



EERC Technology... Putting Research into Practice

Optimization of Cooling-Water Resources for Power Generation

NETL Water Projects Meeting

Pittsburgh, Pennsylvania

October 28, 2008



Northern Great Plains Water Consortium



Spiritwood Industrial Park

- \$350+ million project
- Located in Jamestown, North Dakota
- 100-million-gallon ethanol plant
- Cargill malting facility expansion
- Spiritwood Station (Great River Energy)
 - 99MW coal-fired electricity
 - 200,000 lb/hr steam

Bismarck Tribune

June 16, 2008

- Headline: **Ethanol plant on hold near Jamestown**
 - “The State Water Commission says the *aquifer in the Spiritwood area does not have enough capacity to provide water* for the ethanol plant and for the Cargill malting plant, which has expanded.”

Mankato Power Plant

- 365-MW natural gas-fired combined-cycle plant located in Mankato, Minnesota.
- Calpine Corporation 12-MGD wastewater reclamation facility:
 - 25% used as cooling-tower makeup
 - 75% discharged directly to the Minnesota River
- Project conserves drinking water resources and improves discharge water quality.

Introduction

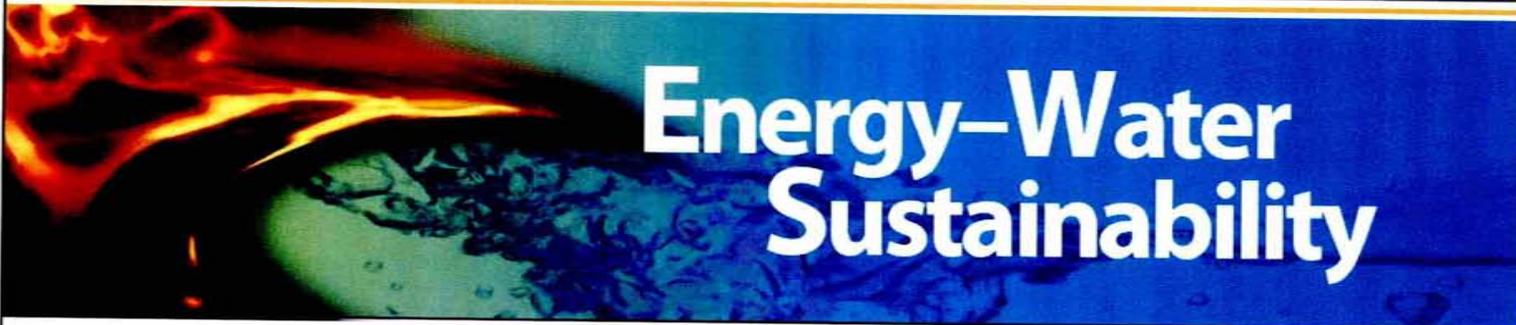
- Adequate supplies of quality water are critical to the existing and future power generation needs of the nation.
- Thermoelectric power generation faces significant societal, political, technical, and legal challenges in addressing water needs.

Justification

- A decision support system (DSS) would be a useful tool for power generation utilities to rapidly assess critical water issues, including the availability of adequate supplies of suitable water for new generation or the assessment of supplemental supplies at existing power plants.

DSS Project Objectives

- Initiate the development of a regional Web-based DSS to provide power utilities with an interactive assessment tool to address water supply issues when planning new, or modifying existing, generation facilities.



Energy–Water Sustainability

Water Law

Water Resource

DSS – Decision Support System

Treatment Technology Description

draft

Featured Tool

This area will be used to highlight a tool on the DSS site.

NGPWC News Today

The Demand for Water

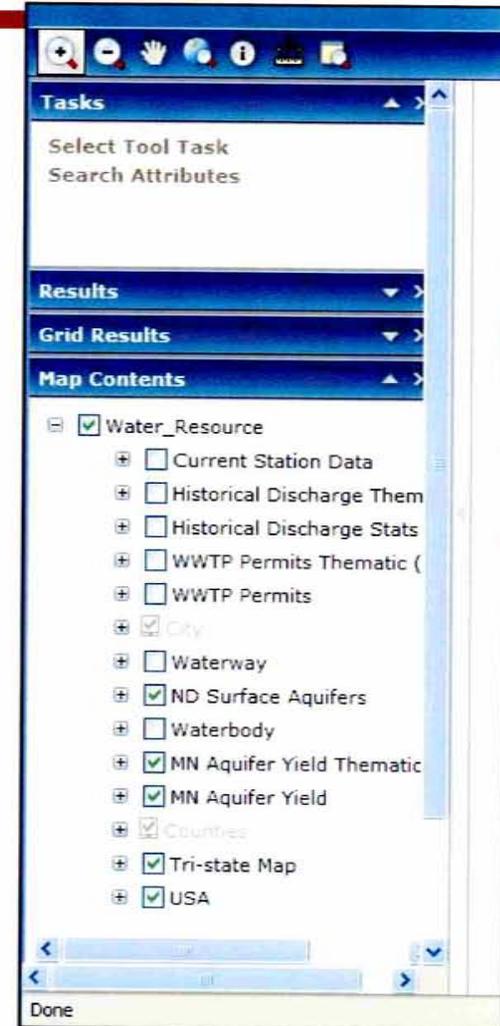
Water is the most critical limiting resource throughout the world. Sustainable economic growth requires a reliable supply of water for energy, agriculture, and a growing population. Water is necessary for urban development, power production, growing and processing high-value crops, oil and gas development and processing, and industrial manufacturing. Satisfying all of these competing needs requires a better **understanding of water**

DSS Region Selection

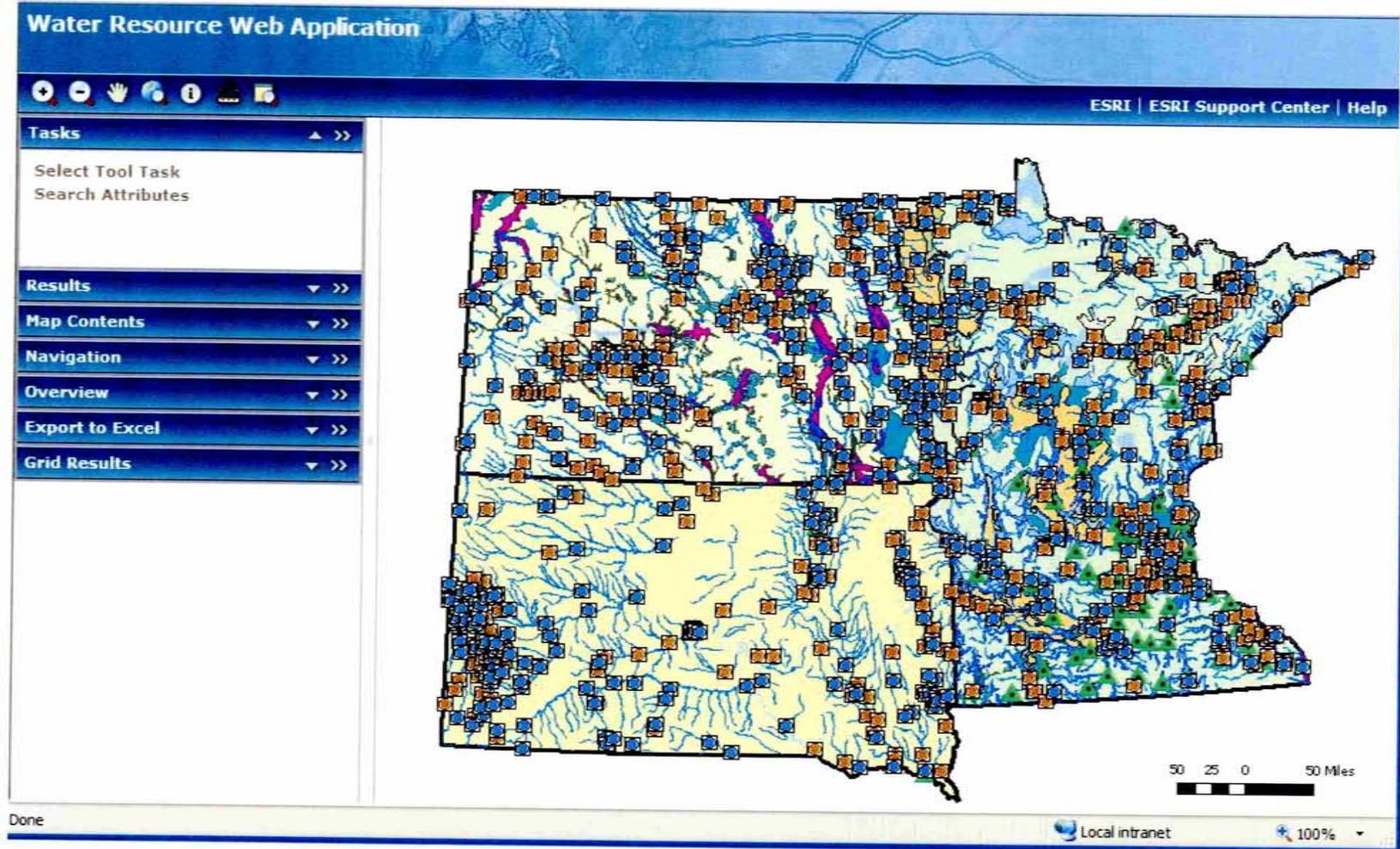
- Minnesota, North Dakota, South Dakota:
 - Politically diverse region
 - U.S. Environmental Protection Agency (EPA) Region 5 (MN), EPA Region 8 (ND, SD)
 - Eastern vs. western water law doctrine
 - Watershed districts vs. county water boards
- The EERC has a history of dealing with local- and state-level jurisdictions in Minnesota and North Dakota on numerous water projects.

Water Resource DSS Components

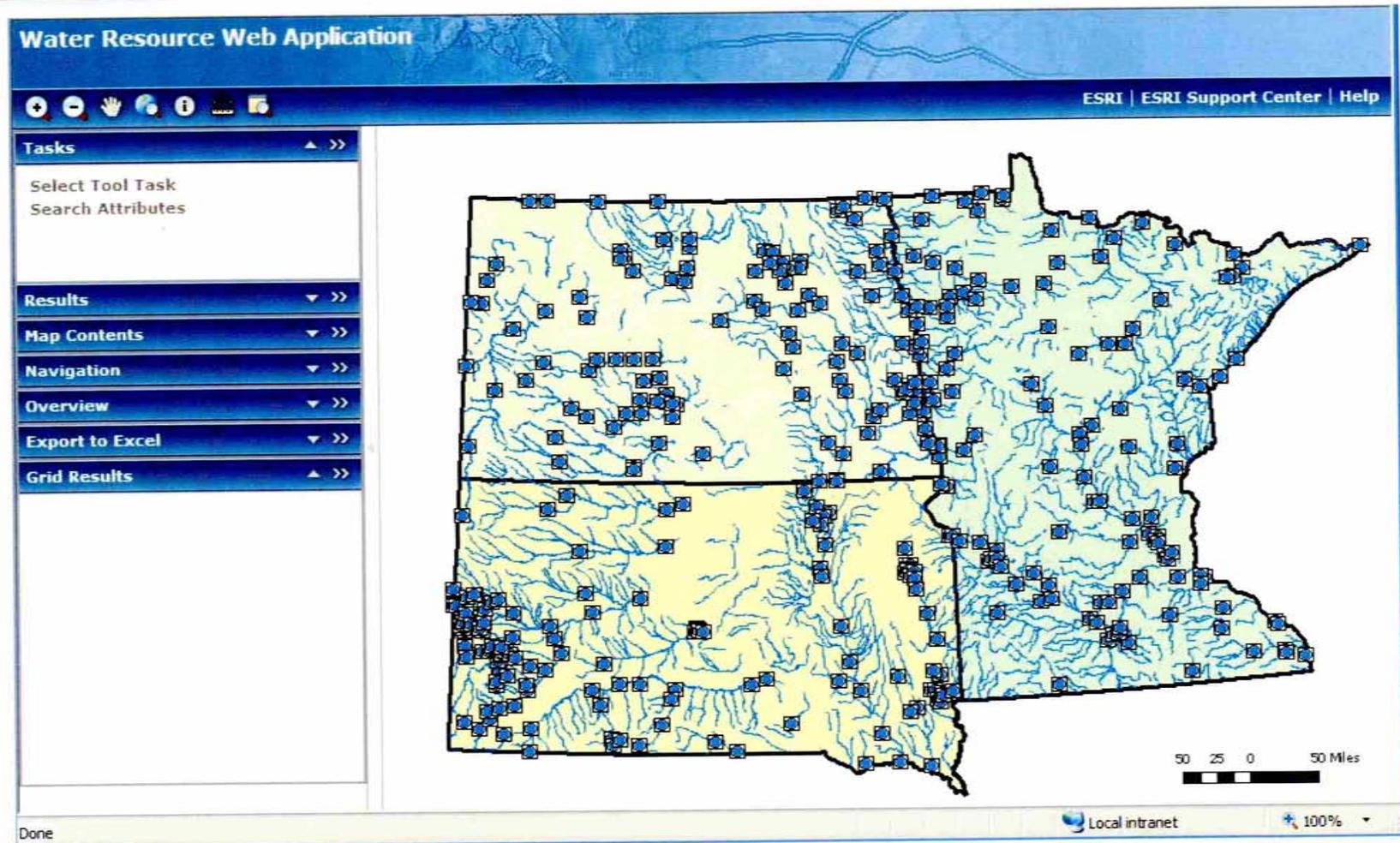
- Geographic information system (GIS)-based
 - Surface waters (U.S. Geological Survey [USGS])
 - Groundwater (states)
 - Nontraditional resources (USGS, states, ?)
 - Water quantity (USGS, states)
 - Water quality (EPA STORET)
- Text-based
 - Water treatment/minimization issues
 - Water quality
 - Legal Issues



Current Data Distribution



Real-Time Water Flow



Live Link to USGS Gaging Station Data

Water Resource Web Application

ESRI | ESRI Support Center | Help

Tasks

- Select Tool Task
- Search Attributes

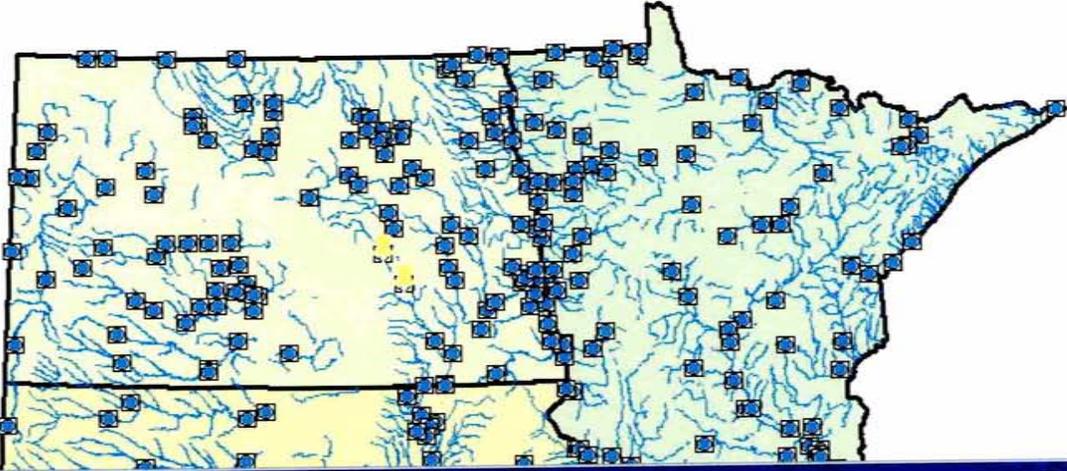
Results

Map Contents

Navigation

Overview

Export to Excel



Grid Results

Current Station Data
Select all, Unselect all, Zoom to all

| Selected | STAID | STANAME | ST | URL |
|--------------------------|----------|----------------------------------|----|--|
| <input type="checkbox"/> | 06469400 | PIPESTEM CREEK NR PINGREE, ND | nd | http://waterdata.usgs.gov/nwis/uv? 06469400 |
| <input type="checkbox"/> | 06470000 | JAMES RIVER AT JAMESTOWN, ND | nd | http://waterdata.usgs.gov/nwis/uv? 06470000 |

Local intranet 100%

Live Link to USGS Gaging Station Data

The screenshot shows the USGS National Water Information System (NWIS) web interface. At the top left is the USGS logo with the tagline "science for a changing world". To the right of the logo is a banner image showing various water-related scenes. Further right are links for "USGS Home", "Contact USGS", and "Search USGS". Below the banner is the title "National Water Information System: Web Interface". A navigation bar contains "USGS Water Resources" on the left and search filters for "Data Category:" (set to "Real-time") and "Geographic Area:" (set to "United States") with a "GO" button on the right. Below the navigation bar, there is a "News:" section with a link to "Recent changes". The main heading is "USGS 06469400 PIPESTEM CREEK NR PINGREE, ND" followed by "PROVISIONAL DATA SUBJECT TO REVISION". Below this is another search bar for "Available data for this site" with a "Time-series:" dropdown set to "Real-time data" and a "GO" button. The text states "This station is operated in cooperation with the" followed by the Army Corps of Engineers Omaha District logo and name. A list of links includes "Flood-tracking chart", "Historical daily values", and "Current stage-discharge rating". At the bottom, there are tabs for "Available Parameters", "Output format", and "Days". The browser's status bar at the very bottom shows "Done", "Internet", and "100%".

USGS
science for a changing world

USGS Home
Contact USGS
Search USGS

National Water Information System: Web Interface

USGS Water Resources

Data Category: Real-time

Geographic Area: United States

GO

News: [Recent changes](#)

USGS 06469400 PIPESTEM CREEK NR PINGREE, ND
PROVISIONAL DATA SUBJECT TO REVISION

Available data for this site

Time-series: Real-time data

GO

This station is operated in [cooperation](#) with the

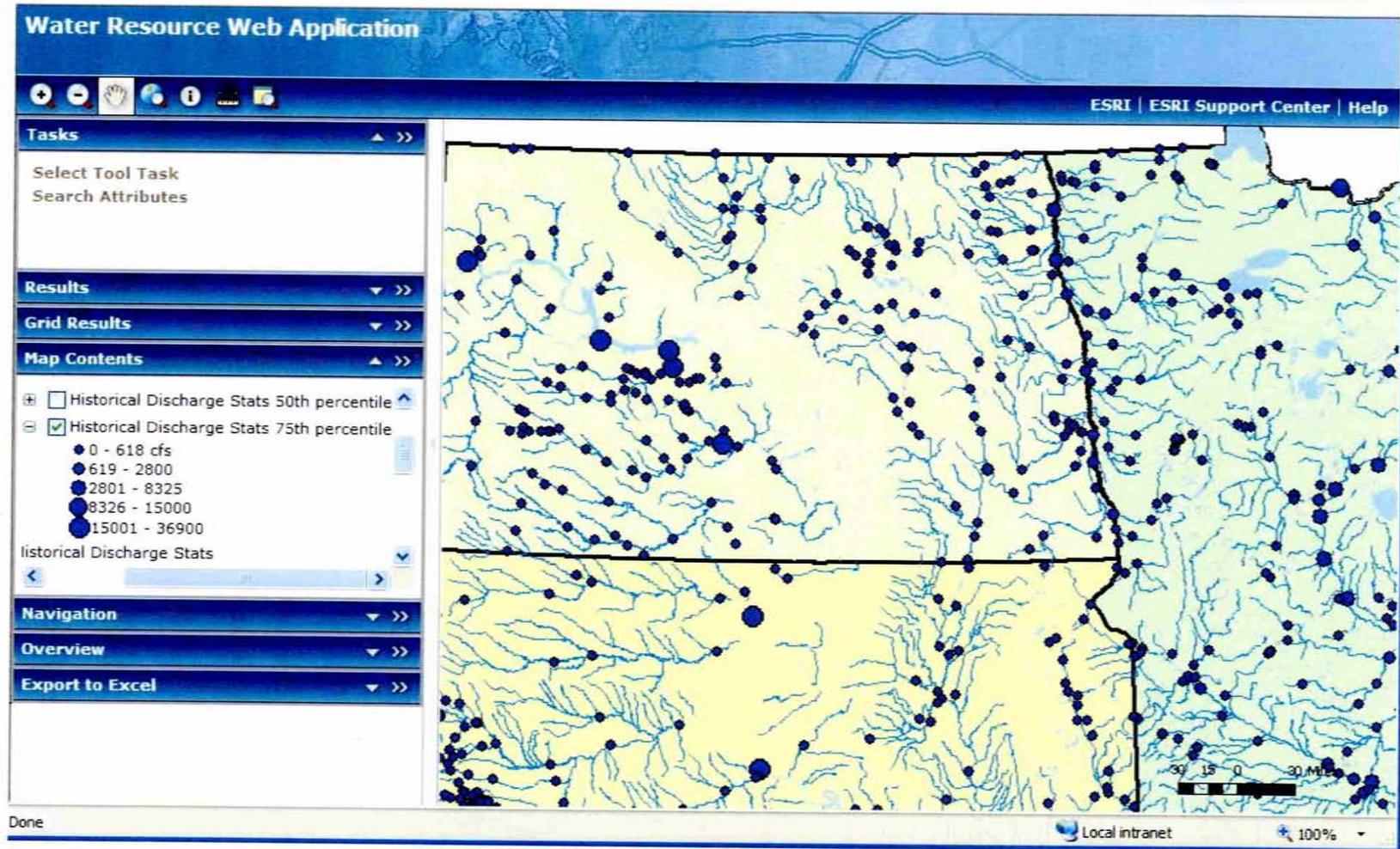
 [Army Corps of Engineers](#)
Omaha District

- [Flood-tracking chart](#)
- [Historical daily values](#)
- [Current stage-discharge rating](#)

Available Parameters Output format Days

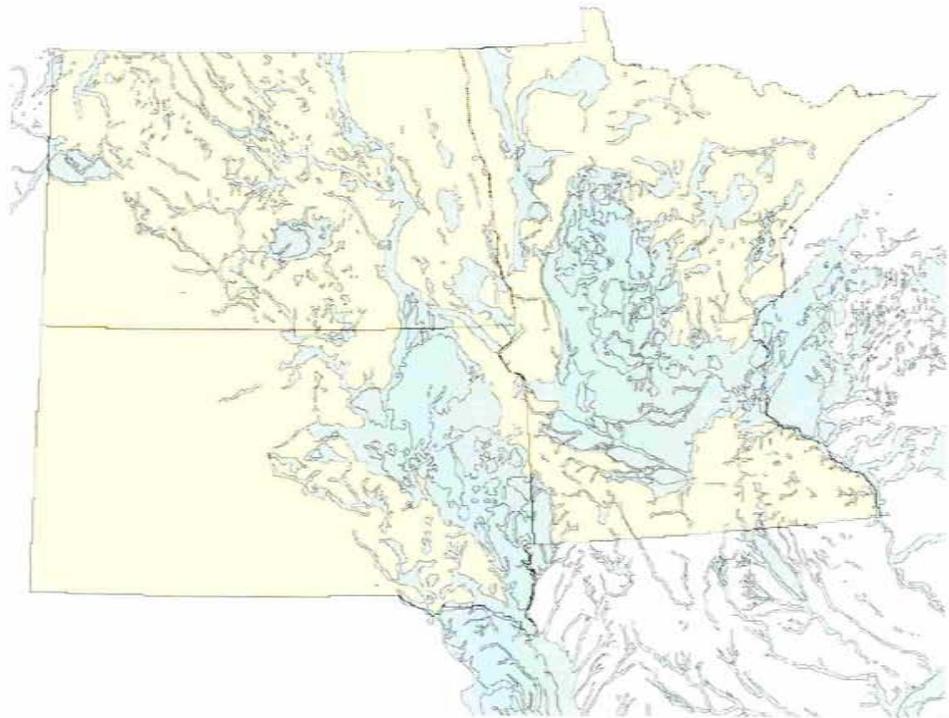
Done Internet 100%

Historical Stream Flow Data



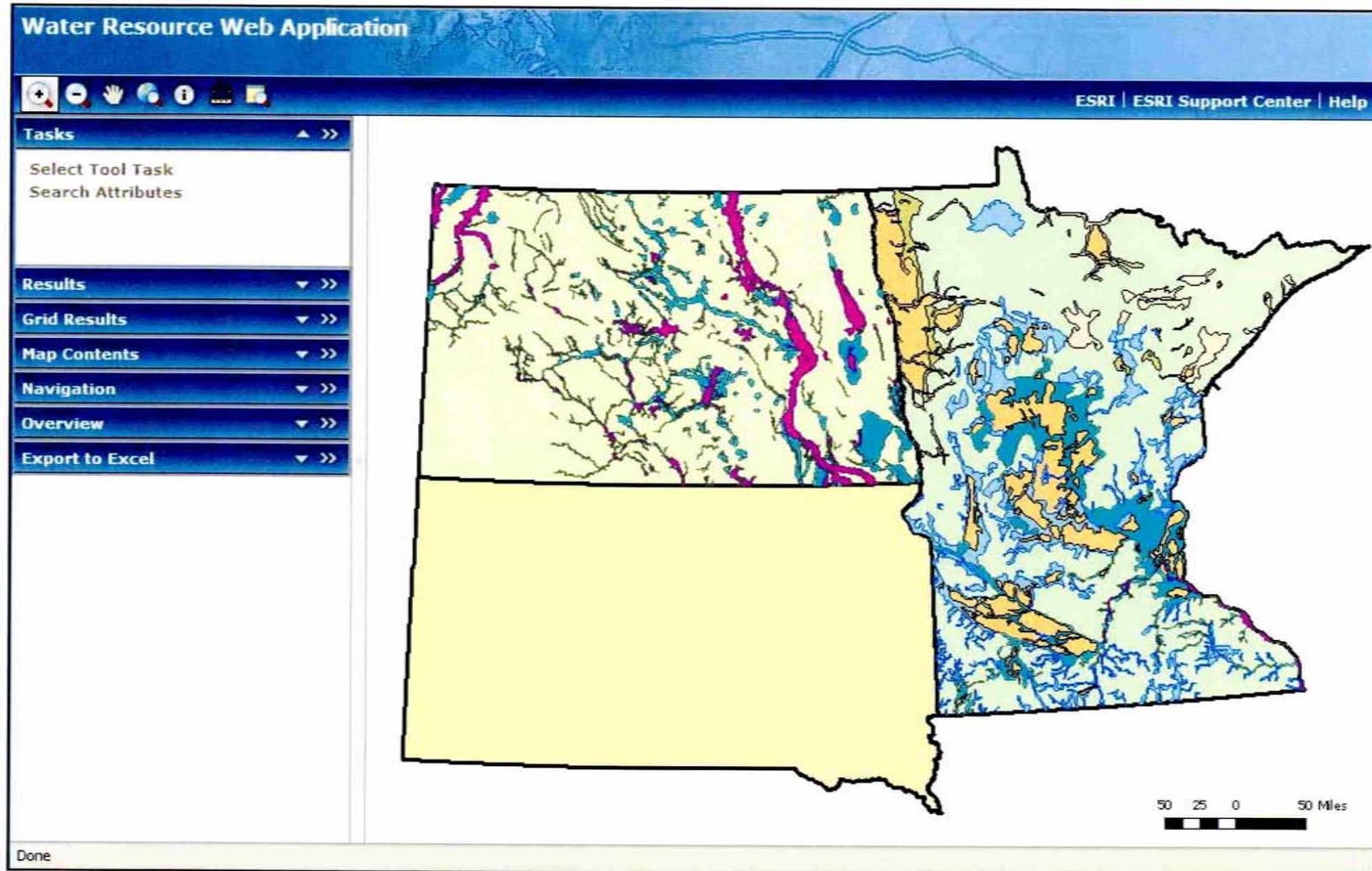
The Hunt for Informative Aquifer Data

- Although there is an understanding of the distribution of aquifer-bearing material, there is much less known with regard to the yield potential.

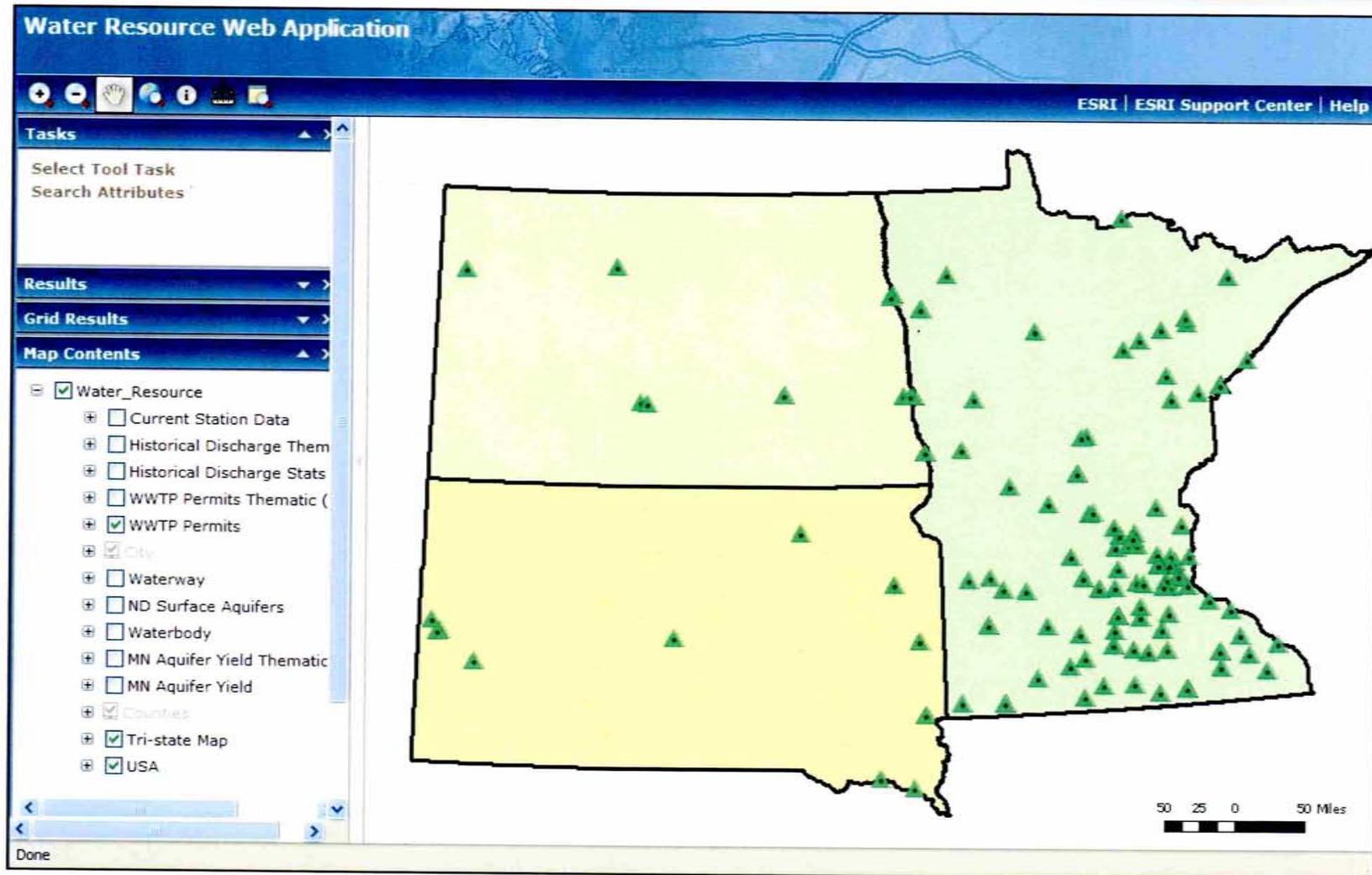


Distribution of Glacial Aquifer Material in the Tristate Area

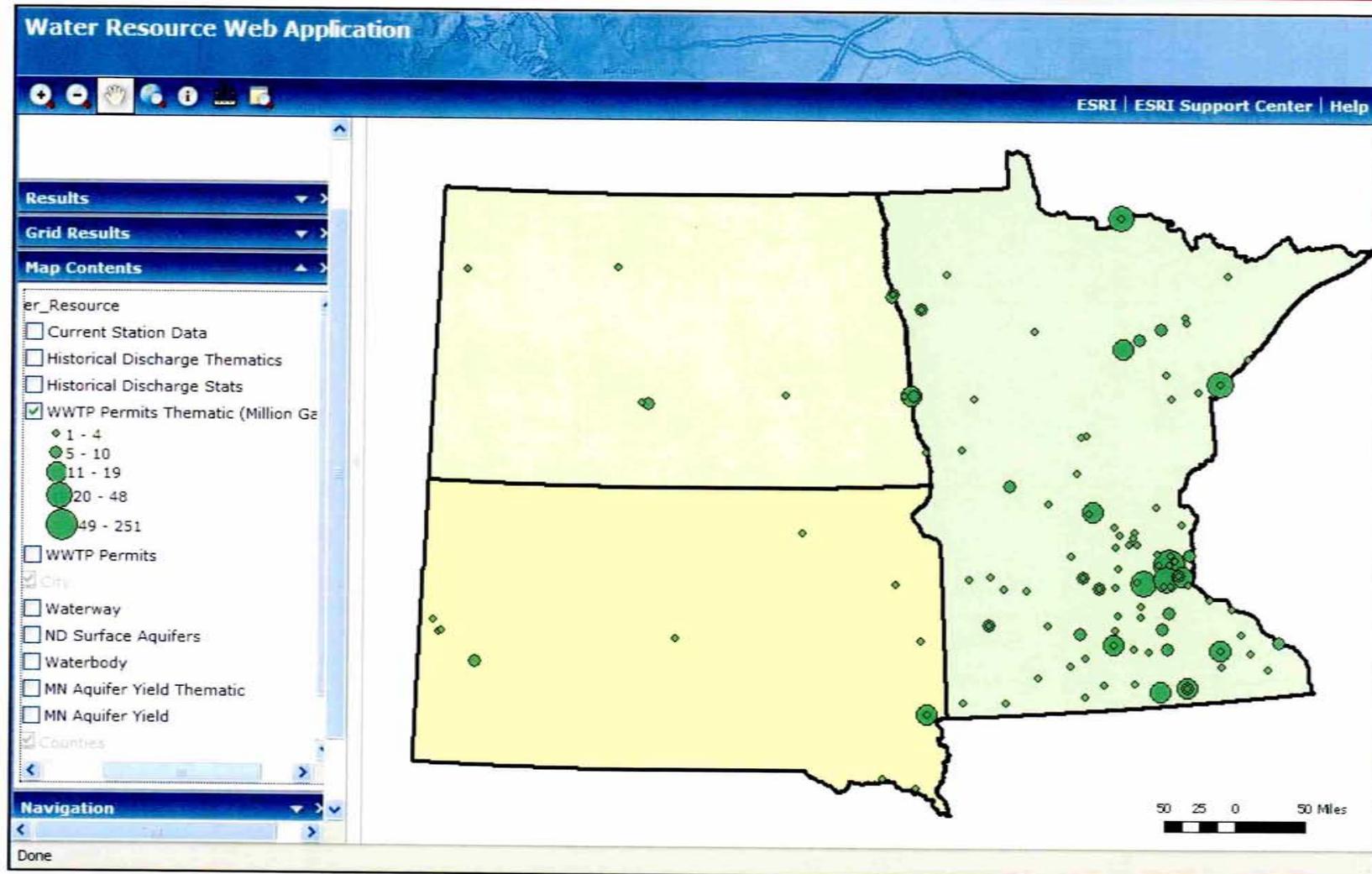
Aquifer Yield Data



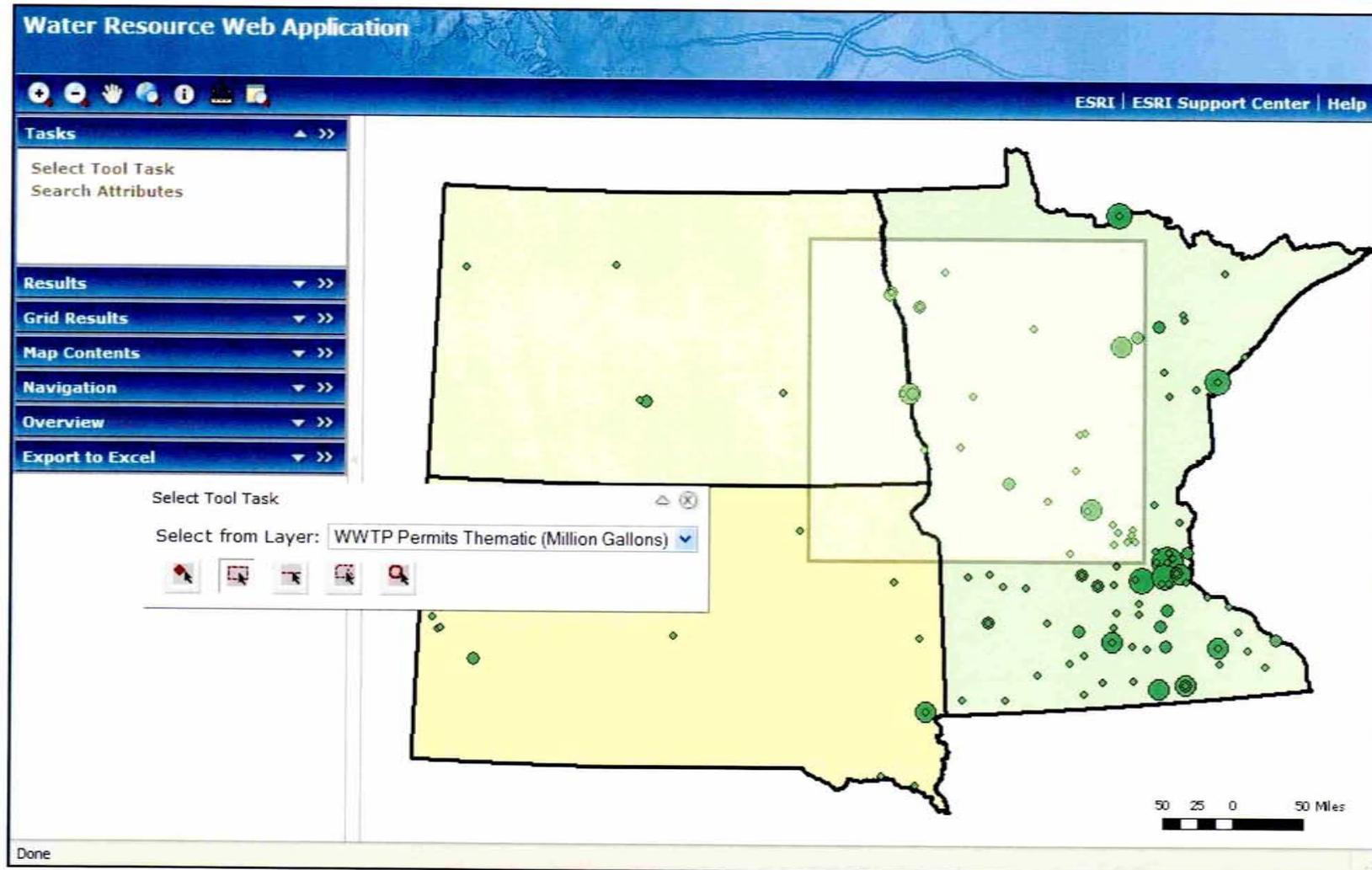
Distribution of Wastewater Treatment Discharge Points



Thematic Map of Wastewater Discharge Data



Selection of Wastewater Treatment Plants (WWTPs)



Results Window Showing WWTP Information

Water Resource Web Application

ESRI | ESRI Support Center | Help

Tasks

- Select Tool Task
- Search Attributes

Results

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Grid Results

WWTP Permits Thematic (Million Gallons)
Select all, Unselect all, Zoom to all

| | Selected | Name | million ga | Permit No | County | City | State | Year |
|--|--------------------------|--|------------|-----------|-----------|------------------|-------|------|
| | <input type="checkbox"/> | Wausau Paper Printing & Writing LLC | 4 | MN0001422 | Crow Wing | Brainerd | MN | 2007 |
| | <input type="checkbox"/> | American Crystal Sugar - Crookston | 5 | MN0001929 | Polk | Crookston | MN | 2007 |
| | <input type="checkbox"/> | American Crystal Sugar - E Grand Forks | 10 | MN0001937 | Polk | East Grand Forks | MN | 2007 |
| | <input type="checkbox"/> | American Crystal Sugar - Moorhead | 10 | MN0001945 | Clay | Moorhead | MN | 2007 |
| | <input type="checkbox"/> | Martin Marietta Materials | 2 | MN0004031 | Stearns | Waite Park | MN | 2007 |
| | <input type="checkbox"/> | Detroit Lakes WWTP | 3 | MN0020192 | Becker | Detroit Lakes | MN | 2007 |

Select Tool Task

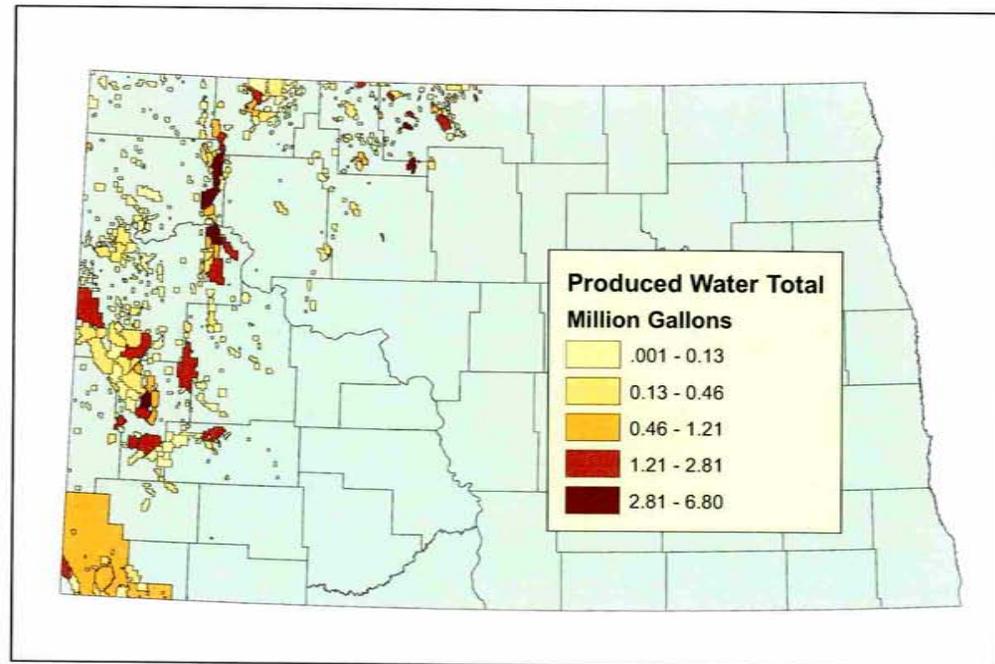
Select from Layer: WWTP Permits Thematic (Million Gallons)

50 25 0 50 Miles

Done

Nontraditional Water

- Produced water from oil and gas production
- Distributed resource
 - Unreliable
 - Low quantity
- Deep saline waters



Water Quality Issues

- Total dissolved solids (TDS)
- Silica
- Iron
- Ca/Mg
- Chemical oxygen demand (COD)
- Fecal contamination

Water Quality

- Currently integrating locations from EPA's STORET database

U.S. Water Law

- Annotated links to the following:
 - Eastern vs. Western Water Law
 - Indian Reserved Water Rights
 - South Dakota Water Law
 - North Dakota Water Law
 - Minnesota Water Law



U.S. Water Law

Western – prior appropriation doctrine – “first in time – first in right.” First to put water to beneficial use has senior water right.

Eastern – riparian rights doctrine – reasonable use by owners of land physically touching water body.

Indian Reservations – water rights reserved when land reserved for reservation. Tribal water rights usually senior to other claimants.

Project Status

- Recent acquisition of software package to augment functionality of interface.
- Compilation of GIS-based information nearly complete.
 - STORET data to be attached next
- Text-based information being integrated into Web layout and tables.
- Test version available for DOE and industry review before December 15.

DSS Phase 2

- Expanded region
- Also include produced water where sufficient quantities exist
- Expand information on deeper (saline) aquifers



Contact Information

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