

Twin Cities Water Supply Planning and Use of the Metro Model

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Minnesota Ground Water Association
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Outline

- Water supply planning at the Council
- 100+ years of water supply system change
- Metro Model 2
 - Anticipating conditions we'd like to prevent
 - How uncertainty informs investment

Minnesota Statutes 473.1565

- Planning activities
 - Master Water Supply Plan
 - Base of technical information
- Advisory committee
 - State agencies
 - Counties
 - Municipalities/utilities
- Reports to legislature
 - State Water Plan

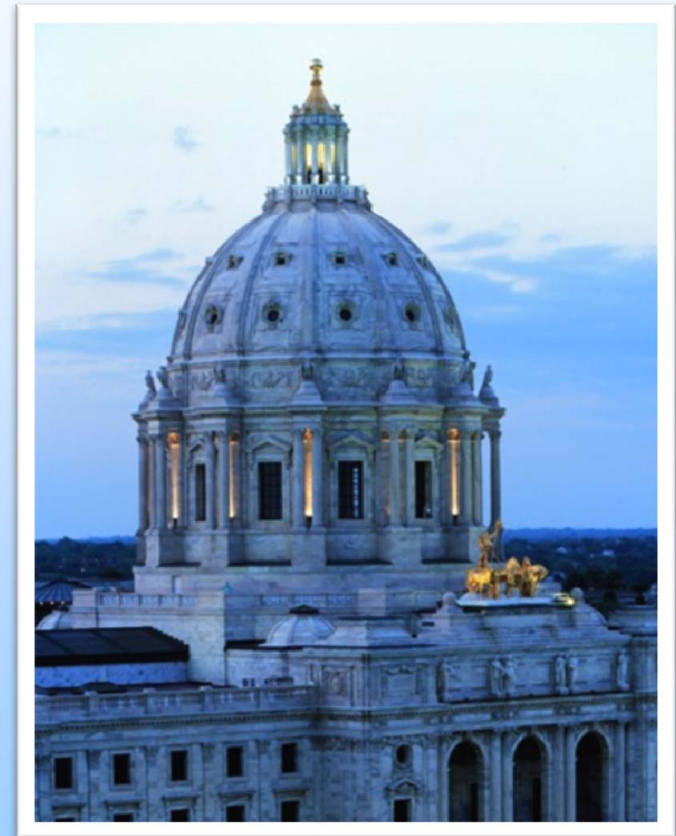


Photo: Minnesota Historical Society

Metropolitan Area Master Water Supply Plan

Twin Cities Metropolitan Area, Minnesota



March 2010

Community Water Supply Profiles

Water use →

Current sources →

Available sources →

Potential Issues →

Coates

Water Demand Projections^(1, 2, A) 2010 2020 2030 2040 2050

Population Served

Annual Total (Million Gal./Yr)

Water demand will be projected for this community as they develop a municipal supply.

Average Day (Million Gal./Day)

Maximum Day (Million Gal./Day)

Maximum Day, Conserving 10%

Estimated Additional Wells,

(if groundwater sources were pumped at metro average rates to meet demand above permit)

Current Water Supply^(C)

The community does not have a municipal supply. Private wells supply existing demand.

Available Future Water Supply Source(s)^(D)

Private wells are expected to meet demand until 2050. If the community plans to develop a municipal supply, an assessment of aquifer capacity, withdrawal impacts, and inter-jurisdictional opportunities should be conducted.

- **Prairie du Chien-Jordan aquifer**
- **Franconia-Ironton-Galesville aquifer**

The following will need to be addressed should water supplies be developed using the sources or in the areas noted (Appendix 3 provides guidance):^(3, A, B, C, D, E)

Potential for well interference

- Due to the pervasiveness of private wells in the metro area, suppliers requesting water appropriations should evaluate the need to address potential well interference

Potential for significant decline in aquifer water levels

- Predicted decline in available head greater than 50% in confined portions of the Prairie du Chien-Jordan aquifer under projected 2030 demand conditions

Minnesota Department of Natural Resources and Department of Health conditions

- Conditions identified on existing and future water appropriation permits issued by the Minnesota Department of Natural Resources
- Issues identified in Source Water Assessments, which can be found on the Minnesota Department of Health website www.health.state.mn.us/divs/eh/water/swp/swa/

Guidance

Use other sources, or:

Verify the issue →

Management plan →

Monitor for impact →

Act when needed →

Water Supply Issue: Potential for significant decline in aquifer water levels

A basic evaluation of the likelihood for unacceptable drawdowns should be conducted for all communities where the potential for significant decline in water levels was identified in Appendix 2. This evaluation should include:

- Analysis of existing and projected water level/water withdrawal data to assess the likelihood of a significant decline in water levels (i.e. exceeding >50% drawdown in available head in confined aquifers or continued decline in unconfined aquifers). The analysis can vary from a graphical comparison of water levels, to basic distance drawdown calculations, to a groundwater flow modeling and should be determined in consultation with the DNR

For those areas where the above analysis suggests future drawdowns are likely to be unacceptable, the following should be included in a management plan⁵:

- Schedule measurement³ of water levels and/or pumping rates in existing production wells⁴.
- Schedule for measurement³ of water levels in at least one observation well² (sentinel well) in the pumped aquifer near the well field.
- Schedule for periodic and timely analyses of water level data and other information to identify the need for action to mitigate impacts on aquifer water levels
- Schedule for periodic and timely submittal of water level data and other information to the DNR. In most cases quarterly submittal of water level data and annual submittal of an analysis of the available information is appropriate.

The management plan should also identify triggers and associated actions to protect aquifer water levels

Sample triggers

- Measured > 50% decline in confined aquifer available head at sentinel well(s)
- Measured or projected significant seasonal declines
- Measured continuing decline in unconfined or confined aquifer head at appropriate sentinel well(s)
- Other triggers developed in cooperation with the DNR

One Hundred Years



DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

WATER-SUPPLY PAPER 256

GEOLOGY AND UNDERGROUND WATERS OF SOUTHERN MINNESOTA

BY

C. W. HALL, O. E. MEINZER, AND M. L. FULLER

WORK DONE IN COOPERATION WITH THE MINNESOTA
STATE BOARD OF HEALTH



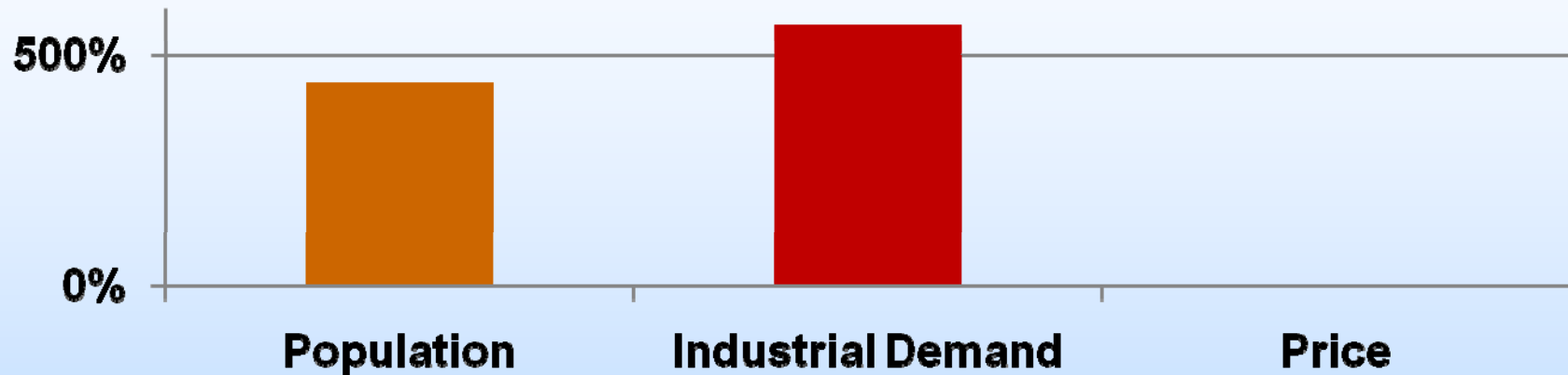
WASHINGTON
GOVERNMENT PRINTING OFFICE
1911

“Though southern Minnesota has passed the pioneer state of agricultural development, there is yet in store for it great industrial progress and an accompanying increase in population.”



Hall, C. W.; O. F. Meinzer; and M. L. Fuller, 1911. Geology and Underground Waters of Southern Minnesota. U.S. Geological Survey Water Supply Paper 256, 406 p.

What has changed since 1911?

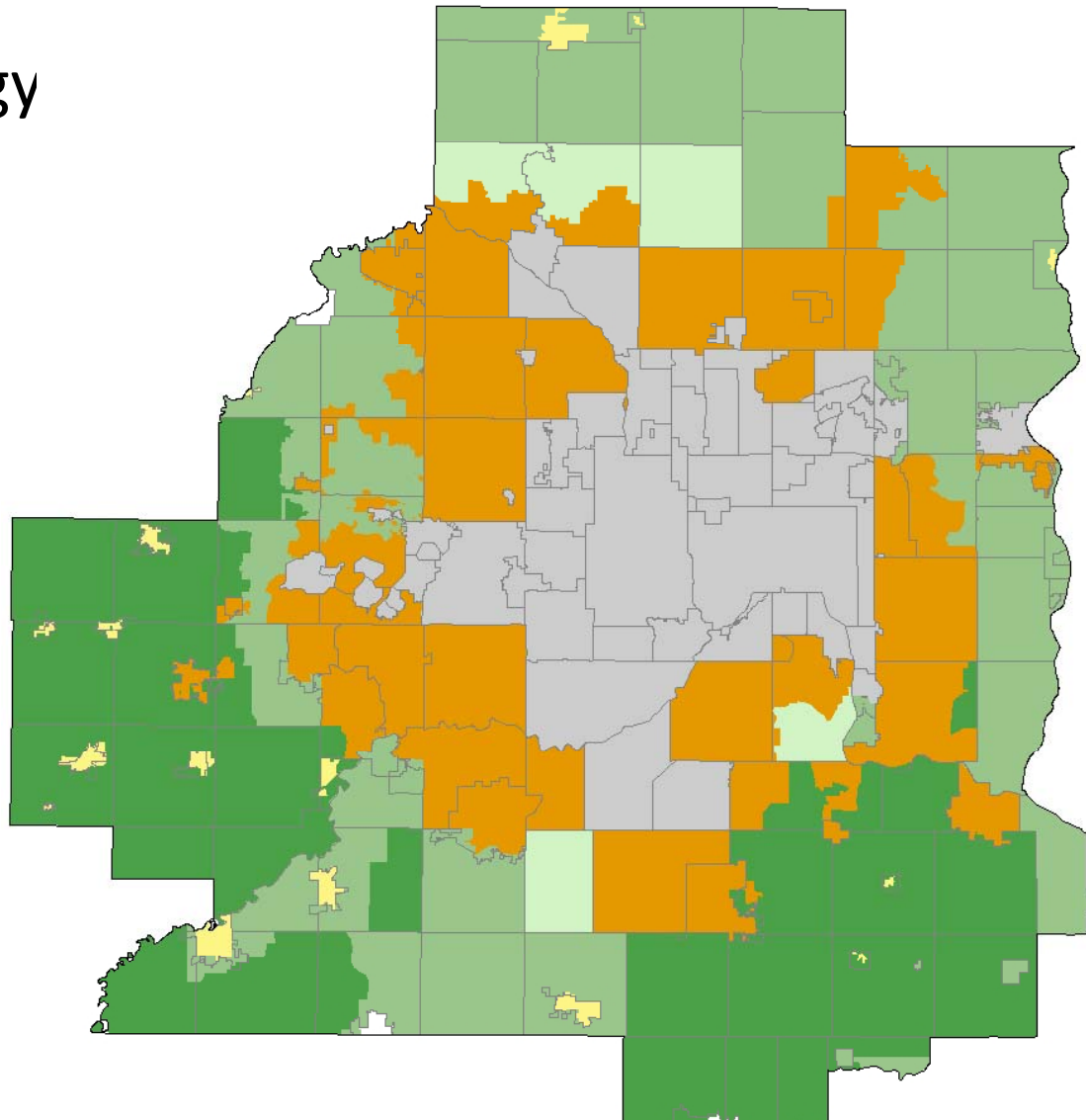


- PDCJ head in the Rum River valley used to rise 20' above land surface
- Wells drilled in the Jordan Sandstone in South St. Paul yielded artesian supplies on Sundays

What will change in the future?







2030 Growth Strategy

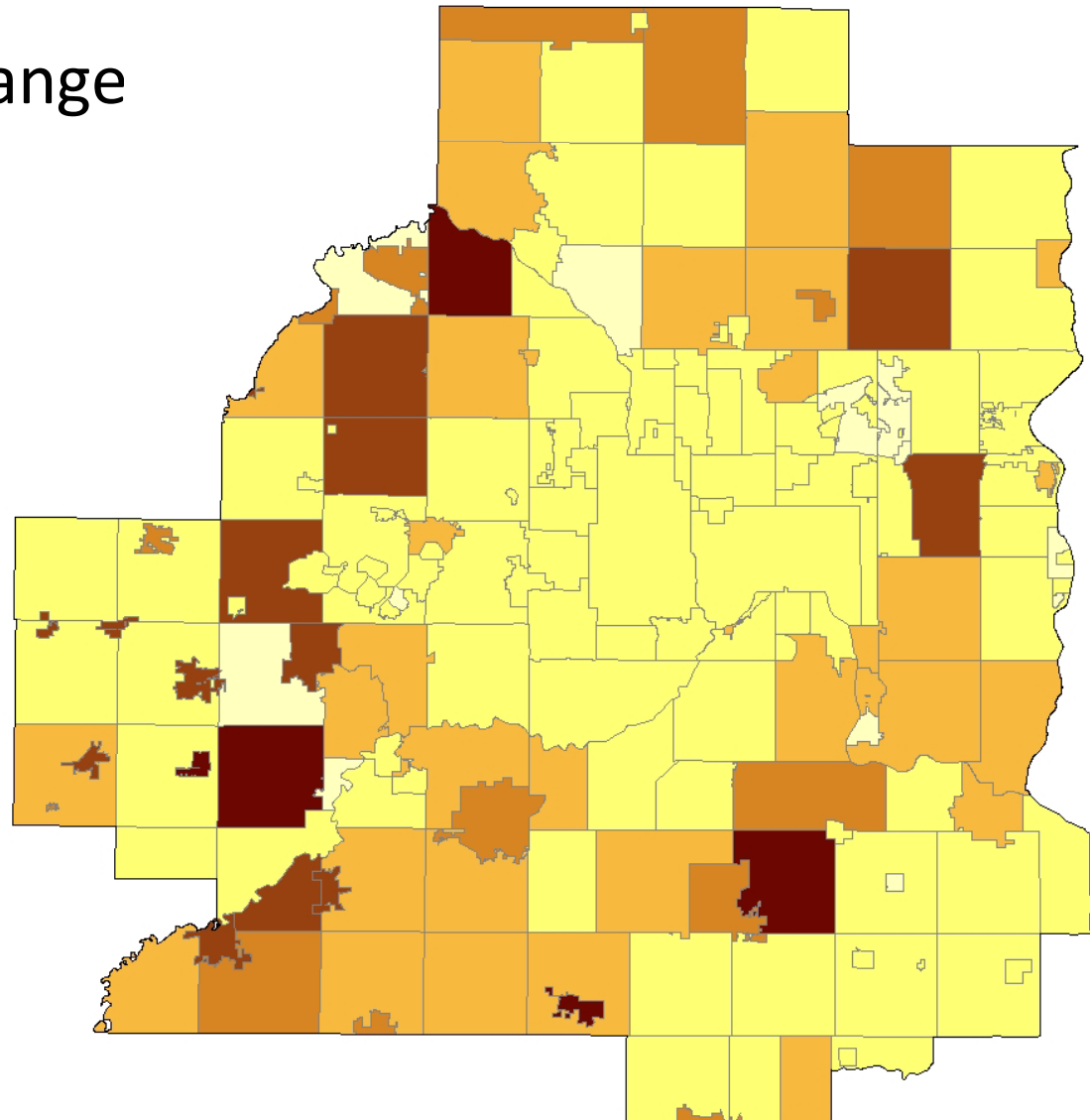
-  Developed Area
-  Developing Area
-  Rural Center
-  Rural Residential
-  Diversified Rural
-  Ag. Preservation Area



What will change in the future?

2030 Population Change




-  Decrease
-  0-25%
-  25-50%
-  50-100%
-  100-200%
-  Over 200%

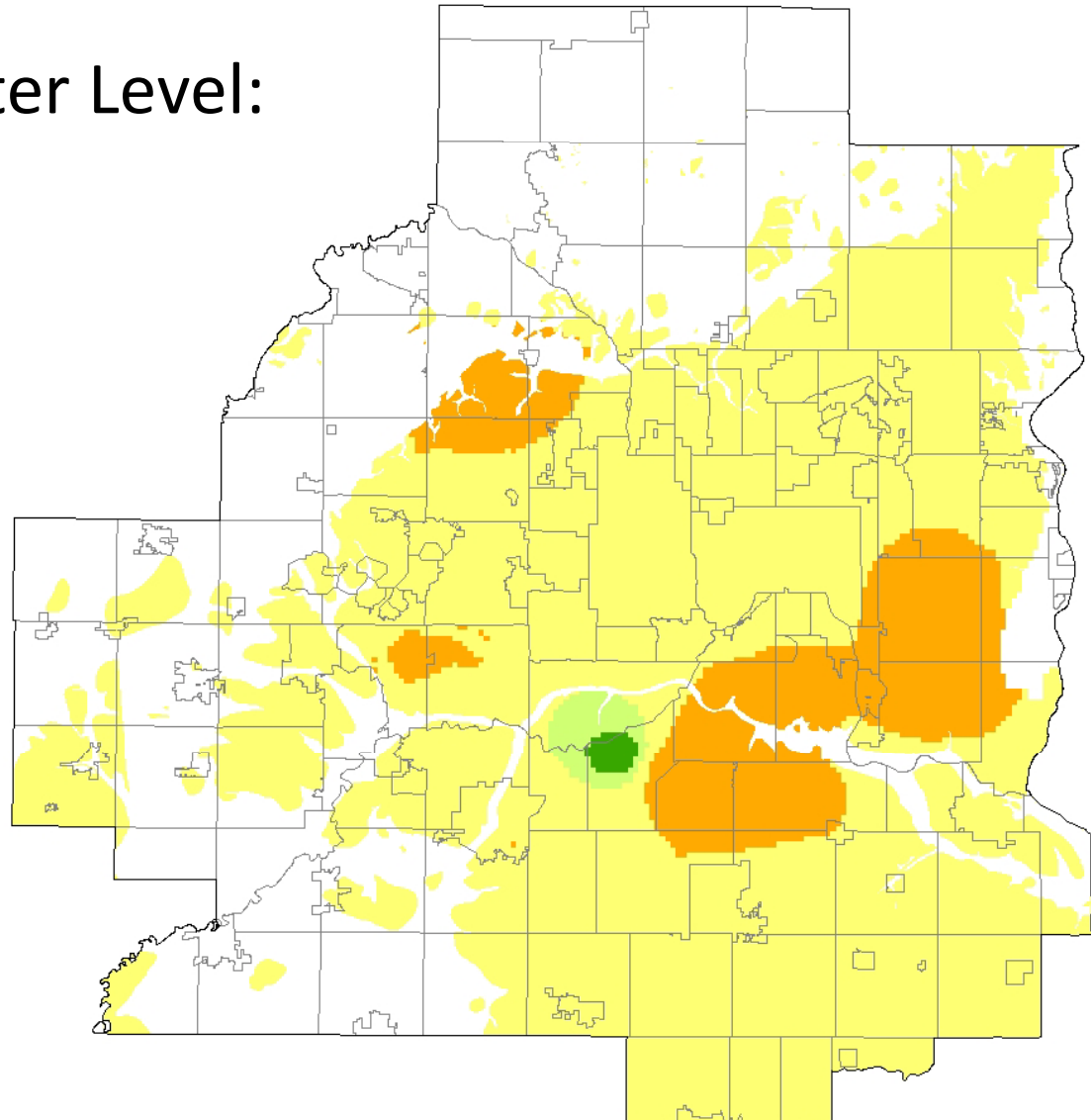


What will change in the future?

Predicted 2030 Water Level:

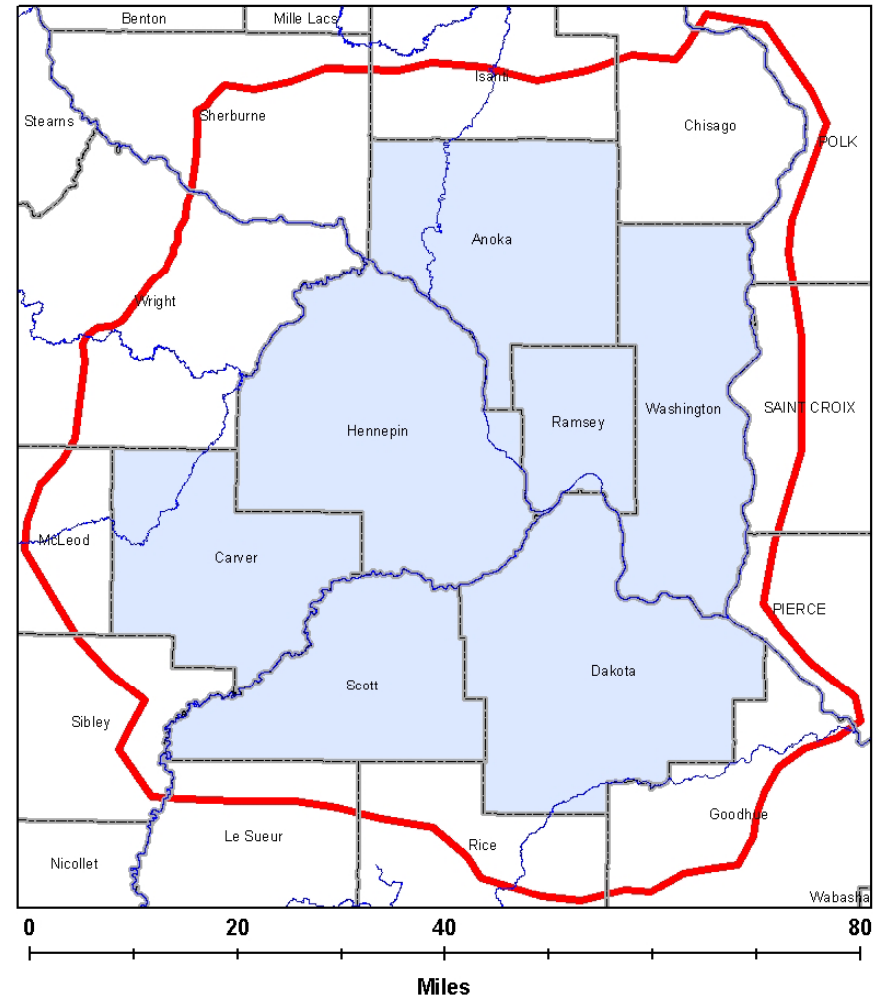
Jordan Aquifer

-  Increase
-  Relatively Constant
-  Decrease

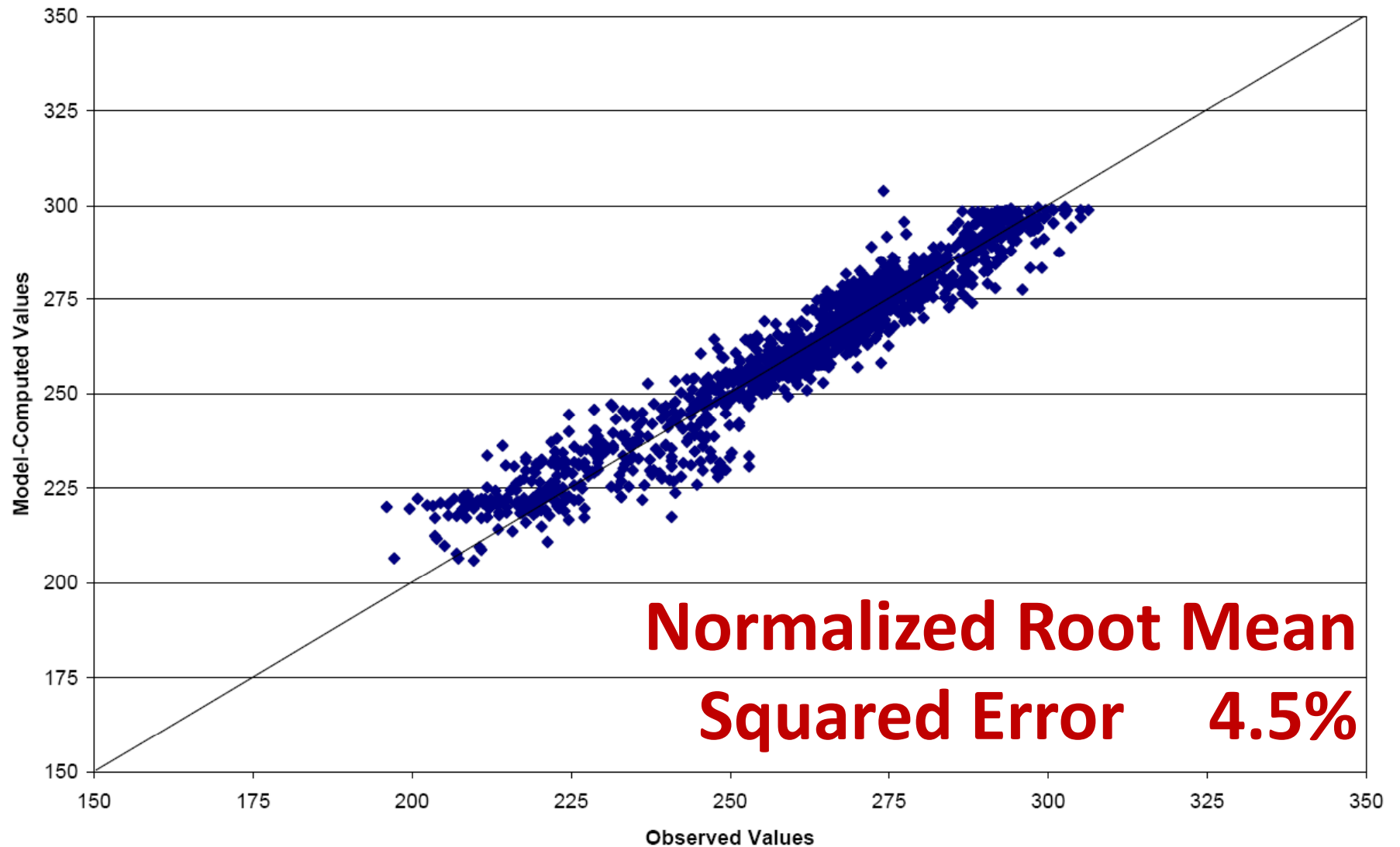


Metro Model 2

- MODFLOW-96
- Regional
- Steady-state
- 9 model layers
- 500 x 500 meter grid
- 33 streams
- 962 lakes & wetlands
- Recharge model
- DNR pumping data

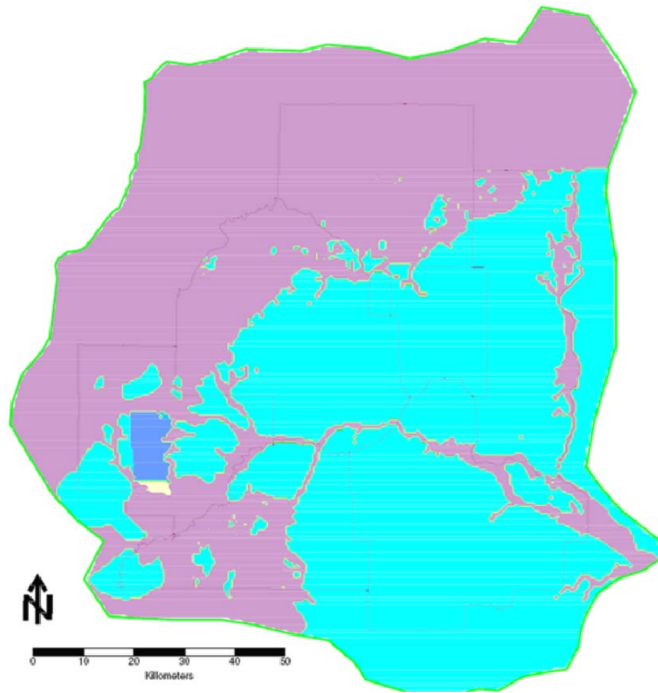


Modeled vs. Measured Water Levels



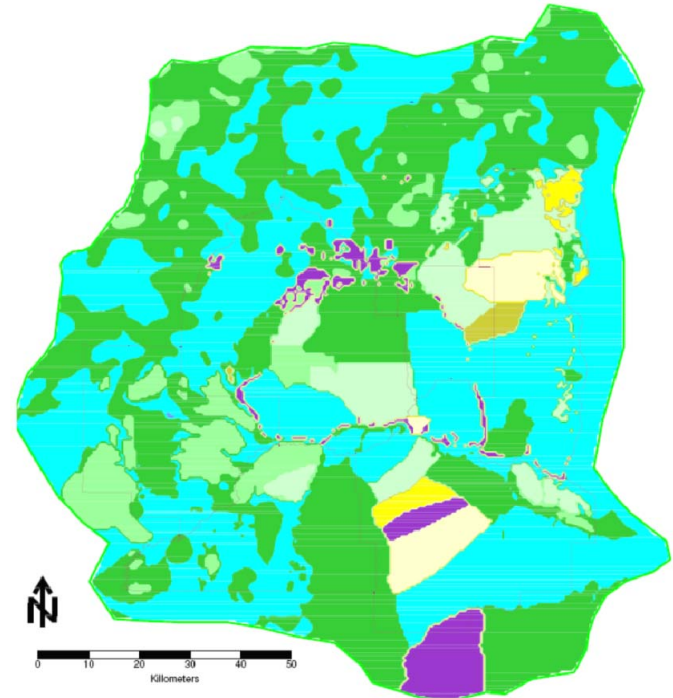
Data represents the Prairie du Chien – Jordan aquifer

Evaluating Different Conceptual Models



9

Aquifer Property Zones



10,000+

Aquifer Property Zones

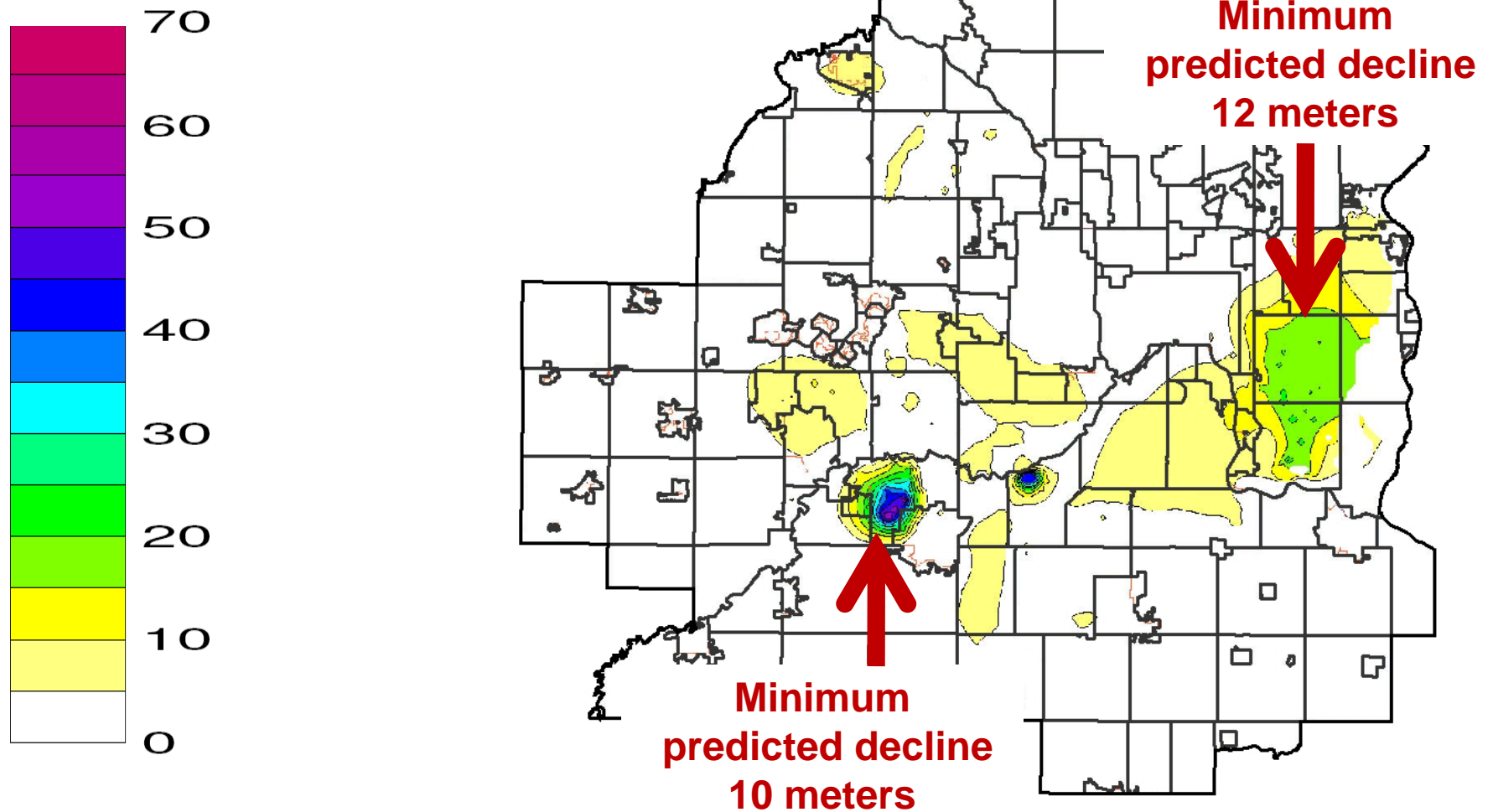
Simple



Complex




Conceptual Model Effect on Predictions

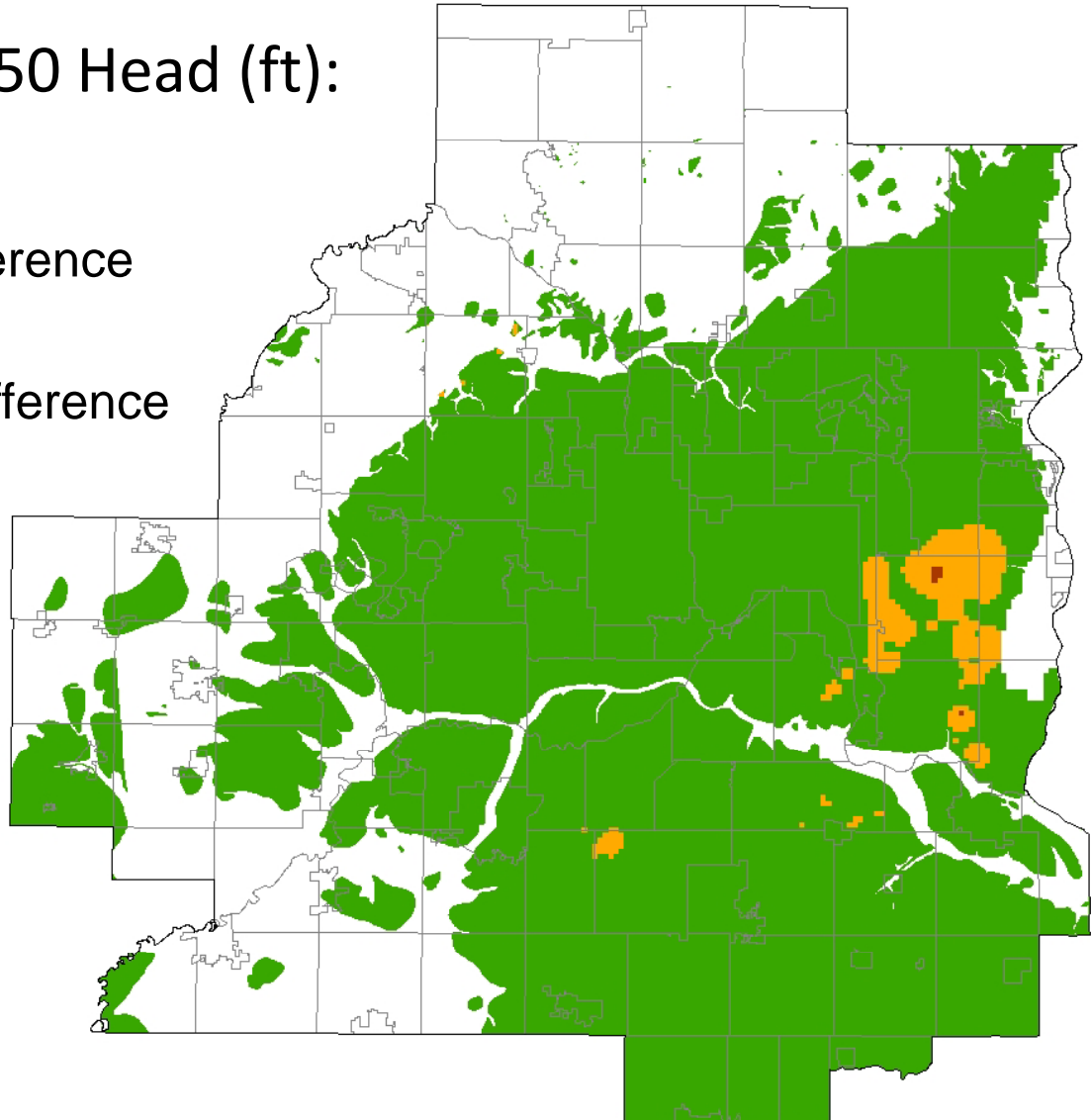
Range in Predicted 2050 Head (m):
Prairie du Chien Aquifer



Uncertain Water Supply Expansion




Range in Predicted 2050 Head (ft):
Jordan Aquifer

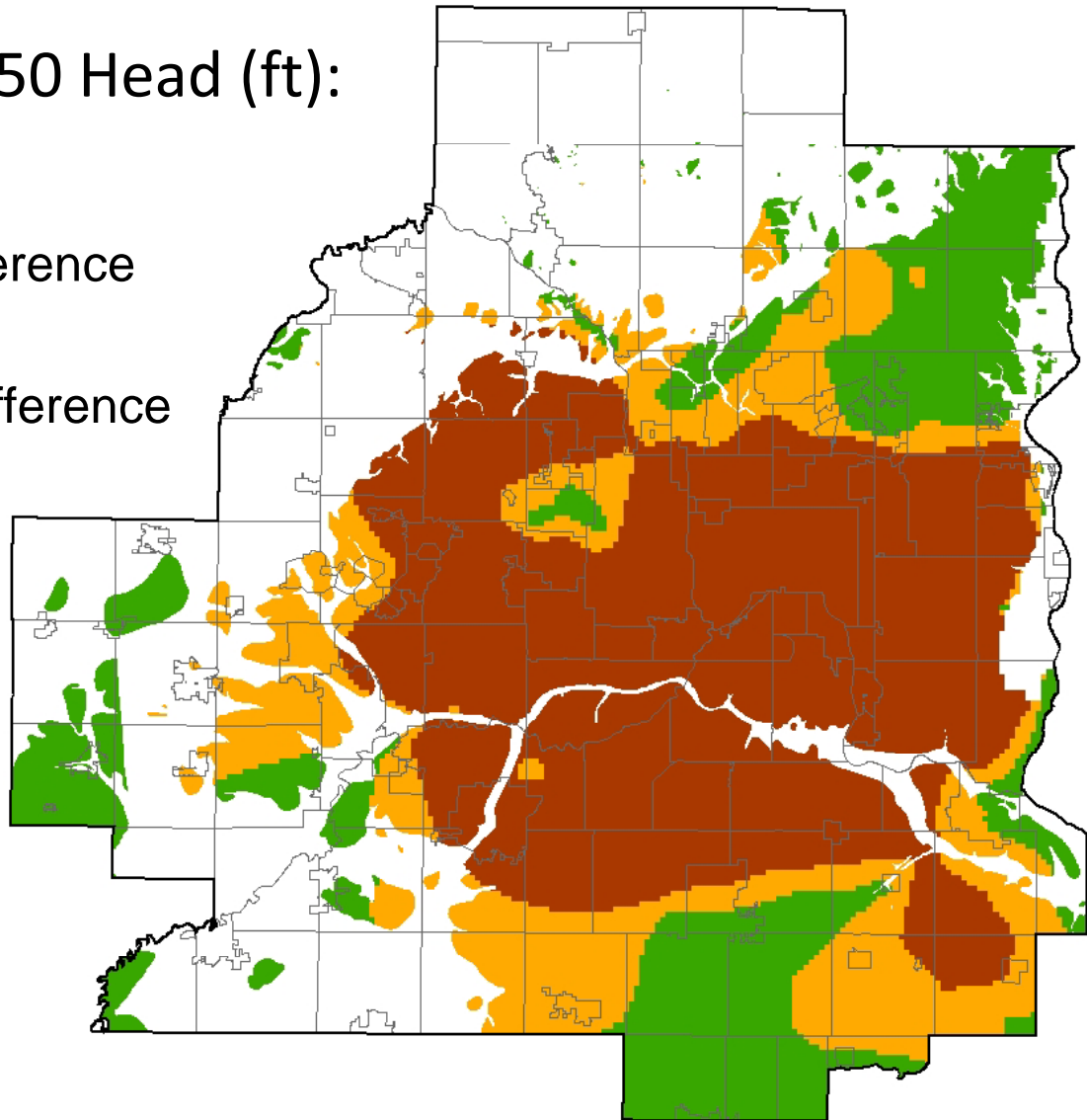
-  Less than 3 feet of difference
-  3-10 feet of difference
-  More than 10 feet of difference



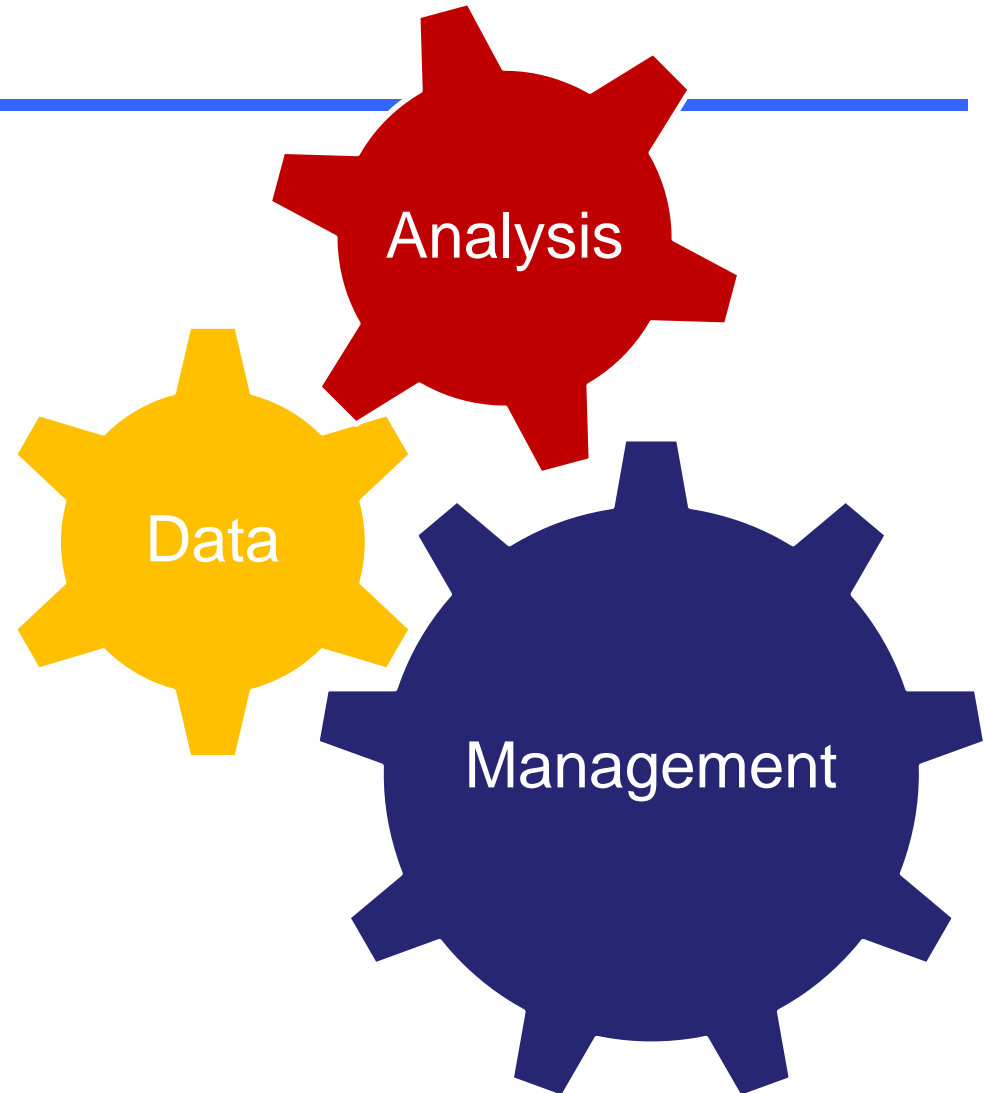
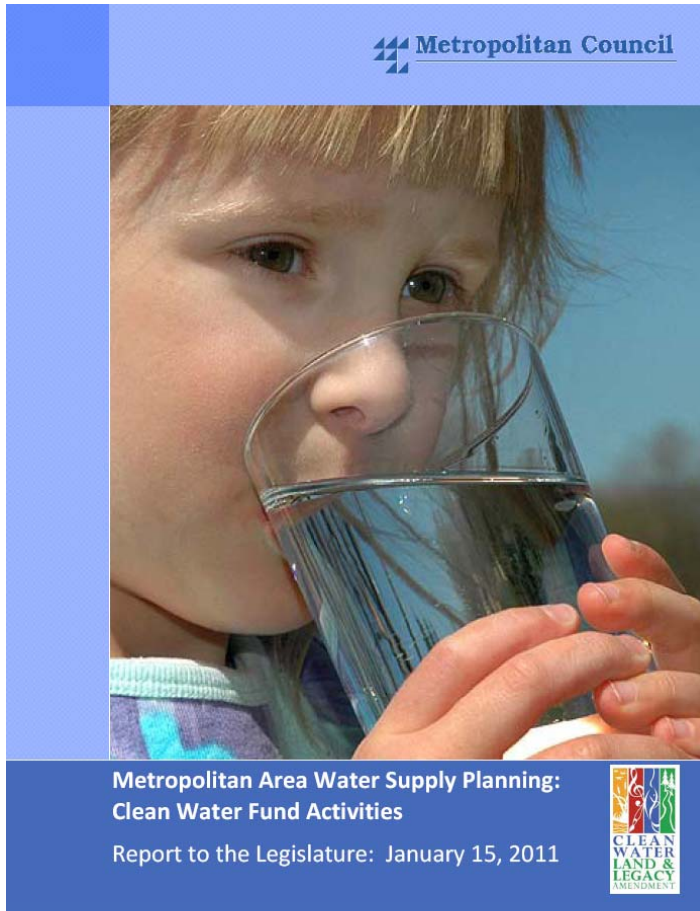
Water Demand and Predictions

Range in Predicted 2050 Head (ft):
Jordan Aquifer

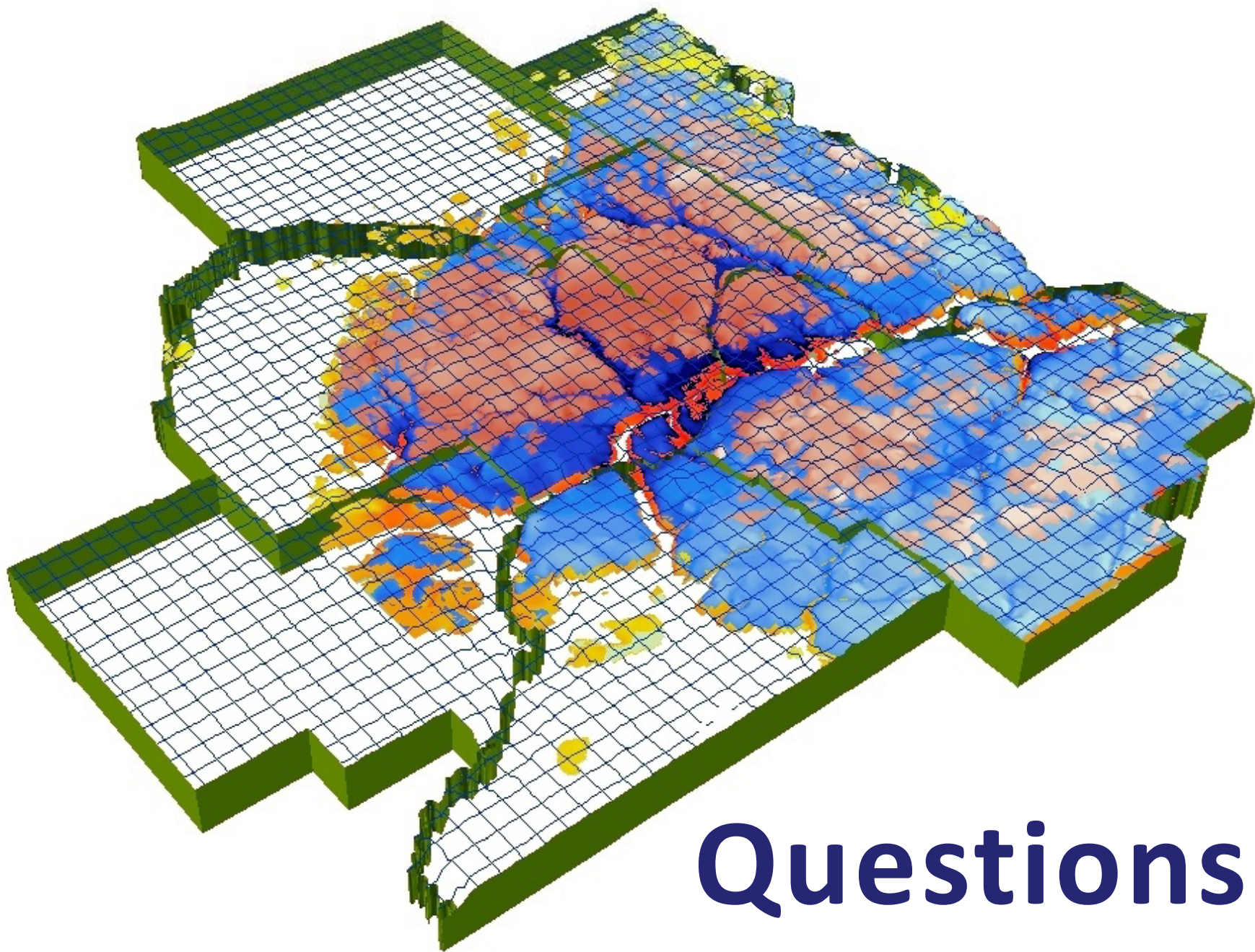
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There's more...



www.metrocouncil.org/environment/WaterSupply/



Questions?