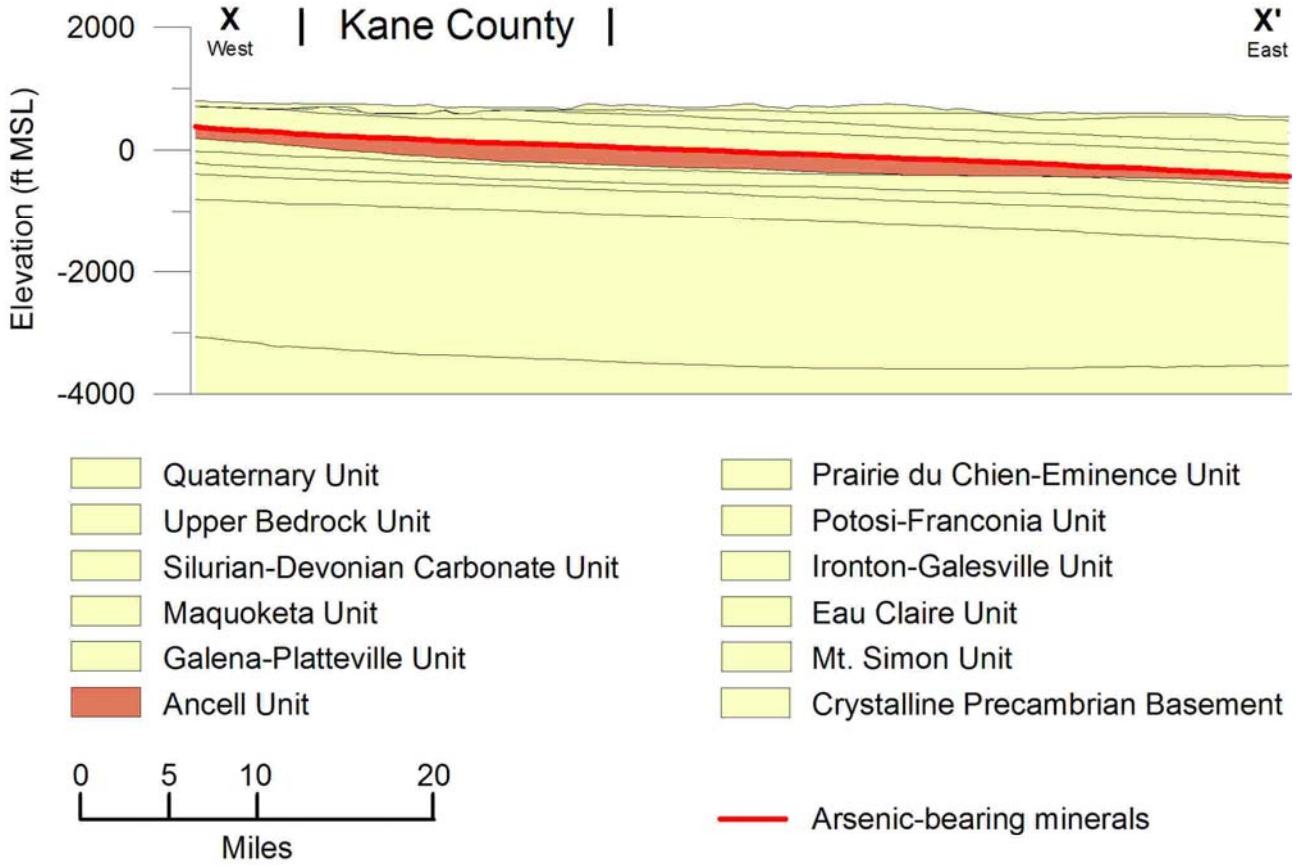

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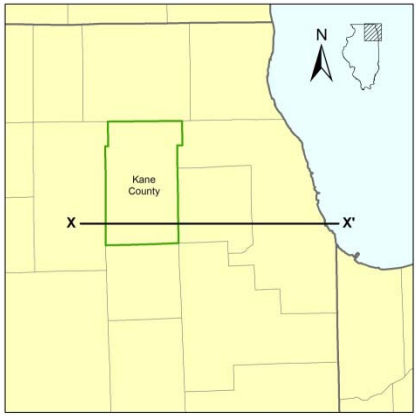

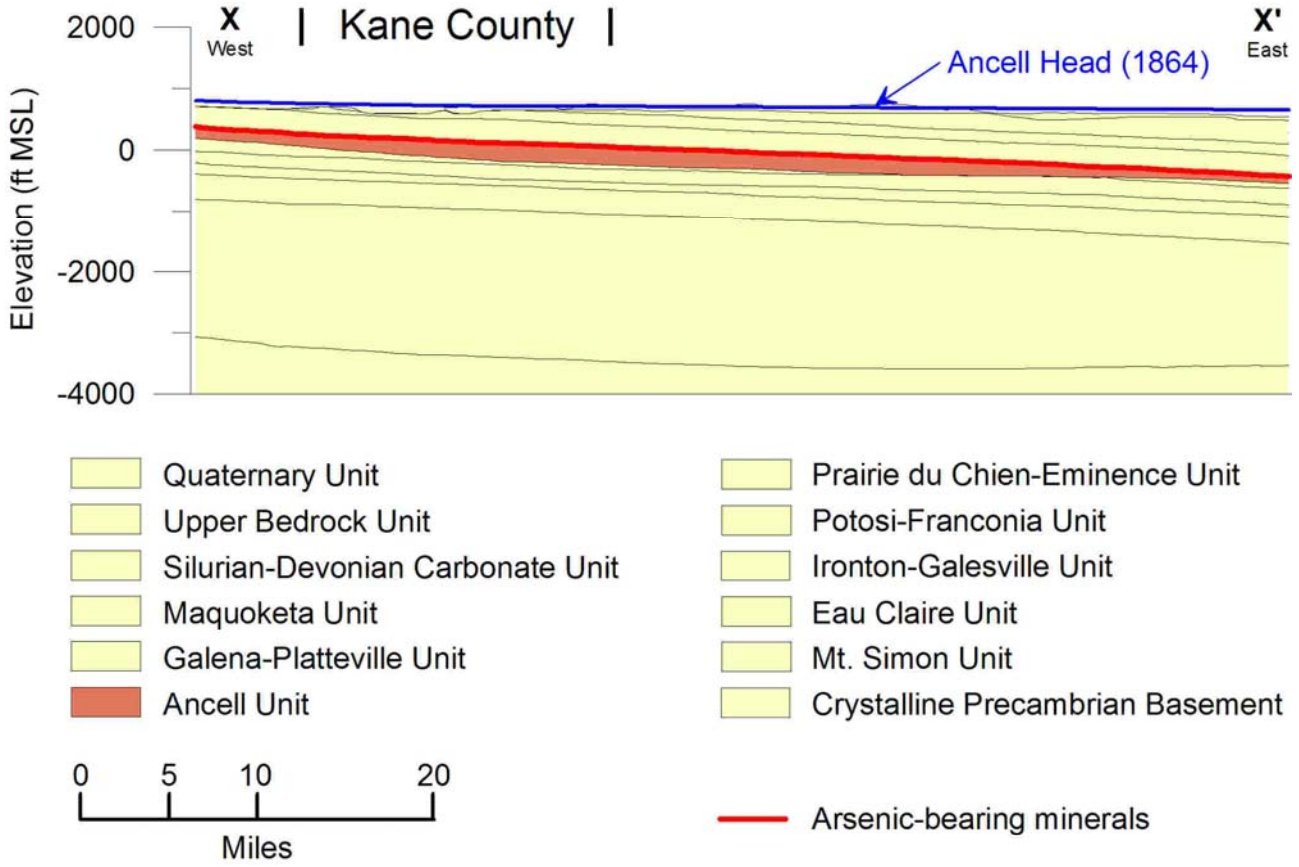

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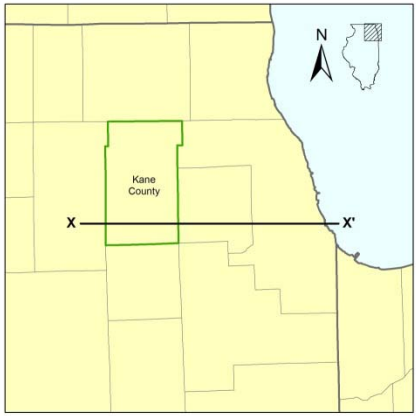

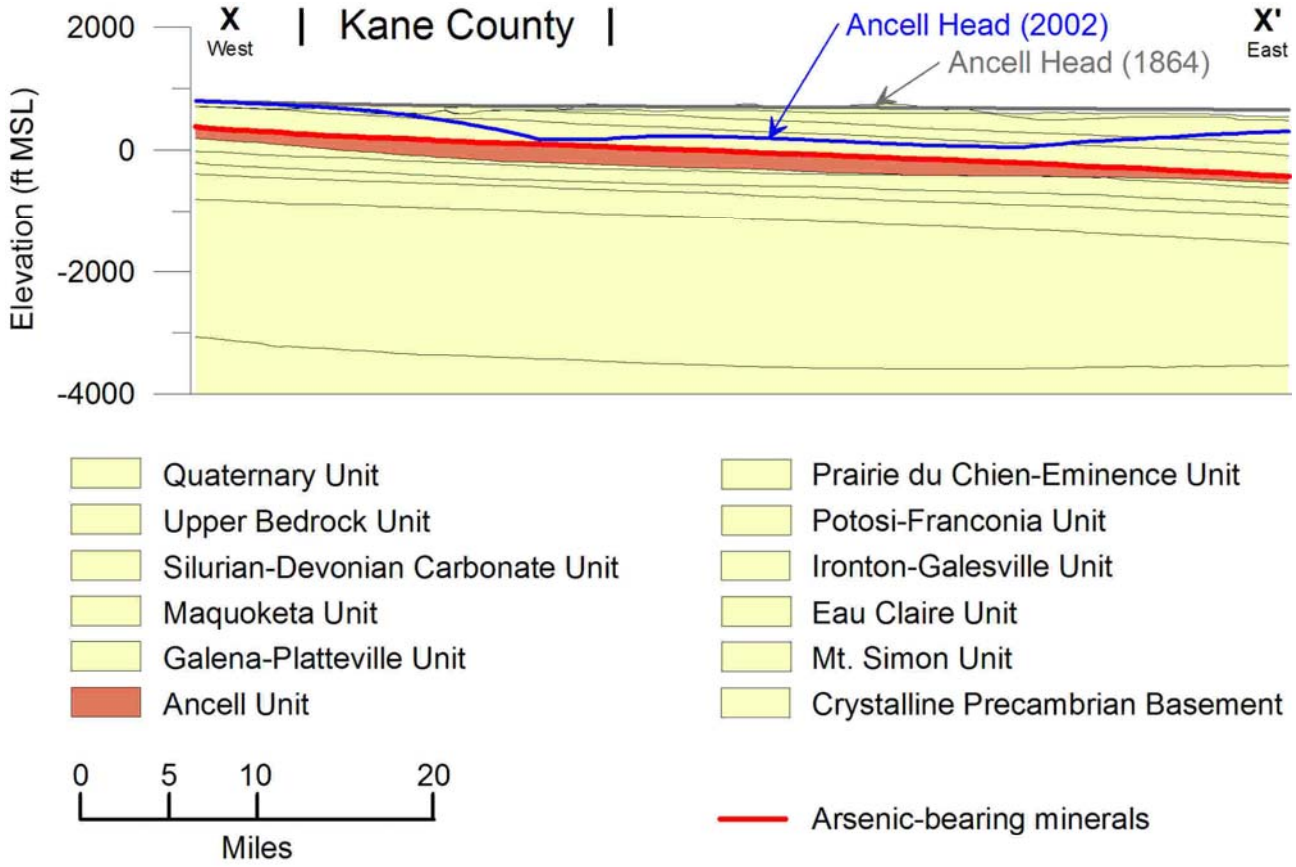

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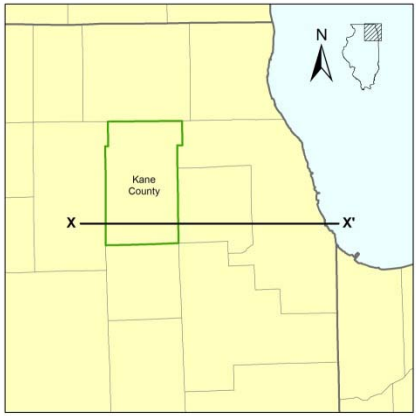
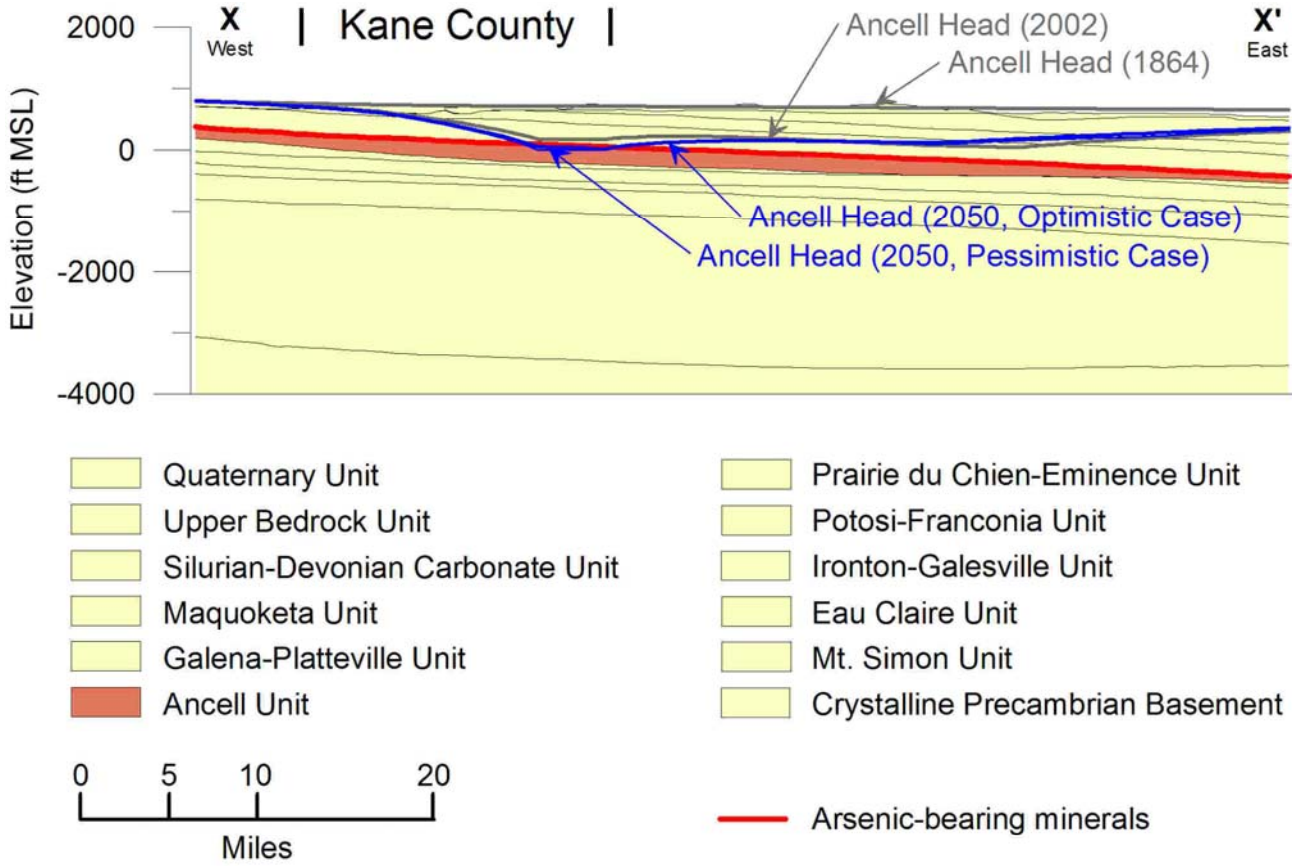
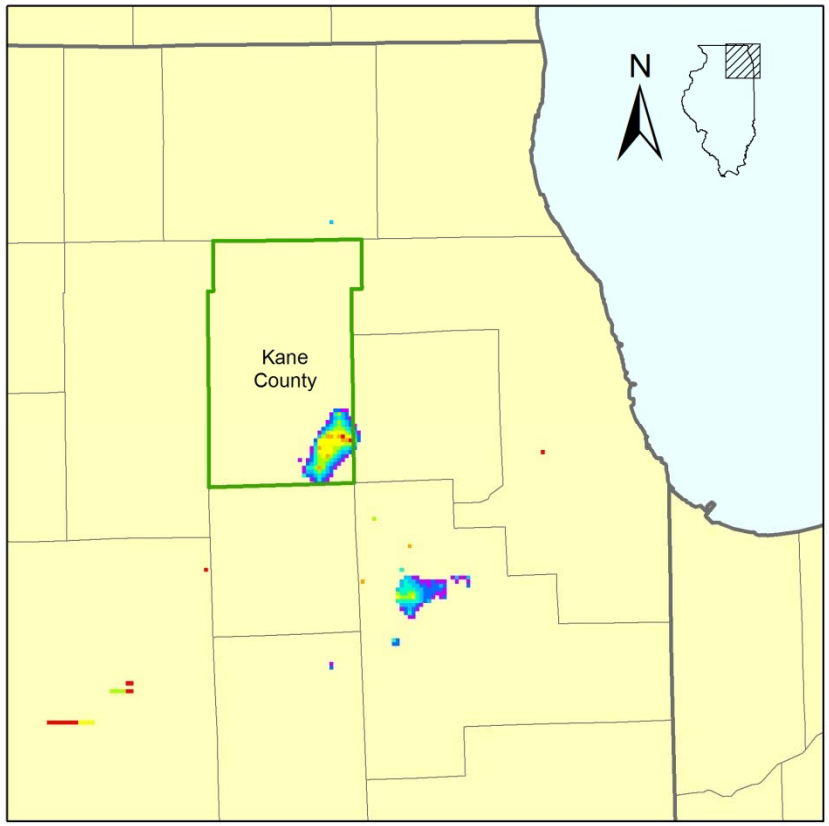




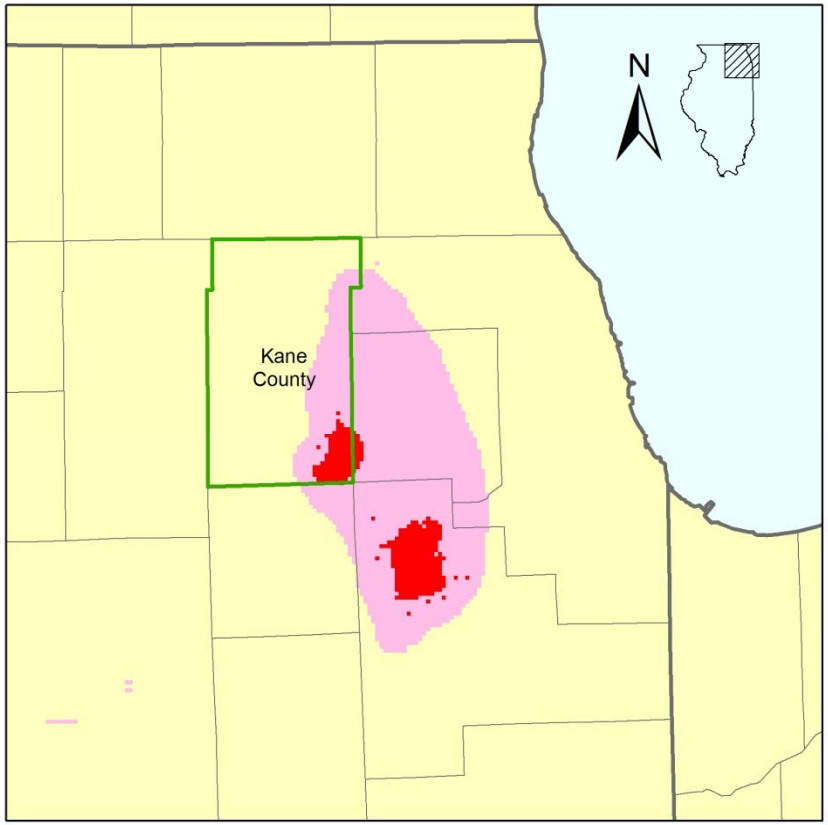
Dewatering of the Ancell Unit



Estimated Areas of
Upper Ancell Dewatering
High Pumping Scenario

- 2015
- 2020
- 2025
- 2030
- 2035
- 2040
- 2045
- 2050

Dewatering of the Ancell Unit



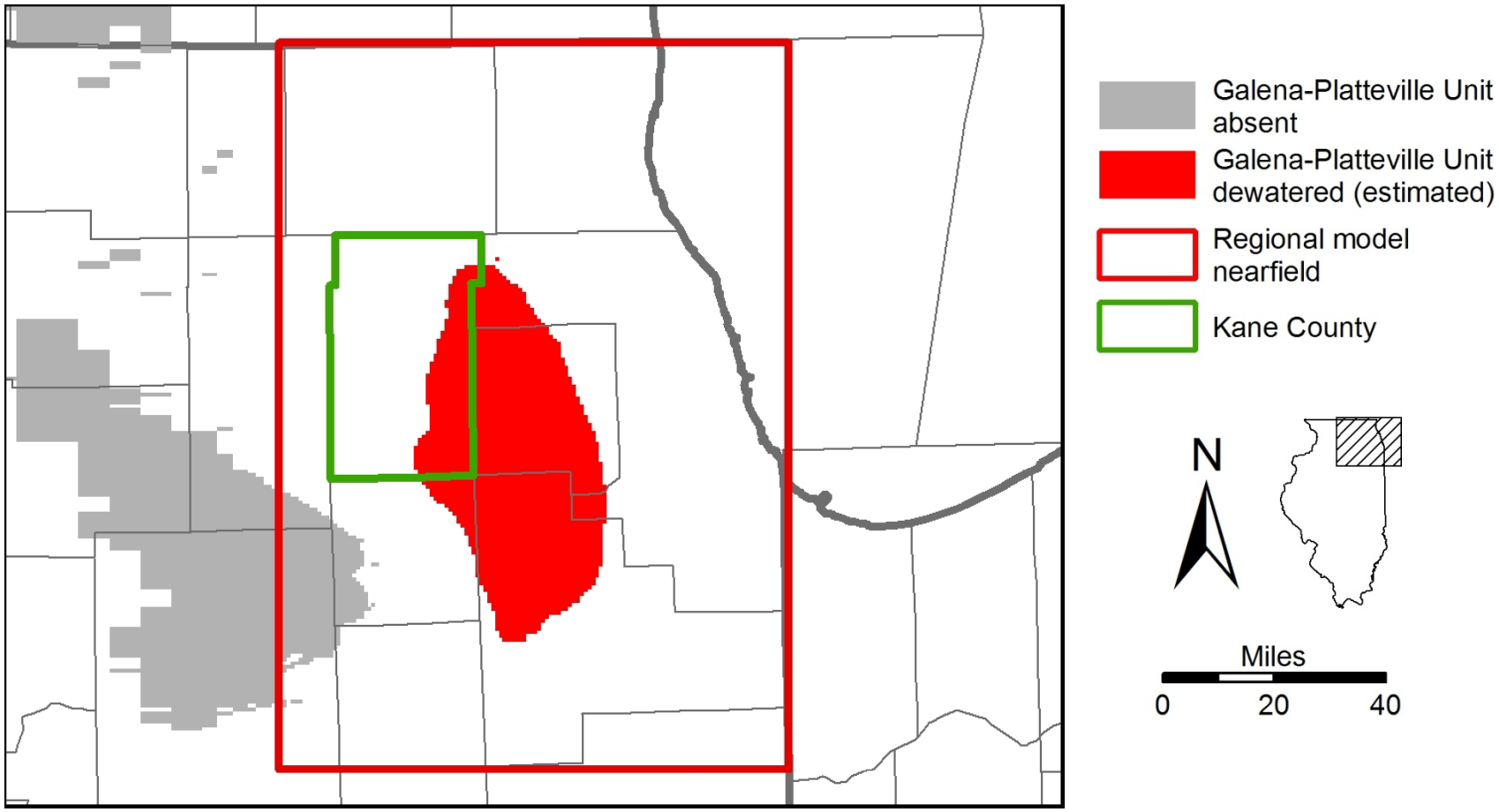
Estimated Dewatering of Ancell Unit

Extended Pumping at 2002 Rates

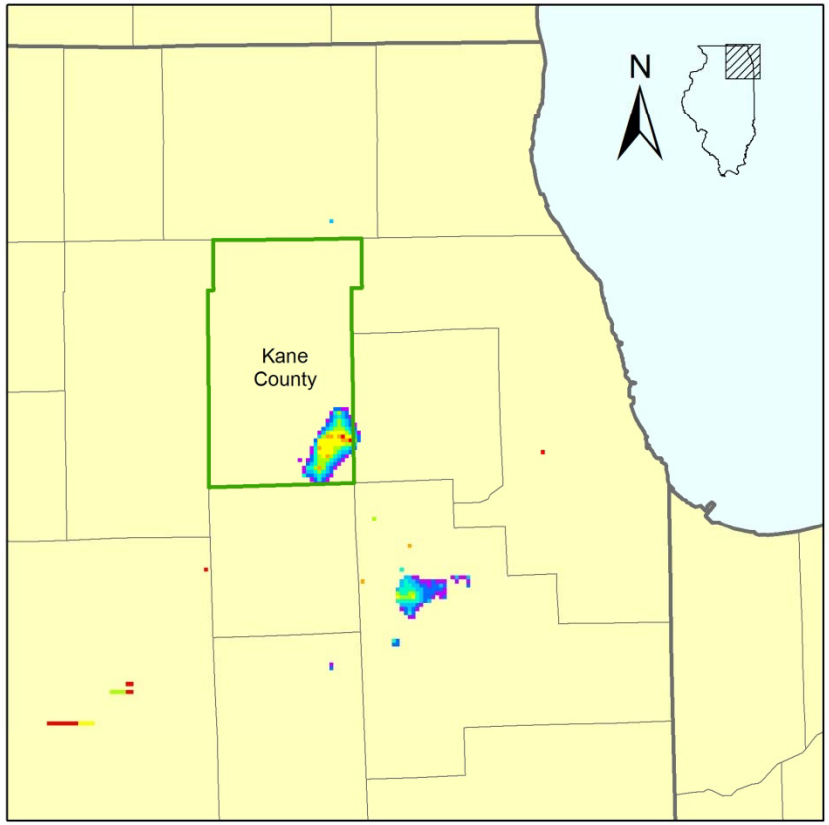
Partial dewatering

Complete dewatering

Estimated Dewatered Area in Galena-Platteville Unit after Extended Pumping



Potential for Dewatering of Base of Galena-Platteville Unit in Northeastern Illinois



Estimated Areas
of Dewatering of Base of
Galena-Platteville

- 2015
- 2020
- 2025
- 2030
- 2035
- 2040
- 2045
- 2050

High pumping scenario

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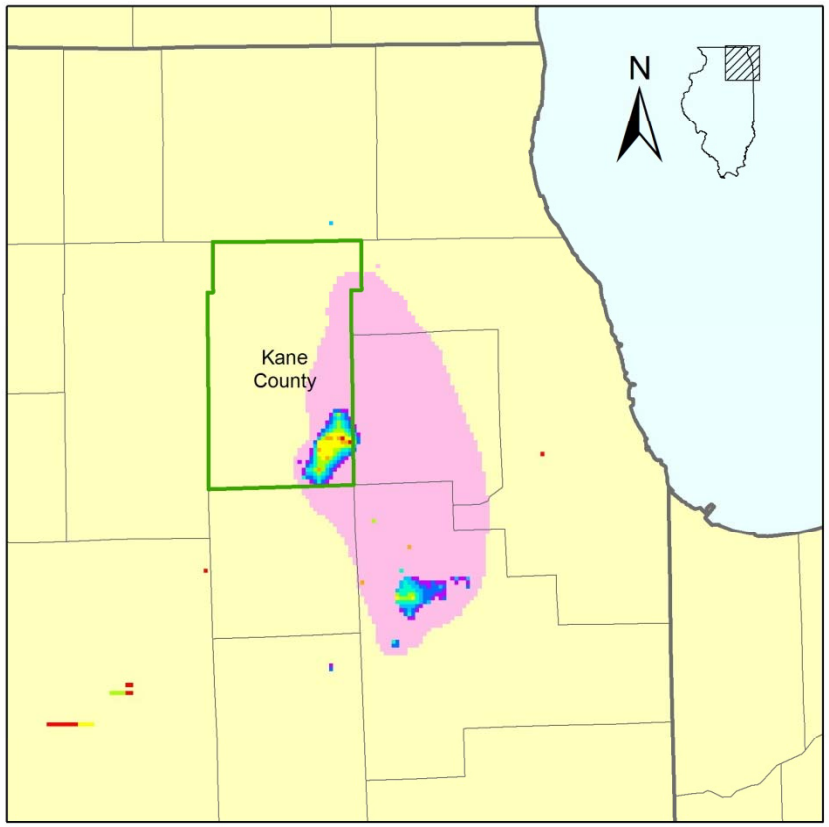


Dewatered area resulting from extended pumping at 2002 rates

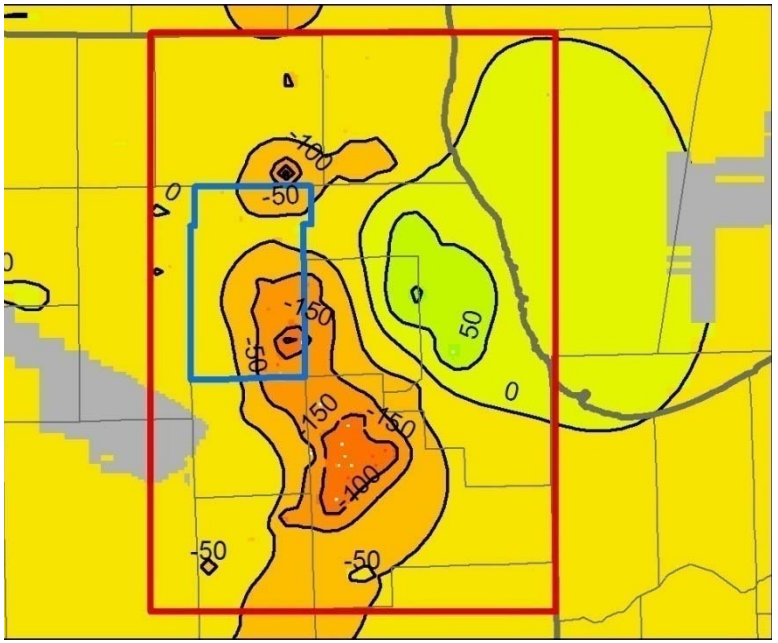
Estimated Areas of Dewatering of Base of Galena-Platteville

- 2015
- 2020
- 2025
- 2030
- 2035
- 2040
- 2045
- 2050
- After extended pumping at 2002 rates

Regional (Deep Bedrock) Flow Model Summary

- New withdrawals assigned to existing well locations
- Both high & low pumping scenarios show more than 150 feet of additional drawdown is expected by 2050 in the Joliet and Aurora areas.
- Some dewatering of the upper Ancell and base of the Galena-Platteville also is expected by 2050.
- For the high & low pumping scenarios, heads will continue to drop past 2050.
- Extended pumping at 2002 rates would cause partial dewatering of the Ancell Unit over a large part of NE Illinois and complete dewatering in the Joliet and Aurora areas, but heads do stabilize above the Ironton-Galesville.
- Water quality impacts are not known.

Expected Head Change, 2002-2050 (ft) (High Pumping Scenario)



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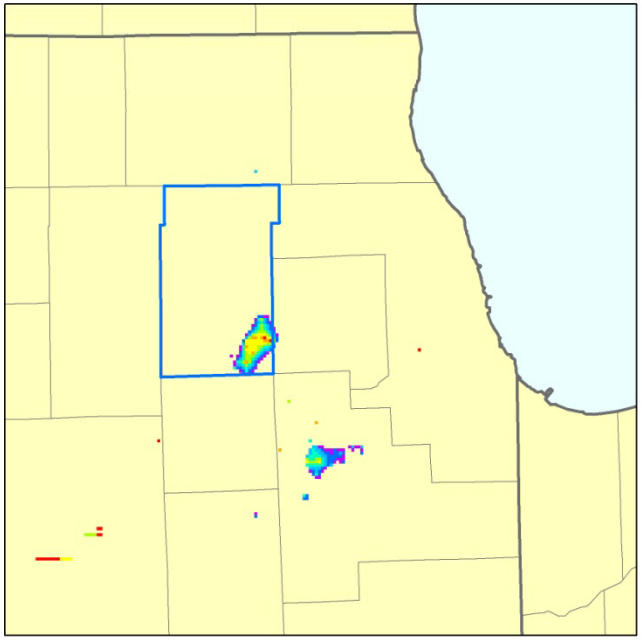
- Water quality impacts are not known.

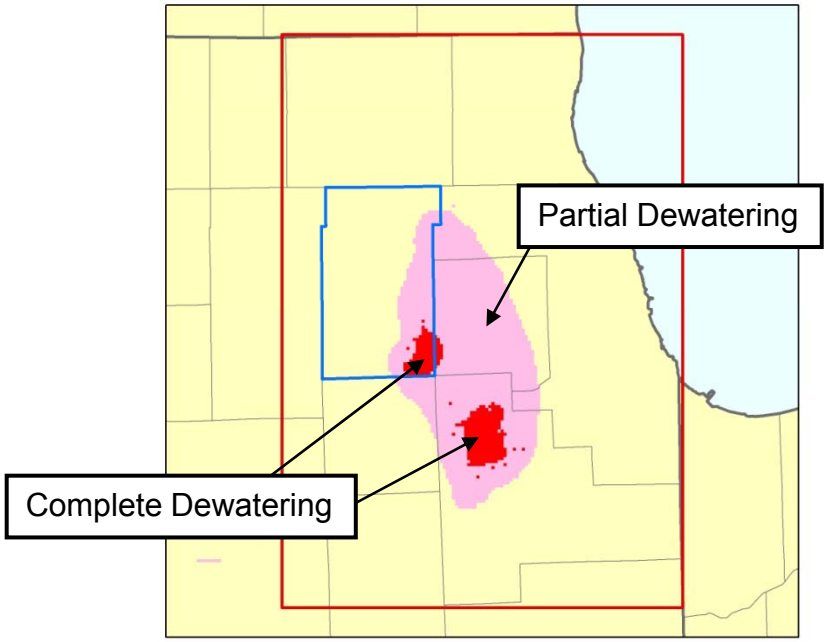
Expected Areas of Dewatering Upper Ancell and Base of Galena-Platteville (2050)



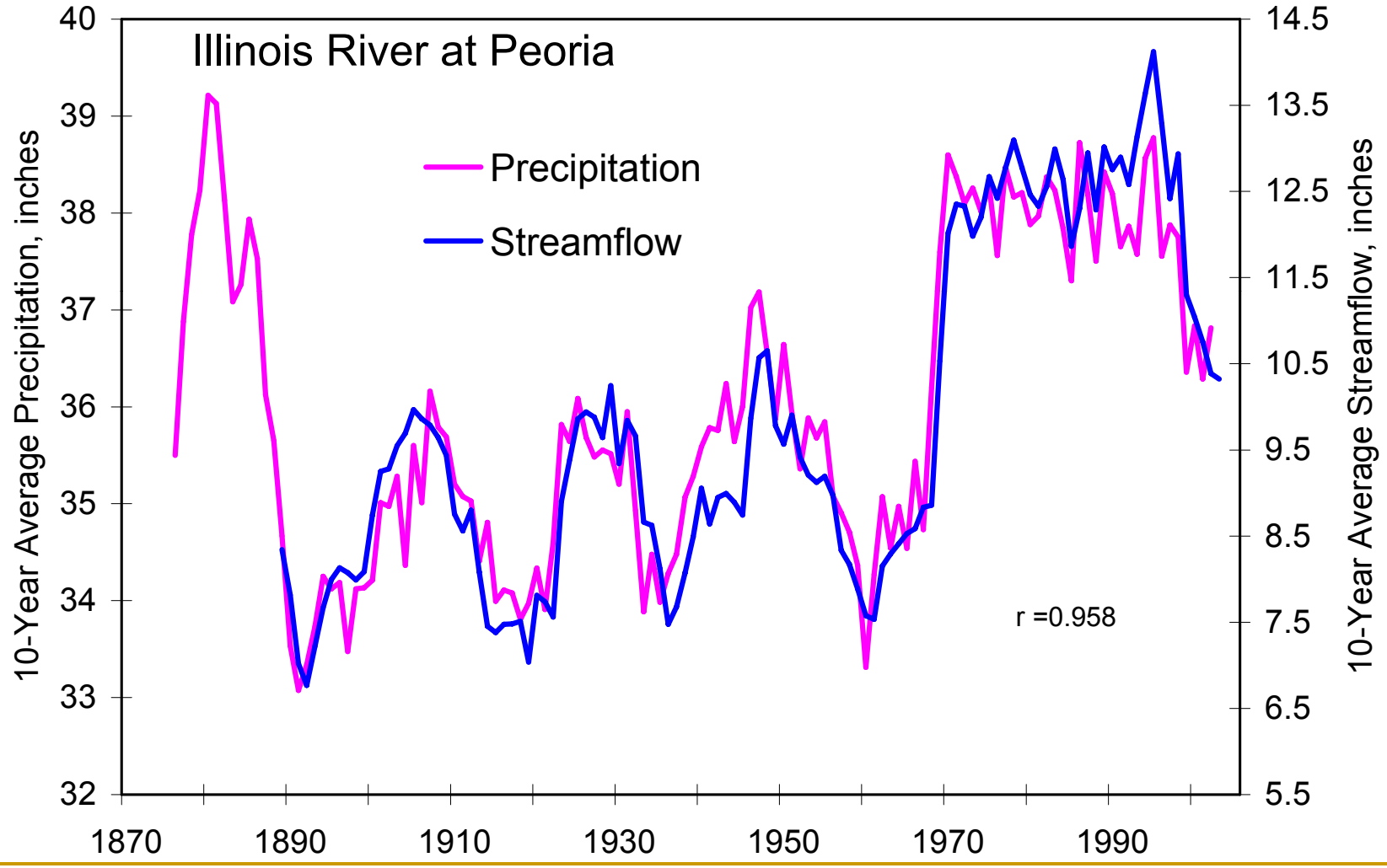
Regional (Deep Bedrock) Flow Model Summary

- New withdrawals assigned to existing well locations
- Both high & low pumping scenarios show more than 150 feet of additional drawdown is expected by 2050 in the Joliet and Aurora areas.
- Some dewatering of the upper Ancell and base of the Galena-Platteville also is expected by 2050.
- For the high & low pumping scenarios, heads will continue to drop past 2050.
- Extended pumping at 2002 rates would cause partial dewatering of the Ancell Unit over a large part of NE Illinois and complete dewatering in the Joliet and Aurora areas, but heads do stabilize above the Ironton-Galesville.
- Water quality impacts are not known.

Expected Areas of Dewatering of Ancell
(Extended Pumping at 2002 Rates)



Climate Variations and An Uncertain Future



Water Resources Planning Process:
A Recommendation

The Kane County products have direct application to the regional planning process, but will evolve with new data, new demand scenarios, and new models (e.g., Fox River Basin flow model).

The results of analyses will not be ready for ~1 year.

We suggest using the Kane County products now as learning tools or as preliminary models for understanding the science and initially identifying alternative management strategies.

The Bottom Line! (Again!)

- All water withdrawals have impacts and costs.
- What environmental and financial costs are you willing to bear to provide adequate and reliable sources of clean water to meet demand?
- How much water are you prepared to conserve?
- How much risk are you willing to bear?
- It is up to you, the public and decision-makers, to ask/answer these questions and incorporate the questions/answers into management policies and strategies.

One last question:

These are the types of data and information you will receive in September 2008.

Would you (or a subcommittee?) like to spend a longer session (whole day?) to better understand the scientific data, tools, options, impacts and risks?

Thank you for your attention. Questions?

ILLINOIS

Illinois State WATER SURVEY

ISGS Illinois State Geological Survey

ILLINOIS DEPARTMENT OF NATURAL RESOURCES