DuluthStreams to LakeSuperiorStreams

- **Making stormwater and stream data come alive for citizens, students, resource agencies and decision-makers**

Presented by Rich Axler at 25th International Symposium of the North American Lake Management Society, 11/9/2005, Madison, WI

Minnesota Pollution Control Agency

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MINNESOTA'S COASTAL LAKE SUPERIOR PROGRAM

DuluthStreams.org and LakeSuperiorStreams.org

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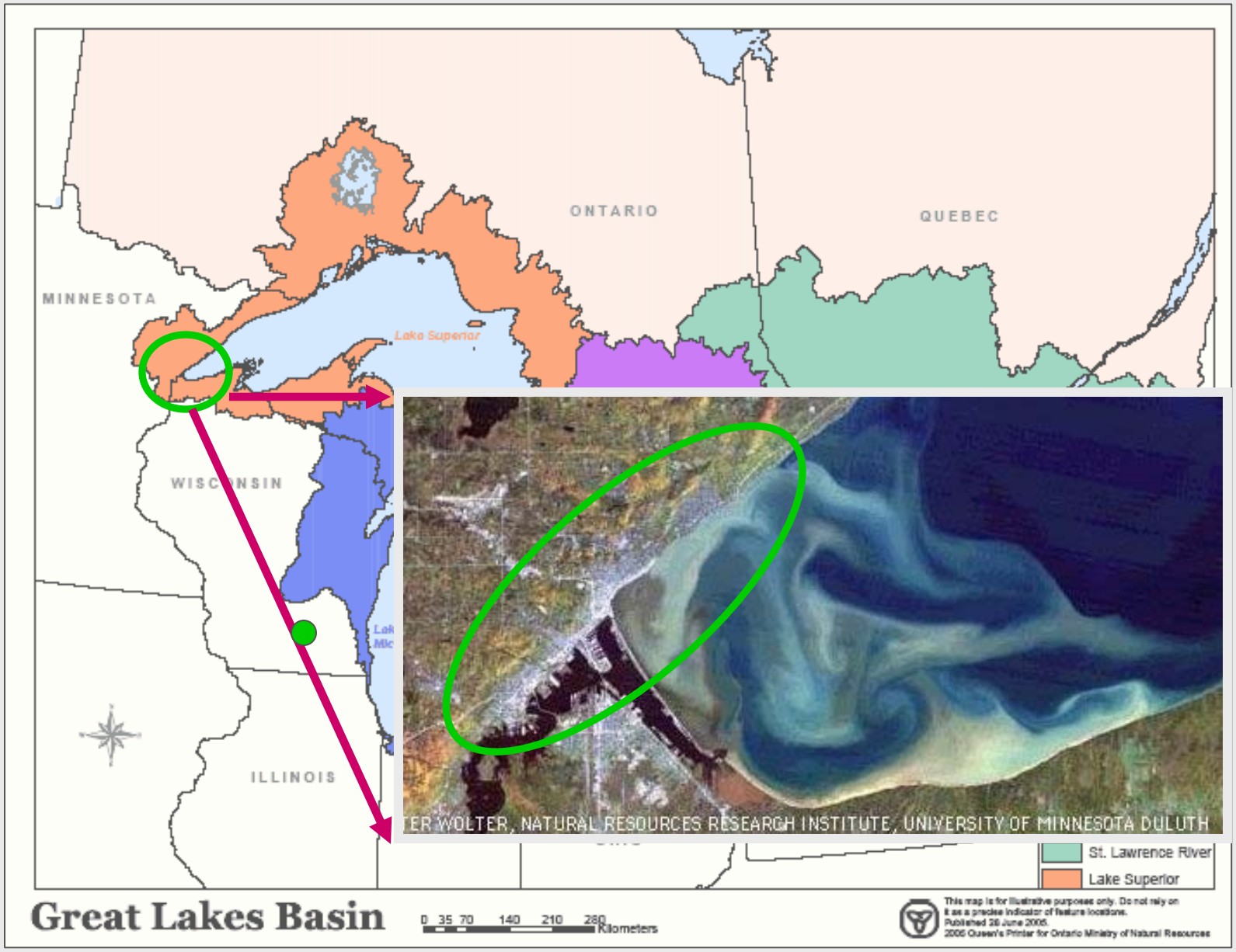
Minnesota Pollution Control Agency

ZOO Lake Superior Zoo - Duluth

South St. Louis Soil & Water Conservation District

UMD Duluth

Northeastern MN – Western Lake Superior

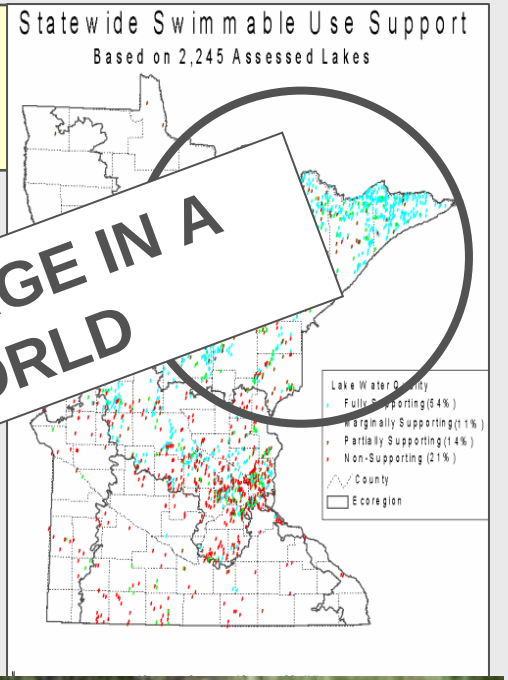


Northeastern Minnesota waters

A very sensitive region

- >5000 high quality lakes
- thin, nutrient poor soils
- high gradient, high-DO,cold and “clear” water streams

A PROTECTION MESSAGE IN A RESTORATION WORLD

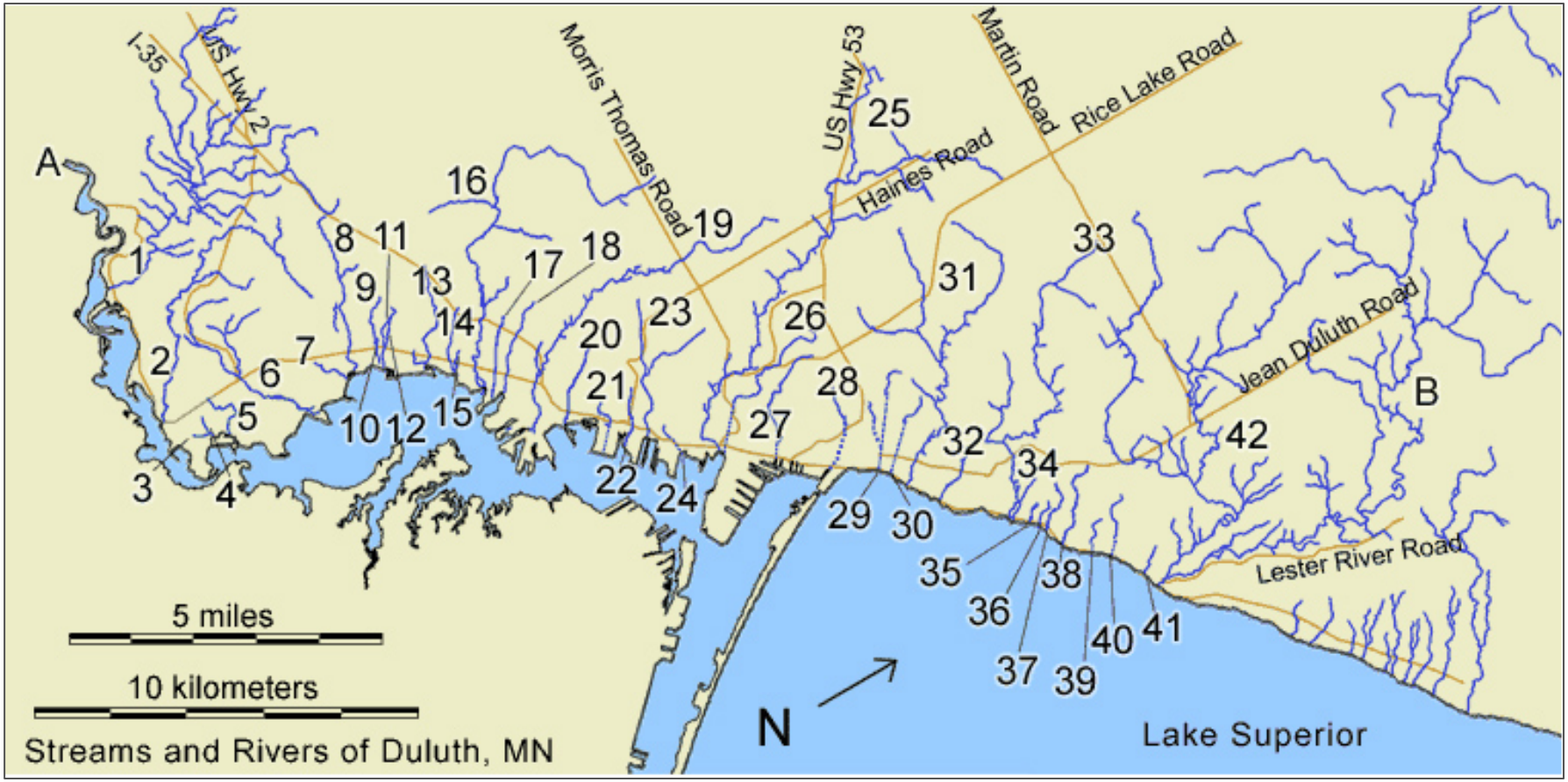


Surface and stormwater quality

- Like many urban streams, northeastern MN streams face environmental threats related to stormwater runoff

DuluthStreams "Rationale"

- Duluth alone has 42 named streams
- High density for size of urban area



12 are designated trout streams

duluth streams.org

explore duluth
understanding
citizen involvement
stormwater management

the streams

Select a Stream: A-K L-U numbered | Trout Streams | About Data | Current Data | Reports | QA/QC

Designated Trout Streams of Duluth

	2001 stocking report
1. Amity Creek and 2. East Branch Amity Creek	data available
3. Chester Creek and 4. East Branch Chester Creek	data available
5. Keene Creek	
6. Kingsbury Creek	data available
7. Lester River	data available
8. Miller Creek	
9. Mission Creek	
10. Sargent Creek	
11. Stewart Creek	
12. Tischer Creek	data available

Where are the fishing holes?
Find a few of them here.

Read detailed information about:

- Brook Trout
- Brown Trout
- Rainbow Trout
- other Duluth Stream fish

DNR 2002 Fishing Regulations
http://www.dnr.state.mn.us/regulations/fishing/index.html

DNR Trout Management Summary
http://www.dnr.state.mn.us/fish/trout/management.html

Mission

- Enhance public understanding of aquatic ecosystems and their connections to watershed land use

Focus on

- Economic and environmental sustainability
- People actions

… using near real-time data

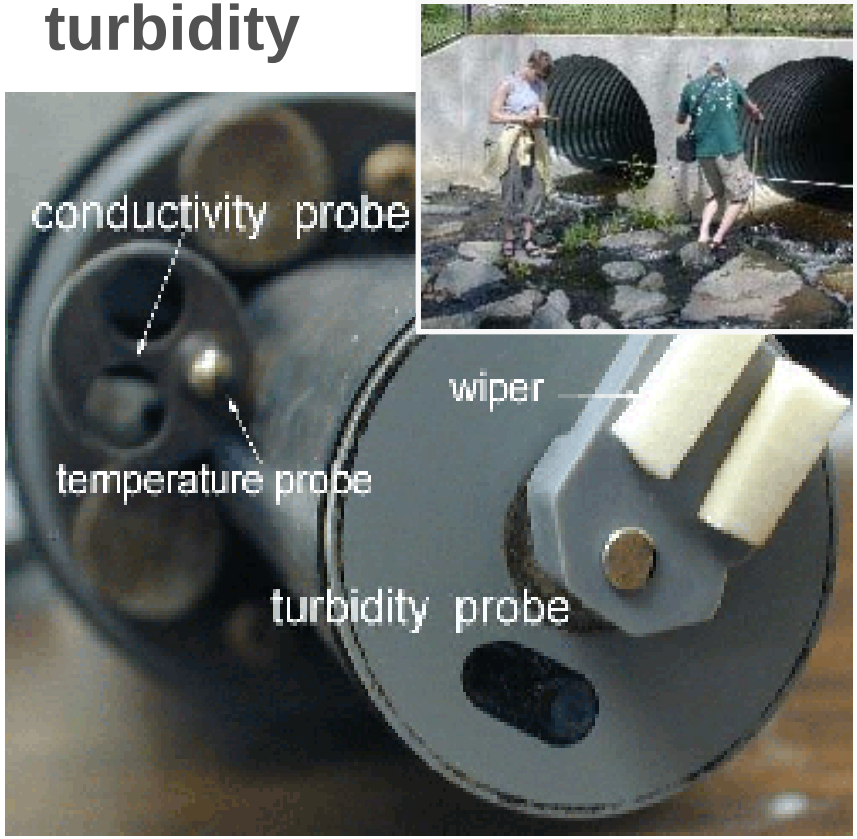
- **The “*easy*” part:**
  - Data collected and on the Web
  - Data visualization tools
  - Explanatory materials
- **The hard part:**
  - Making the data understandable and interesting for everyone!
    - General public
    - Students and teachers
    - Contractors and consultants
    - Decision makers
    - Agencies
    - Scientists

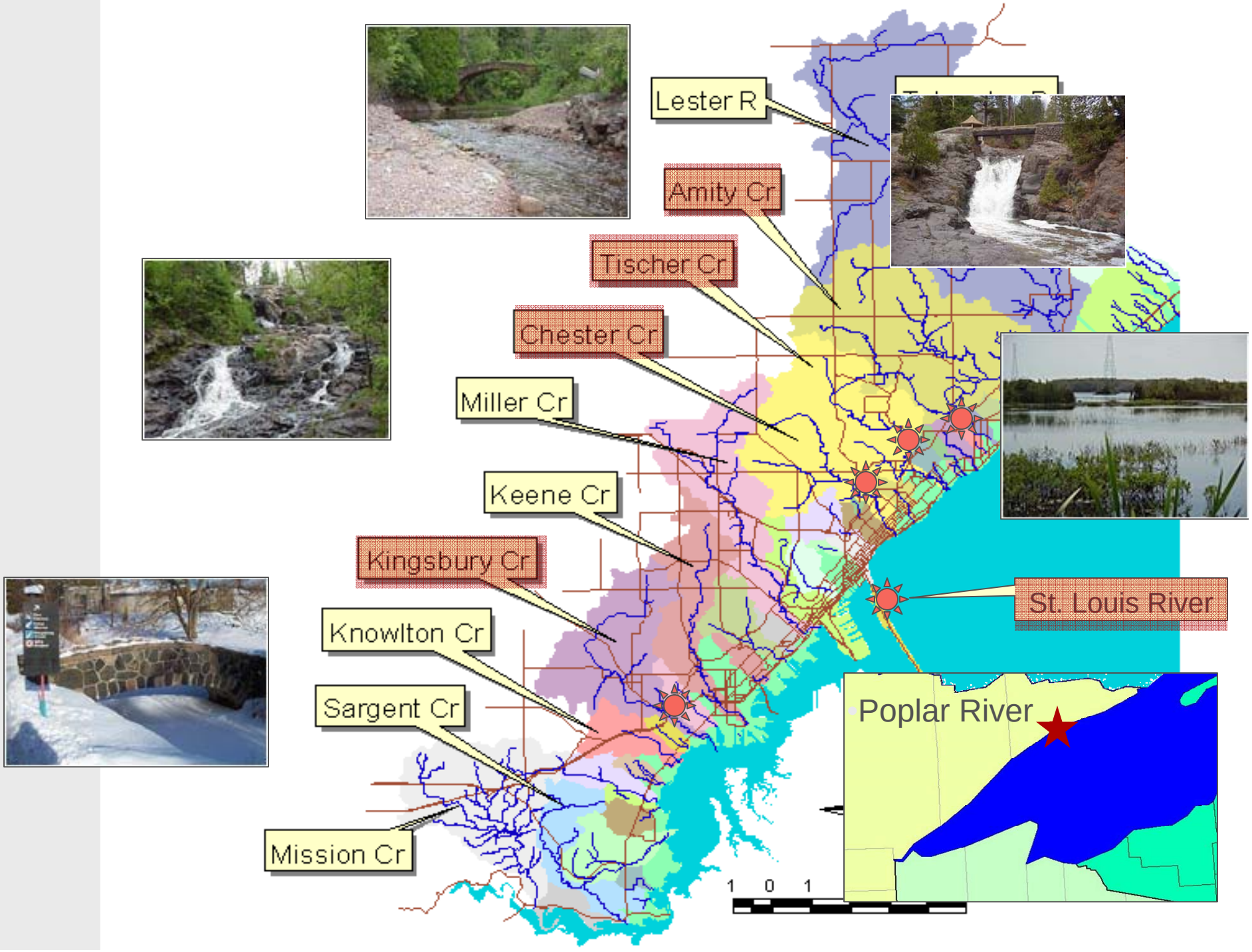
More specific original objectives:

- Install real-time remote WQ sensors in Tischer, Chester, Kingsbury, Amity Creeks and the St. Louis R.
- Deliver information using advanced data visualization tools over the Internet and at public kiosks (Great Lakes Aquarium and Duluth Zoo)
- Link data for 12 trout streams with GIS technology to current and historical WQ and biological databases
- Incorporate visually engaging interpretive text, animations and videos into the website to illustrate the nature and consequences of degraded stormwater and real costs to society

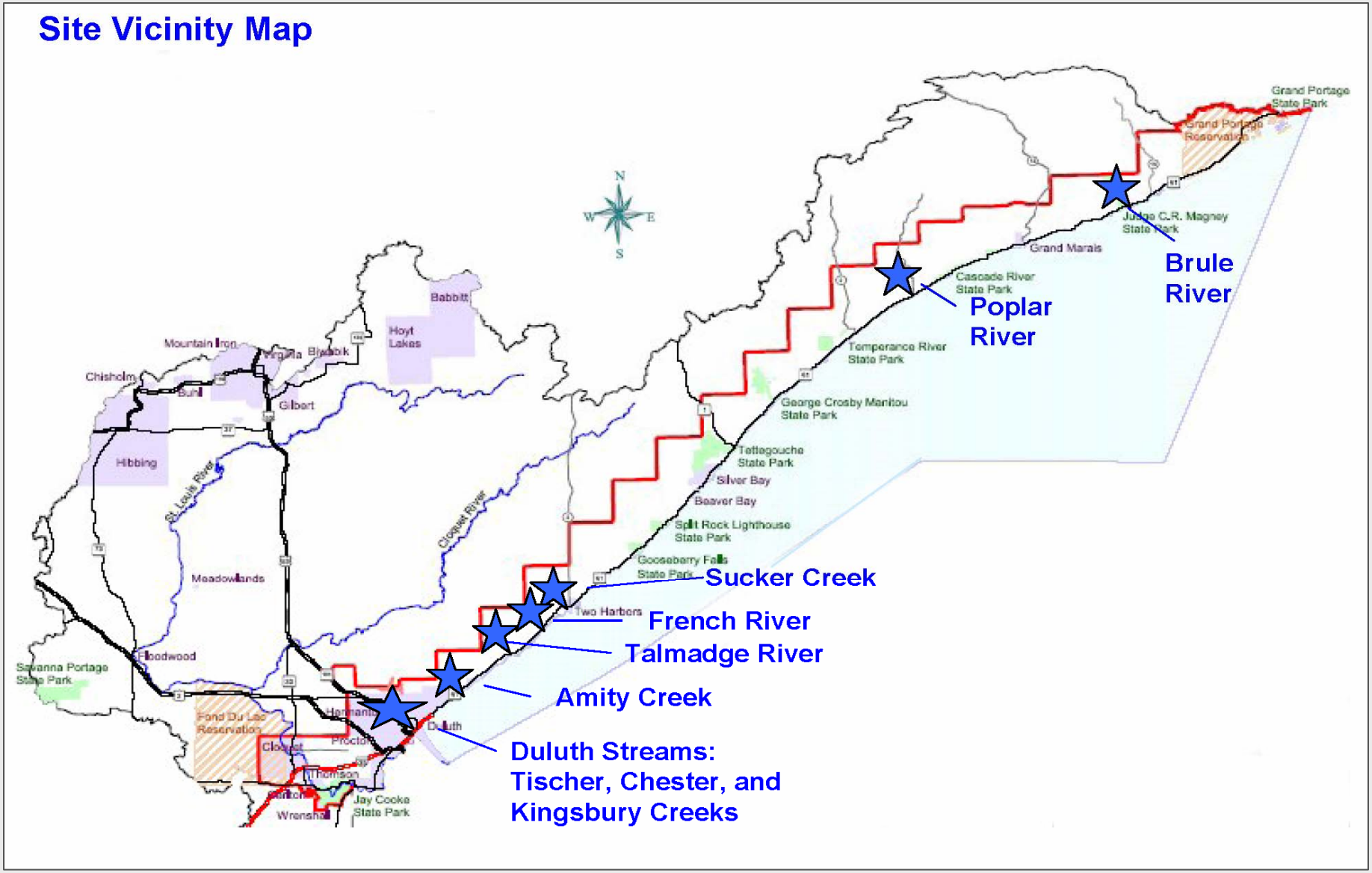
Automated stream sampling

- Instruments log data every 15 minutes for daily delivery to web-site and data visualization tools
- Flow, temperature, specific conductivity (EC25), turbidity

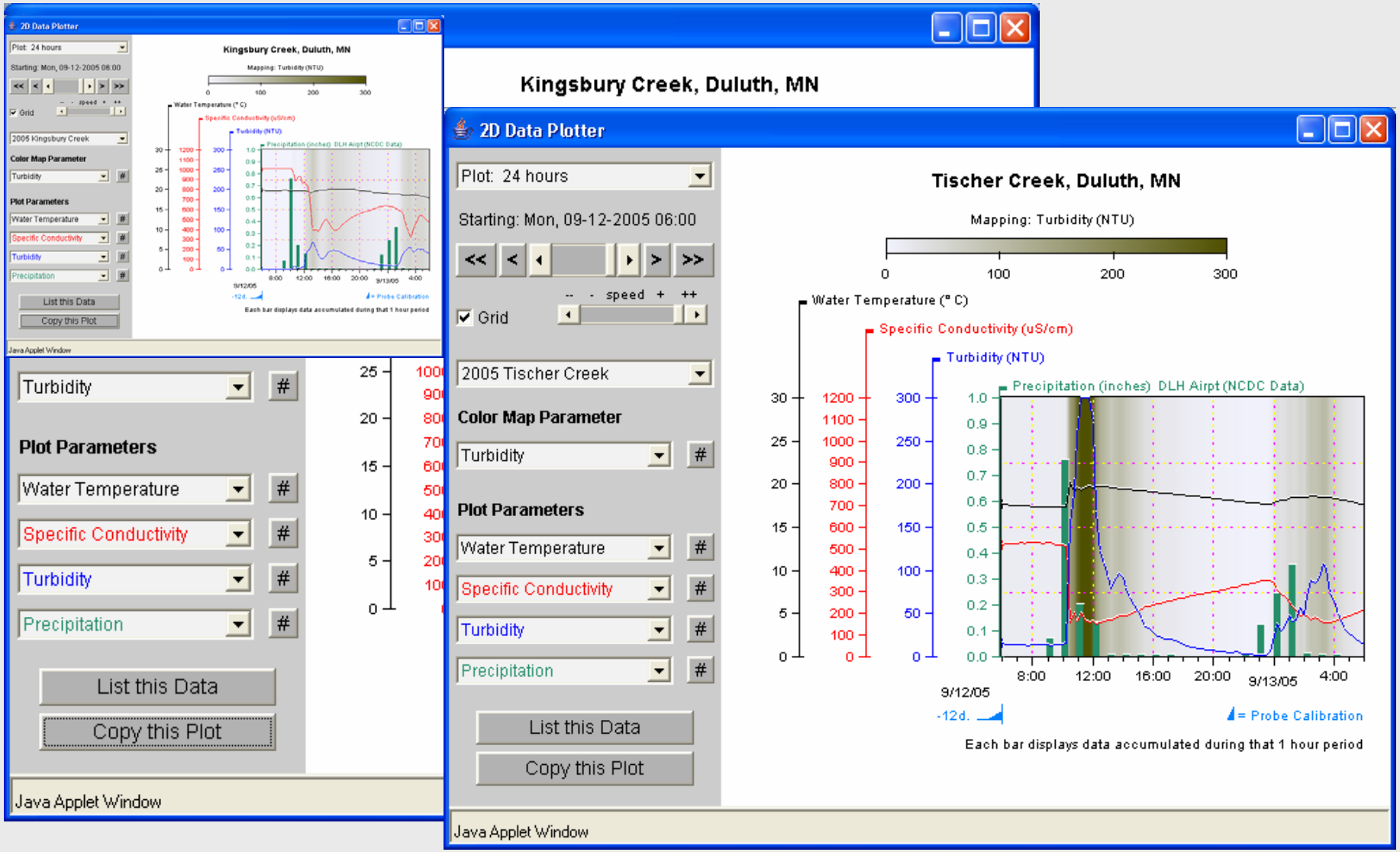



Lester R
Amity Cr
Tischer Cr
Chester Cr
Miller Cr
Keene Cr
Kingsbury Cr
Knowlton Cr
Sargent Cr
Mission Cr
St. Louis River
Poplar River
1 0 1

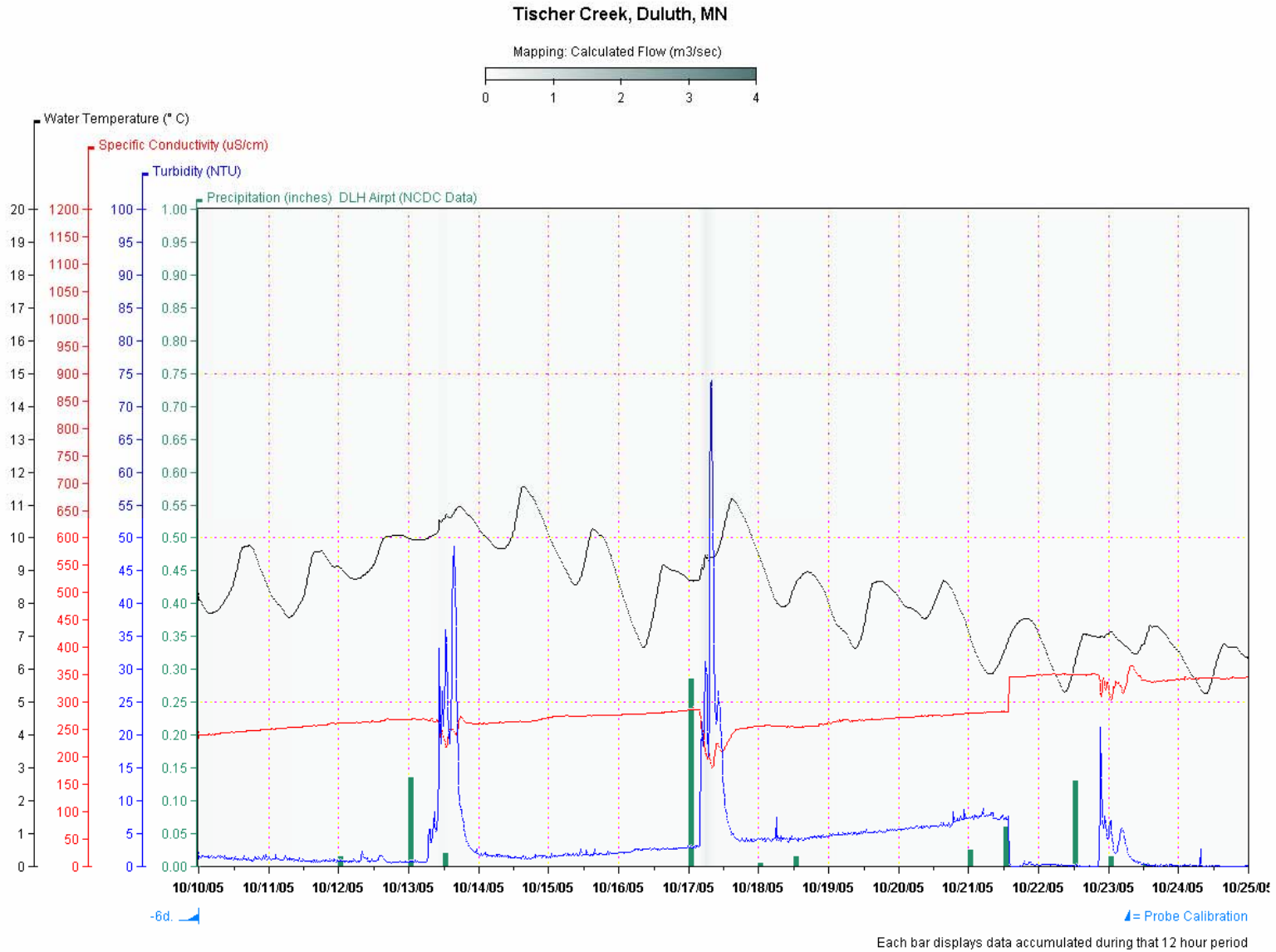
Future sites: Wish list – MPCA long-term sites



Data visualization and animation tools: September - October 2005 gully washers



Tischer Creek, Duluth, MN



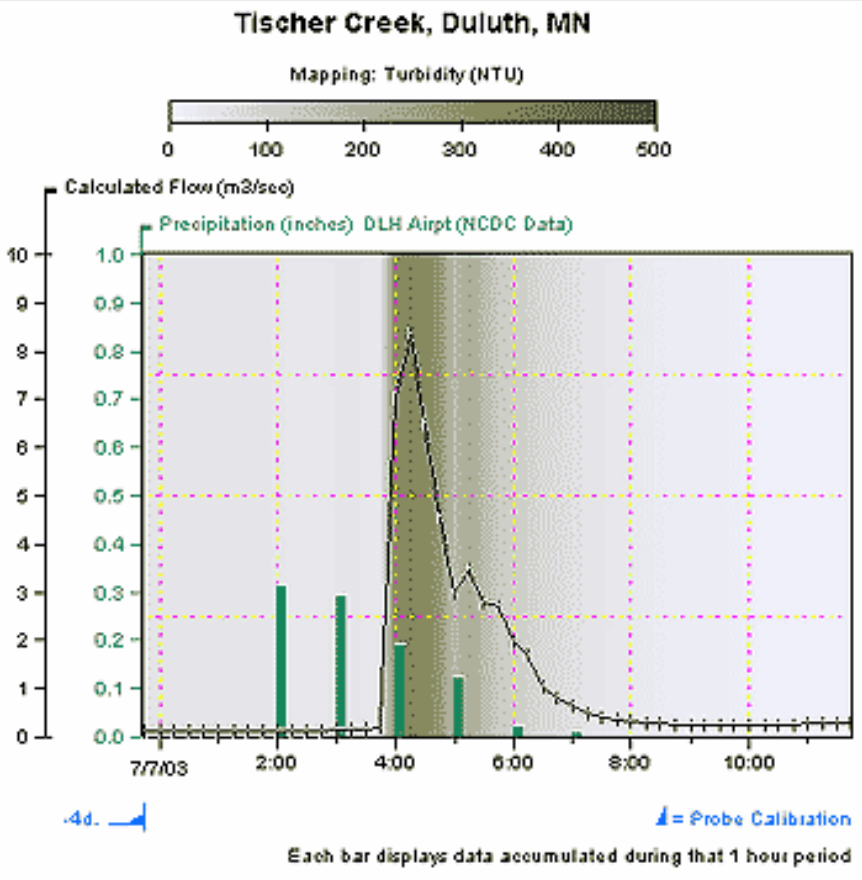
Java Applet Window

Examples of data “vignettes”

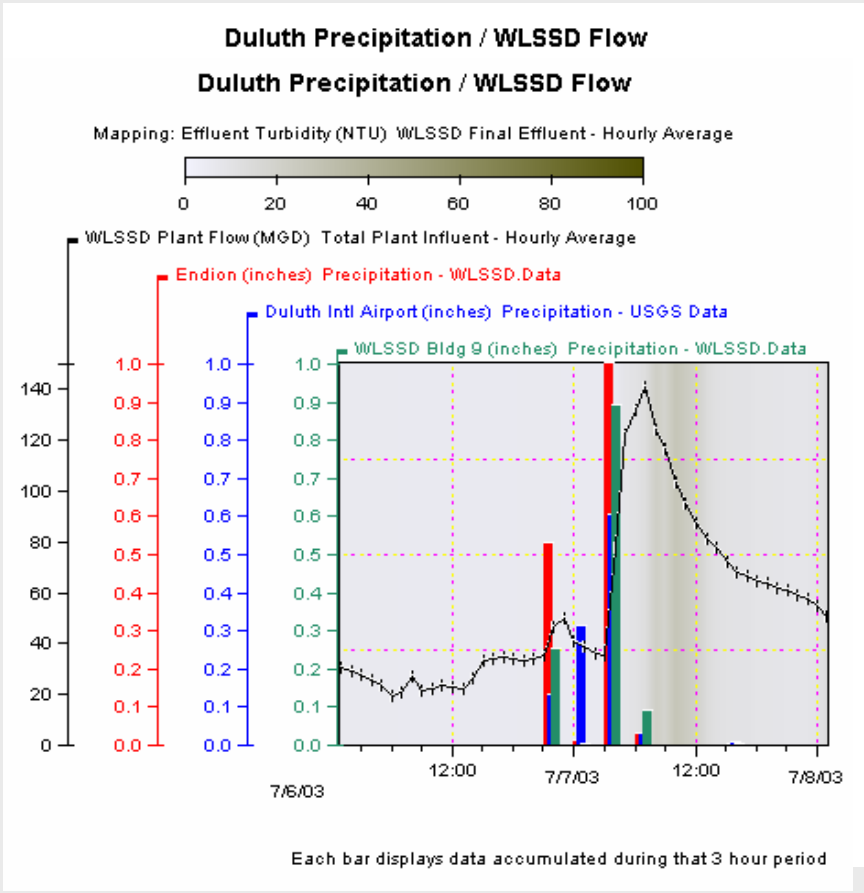
- Increased turbidity from high runoff and erosion
- Flashy stream flow surges and Inflow and Infiltration (*I & I)* events causing sewage overflows and spills
- Temperature “spikes” from rain water running across hot roads and parking lots
- Short-term (hours) increases in salt concentration during early winter snowfalls from de-icers
- Longer-term (weeks) increases in salt and turbidity levels during early stages of spring runoff
- Seiche effects between Lake Superior and the St. Louis River Estuary (Duluth-Superior Harbor)

When it rains hard in Duluth… July 2003

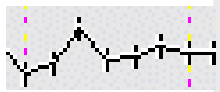
Stream flashiness
Flow and turbidity (sediment)



Sewage plant flashiness
Inflow & Infiltration (I&I)

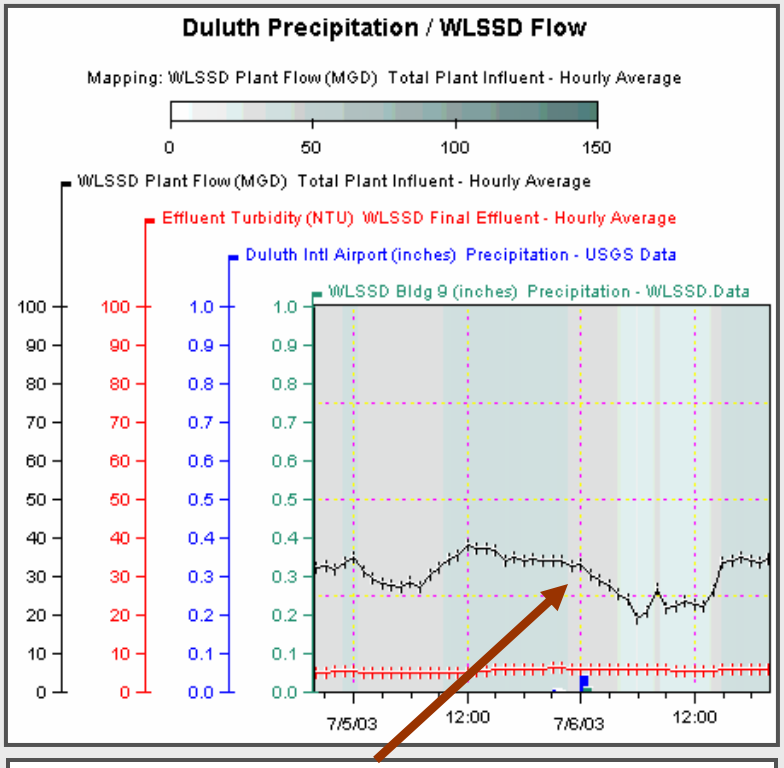


Look for increased rain , muddy **brown** water and WLSSD discharge



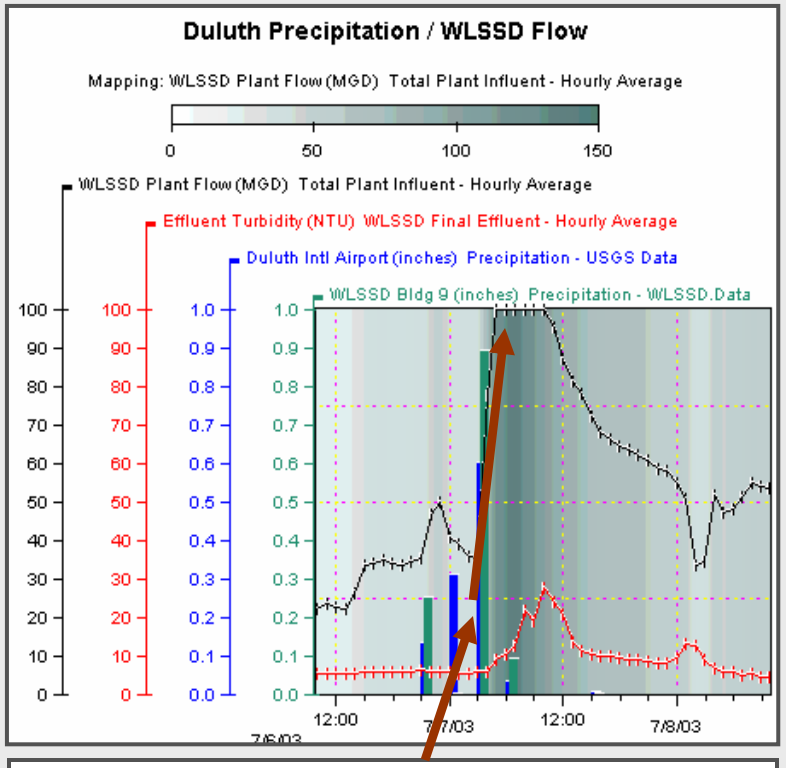
When it rains hard in Duluth 2003…

July 6, 2003 - cloudy



Plant running @ 25-40 mgd

July 7, 2003 – 1- 2 “ rain



Plant running @ 140 mgd

Eight overflows in WLSSD’s collection system released roughly one million gallons of untreated sewage.

A lot happens from all this “extra” water

- About 5.8 mgd in sewage overflows
- Elevated coliform bacteria (health risks)
- Pollutant loads to Lake Superior

LakeSuperiorStreams and the new Lake Superior Beach Monitoring Program

NEWS RELEASE

Minnesota Pollution Control Agency

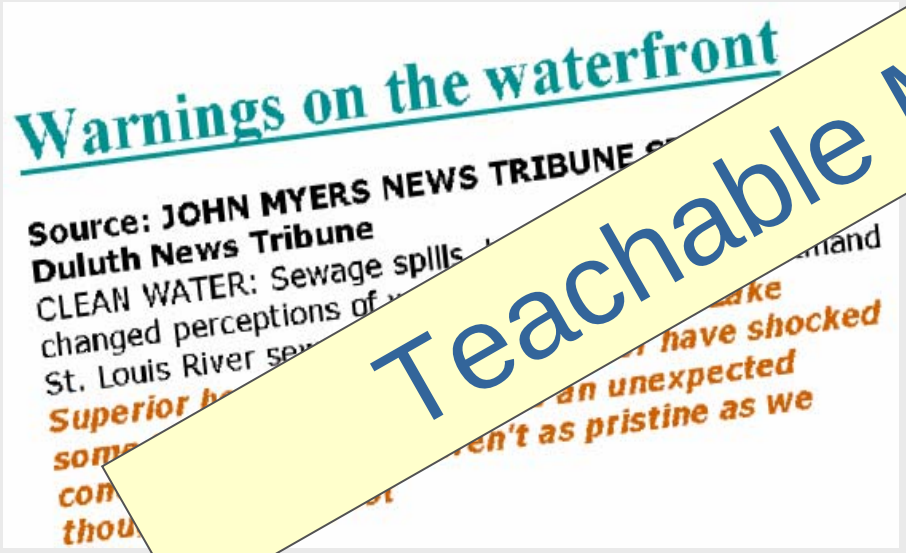
www.pca.state.mn.us

Toll-free and TDD 1 (800) 657-3864

Saint Paul • Brainerd • Detroit Lakes • Duluth • Mankato • Marshall • Rochester • Willmar

FOR I... E

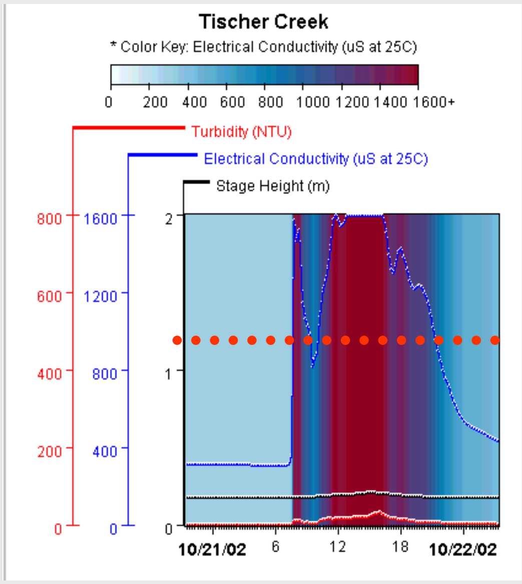
R... August 5, 2003



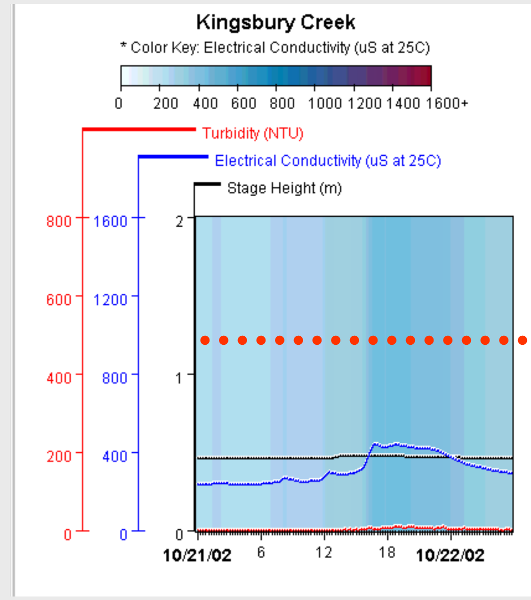
Teachable Moment!!

FOUR WATERFRONT AREAS OFF-LIMITS

Stream data visualization tool: Salt loading, October, 2002



Tischer



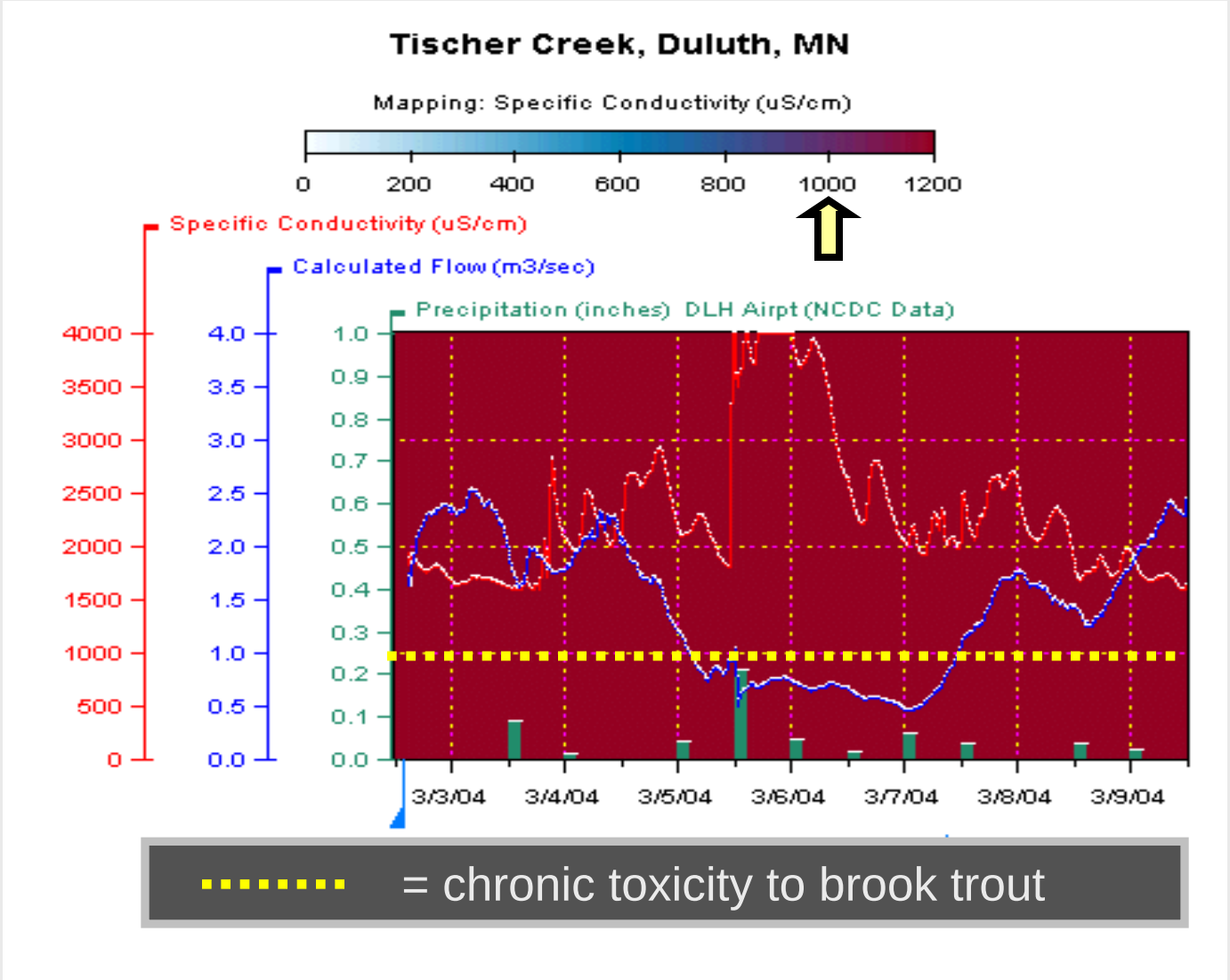
Kingsbury

Higher salt level = higher electrical conductivity

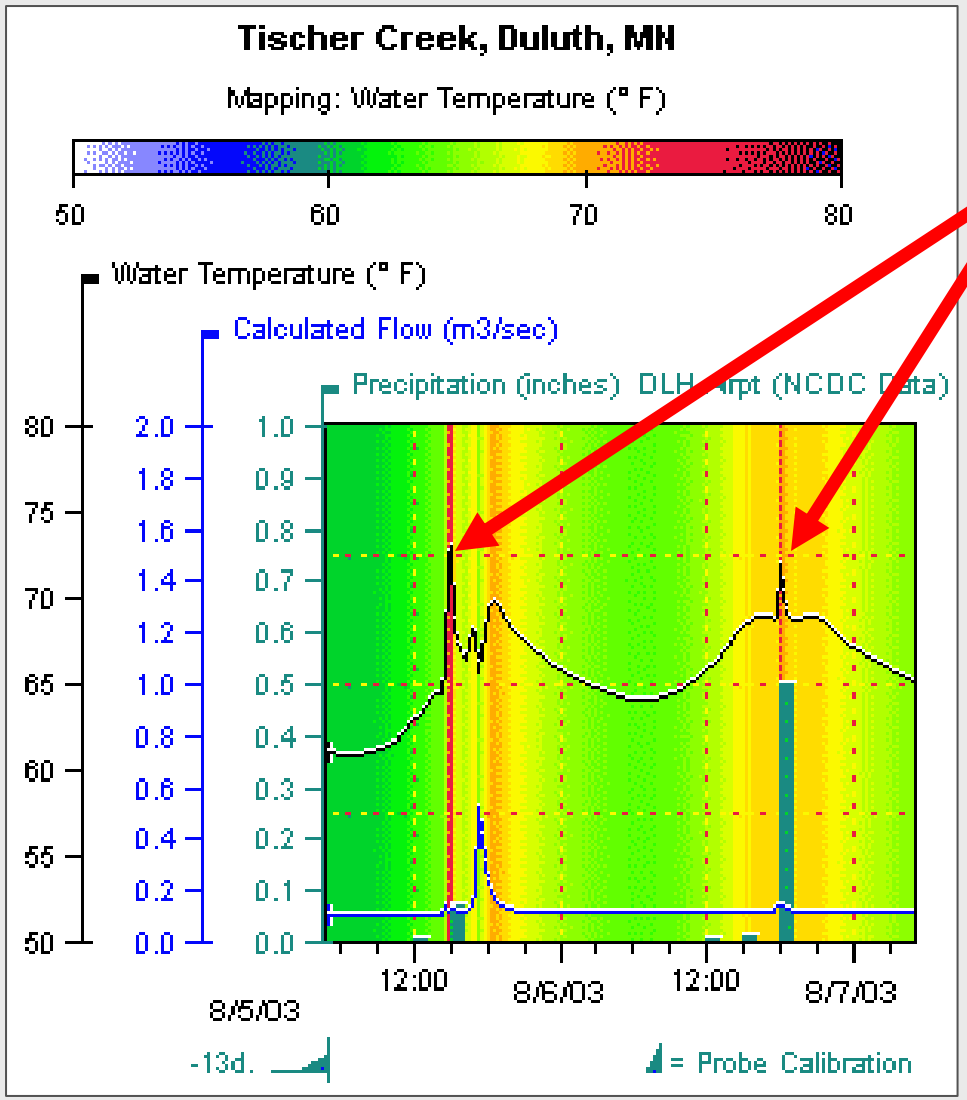
(Look for darker blue to magenta changes)

• Chronic toxicity to brook trout

Spring runoff 2004 – 3 weeks of salt exceeding chronic adult brook trout criterion



Middle of the night spikes of 3-6ºC from stormwater road/lot runoff



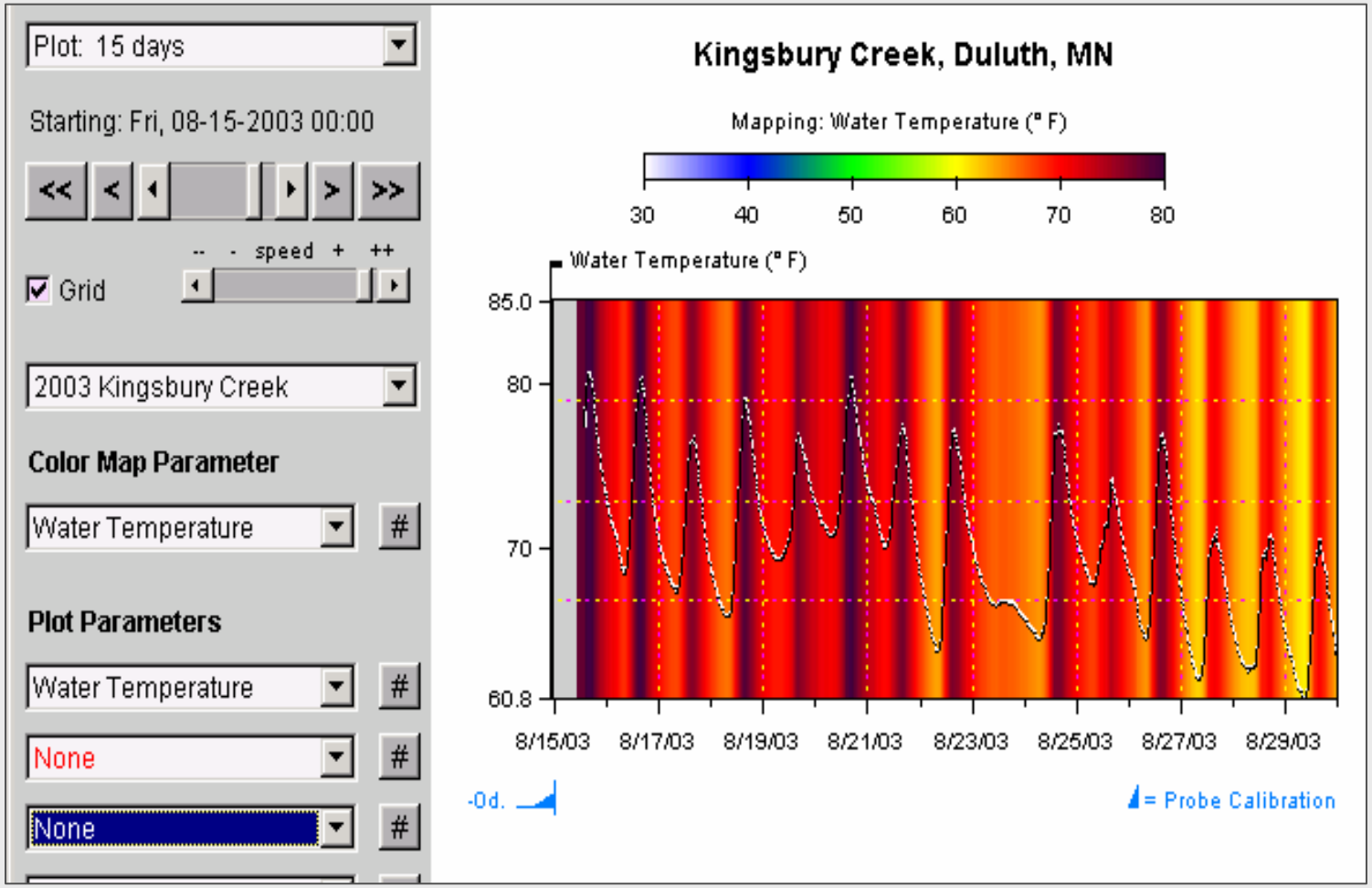
Stream temperature is a major stressor of Duluth trout. See how roads and lots warm the water by >5 ºF

Lesson – even moderate rain can cause a 5-11 ºF jump as water moves across warm asphalt.

Trout in more developed watersheds are already near the upper range of their temperature tolerance in the summer.

Brook trout stress

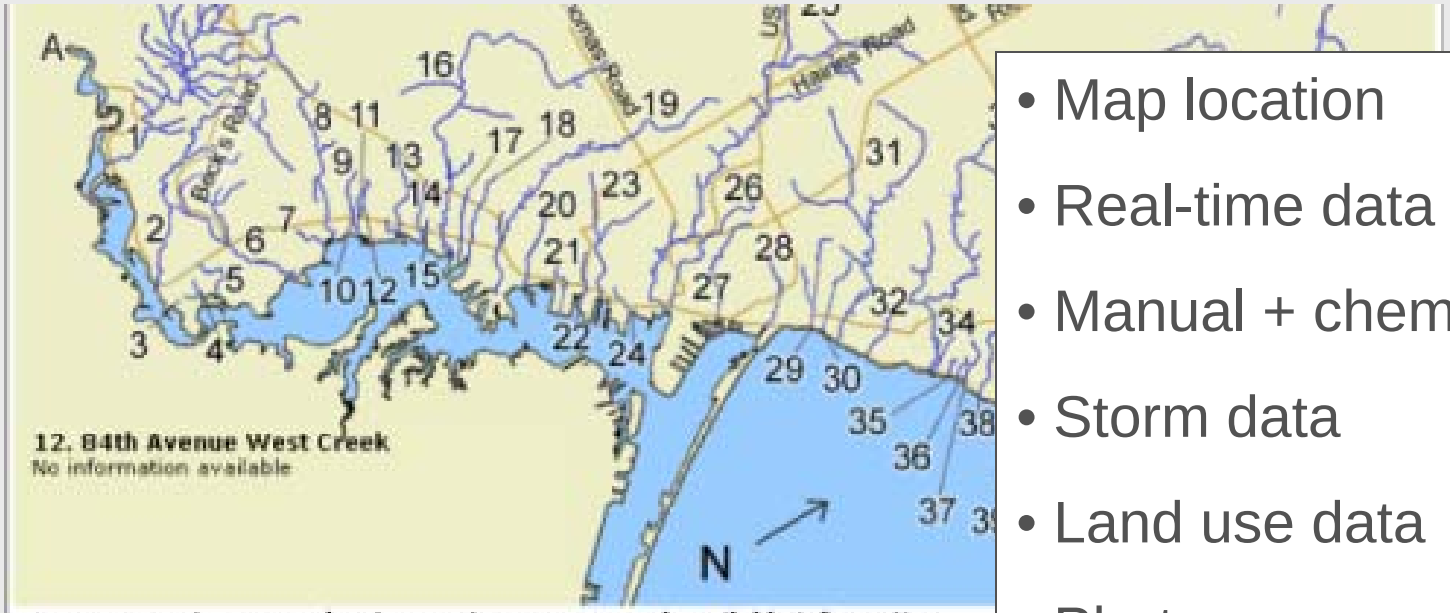
- 15 days continuously over the optimal temperature range for brook trout; exceeding upper limit 10 times



Other *DuluthStreams* Data – Check out the GIS-IMS Utility

You can zoom in and overlay streams, roads, land uses, etc.

Stream data “library” index



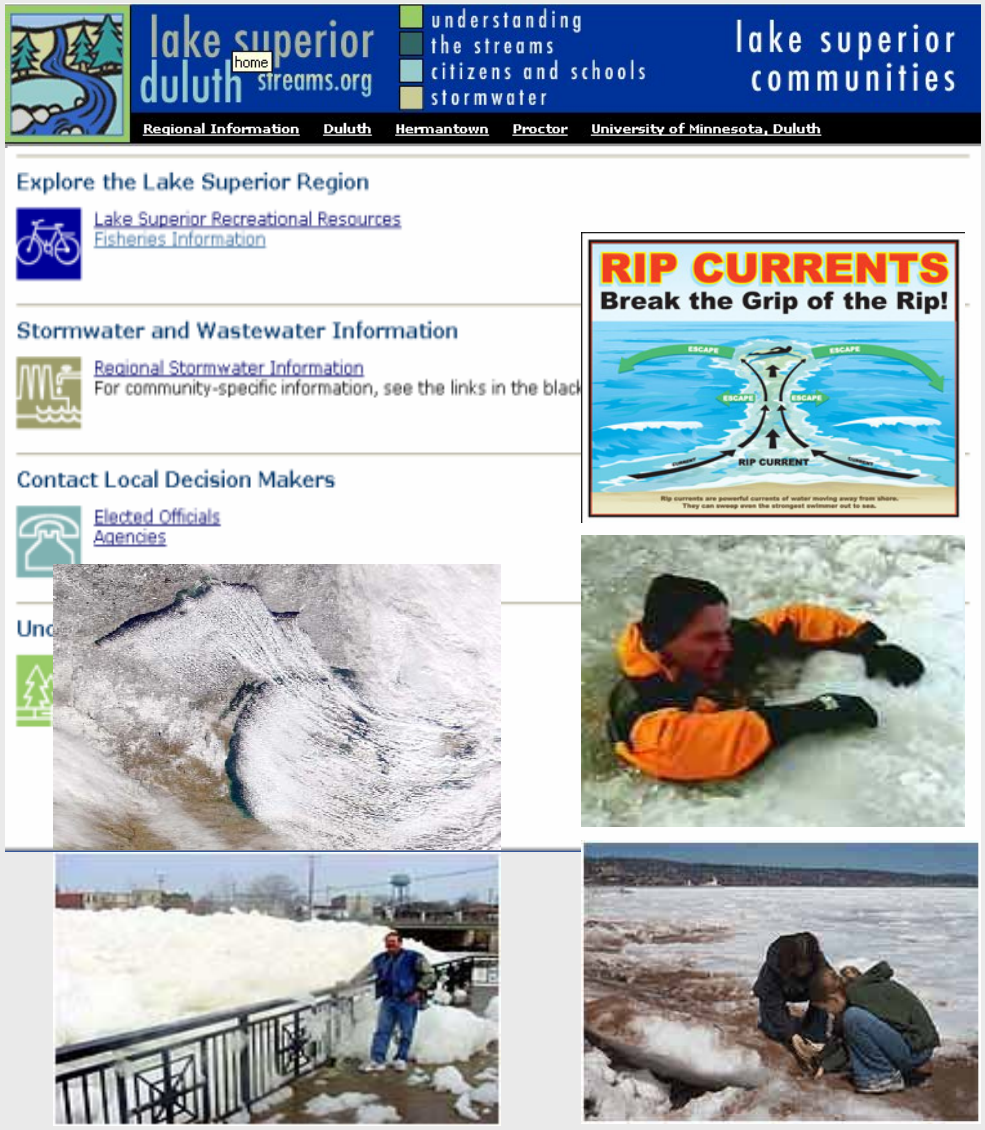
mouse over stream number to see stream name and available information

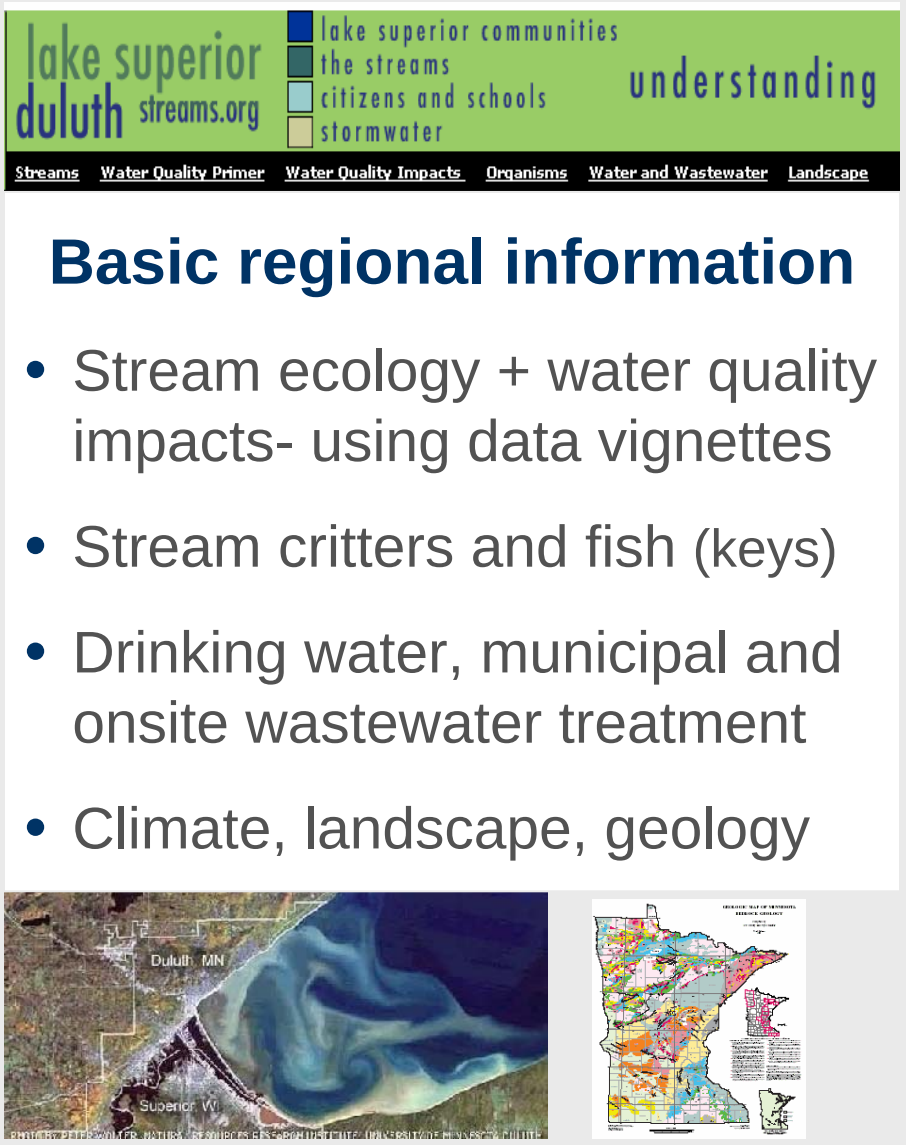
Data and information available for the Duluth Streams:

Stream	Map location	Real-time data	Manual & chemistry data	Trout stream	Storm data	Land use data	Ph			
Amity Creek	42	yes	yes	yes		yes				
Bowser Street Creek	4									
Brewery Creek	29					yes				
Buckingham Creek	27					yes				
Chester Creek	31	yes	yes	yes	yes	yes				
Clarkhouse Creek	28					yes	yes	yes		
Coffee Creek	26					yes	yes			

- Map location
- Real-time data
- Manual + chemistry data
- Storm data
- Land use data
- Photos
- Historical photos
- GIS Map utility
- Reports (links + pdfs)

Communities, Understanding, Citizens & Schools, Stormwater

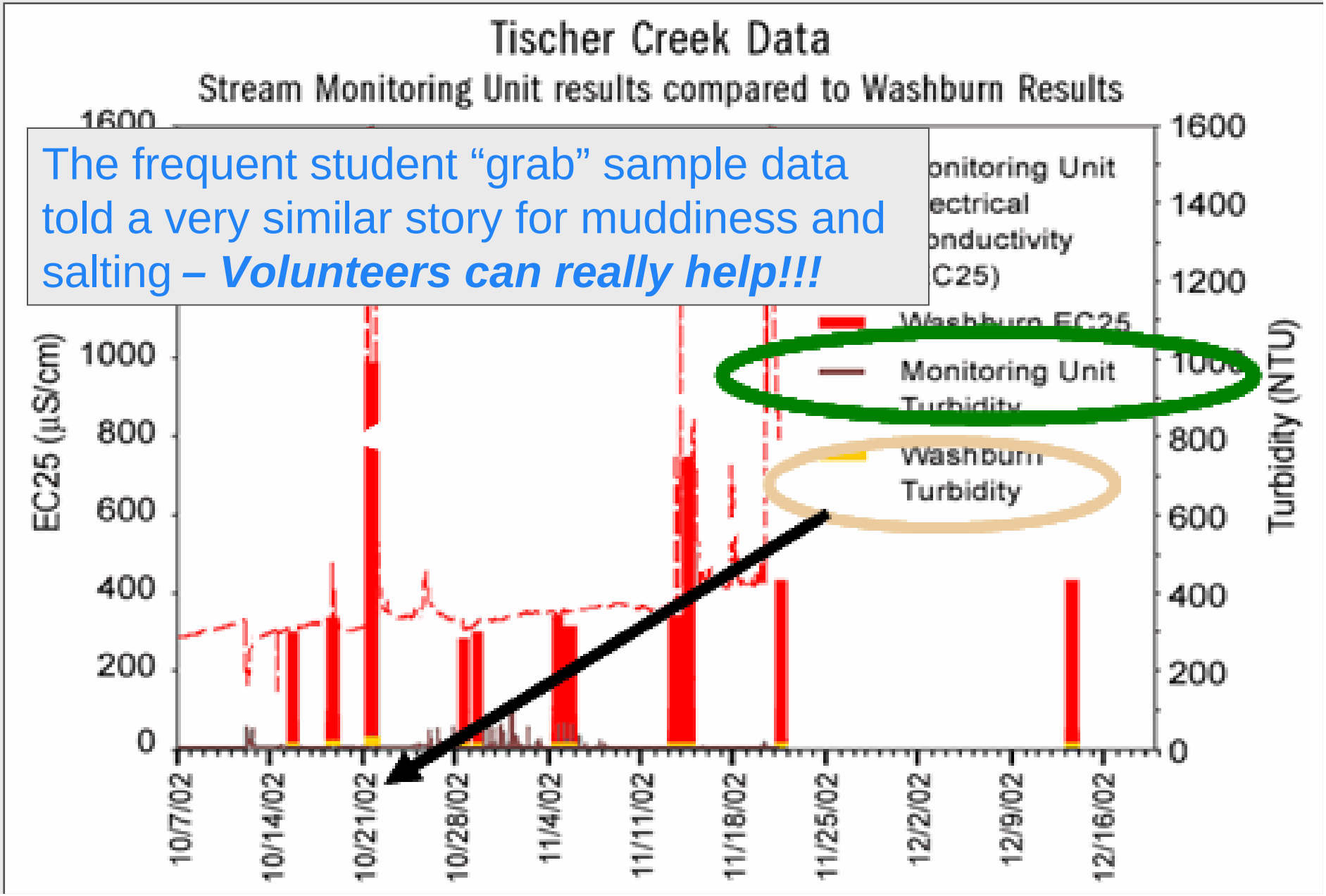




Basic regional information

- Stream ecology + water quality impacts- using data vignettes
- Stream critters and fish (keys)
- Drinking water, municipal and onsite wastewater treatment
- Climate, landscape, geology

School Curricula and Volunteer Monitoring



Stormwater: Site Design Toolkit, RSPT, permits…

lake superior duluth streams.org

lake superior communities understanding the streams citizens and schools

stormwater

Stormwater Plan | Inflow and Infiltration | Regional Stormwater Protection Team | Site Design Toolkit

Site Design Toolkit

This "toolkit" includes information associated with a new, comprehensive land planning and engineering design approach that aims to minimize stormwater impacts associated with water quality, hydrology (volume of water and peak flows), water supply, flooding and physical effects. A primary goal is to maintain and enhance the pre-development hydrologic regime of urban and developing watershe
management schemes and includes Low Impact Development (LID)
Growth, and probably some others. DuluthStreams is collaborating
Pollution Prevention staff and others to include information from th
homeowners, contractors, developers, contractors, realtors and go
the goal of reducing stormwater flows and pollutant loads in order
resources. Although these techniques are most effective in terms
planning and design stage, they are also effective at any stage of
repair.

Example of Alternative Paving webpage

HOME | ABOUT US | CONTACT US | DATA VIEWER | SEARCH | GL

SITE DESIGN TOOLKIT

SITE EVALUATION

TOOLS FOR SITE DESIGN

Rain Gardens
Grassed Swales
Pervious Pavement
Parking Lot Filter Strips
Bioretention Basins
Underground Storage
Green Roofs
Rain Barrels

APPLICATION
Single Unit
Subdivision
Commercial

POLICY
Community Planning
Implementing Pollution Prevention

CONTRACTOR TRAINING

CASE STUDY INDEX

RESOURCES

Rain Gardens

Rain Gardens are gardens containing flowering plants and grasses (preferably native species of both) that can survive in soil soaked with water from rain storms. However they are not gardens that have standing water. Rain Gardens collect and slow stormwater run off and increase its infiltration into the soil.

These attractive gardens help reduce the rapid flow of stormwater from homes and businesses to storm drains and thus protect streams and lakes from pollutants that are washed from house roofs and paved areas.

Applications

1. Provide a low maintenance, attractively landscaped property with minimum cost.
2. Reduce the amount of household or business stormwater and associated pollutants to area streams and lakes-improve local water quality.
3. Reduce potential of basement flooding.
4. Improve or eliminate wet spots in yard.
5. Increase habitat for beneficial insects, butterflies and birds.

Examples

City of Superior Rain Gardens
Superior, WI

The purpose of this project was to demonstrate the effectiveness of rain gardens in a region with heavy clay soils, harsh winters, and deep frost.

City of LaPoint
Apostle Islands, WI

Development of a Stormwater Management plan and a stormwater demonstration project, all in an effort to protect the Lake Superior shoreline and coastal wetlands.

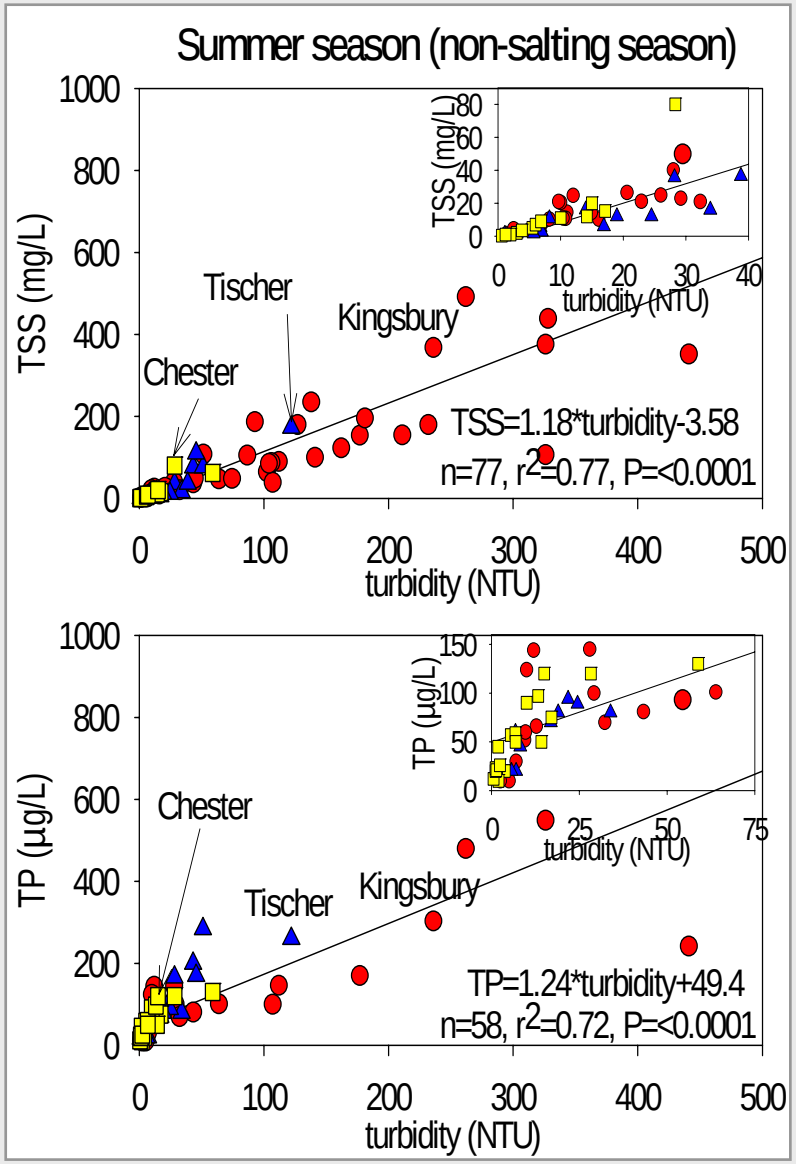
Focus: Low impact and conservation designs, regional case studies and contractor training

Regional Stormwater Protection Team

- **Coordinated educational programs and technical assistance**
- **Entities involved include both Minnesota and Wisconsin MS4s, education/outreach, agencies**
- **Organizations involved (21):**
  - City
  - County
  - MNDOT
  - Township
  - Tribal
  - State agency
  - SWCDs
  - University
  - Nonprofits
  - Wastewater treatment facilities

STORMWATER
REGIONAL RSPT PROTECTION
TEAM

Further data analyses in progress

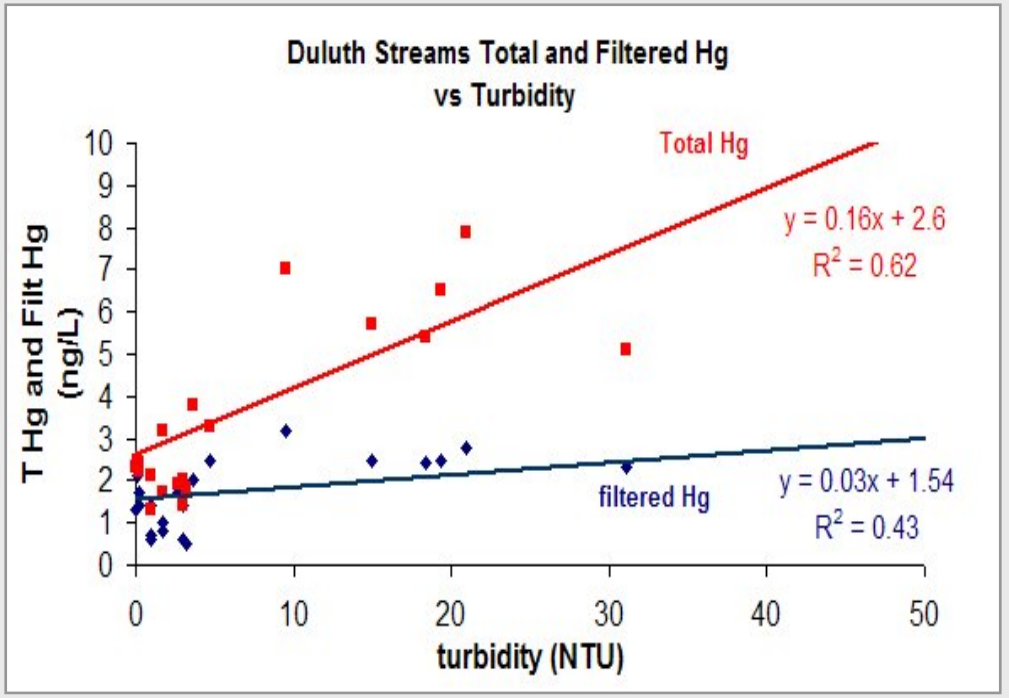


Turbidity appears to correlate well with:

- TSS
- Total - P
- Total - Hg

Specific conductivity correlates with:

- TDS
- Cl^- (Not shown)



Website page requests/month (Aug 2005)

Seasonal peaks probably related to student and teacher use

Summary

- Flow, temperature, electrical conductivity, turbidity can tell us a lot about water quality and habitat condition
- We need data during storm events to really understand impacts to streams and their health
- Data can help provide the link between people's actions in the watershed and the condition of our water resources
- Partnerships between scientists, teachers, agencies, NGOs, and the private sector are essential
- Please take time to explore

lakesuperiorstreams.org

Lake Superior Streams: Focus on education and data

Poster children for controlling pet wastes