Regional Groundwater Modeling Results for Water Supply Planning in Northeast Illinois

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Acknowledgments

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Aquifers of Northeastern Illinois

West

East

DeKalb
Chicago

Top of Ancell (St. Peter ss)
Top of Ironton-Galesville

Unconsolidated Aquifer System

Shallow Bedrock Aquifer

Deep Bedrock Aquifer System
(Ancell and Ironton-Galesville sandstones)

Elmhurst-Mt. Simon Aq. (saline?)

Cross-Section Modified from Bretz (1939)
Analysis of impacts, not assessment of availability

Using prescribed demand scenarios to evaluate impacts primarily in the form of drawdowns & critical water levels – streamflows have not been assessed yet

Model runs used pumping rates from the various aquifers based on the proportional split of the 2005 pumping rates – sources were not shifted if a source ran out or levels went below a certain level

Results from pumping shallow s/g wells outside the FRB are highly uncertain and not shown – uncertainties also exist within the FRB

We have not assessed the shallow bedrock yet or all wells that went “dry”
Drawdown in Quaternary Coarse-Grained Unit 2

*End of Summer Irrigation Season, 1985*
Drawdown in Quaternary Coarse-Grained Unit 2

End of Summer Irrigation Season, 2005
Drawdown in Quaternary Coarse-Grained Unit 2

End of Summer Irrigation Season, 2025

Baseline Scenario
Drawdown in Quaternary Coarse-Grained Unit 2

End of Summer Irrigation Season, 2025

Less Resource-Intensive Scenario
Drawdown in Quaternary Coarse-Grained Unit 2

End of Summer Irrigation Season, 2025

More Resource-Intensive Scenario
Drawdown in Quaternary Coarse-Grained Unit 2

End of Summer Irrigation Season, 2050

Baseline Scenario
Drawdown in Quaternary Coarse-Grained Unit 2

End of Summer Irrigation Season, 2050

Less Resource-Intensive Scenario

[Map showing drawdown since predevelopment with color scale]

Fox Watershed
Geologic Model Area

Unit Absent
Drawdown in Quaternary Coarse-Grained Unit 2

End of Summer Irrigation Season, 2050

More Resource-Intensive Scenario

Map showing drawdown since predevelopment (feet) in the Fox Watershed Geologic Model Area.
Simulated Hydrograph Locations

- Coarse-Grained Unit 2 (Model Layer 5)
- “Deep” Bedrock Ancell & Ironton-Galesville Units (Model Layers 14 & 17)
Crystal Lake operated 11 wells in 2005:
7 shallow wells from 206-258' deep (55% of total Q)
4 deep wells from 1293-1400' deep (45% of total Q)
Crystal Lake Area
Quaternary Coarse-Grained Unit 2

Simulated Heads (Historical)
Simulated Heads (Baseline Scenario)
Simulated Heads (MRI Scenario)
Simulated Heads (LRI Scenario)

Top of Quaternary Coarse-Grained Unit 2

Feet above Mean Sea Level

Year

Crystal Lake Cone Center

Quaternary Coarse-Grained Unit 2

Year

Feet above Mean Sea Level

Top of Quaternary Coarse-Grained Unit 2

Simulated Heads (Historical)

Simulated Heads (LRI Scenario)

Simulated Heads (MRI Scenario)

Simulated Heads (Baseline Scenario)
Carpentersville PWS Withdrawals

1980 - 2050

Public Water Supply Withdrawals, million gallons per day

4 active wells in 2005 ranging in depth from 183-215' deep
Carpentersville
Quaternary Coarse-Grained Unit 2

Simulated Heads (Historical)
Simulated Heads (MRI Scenario)
Simulated Heads (LRI Scenario)
Simulated Heads (Baseline Scenario)

Top of Quaternary Coarse-Grained Unit 2

Year
Feet above Mean Sea Level
Carpentersville Cone Center
Quaternary Coarse-Grained Unit 2

- Simulated Heads (Historical)
- Top of Quaternary Coarse-Grained Unit 2
- Simulated Heads (MRI Scenario)
- Simulated Heads (Baseline Scenario)
- Simulated Heads (LRI Scenario)
- Bottom of Quaternary Coarse-Grained Unit 2
Algonquin PWS Withdrawals

1980 - 2050

Algonquin:
7 active wells in 2005;
6 wells from 121-240' deep
1 well 1315' deep
Deep well accounted for only 3% of 2005 pumpage
Algonquin
Quaternary Coarse-Grained Unit 2

Feet above Mean Sea Level

Top of Quaternary Coarse-Grained Unit 2

Year


Simulated Heads (Historical)
Simulated Heads (LRI Scenario)
Simulated Heads (Baseline Scenario)
Simulated Heads (MRI Scenario)
Aquifers of Northeastern Illinois

Aquifers of Northeastern Illinois

West

East

DeKalb

Chicago

Top of Ancell (St. Peter ss)

Top of Ironton-Galesville

Unconsolidated Aquifer System

Shallow Bedrock Aquifer

Deep Bedrock Aquifer System
(Ancell and Ironton-Galesville sandstones)

Elmhurst-Mt. Simon Aq. (saline?)

Cross-Section Modified from Bretz (1939)
11-County Deep Bedrock Withdrawals

Regional Water Supply Planning Demand Scenarios (LRI, BL, MRI)

11-County simulated historic deep bedrock withdrawals
Drawdown in the Ironton-Galesville Unit

End of Summer Irrigation Season, 1985
Drawdown in the Ironton-Galesville Unit

*End of Summer Irrigation Season, 2005*
Drawdown in the Ironton-Galesville Unit

End of Summer Irrigation Season, 2025

Baseline Scenario
Drawdown in the Ironton-Galesville Unit

End of Summer Irrigation Season, 2025

Less Resource-Intensive Scenario
Drawdown in the Ironton-Galesville Unit

*End of Summer Irrigation Season, 2025*

*More Resource-Intensive Scenario*
Drawdown in the Ironton-Galesville Unit

End of Summer Irrigation Season, 2050

Baseline Scenario
Drawdown in the Ironton-Galesville Unit

End of Summer Irrigation Season, 2050

Less Resource-Intensive Scenario
Drawdown in the Ironton-Galesville Unit

End of Summer Irrigation Season, 2050

More Resource-Intensive Scenario

Eleven-County Area

Drawdown Since Predevelopment (feet)
Simulated Hydrograph Locations

- Coarse-Grained Unit 2 (Model Layer 5)
- “Deep” Bedrock
- Ironton-Galesville Unit (Model Layer 17)
Lake in the Hills
Ironton-Galesville Unit

Simulated Heads (Historical)
Simulated Heads (LRI Scenario)
Simulated Heads (MRI Scenario)
Simulated Heads (Baseline Scenario)

Feet above Mean Sea Level

Year

Top of Ironton-Galesville Unit
St. Charles
Ironton-Galesville Unit

Feet above Mean Sea Level

Year


Simulated Heads (Historical)
Simulated Heads (MRI Scenario)
Simulated Heads (LRI Scenario)
Simulated Heads (Baseline Scenario)

Top of Ironton-Galesville Unit
Shorewood
Ironton-Galesville Unit

- Simulated Heads (Historical)
- Simulated Heads (MRI Scenario)
- Simulated Heads (Baseline Scenario)
- Simulated Heads (LRI Scenario)

Feet above Mean Sea Level

Year

Oswego
Ironton-Galesville Unit

Feet above Mean Sea Level

Simulated Heads (Historical)
Simulated Heads (LRI Scenario)
Simulated Heads (MRI Scenario)
Simulated Heads (Baseline Scenario)

Year

Available Head Above Top of Ironton-Galesville

End of Summer Irrigation Season, 1985
Available Head Above Top of Ironton-Galesville

End of Summer Irrigation Season, 2005

Available head not shown where ...
1. It is >200 ft
2. It was <200 ft before development
Available Head Above Top of Ironton-Galesville

End of Summer Irrigation Season, 2025

Baseline Scenario
Available Head Above Top of Ironton-Galesville

End of Summer Irrigation Season, 2025

Less Resource-Intensive Scenario

Available head not shown where...
1. It is >200 ft
2. It was <200 ft before development
Available Head Above Top of Ironton-Galesville

End of Summer Irrigation Season, 2025

More Resource-Intensive Scenario
Available Head Above Top of Ironton-Galesville

End of Summer Irrigation Season, 2050
Baseline Scenario

Available head not shown where ...
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Available Head Above Top of Ironton-Galesville

End of Summer Irrigation Season, 2050
Less Resource-Intensive Scenario

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End of Summer Irrigation Season, 2050

More Resource-Intensive Scenario

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Conclusions

• Regional groundwater flow model results have been produced for the 3 basic demand scenarios
• Results for shallow sand/gravel aquifers within the Fox River Basin were presented - cones of depression are evident in major pumping centers – some Carpentersville wells apparently went dry in the Baseline and MRI scenarios
• Stream flow impacts have not been examined yet – stream flow may be contributing significantly to sand/gravel wells
• Results for Ironton-Galesville were presented and some future demand scenarios show significant impacts, esp. in areas near Aurora and Joliet
• Model results suggest future demands can largely be met only if the impacts are deemed acceptable
• There is time to make model improvements and plan alternatives, but not time to waste
To-Do List for 2009

- Evaluate model results to see if more wells went dry than just Carpentersville
- Model impacts of drought and climate change
- Assess impacts of all scenarios on streamflow
- Assess impacts on shallow bedrock aquifers
Happy Holidays!

See you next year...