

Effects of Future Pumping on Deep Groundwater Circulation

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Illinois State Water Survey

Illinois Department of Natural Resources



Illinois State
WATER
Survey (1895)

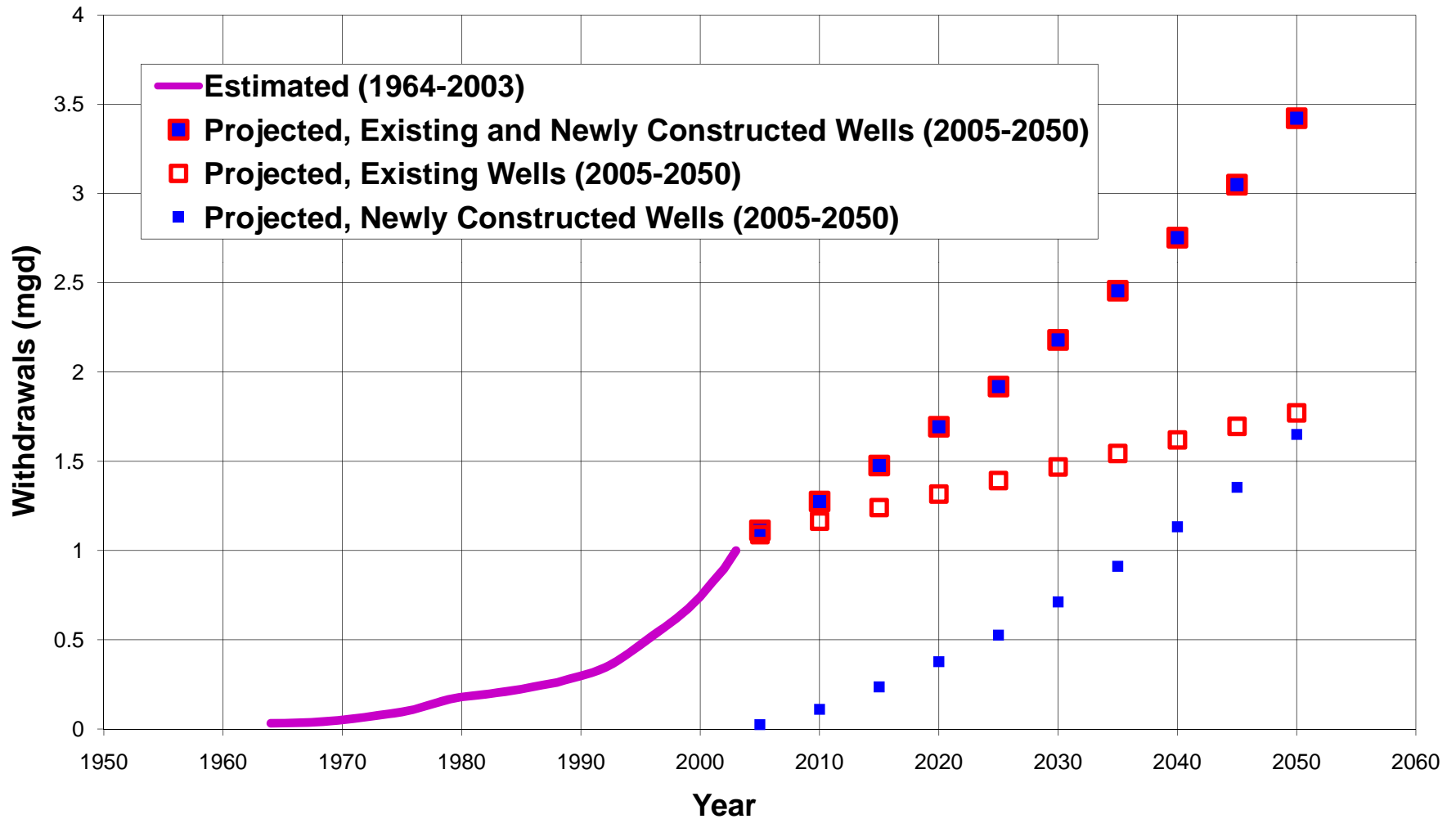




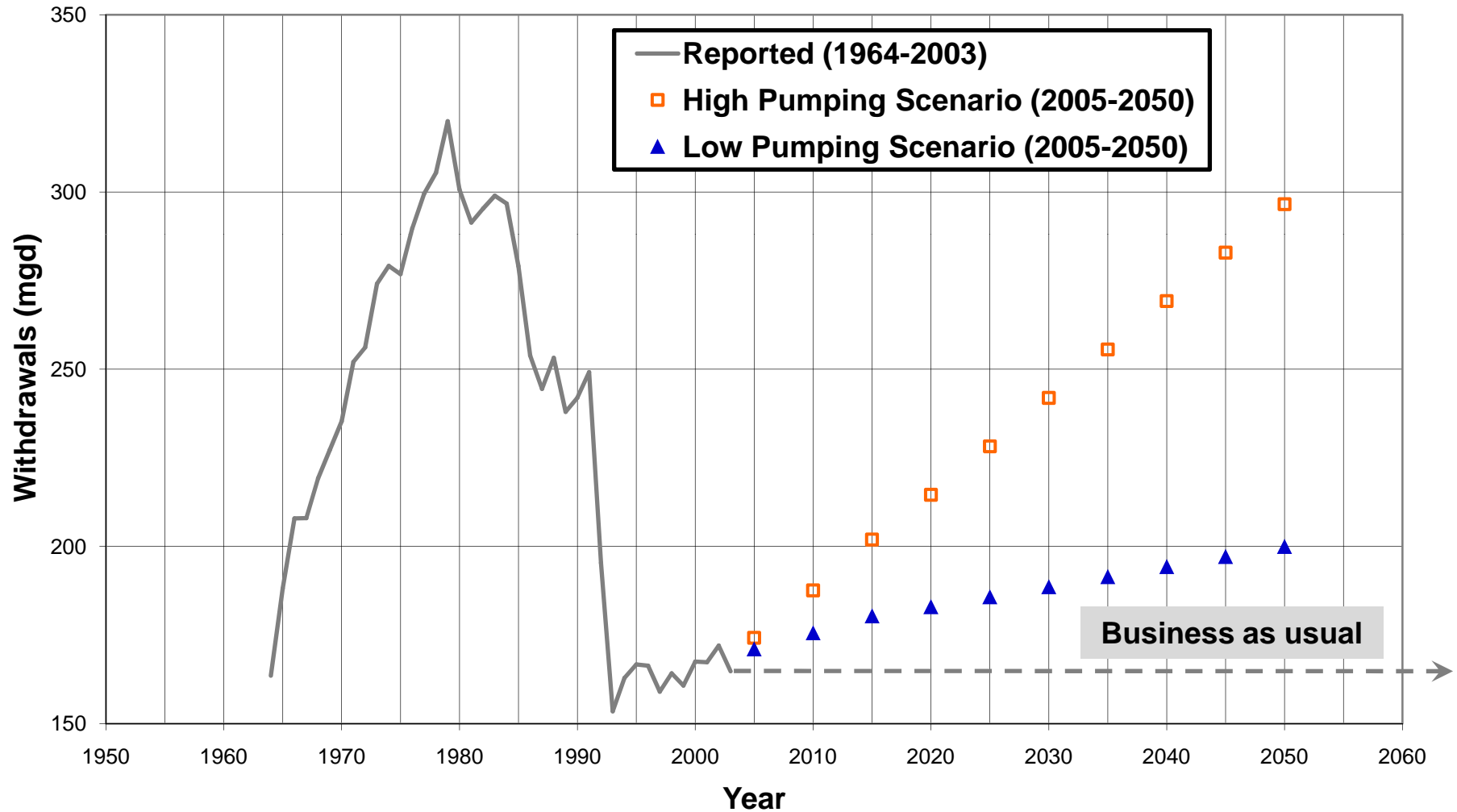
Effects of Future Pumping Based on...

- **Business as usual:**
Simulation to extend current condition
- **Projection of future withdrawals:**
Simulations using various pumping scenarios
- **Projection including natural uncertainty:**
Simulations based on various surficial recharge conditions

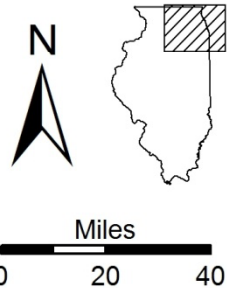
Example 1: Total Estimated (1964–2003) and Projected (2005–2050) Withdrawals from Deep Domestic Wells in Northeastern Illinois



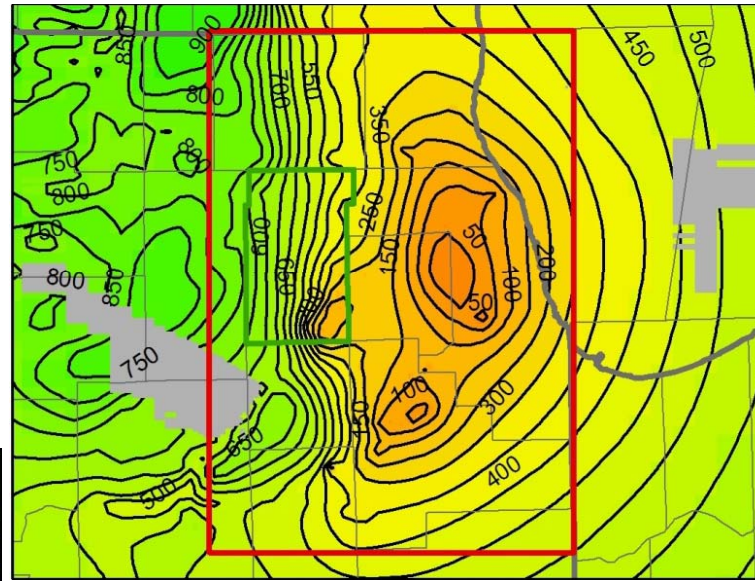
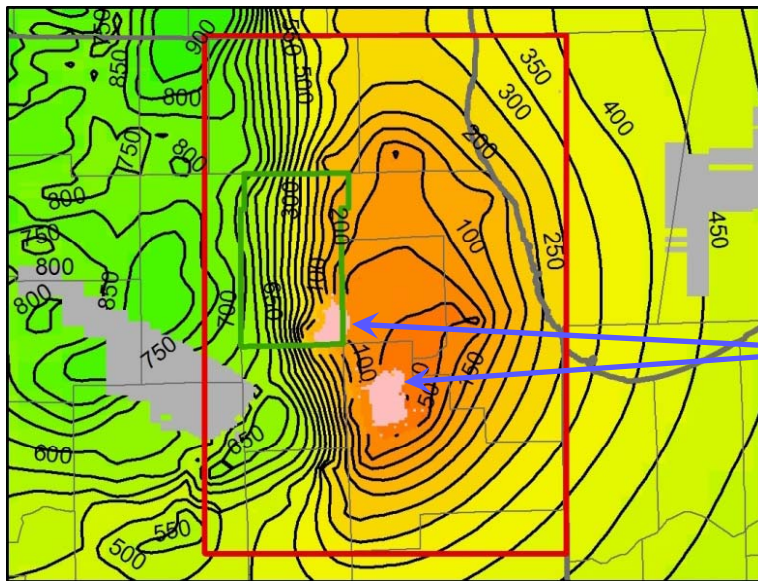
Example 2: Reported and Projected Groundwater Withdrawals from Public Supply, Self-Supplied Commercial and Industrial, and Irrigation Sectors in northeastern Illinois







Simulated Heads in Ancell Unit for 2002 and Extended Pumping



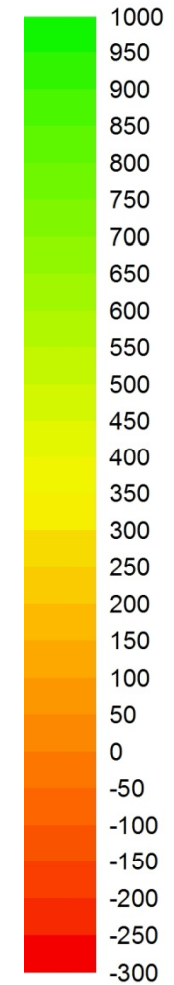
Simulated Head After 2002
Extended Pumping



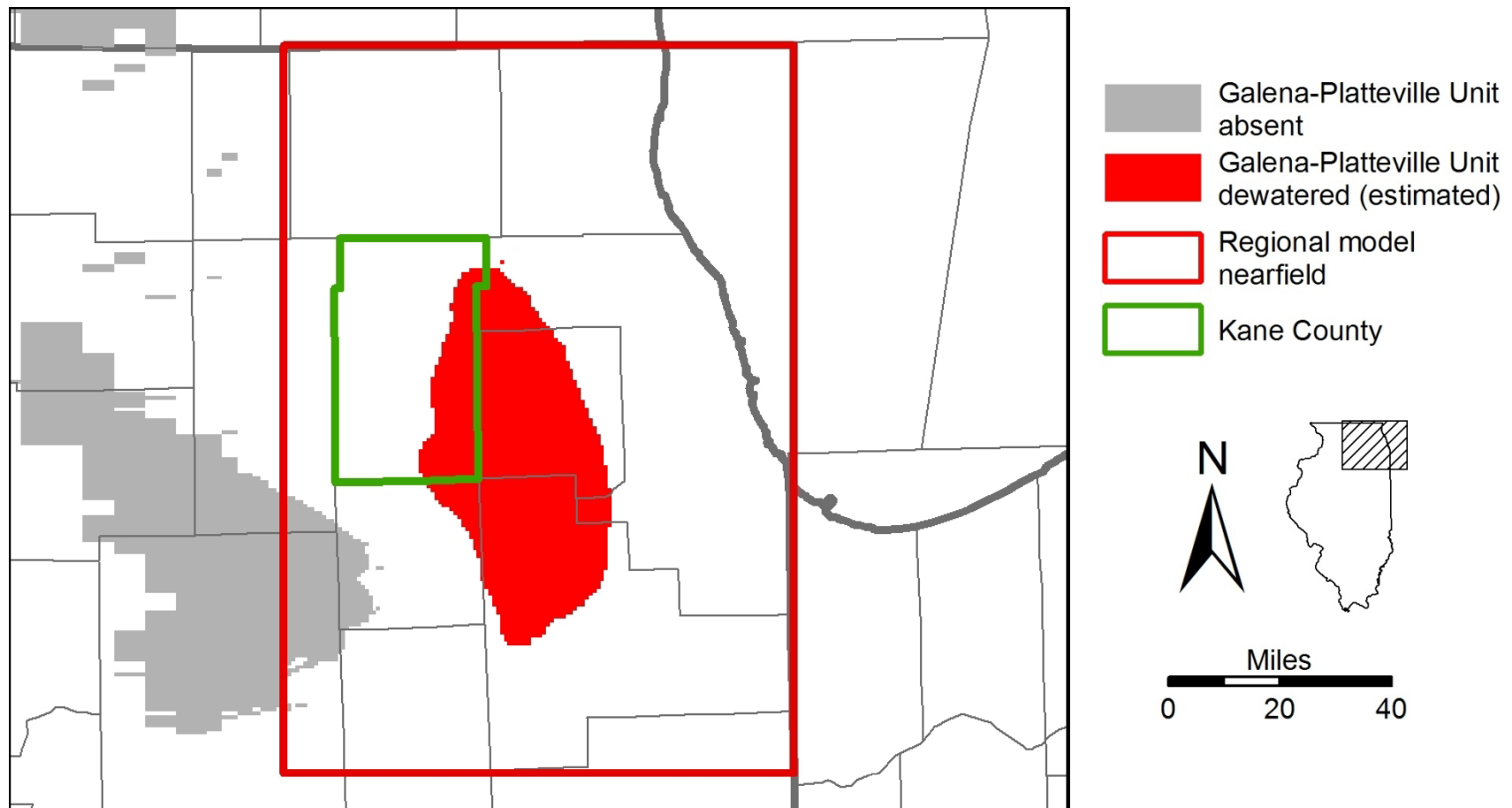
Simulated Head in the end of 2002

-  Ancell Unit absent
-  Ancell Unit dewatered (estimated)
-  Regional model nearfield
-  Kane County

Head
(ft above MSL)



Estimated Dewatered Area in Galena-Platteville Unit after Extended Pumping

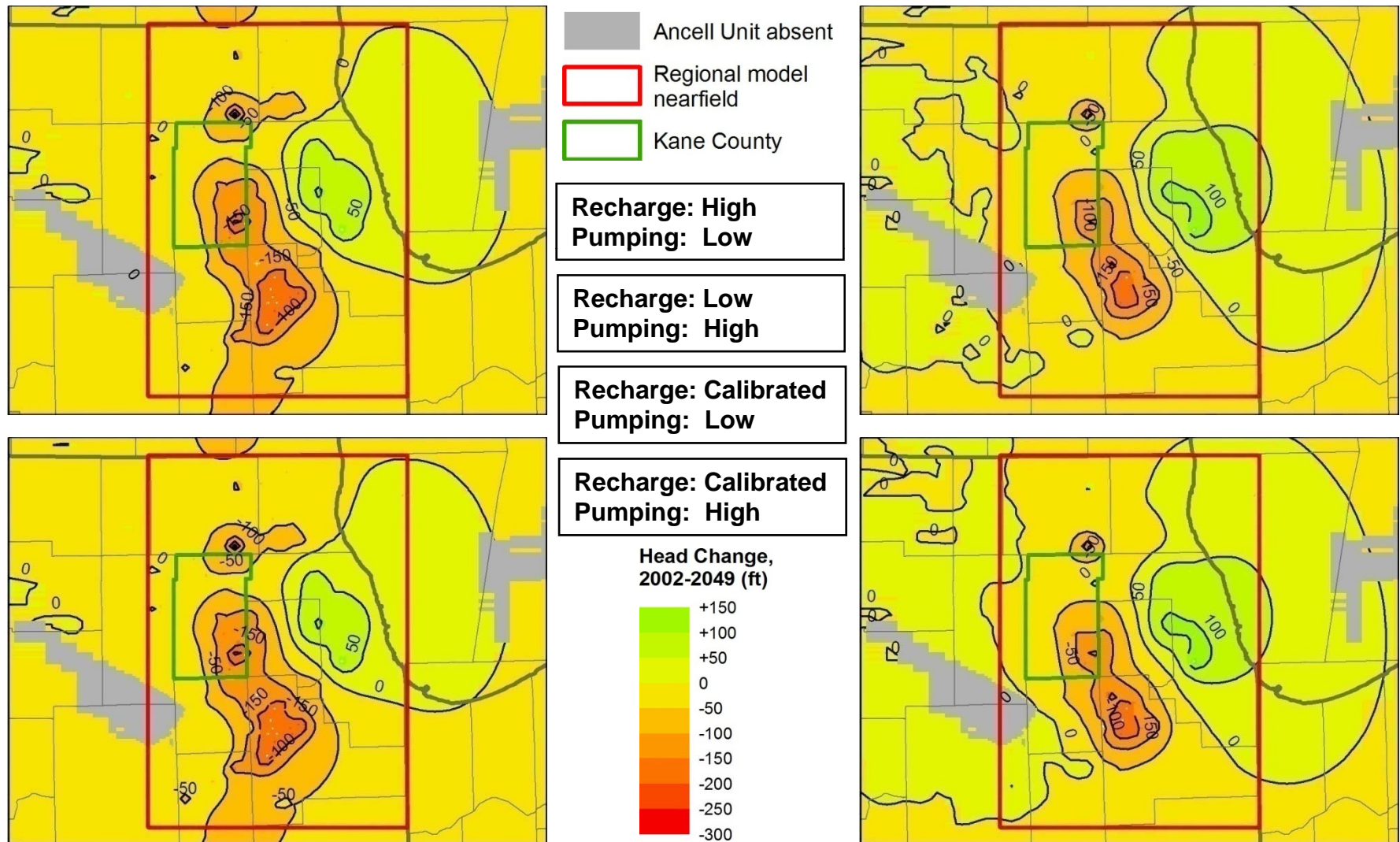




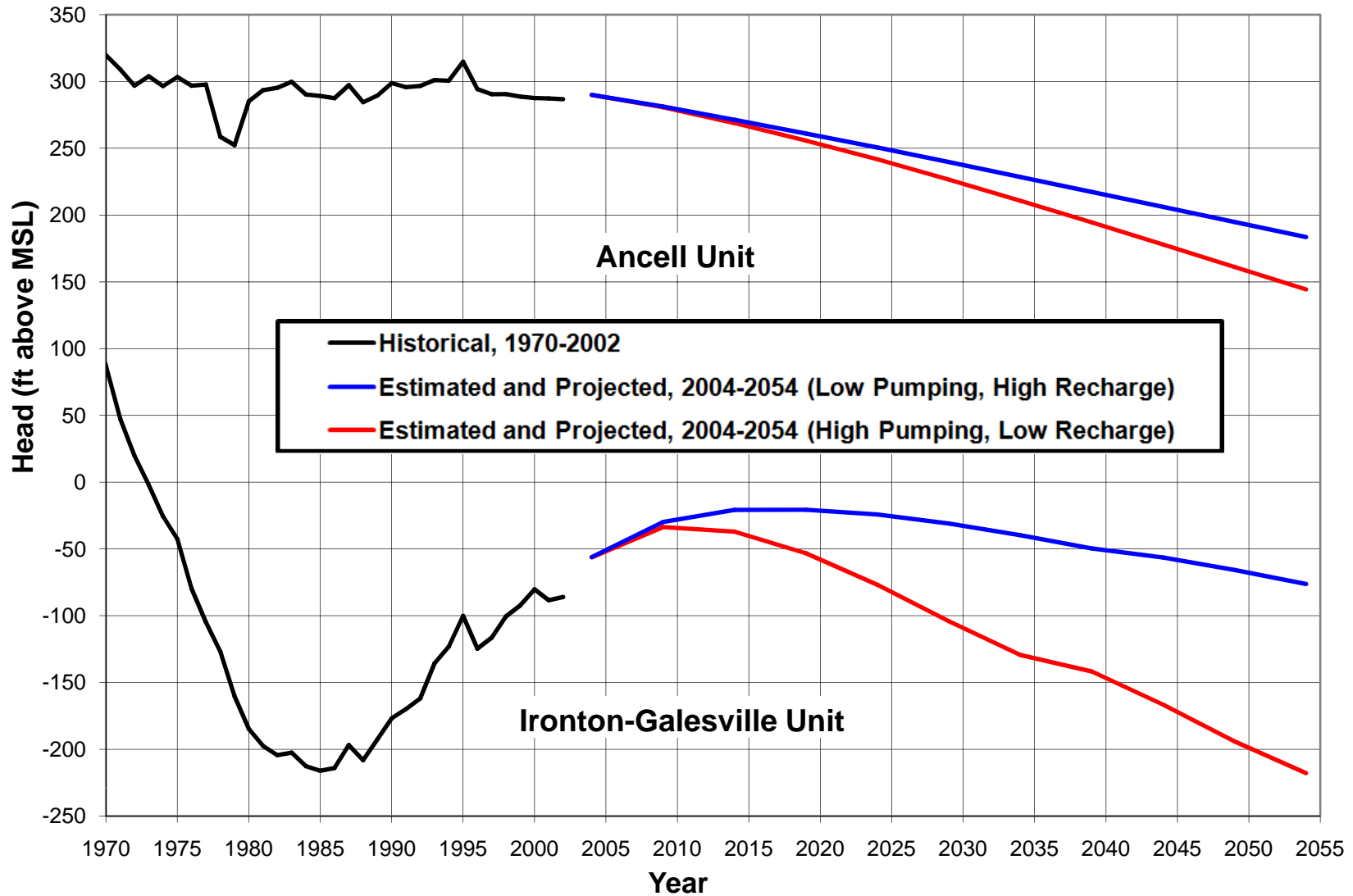
Simulations of Future Pumping and Recharge Conditions

Pumping Scenario	Recharge Scenario	Intensity of Resource Use	Simulated
High	Low	Most	Yes
High	Calibrated	Intermediate	Yes
High	High		No
Low	Low		No
Low	Calibrated		Yes
Low	High	Least	Yes

Estimated Head Change between 2002 and 2049 in Ancell Unit under Various Pumping Scenarios and Recharge Conditions



Simulated Head from End of 1970 through End of 2054 in Ancell (top) and Ironton-Galesville Units (bottom) at St. Charles





Summary

- **Business as usual:**
Simulated dewatered area in multiple units will be enlarged.
- **Projection of future withdrawals:**
Simulated head change is significant under various pumping scenarios. The effort of withdrawal conservation is effective.
- **Projection including natural uncertainty:**
Changes in surficial recharge rates affect heads in the deep aquifers very little in the approximate half-century represented.



Two Pumping Scenarios (2005–2050)

- **Type of withdrawal projections:**

- Public water system wells
- Major commercial, industrial, and irrigation wells
- Domestic deep wells open to the Ansell and underlying units

- **Anticipated well locations in suburban residential areas:**

- Current high well density
- Drilling rates
- Productive shallower aquifers are largely absent

- **Potential source intervals:**

- Based on historical trend of nearby wells

- **Withdrawal rate predictions:**

- Based on the various predictions such as population growth, economical development, per capita water consumption, water conservation.
- Both scenarios used same projected withdrawals rates for irrigation and domestic deep wells in Illinois, and for all wells in Indiana and Wisconsin.

Three Surficial Recharge Scenarios Based on Previous and Current Studies

Zone	Assumed Recharge Rate (ft/day)		
	Low Recharge Scenario	Calibrated Recharge Scenario	High Recharge Scenario
2	0.000449	0.000539	0.000899
3	0.000798	0.000798	0.001361
4	0.000009	0.000225	0.000449
5	0.000009	0.000229	0.000449
6	0.000449	0.000702	0.000899
7	0.000228	0.000767	0.002282
8	0.000746	0.001232	0.001232
9	0.000899	0.001111	0.001348
10	0.001348	0.001573	0.001798
11	0.001798	0.002020	0.002247
12	0.000899	0.001124	0.001348
13	0.002697	0.002894	0.003146
14	0.000009	0.000231	0.000449
16	0.001155	0.001692	0.003240

