

Use of Minnesota's Renewable Water Resources: Moving Toward Sustainability



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Environmental Quality Board**

**Water Availability Focus Group
June 24, 2008**

Water Sustainability Project

➤ *Minnesota Statutes*

- **M.S. 103A.43(c) Water Assessment and Reports**
- **Assess and analyze the quantity of surface and ground water in the state and the availability of water to meet the state's needs**

➤ **April 2007 report**

- ***Use of Minnesota's Renewable Water Resources: Moving Toward Sustainability***

➤ **Lead agencies**

- **EQB and DNR**

➤ **Other partners**

- **USGS, MGS, U of M, Met Council, MDH & EPRI**

Adding Value

- Understand how Minnesota is doing
- Define unknowns in quantity & use
- Recognize the importance of water in planning for growth
- Highlighted by drought of 2006 & 2007

Use of Minnesota's Renewable Water Resources *Moving Toward Sustainability*



A report of the Environmental Quality Board
and Department of Natural Resources
April 2007

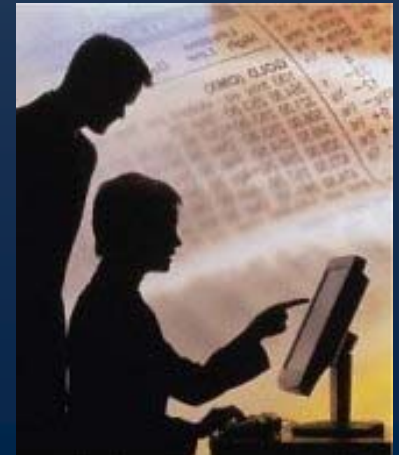
Project Steps

- Determine current water use (2005)
- Estimate future use (2030)
- Quantify sustainable supply
- Compare supply & demand on a county scale

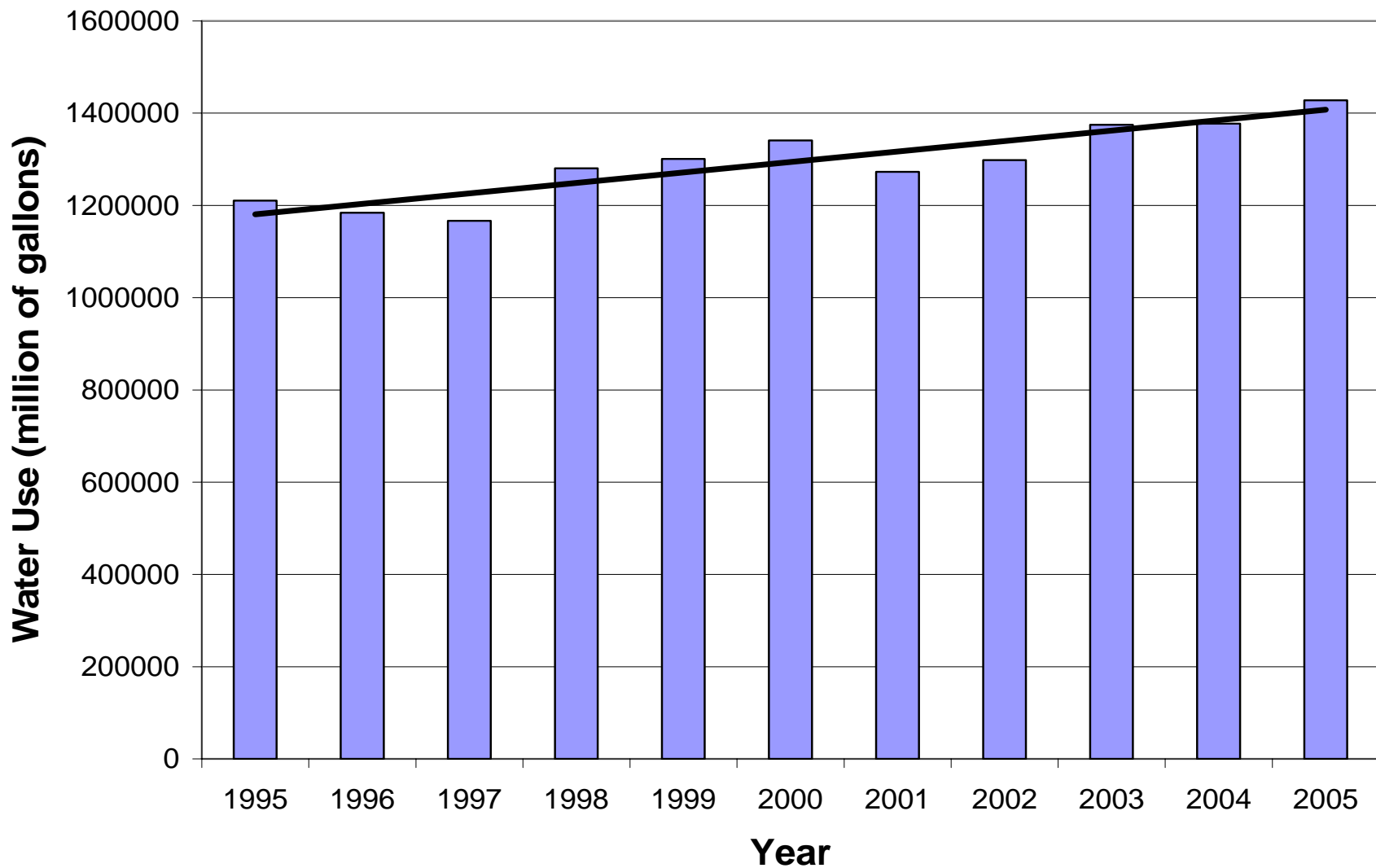


Current Water Use: Permitted Use

- Focused on 1995-2005
- Summarized DNR permit database
- Compiled population by county
- Calculated per capita usage



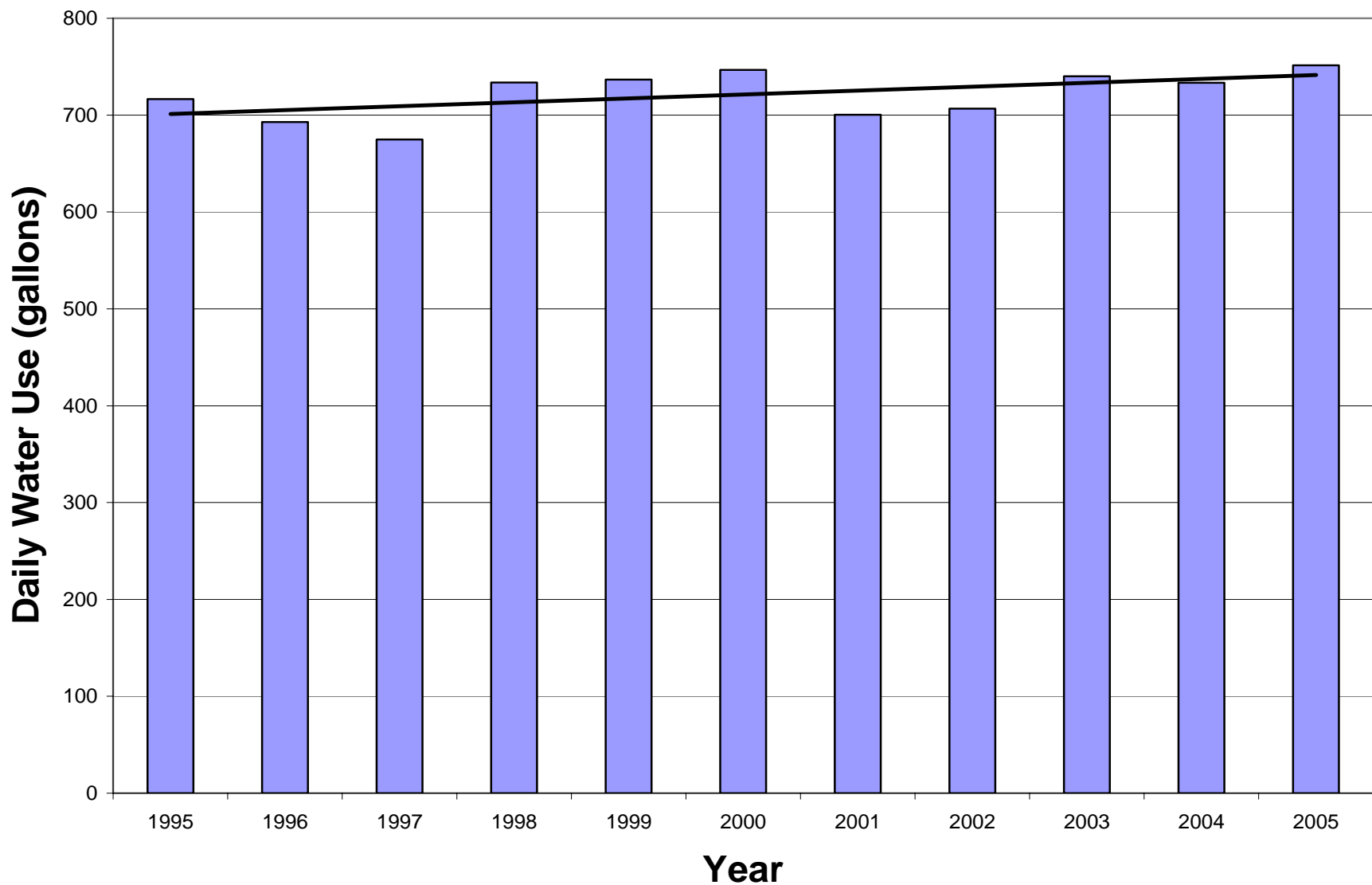
Minnesota Annual Water Use



Water Use Trends 1995-2005

- **12% increase in population**
- **18% increase in total water use**
- **6% increase in per capita use**

Daily Per Capita Water Use



Current Water Use: “Unpermitted”

- Established population on private wells
- Used MDH & census data
- Calculated unpermitted use



2005 Gross Water Use

- Added unpermitted & permitted to establish base use
Per Capita 1995-2005 = Permitted + Unpermitted
- Calculated baseline
2005 Gross Use = Per Capita 1995-2005 x Population 2005
- Reduced impact of climatic variations

2005 Net Water Use

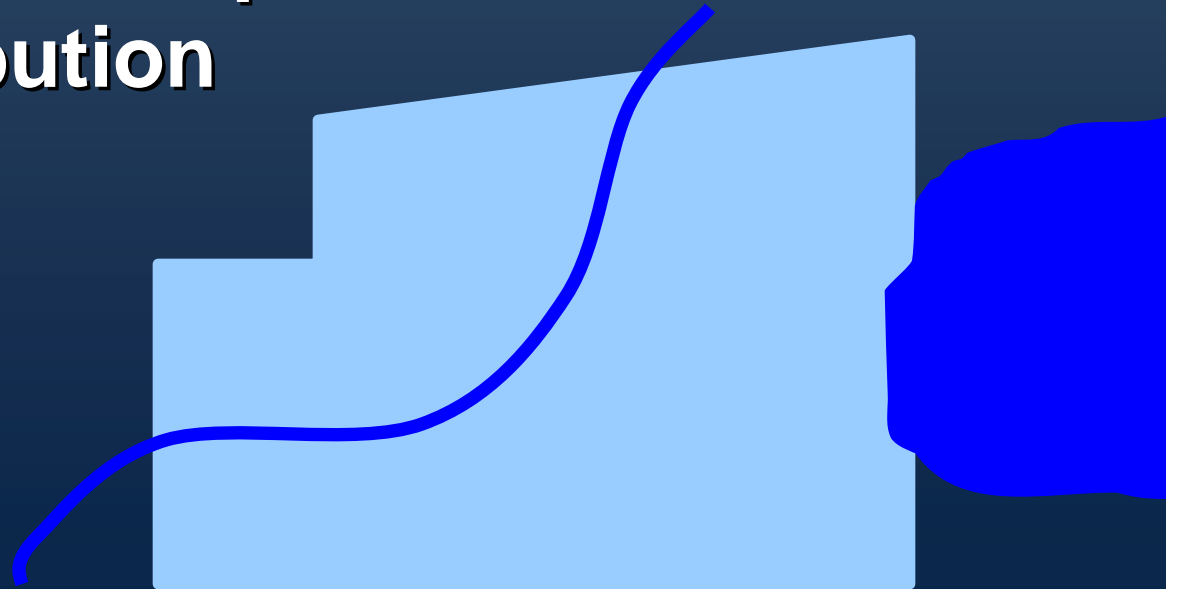
- Evaluated all 1,600 surface water permit
- Removed imported water & non-consumptive use

Imported Waters

- Surface water originating outside of a county
- Removed in analysis
- Treated as ratio of upstream to in-county contribution

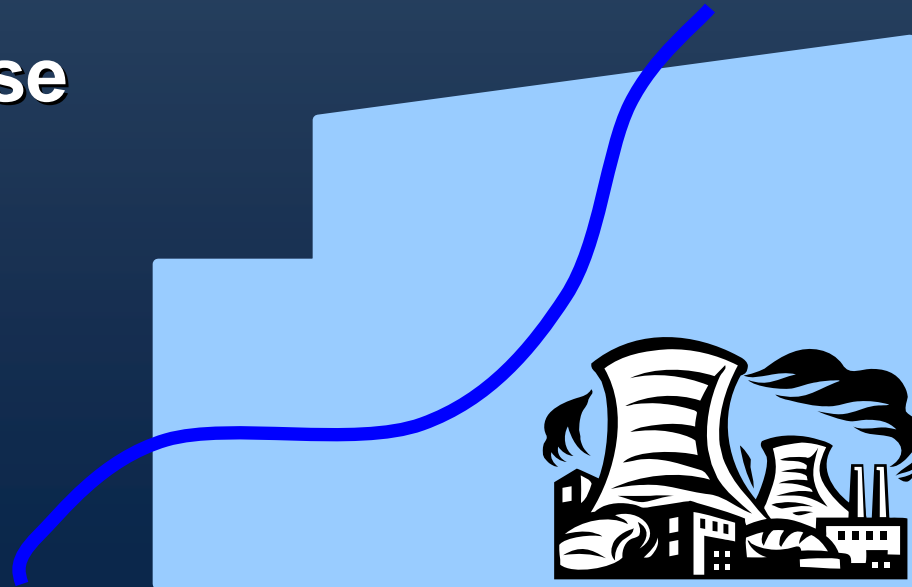
Examples:

Mississippi River
Minnesota River
Lake Superior



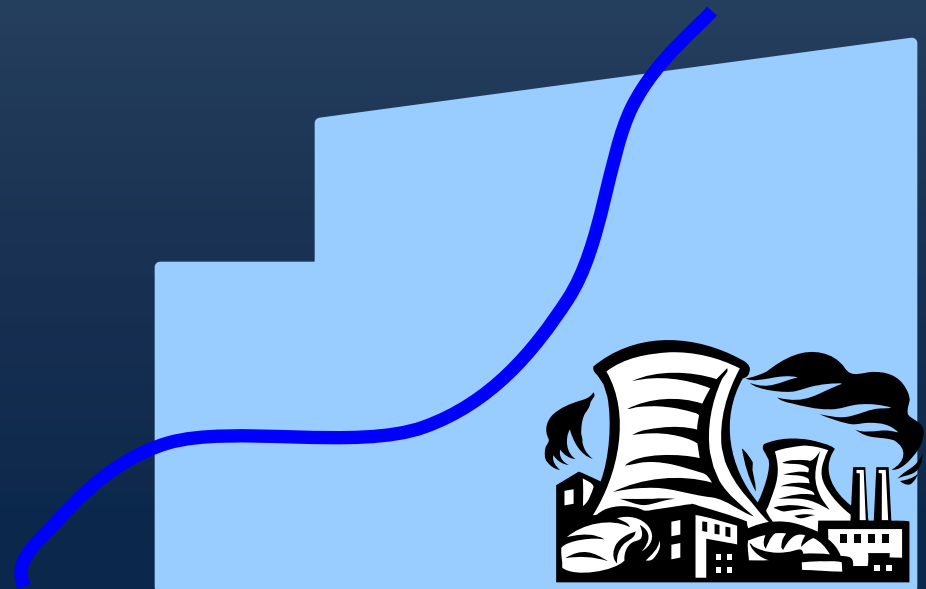
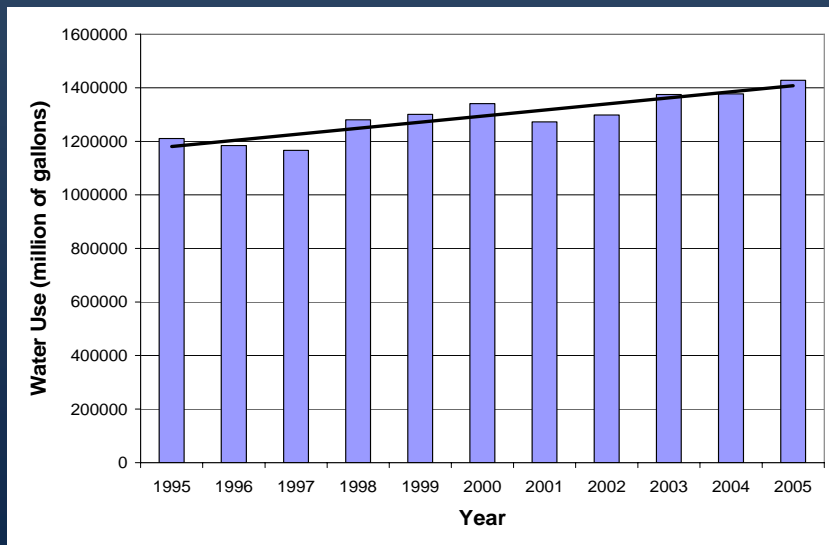
Non-Consumptive Use

- An industry may return much of its water to the hydrologic system
 - **Steam power cooling consumes only 2%**
- Ground water use considered consumptive



2005 Net Water Use

**2005 Net Water Use = 2005 Gross Use –
Imported Waters – Non-consumptive Use**



Future Water Use: Estimate 2030 Demand

➤ Assumed per capita use is constant to 2030

- Increase
- Constant
- Decrease



➤ Estimated 2030 population from State Demographer & Met Council

2030 Gross Water Use

2030 Gross Use = Per Capita 1995-2005 x Population 2030

2030 Net Water Use

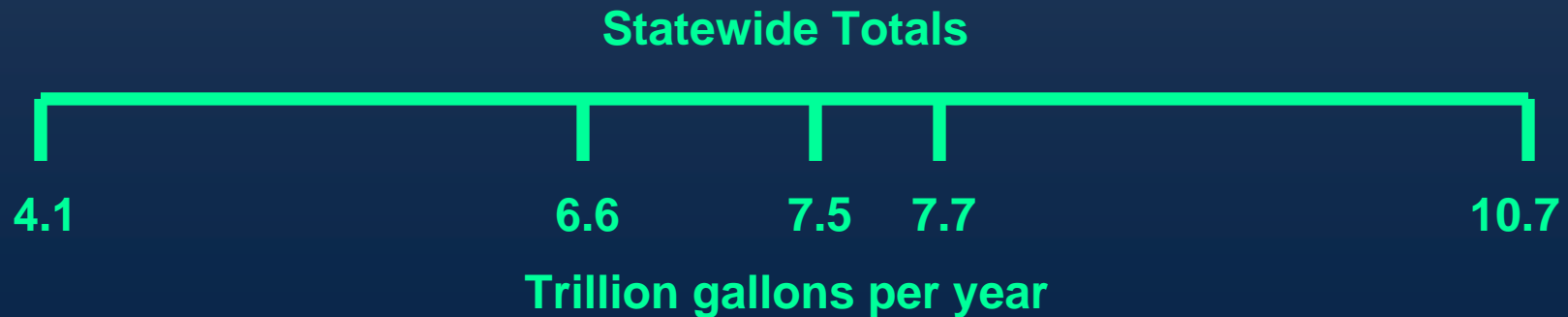
2030 Net Use = 2030 Gross – Imported – Non-consumptive

Quantify Renewable Resources

- Published supply methods
- Surrogates for sustainable supply
- Quantified at county scale
- Considers:
Soils, precipitation, watershed discharge, evapotranspiration, ecoregion, hydrology, etc.

Supply Methods

- Regional regression recharge (USGS)
- Watershed characteristics (MGS, UofM)
- Net available precipitation (EPRI)
- Fractional precipitation (DNR/USGS)



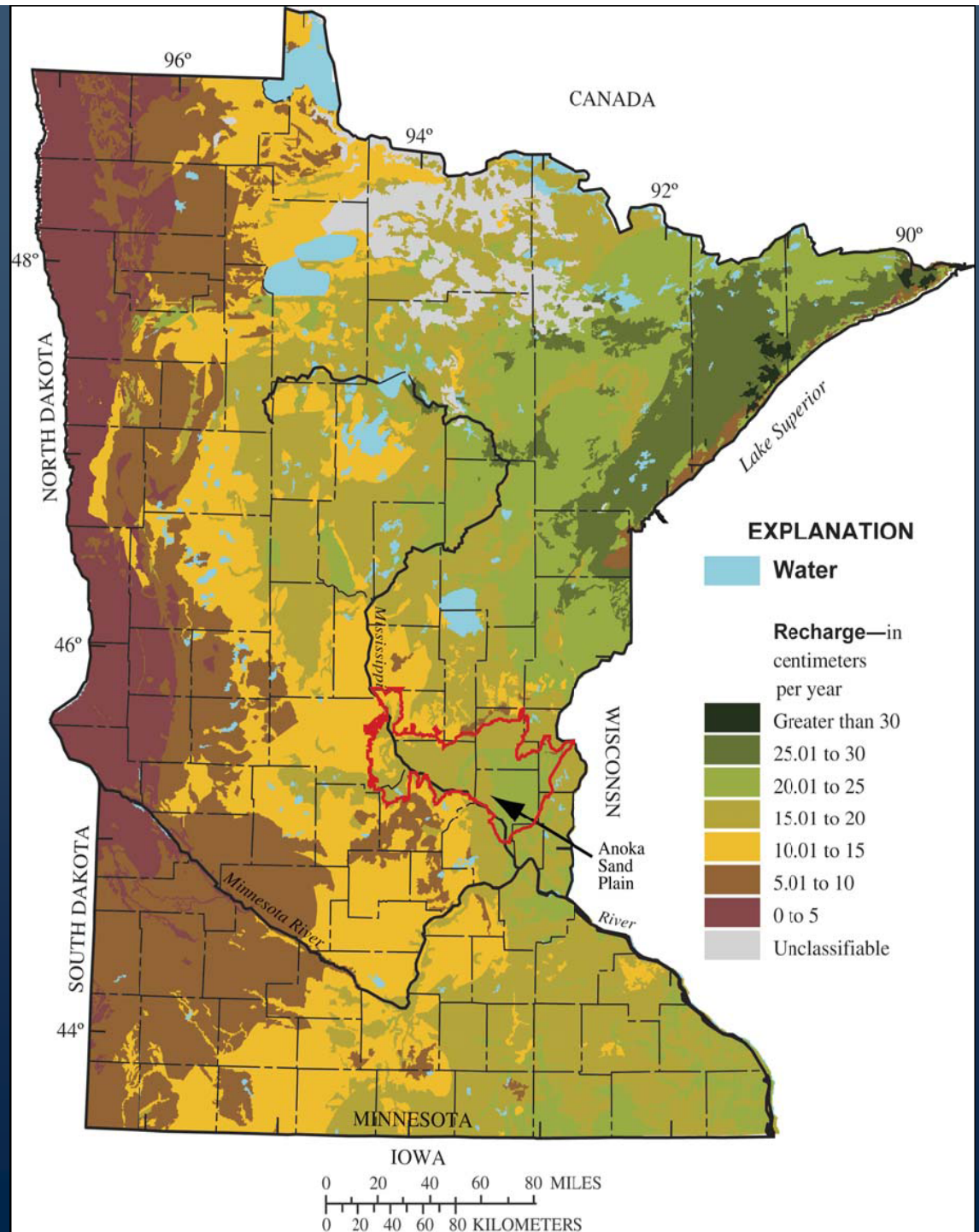
Supply Value

- RRR high & low bracket others statewide
- Median of remaining three

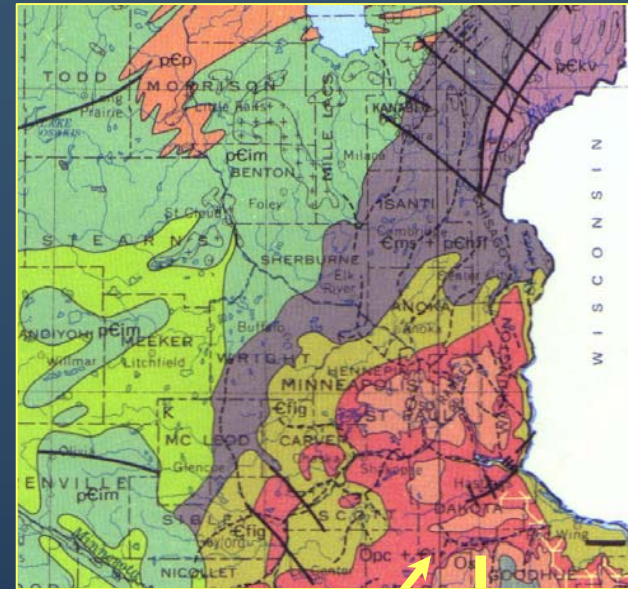
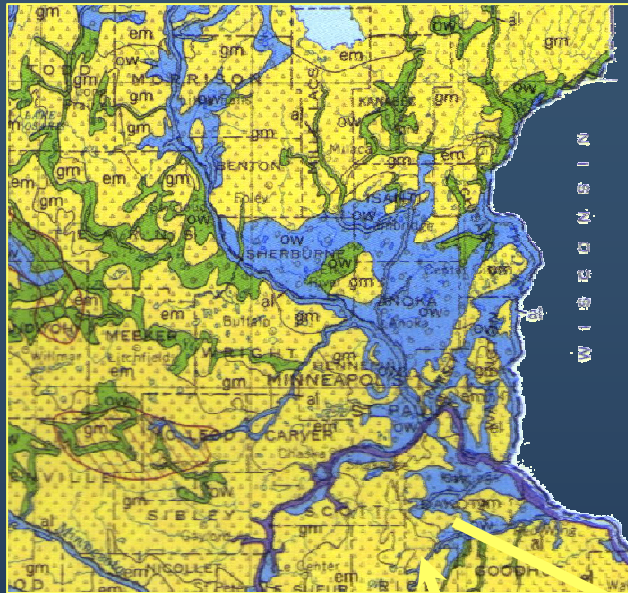


RRR Model Results

Average annual recharge to surficial materials (1971 - 2000)



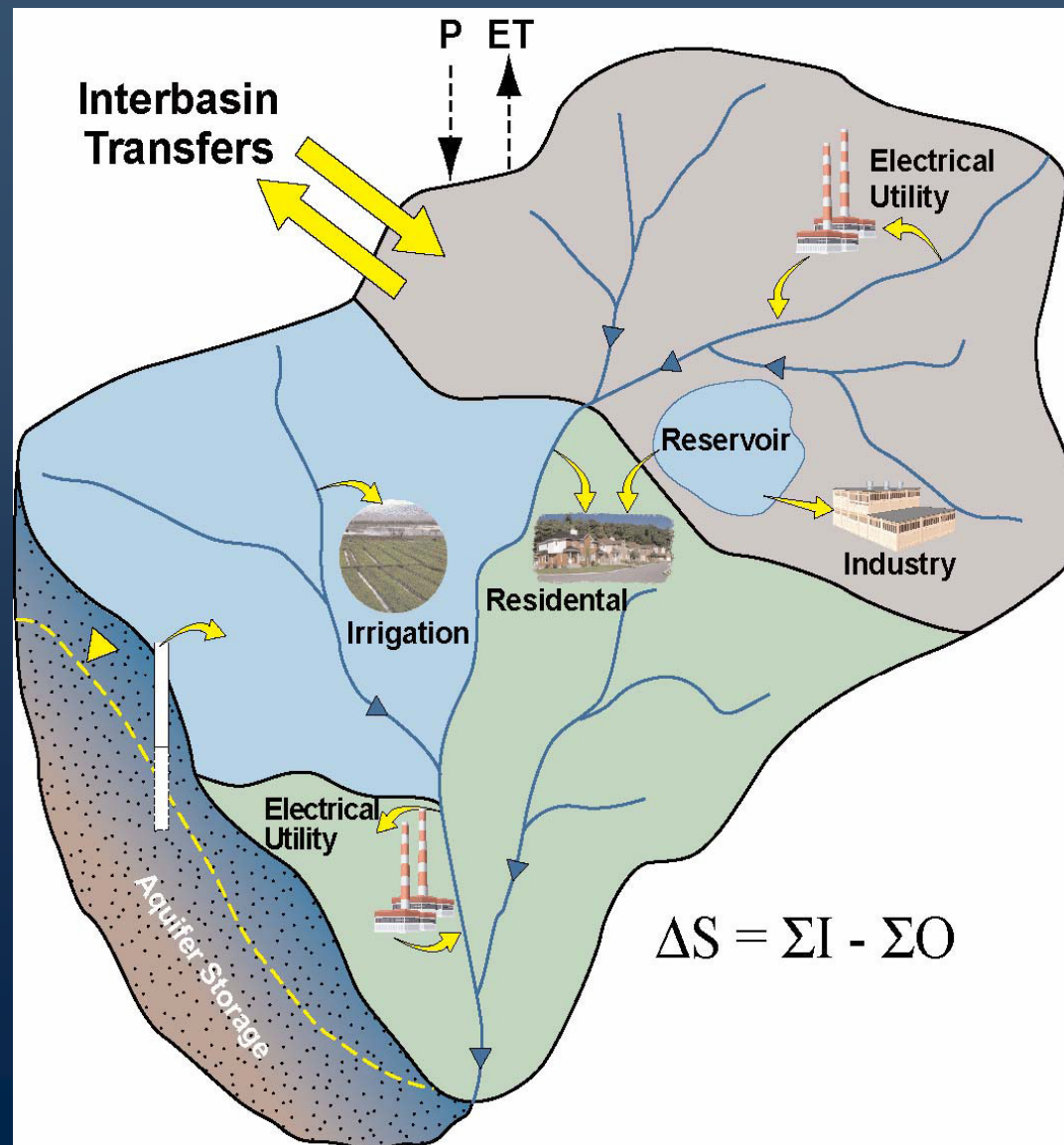
Watershed Characteristics



$$X_{(n*j)} =$$

$S_{m-1(i,j)}, q_{m-1} \dots$
 $S_{m(2,1)}, q_m \dots$
 \dots
 $S_{m(3,1)}, q_m \dots$
 $S_{m(2,2)}, q_m \dots$
 $S_{m(3,2)}, q_m \dots$
 $S_{m+1(i,j)}, q_{m+1} \dots$

Net Available Precipitation Fractional Precipitation



Supply vs. Demand

- **County by county**
- **Use as percent of renewable resource**
- **2005 & 2030**



County Supply








County Demand

Net Water Use as a Percent of Renewable Resource

- <25
- 25 - 50
- 50 - 75
- 75 - 100
- >100

Note, this map provides a county-scale assessment and is not designed for site specific decision making.

 <25
 25 - 50
 50 - 75
 75 - 100
 >100

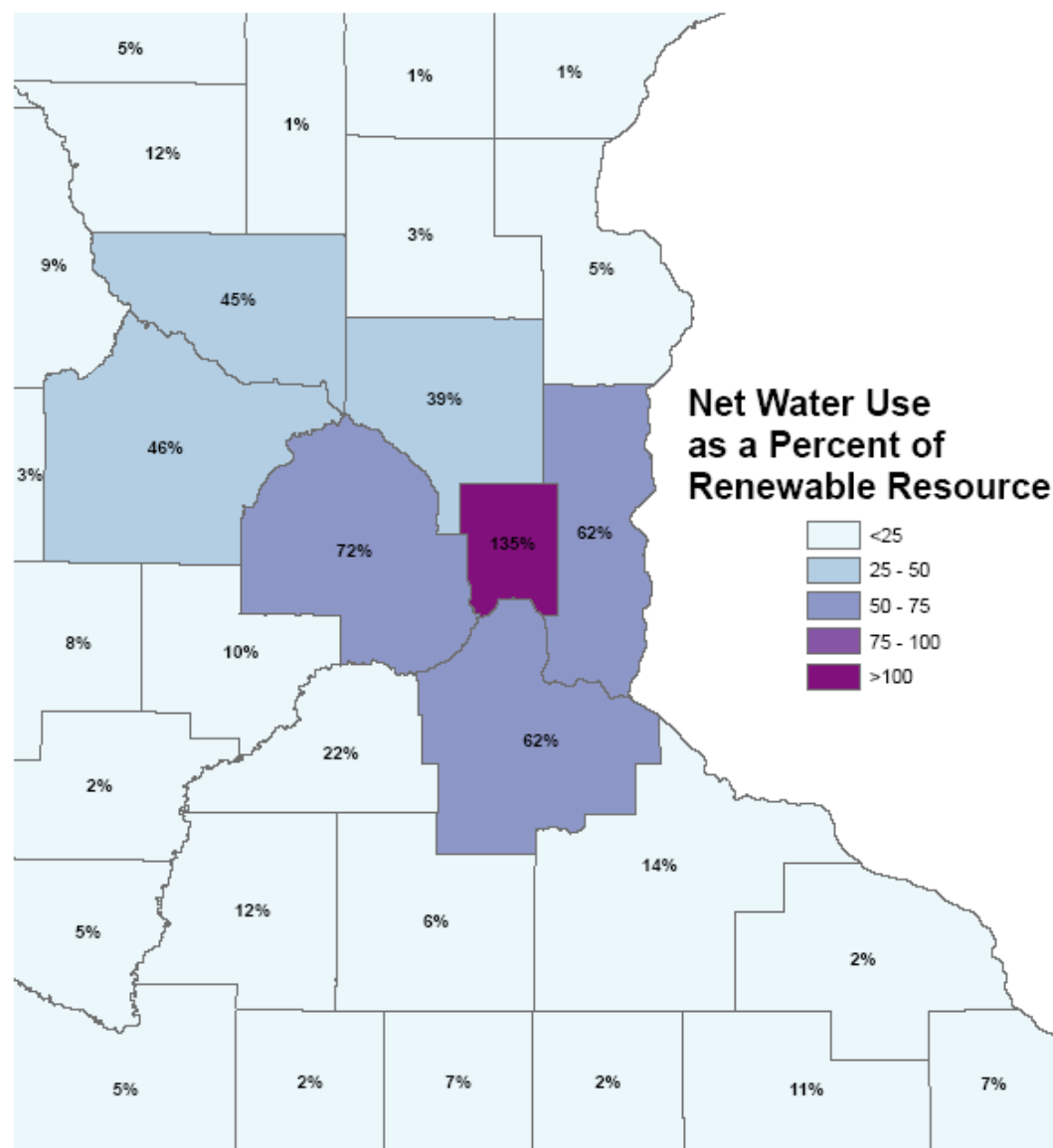
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- **Ramsey County 135%**
- **Four counties used more than 50%**
- **Metro range was 10% to 135%**
- **Greater Minnesota range was <1% to 46%**

2005 Water Use in Minnesota

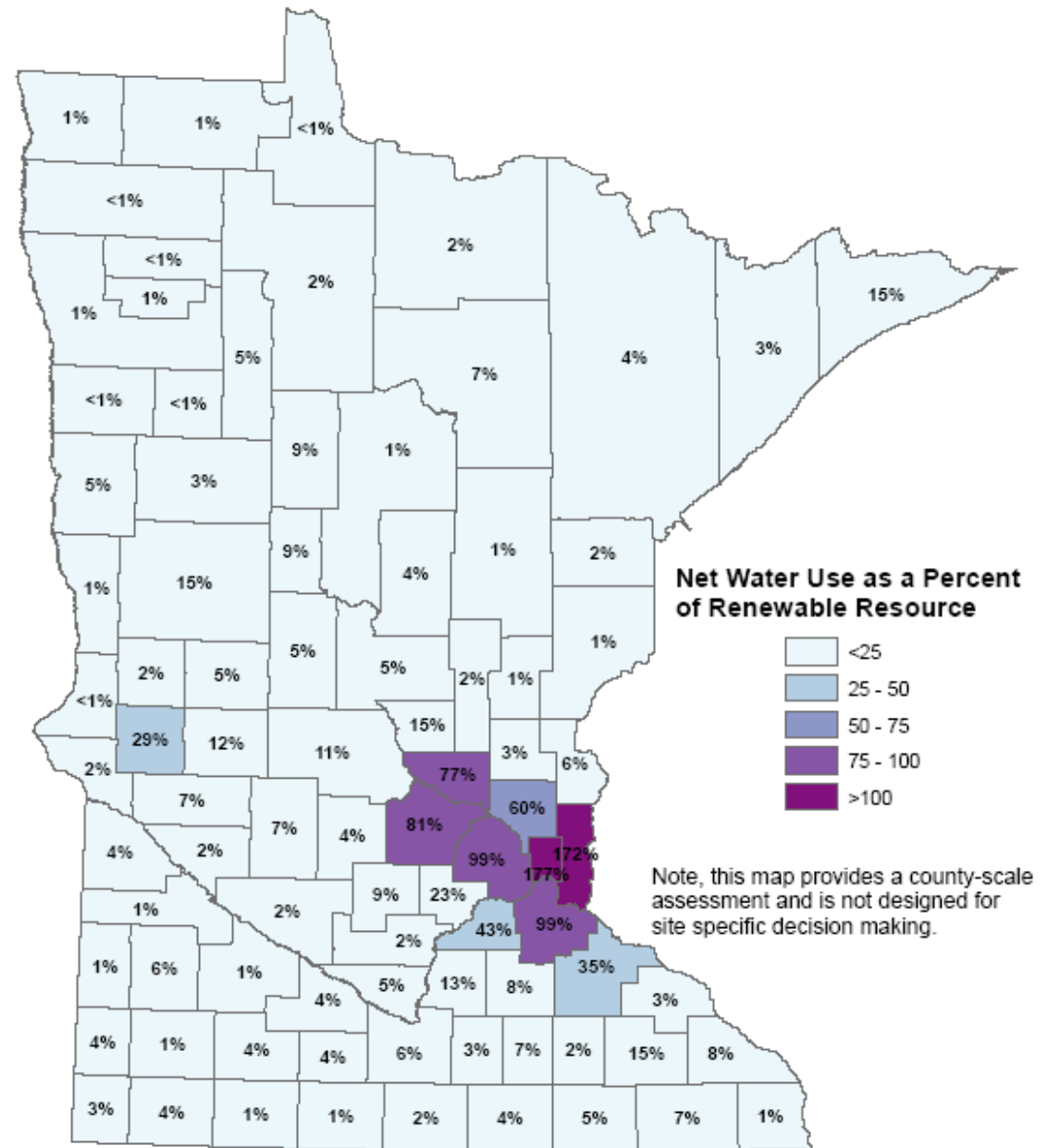
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2005 Net Water Use as a Percent of the Renewable Resource



- **Ramsey County 177%
Washington County 172%**
- **Seven counties used more than 50%**
- **Metro range was 23% to 177%**
- **Greater Minnesota range was <1% to 81%**

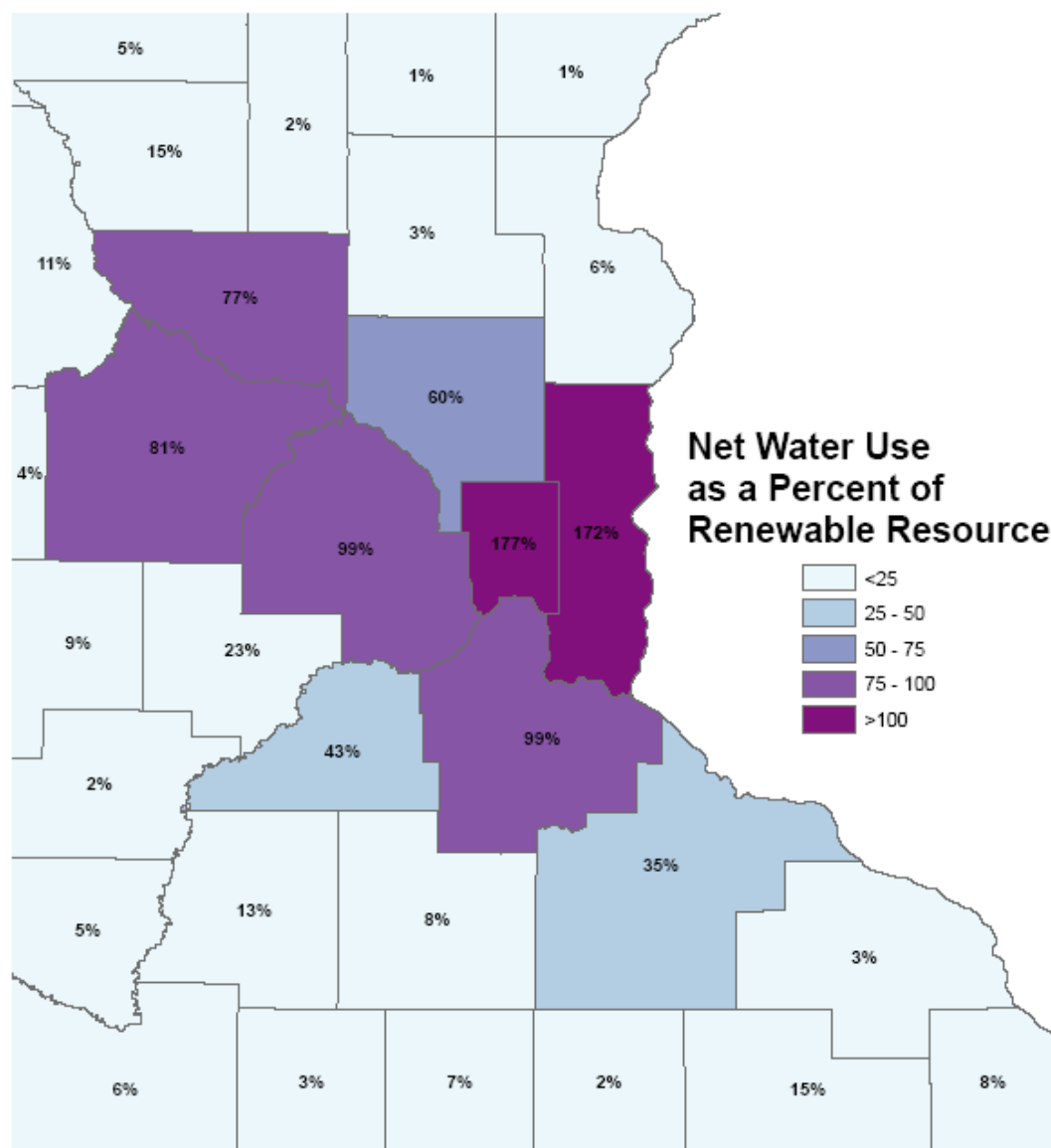
2030 Net Water Use as a Percent of the Renewable Resource



2030 Water Use in Minnesota

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2030 Net Water Use as a Percent of the Renewable Resource

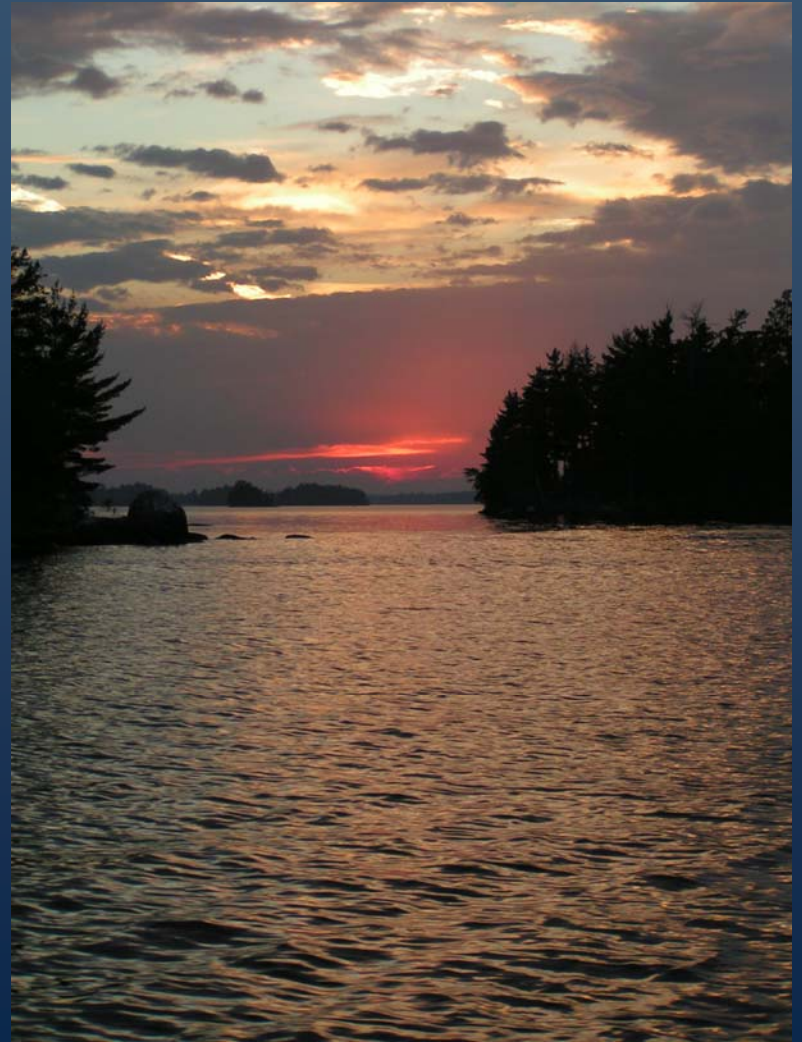


A “Water Rich” State?

- Can Minnesota still be considered water rich?
- Real limits exist ...
 - Regionally, the growth corridor
 - Locally, throughout the state

Adding to this Foundation

- **Water quality**
- **Seasonal or monthly assessments, as well as annually**
- **Ecosystem needs for water**
- **Sub-county level work**



In Summary

- **Used best available information**
- **High level of agreement in model predictions**
- **Developed “most likely” scenario**
- **Chose median values for population, use & supply**
- **Did not include “safety factor”**
- **Doesn’t inform site-specific permitting**

The Charge

➤ Statute

- **Assess and analyze the quantity of surface and ground water in the state and the availability of water to meet the state's needs**

➤ Environmental Quality Board

- **Find a way to put consideration of proposed water uses into a broader framework**



Questions?

Sustainable Supply and Use

➤ *Sustainable supply or renewable resource* defined:

- The quantity of water that can be removed from the system on a renewable basis without drawing down the resource

➤ *Sustainable use* defined:

- *Sustainable water use* is the use of water to provide for the needs of society, now & in the future, without unacceptable social, economic or environmental consequences