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

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Environmental Quality Board

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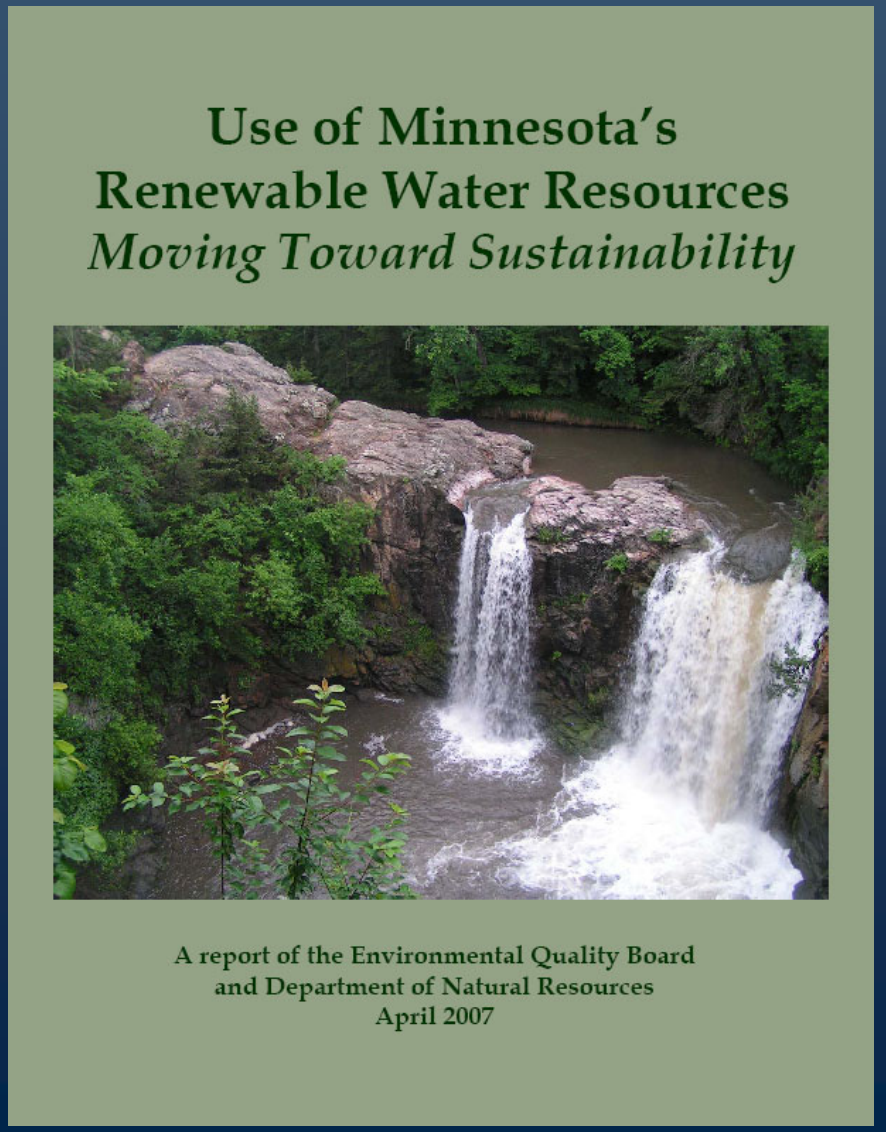
Water Affects Minnesota's…

- Economic development
- Agriculture
- Water quality
- Wildlife
- Recreation
- Quality of life

Potential Applications

- Planning
- Know now
- Need to yet learn
- An example



Environmental Quality Board

- 9 Commissioners
- 5 citizen members
- Governor's representative

- Administration
- Agriculture
- Commerce
- Employment & Economic Development
- Health
- Natural Resources
- Pollution Control
- Transportation
- Water & Soil Resources

EQB Mission

- The board develops policy, creates long-range plans and reviews proposed projects that would significantly influence Minnesota's environment and development

Water Sustainability Project

- ***Minnesota Statutes***
  - **Section 103A.43 (c)**
  - ***The EQB shall work with DNR to coordinate an assessment and analysis of 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***

Acknowledgements

- Partners
  - DNR – Sean Hunt, Laurel Reeves, Jan Falteisek, Sarah Tufford
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  - U of M – Roman Kanivetsky, John Nieber
  - Met Council – Sara Bertelsen, Chris Elvrum
  - EPRI
  - MDH
  - MGS

Presentation Overview

- Need
- Methods
  - Water demand
  - Water supply
- Findings
- Recommendations

Sustainable Supply

- **"Sustainable supply" or "renewable resource" are defined as:**
  - ***Sustainable water use* is the use of water to provide for the needs of society, now and in the future, without unacceptable social, economic or environmental consequences**
  - **The quantity of water that could be removed from the system on a renewable basis without drawing down the resource**

Project Need

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

Project Methods

- County level analysis
- Evaluated in 2005 & 2030
- Compared water supply & use

Apply methods, as highlighted today

Project Findings

- 2005
  - Four counties used more than 50%
  - Range was 1% to 135%
- 2030
  - Seven estimated at more than 50%
  - Range was 1% to 177%

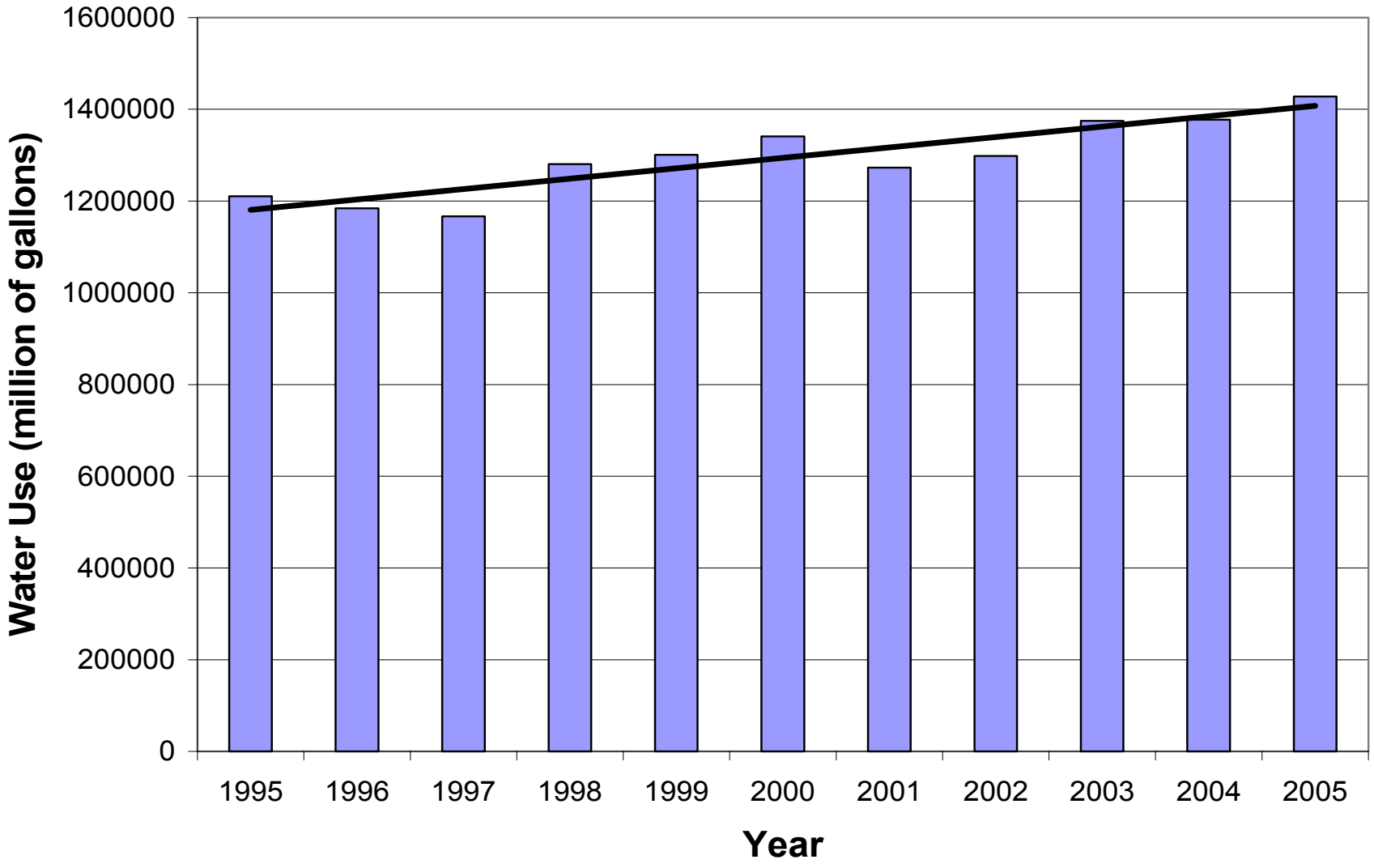
Project Steps

- Determine current water use
- Estimate future use
- Quantify sustainable supply
- Compare supply and demand

Current Water Use: Permitted Use

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

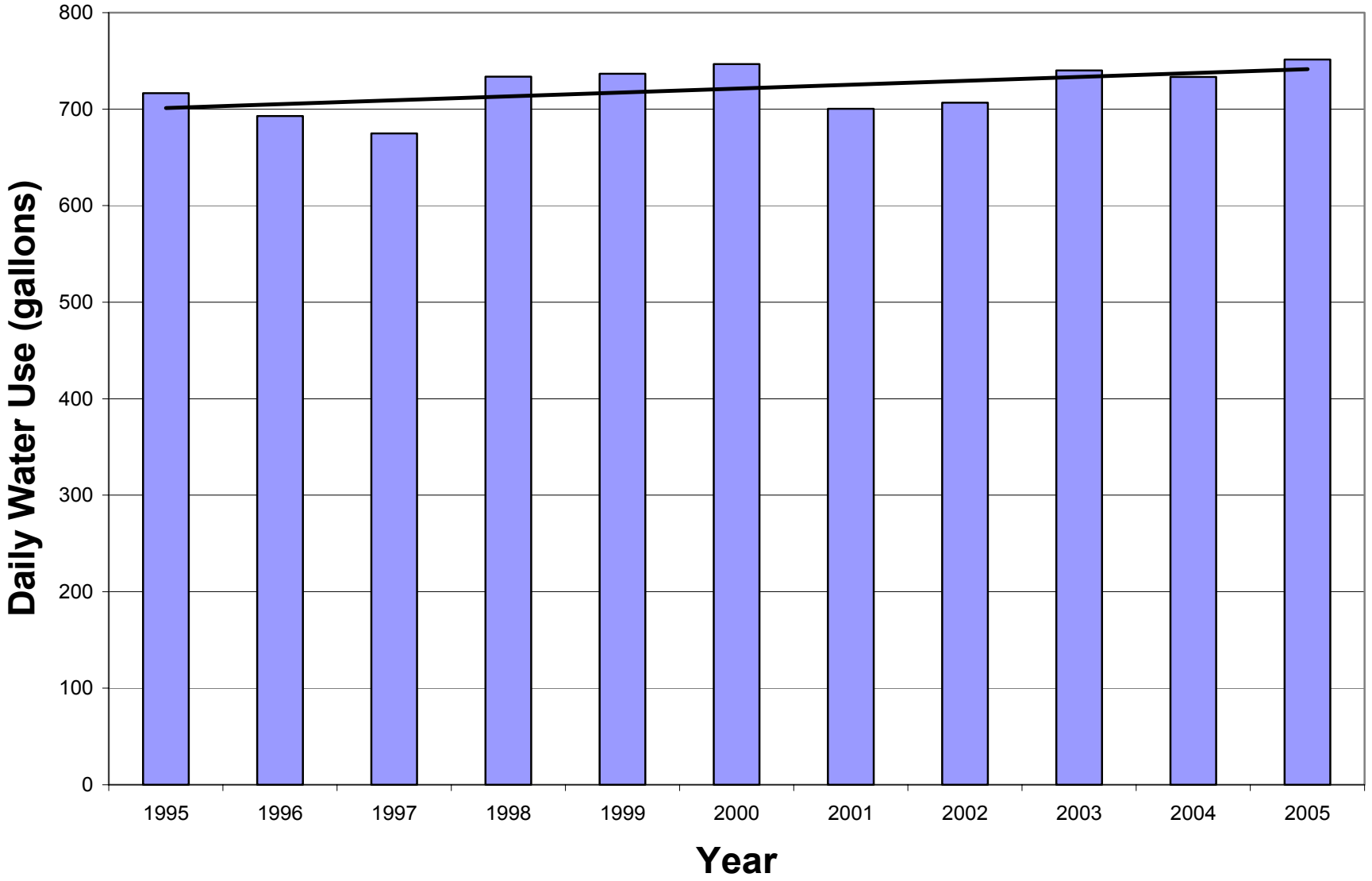
Minnesota Annual Water Use



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

Per Capita Water Use

- Added unpermitted & permitted to establish base use

Per Capita 1995-2005 = Permitted + Unpermitted

2005 Gross Water Use

- Calculated baseline

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

- Reduce impact of climatic variations

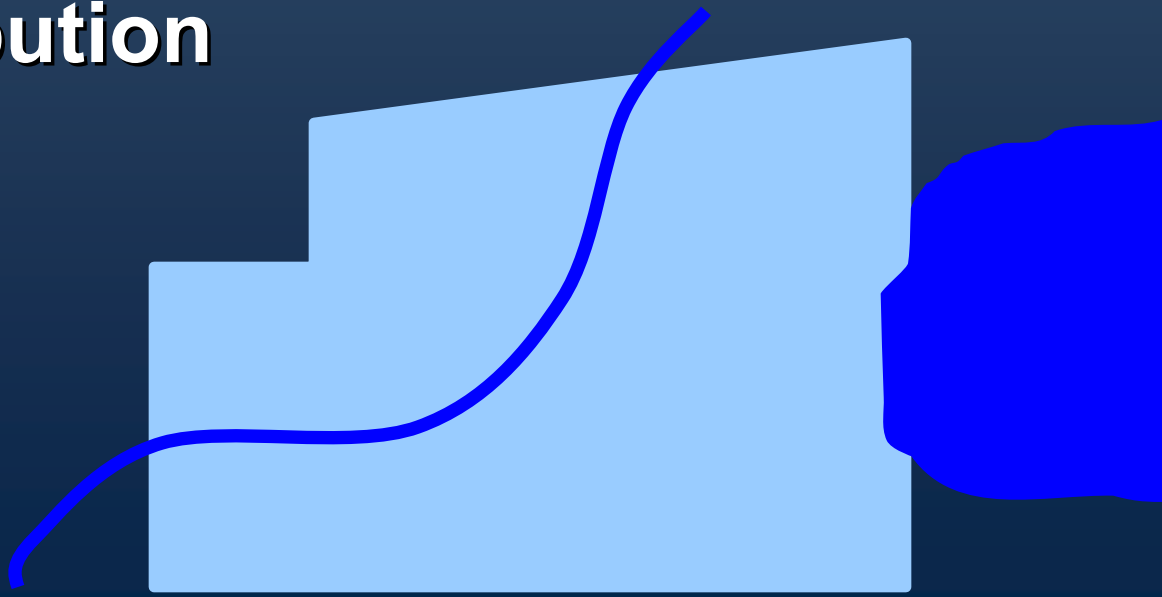
2005 Net Water Use

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

Imported Waters

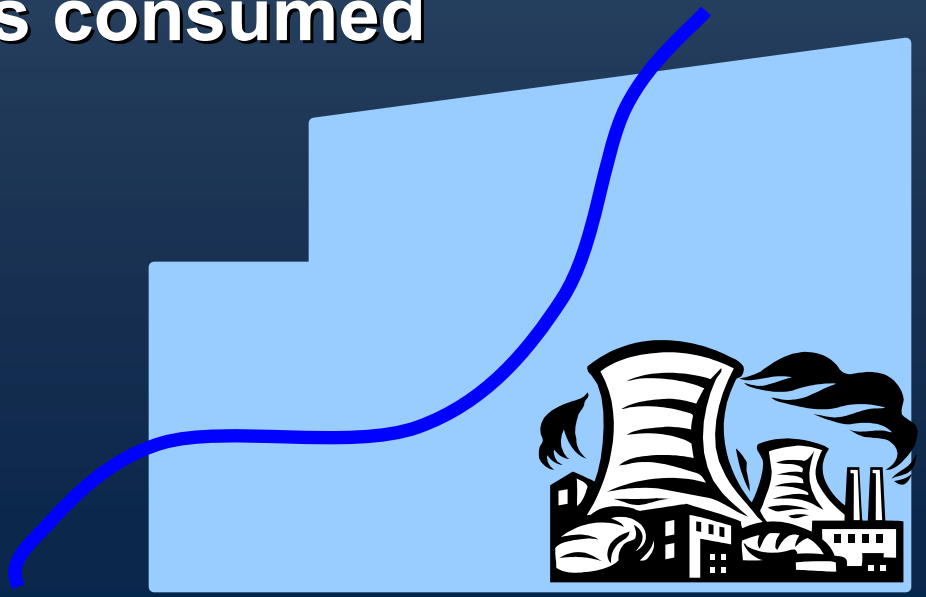
- Surface water
- Originate outside of county
- Should be removed in analysis
- Treated as ratio of upstream to in-county contribution

Good Examples:
Mississippi River
Minnesota River
St. Croix River
Lake Superior



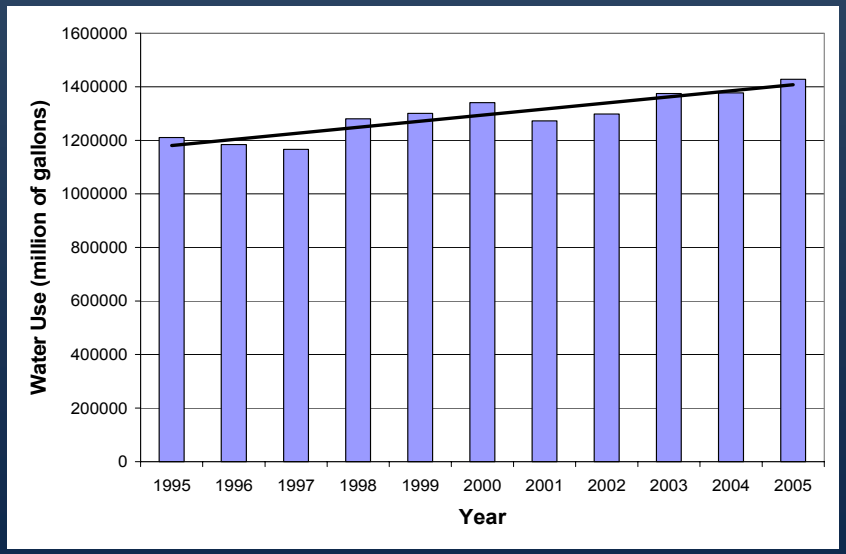
Non-Consumptive Use

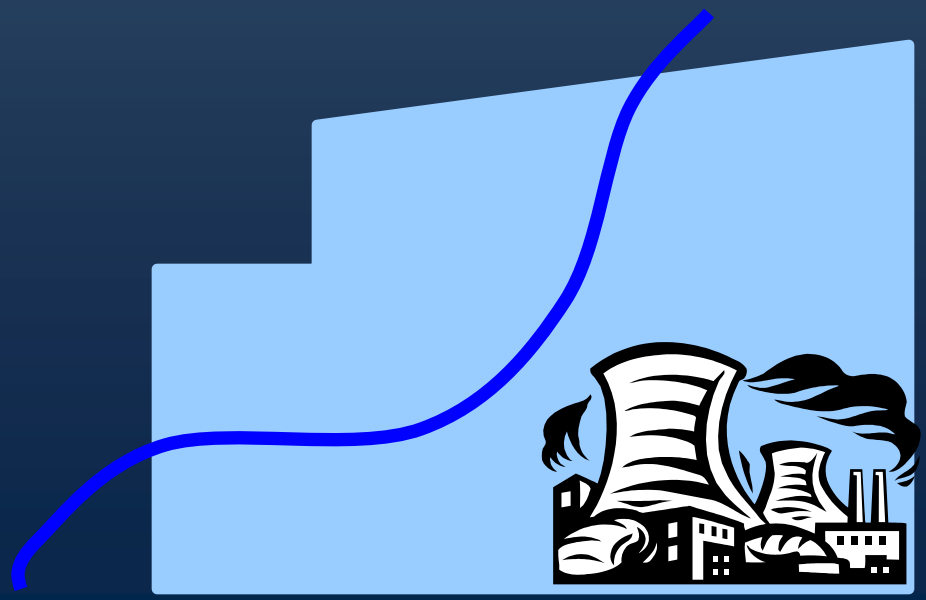
- Some industries return much of their water to surface water source
- Good example is steam power cooling, where only 2% is consumed
- Ground water is considered consumed



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

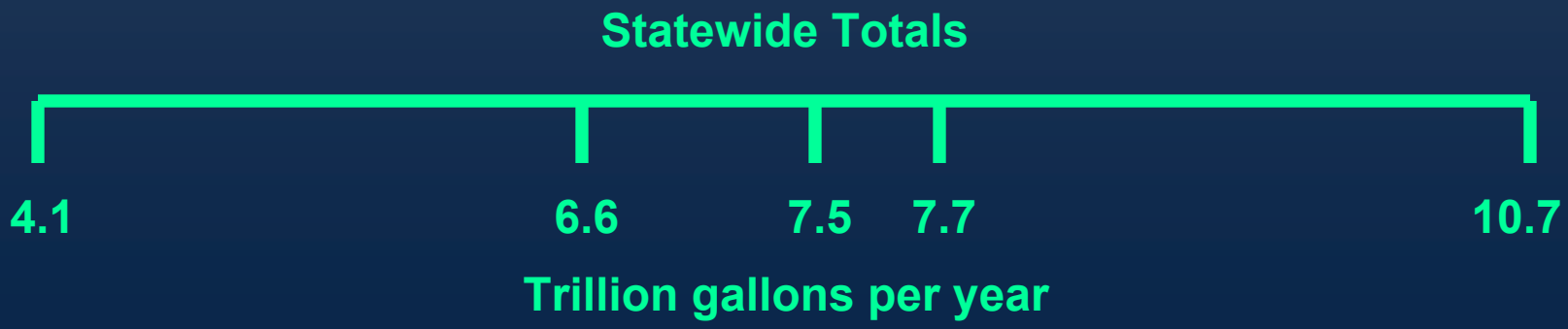
Quantify Renewable Resources

- Challenge!
- Published supply methods were used
- Surrogates for sustainable supply
- Quantified at county scale
- Considers the following variability:

  Soils, precipitation, watershed discharge, evapotranspiration, ecoregion, hydrology, etc.

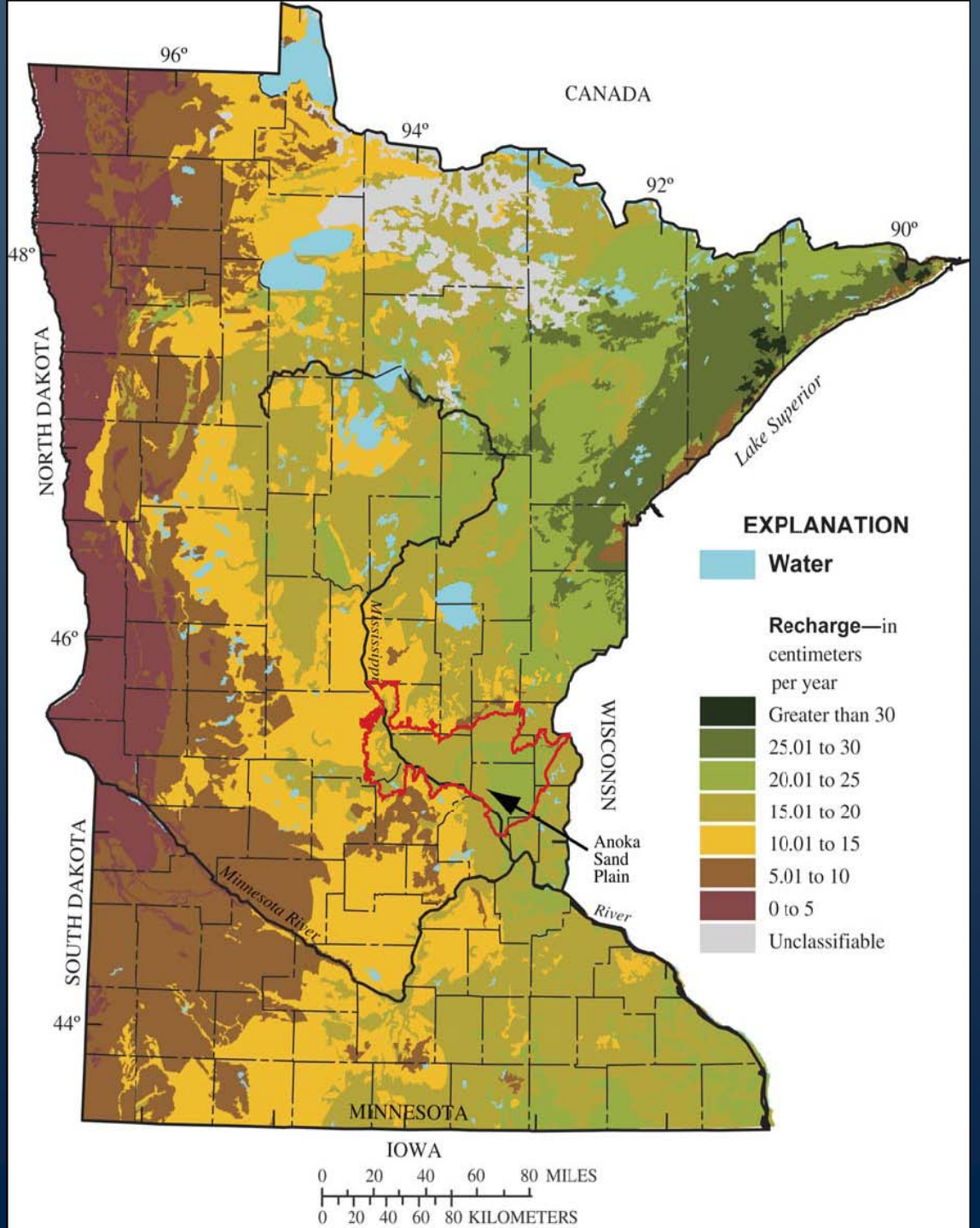
Supply Methods

- Regional regression recharge
- Watershed characteristics
- Net available precipitation
- Fractional precipitation

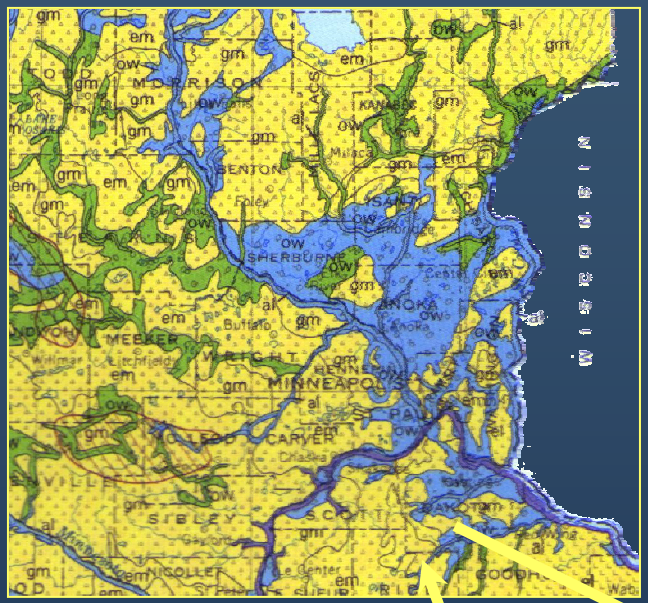


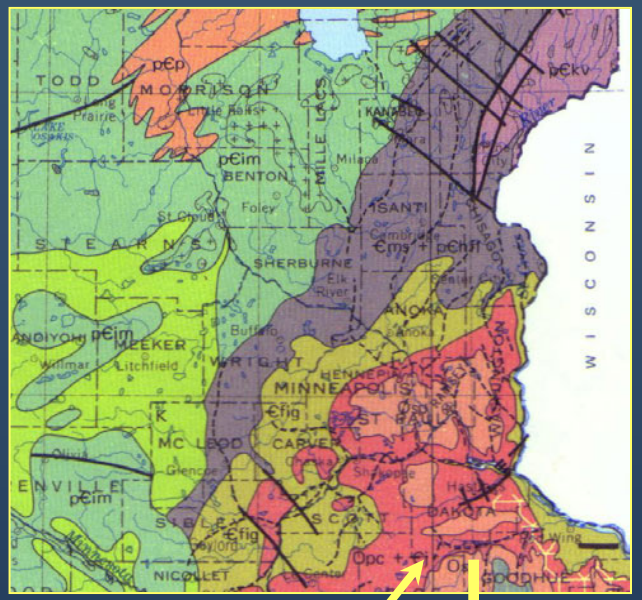
RRR Model Results

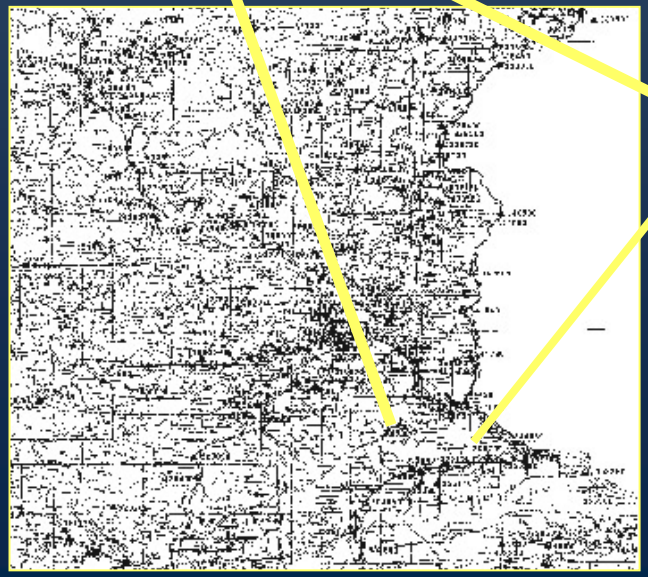
Average annual recharge to surficial materials (1971 - 2000)



Watershed Characteristics



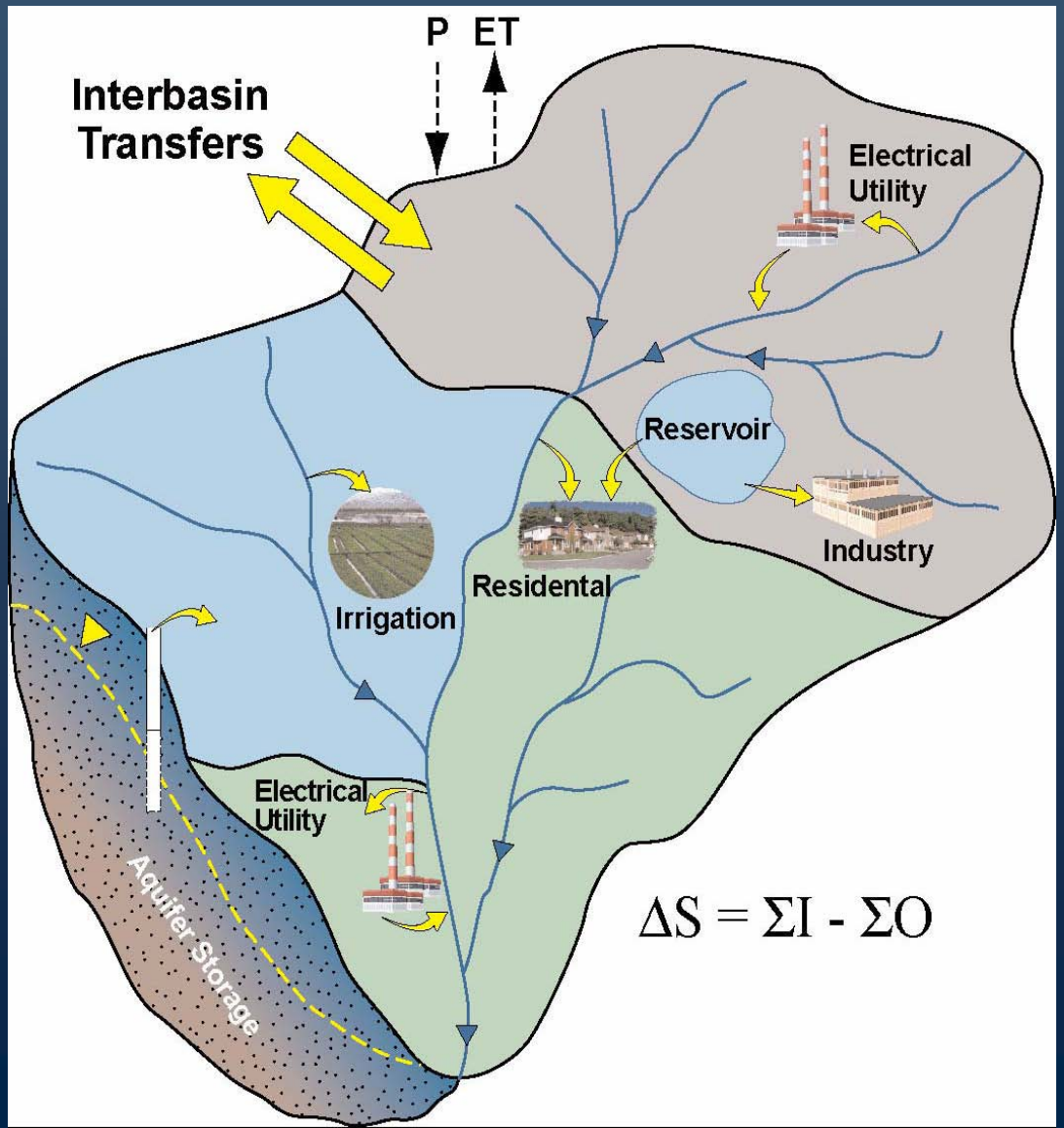




$X_{(n*j)} =$

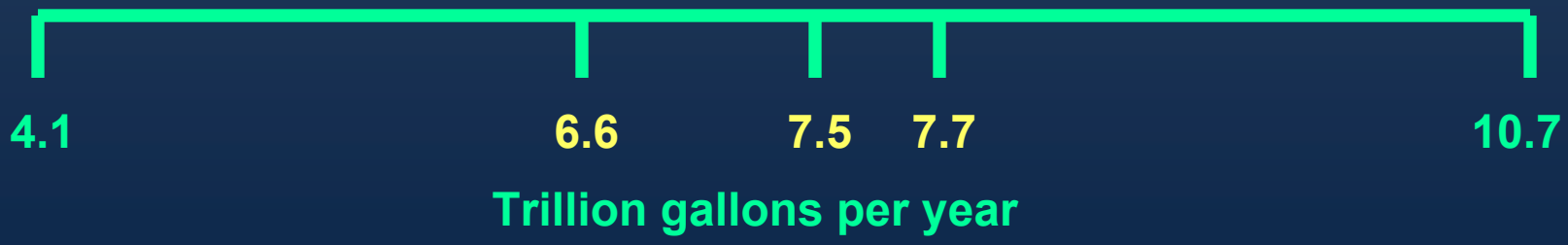
$S_{m-1\ (i,j)}, q_{m-1} \cdots$
$S_{m(2,1)}, q_m \ldots$
$\ldots$
$S_{m(3,1)}, q_m \ldots$
$S_{m(2,2)}, q_m \ldots$
$S_{m\ (3,2)}, q_m \ldots$
$S_{m+1(i,j)}, q_{m+1} \cdots$

Net Available Precipitation
Fractional Precipitation



Supply Value

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

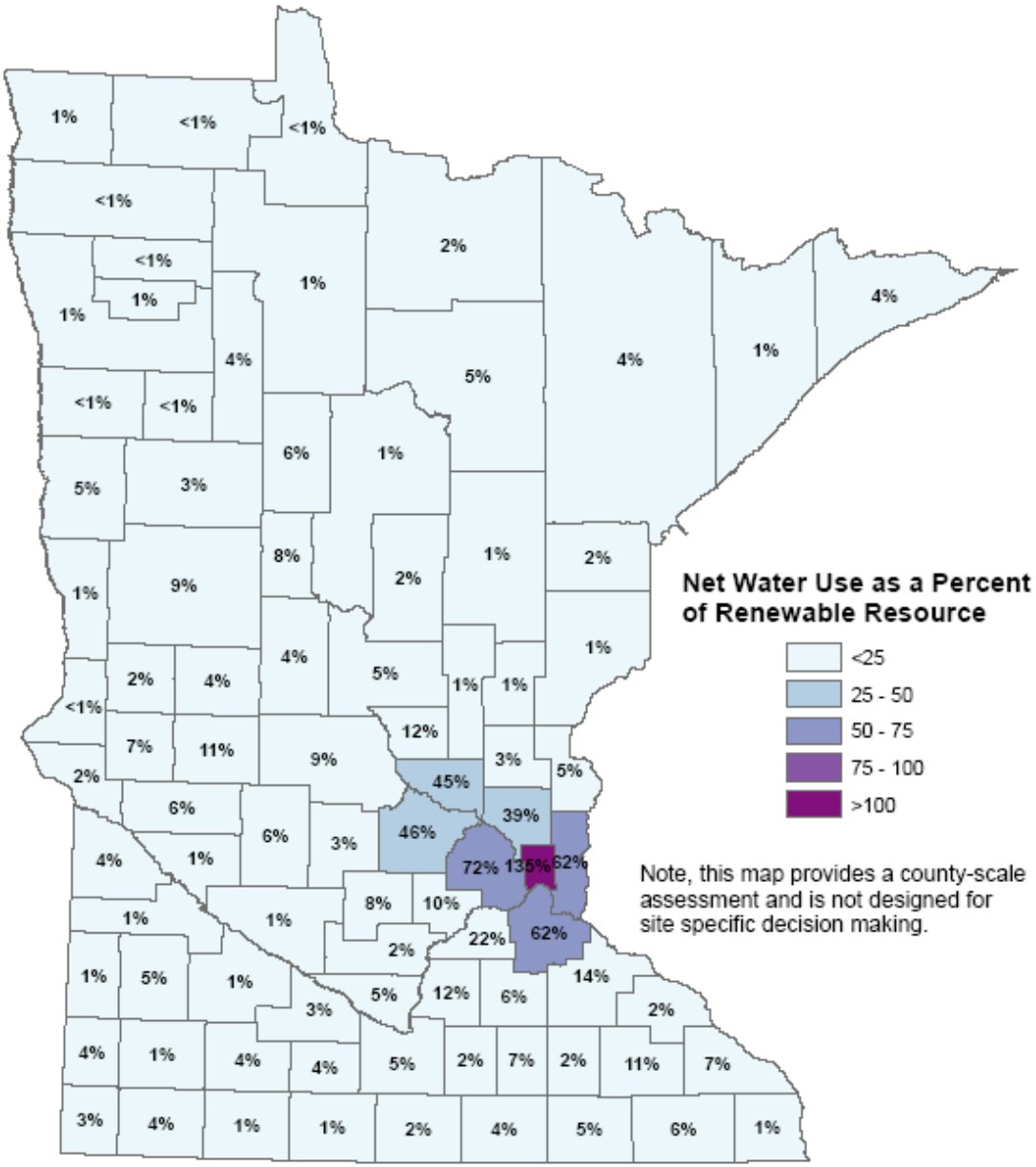


Supply vs. Demand

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

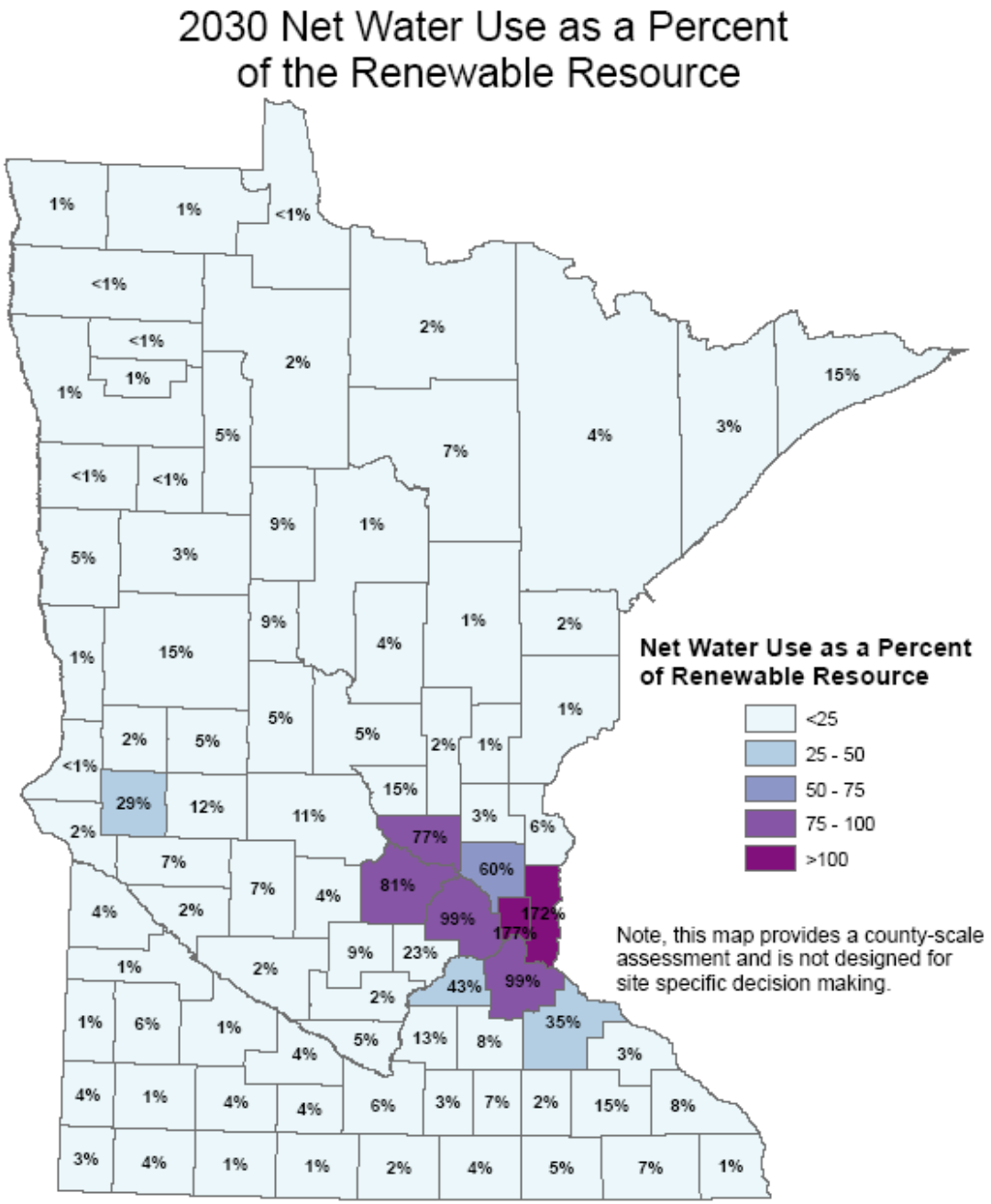
County Supply

County Demand



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

- 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%



Water Use in a Typical County

Typical County

Area = 716 sq mi

Renewable water resource of 54,722 MGY

Gross water use of 2,111 MGY

Net water use of 1,823 MGY

2005 net use at 3.3% of the county's renewable water resource

Water Use in a Typical County

What if the county were to add a high water-using industry?

Example

New Use = 750 MGY

Water Use in a Typical County

750 MGY

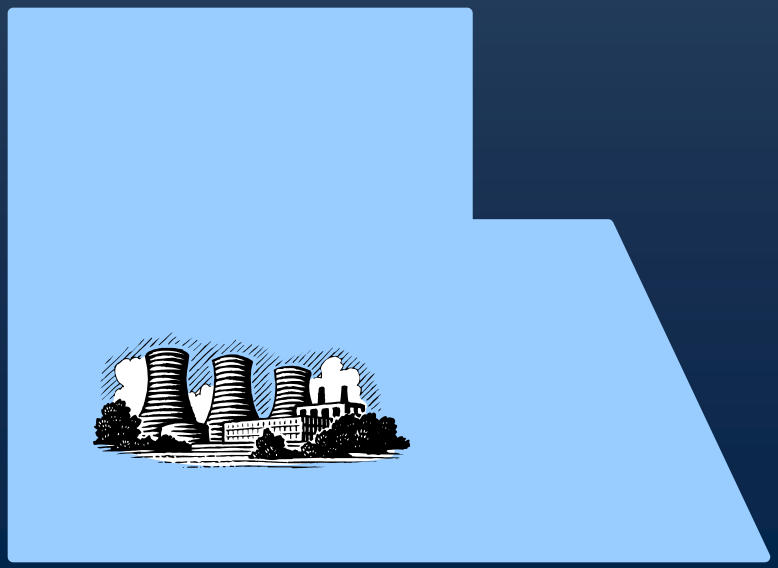
1.4% of the county's supply

36% of the county's current gross water use (41% of the net use)

10 square miles of renewable water

Water Use in a Typical County

- Assumes water supply evenly distributed over county
- Provides basic tool for putting a proposed use in perspective



Study Characteristics

- 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

A “Water Rich” State?

- Can Minnesota still be considered water rich?

- Real limits exist …
  - Regionally, the growth corridor
  - Locally, throughout the state

Applications

- Element of priority setting
  - Inform monitoring & research priorities
- Tool for planning
  - Local water commitments; need for conjunctive use; Minnesota's long-term needs
- Aid in call for better water resource information
- Research opportunities
  - Ecosystem needs, impacts of land use & climate change, etc.

Add to the Foundation

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

In Conclusion

- First systematic assessment lays a strong foundation for future work
- Fosters important discussions
- Identifies what we know, what we don't know, and what we need to do about it

The Opportunity

To strengthen management of Minnesota's renewable water resources …

- **To better define their location, capacity and vulnerability**
- **To better understand their limits**
- **To promote continued conversations**


Questions?