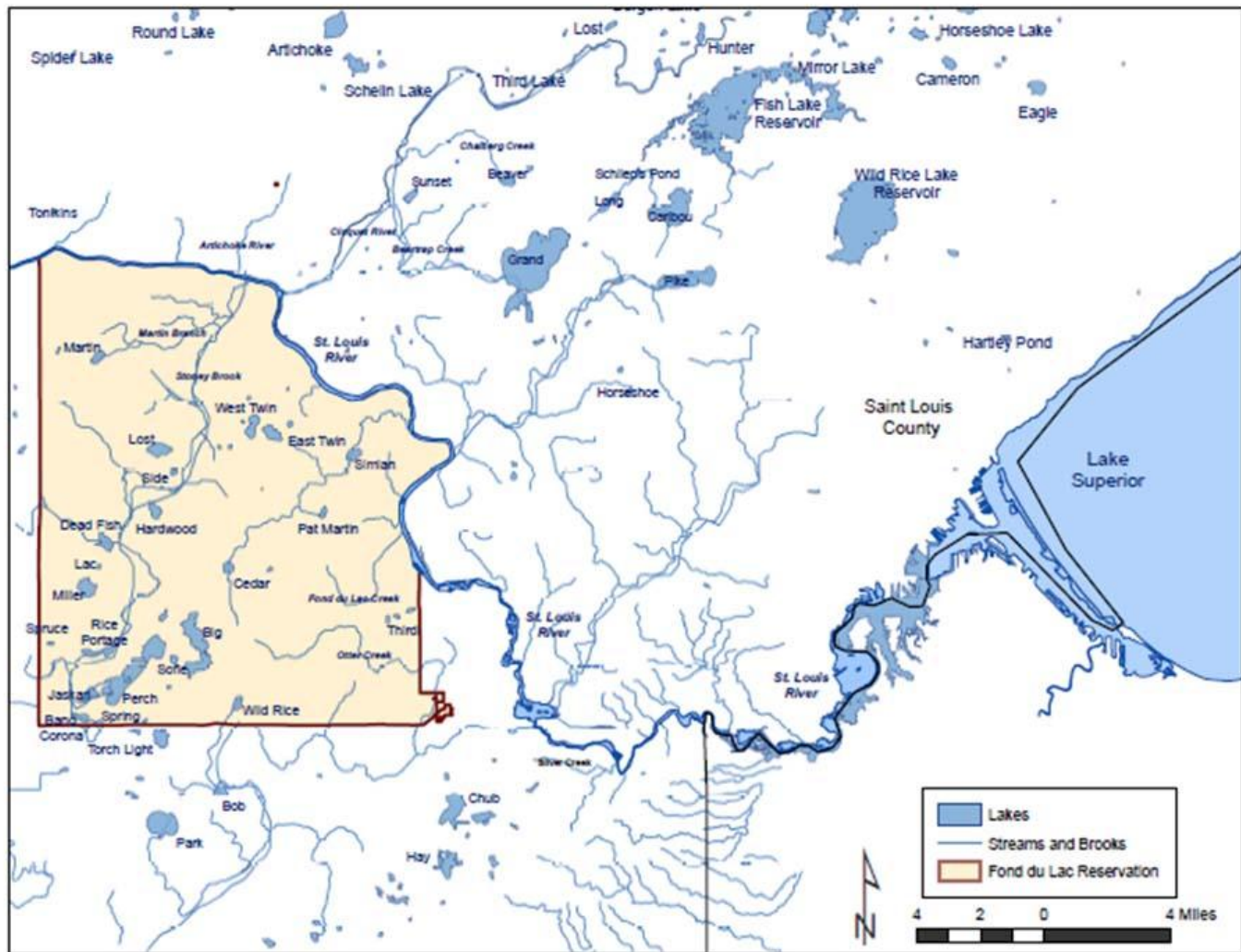
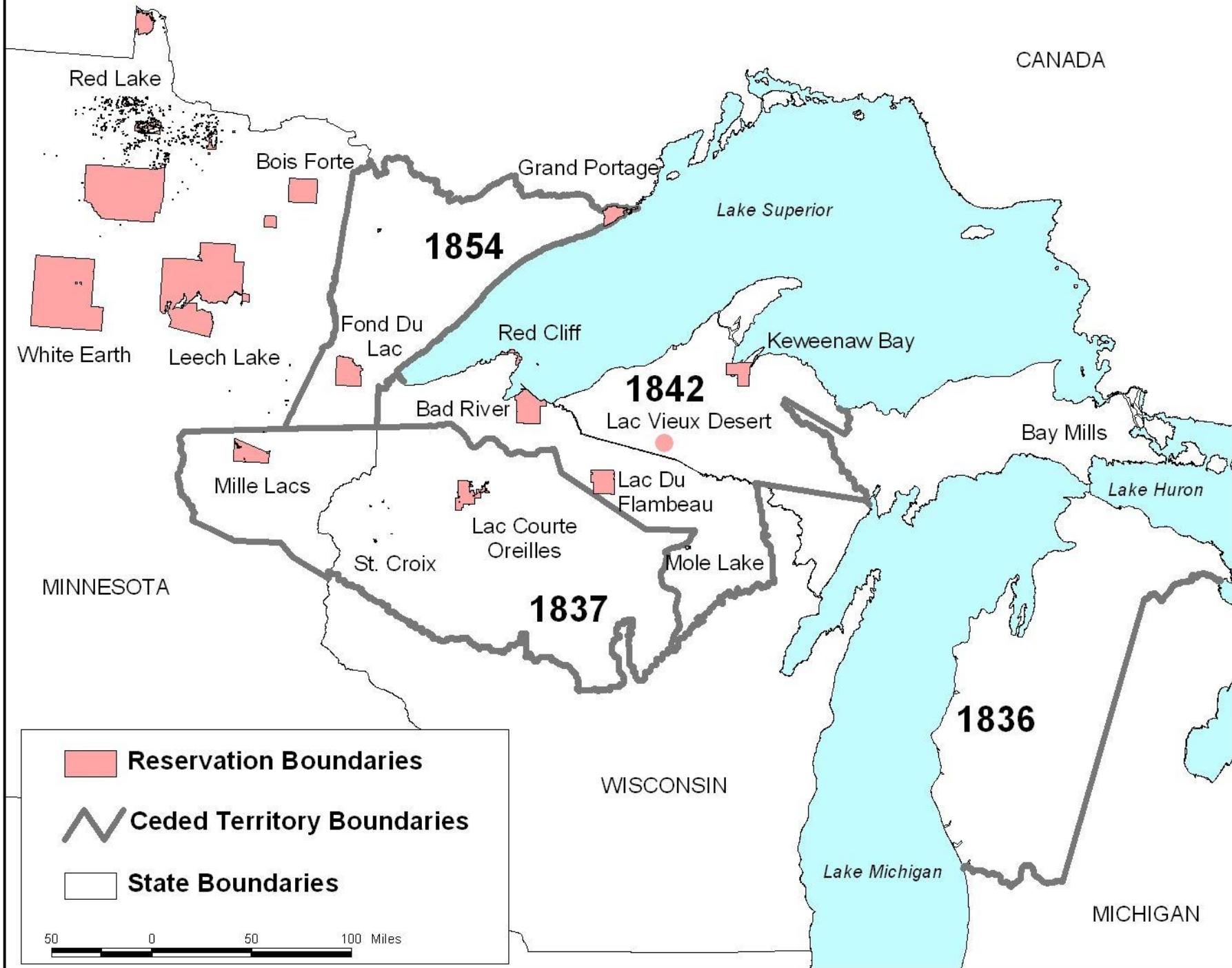




Monitoring and environmental data collection on- and off-reservation









5/1/2002 2





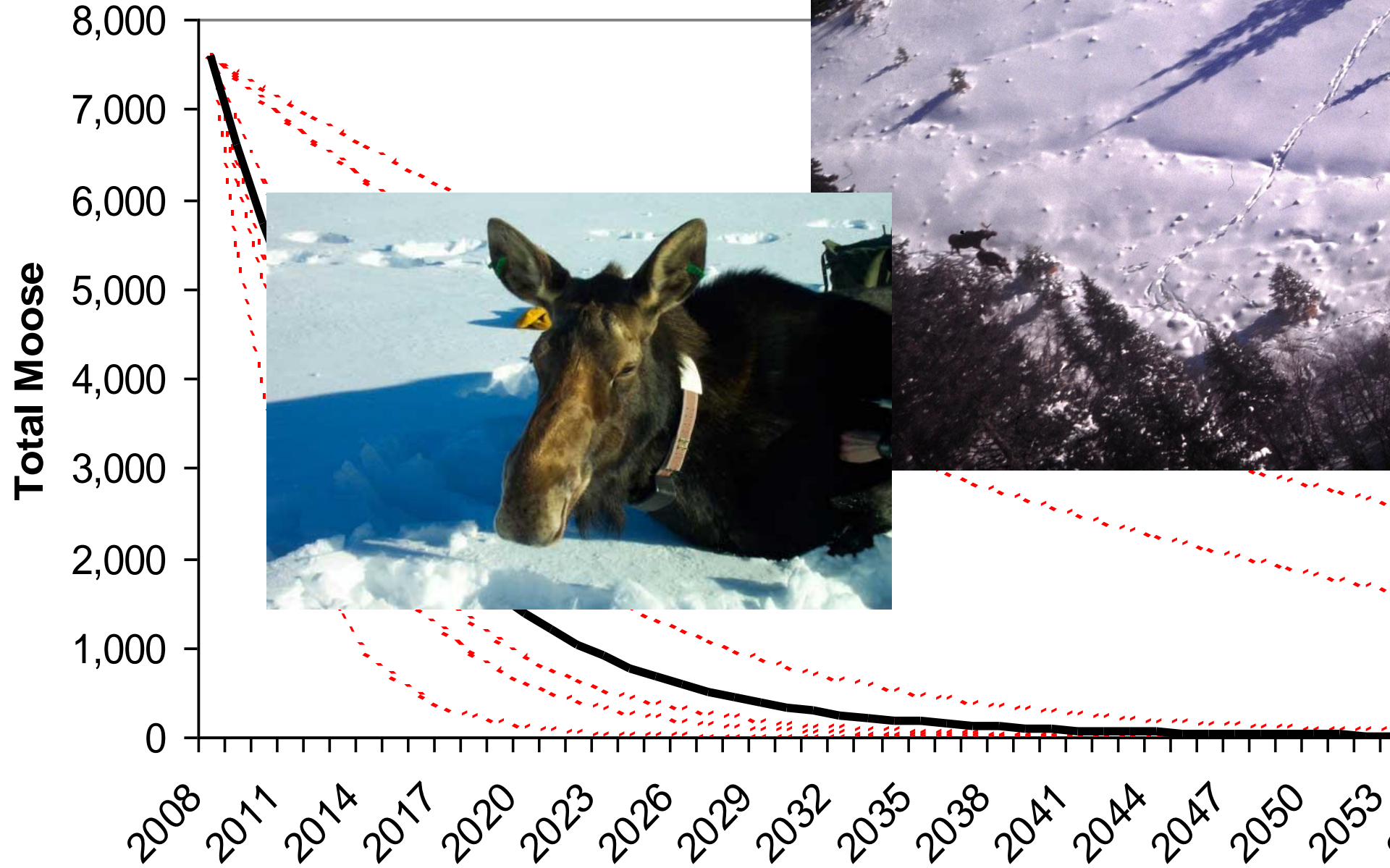








# Northeastern Minnesota







**Participate in collaborative surveys  
For game, non-game species,  
ETS species**





Ern Laboratories, Inc. Nut's / TPha  
218-727-4380  
5-18-06 10:35 NS  
Fdl  
Perch Lake South

Ern Laboratories, Inc. Mistal  
218-727-4380  
Fdl  
Perch Lake South  
5-18-06 10:35 NS

Fond du Lac  
Perch Lake  
South  
5-18-06

Fond du Lac  
Perch Lake  
North  
5-18-06

Ern Laboratories, Inc.  
218-727-4380  
Fdl  
Perch Lake North  
5-18-06 9:45 NS

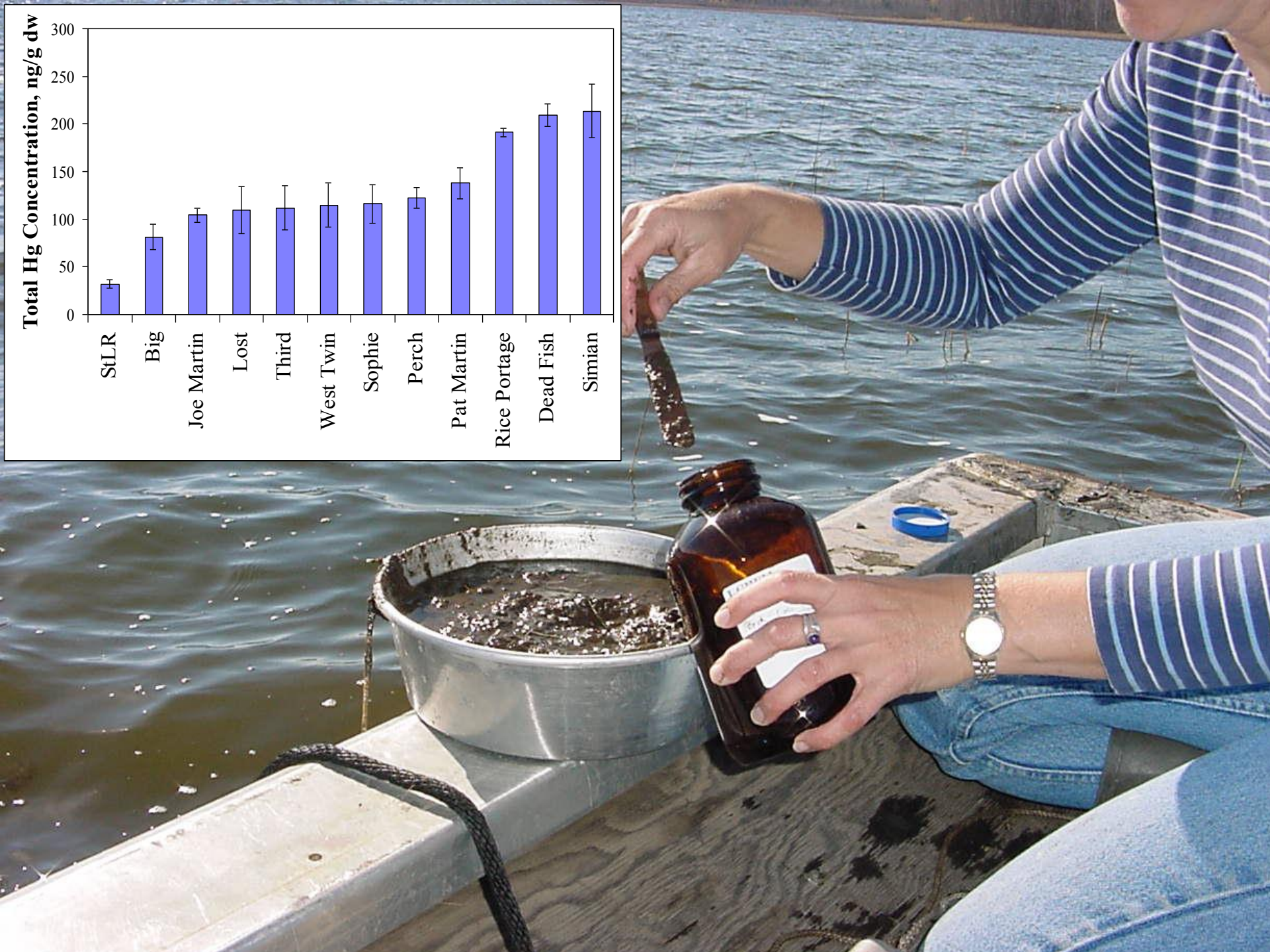
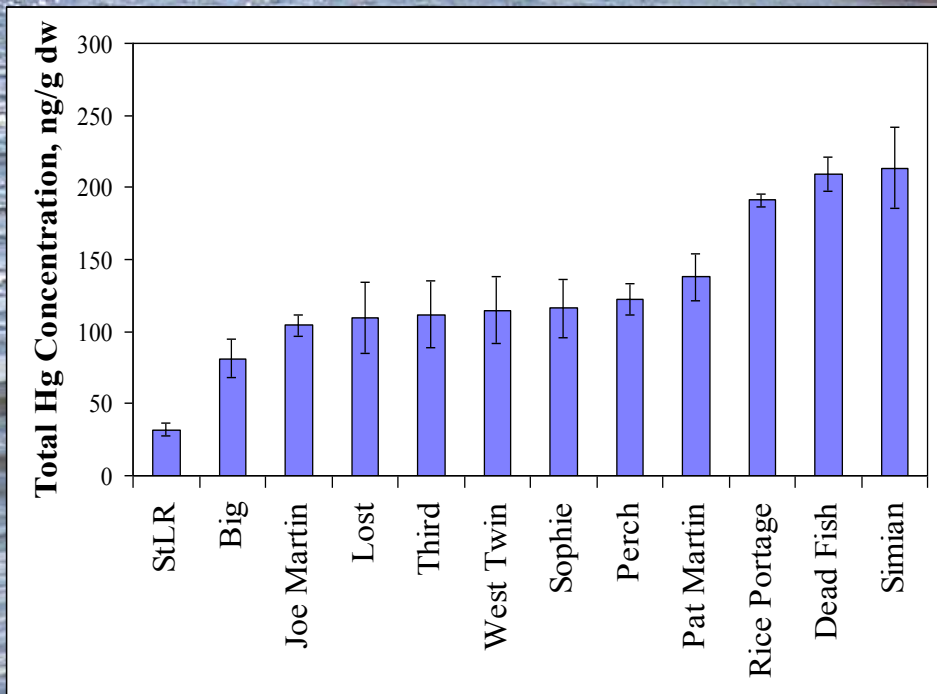














You can't see, smell or taste the mercury or PCBs in fish. That's why it's important to know which fish are safer than others to eat. Larger fish, older fish and fatty fish have higher amounts of contaminants. Fish that feed on other fish — such as walleyes, northern pike and bass — have the highest amounts of mercury in their meat.

**Remember the following tips when eating fish:**

- 1 Eat smaller fish.
- 2 Eat more panfish (sunfish, crappies) and fewer predator fish (walleyes, northern pike, lake trout).
- 3 Trim skin and fat, especially belly fat. Also, eat fewer fatty fish such as carp, catfish and lake trout. PCBs build up in fish fat. For instructions on cleaning and cooking fish properly, see the question and answer section inside this brochure.

**Safe Eating Guidelines: Special Populations**

For pregnant women, women who may become pregnant and children under age 15\*

**Kind of fish** **How often can you eat it?**

**Fish caught in Minnesota:**  
 Panfish (sunfish, crappie), perch, bullheads → 1 meal a week

Walleyes shorter than 20 inches, northern pike shorter than 30 inches, all sizes of other species → 1 meal a month

Walleyes longer than 20 inches, northern pike longer than 30 inches, muskellunge → **Do not eat.**

**Commercial fish:**  
 • Shark, swordfish, tile fish, king mackerel → **Do not eat.**  
 • Other commercial species, including canned tuna → See MDH's brochure,

*"An Expectant Mother's Guide to Eating Fond du Lac Fish," for guidelines.*

\* There is no change in these guidelines for eating fish just during vacation or one season.

**Special Note:**

Fish from certain Minnesota lakes and rivers are known to have higher levels of contaminants. Please contact the MDH for a copy of "Eat Fish Often? A Minnesota Guide to Eating Fish" for exceptions to these guidelines.

www.

Call or visit us on the Web:



Fond du Lac Environmental Program  
[www.fdlrez.com](http://www.fdlrez.com)  
 218/878-8010



1720 Big Lake Road  
 Cloquet, MN 55720

Fond du Lac Environmental Program



Minnesota Department of Health  
[www.health.state.mn.us](http://www.health.state.mn.us)  
 651/215-0950  
 1-800-657-3908  
 TDD: 651/215-0707

121 East Seventh Place, Suite 220  
 P.O. Box 64975  
 St. Paul, MN 55164-0975

Minnesota Department of Natural Resources  
[www.dnr.state.mn.us](http://www.dnr.state.mn.us)  
 651/296-6157  
 1-800-MINNDNR  
 TTY: 651/296-5484 or 1-800-657-3929

Printed on recycled paper  
 Artwork by Gordon L. Northbird, Jr.

September 2001

# Eat fish often?



A Fond du Lac Guide to Eating Fish



Mercury in fish collected in 2001, 2008; will update in 2015

Eco-ambassadors grant: FDLTCC  
 Collecting odonates for Hg analysis  
 (mercury bioaccumulation for St. Louis River TMDL)





**Wild rice lake  
Water level  
Monitoring and  
Management**

**Stream gauging for long term  
Hydrologic data collection;  
Track trends, climate change**





**Bathymetry – lake maps,  
AOC habitat classification**







26 3:01 PM



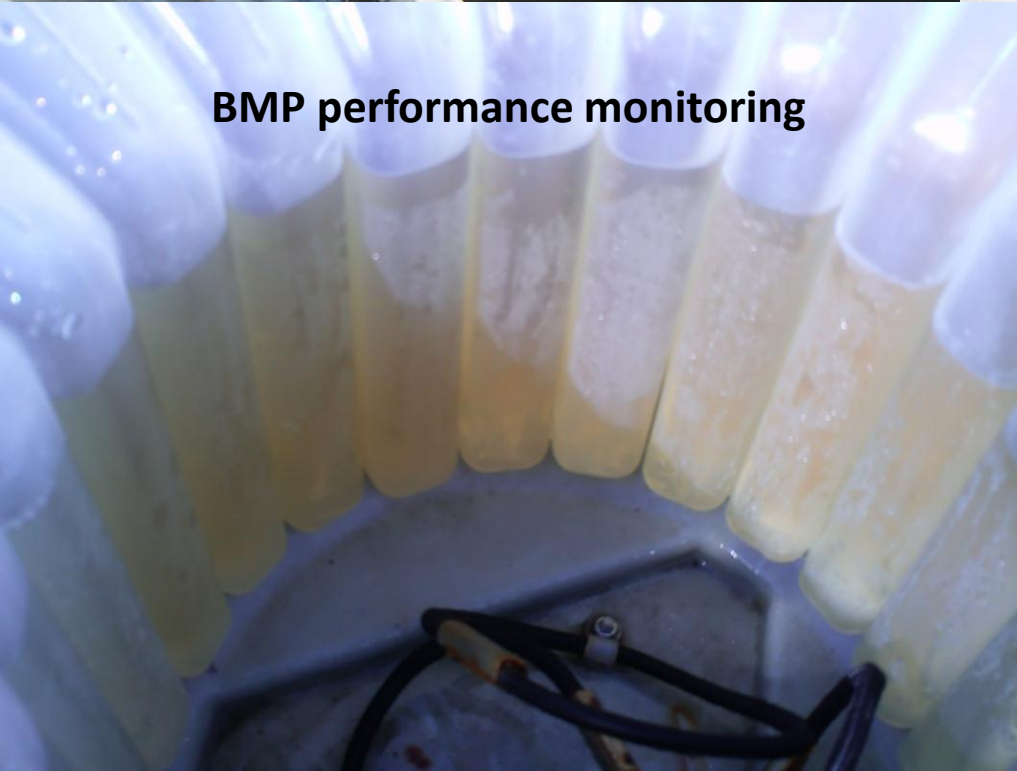
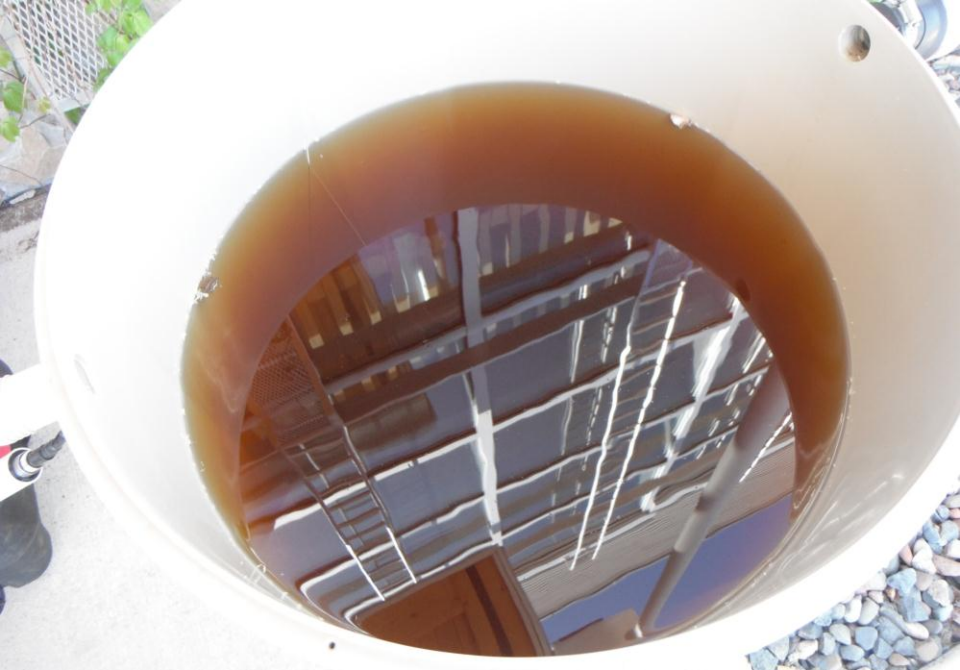






**Post-restoration monitoring**



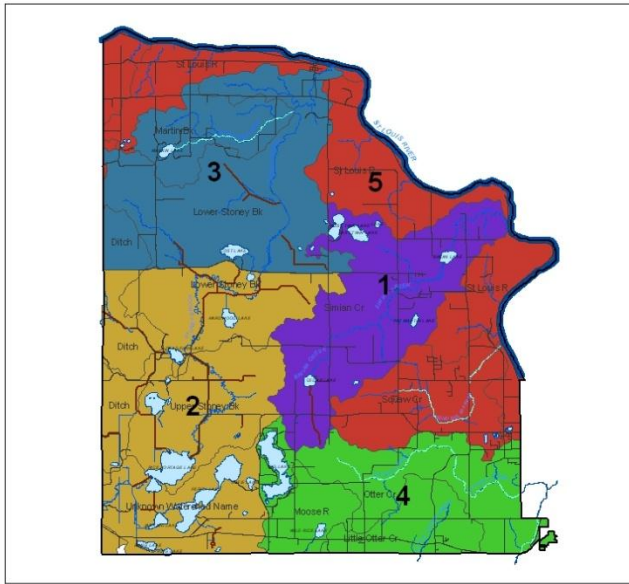


**BMP performance monitoring**





## Fond du Lac Reservation- Monitoring and Assessment Cycle



Legend	
	Boundary
	Roads
	Lakes
	Streams
	Rivers
	Designated Trout Streams
	Judicial Ditches
<b>Monitoring and Assessment Cycle</b>	
<b>YEARS</b>	
	1st
	2nd
	3rd
	4th
	5th

0 0.5 1 2 3 4 Miles



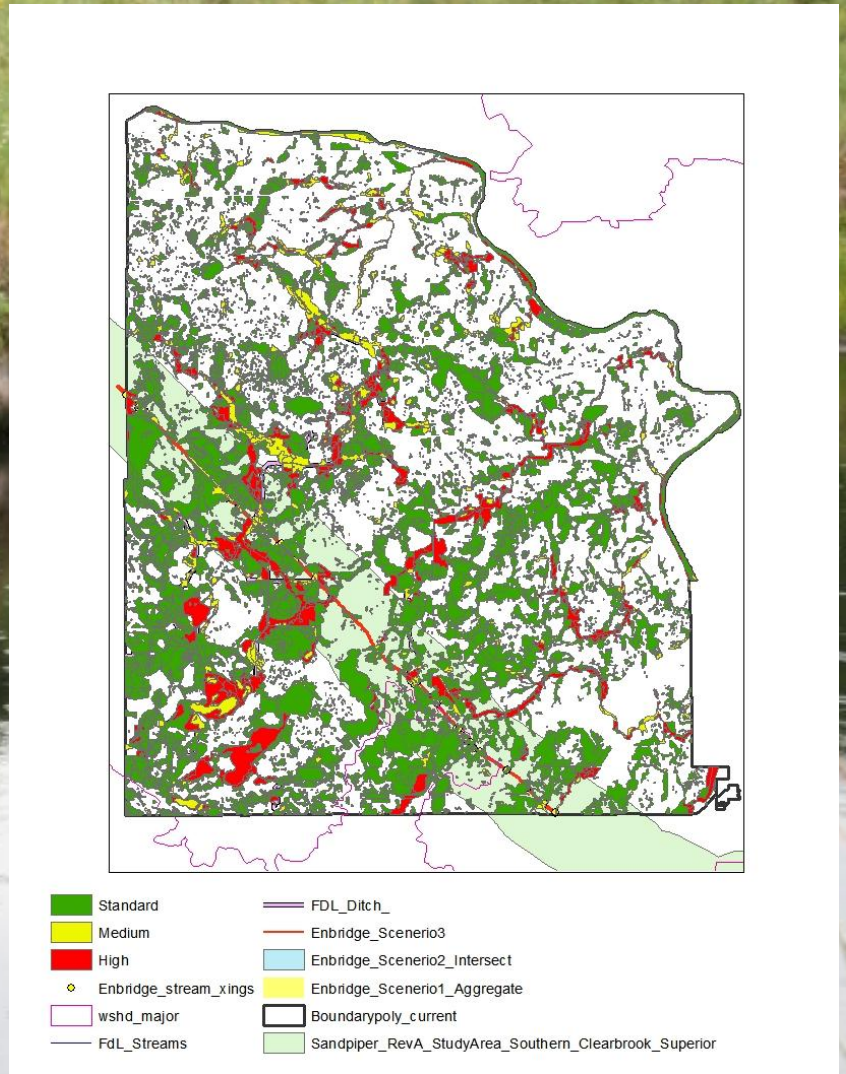
Disclaimer: FDLA does not express a formal opinion on the accuracy, completeness, or timeliness of the data provided. The map is provided as a reference only and does not constitute a warranty or any other form of insurance. The map is provided for informational purposes only and does not constitute a warranty or any other form of insurance.

Created by: S. Hagan (04/30/13)

## Wetland Functional Assessments








**Inspect Enbridge pipelines during construction; routine oversight**



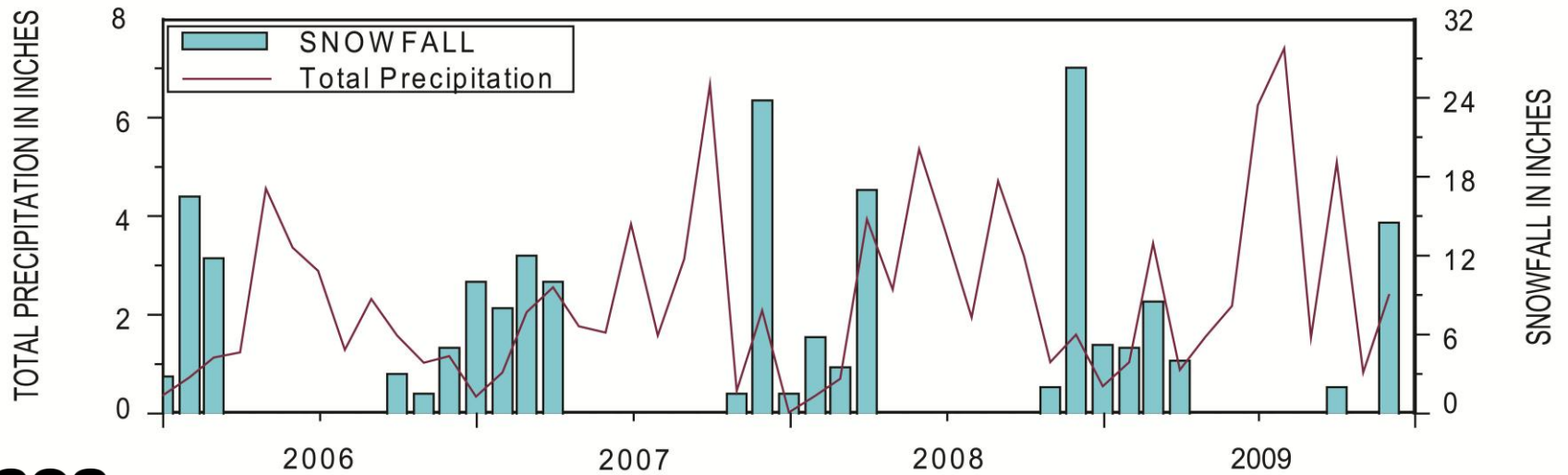
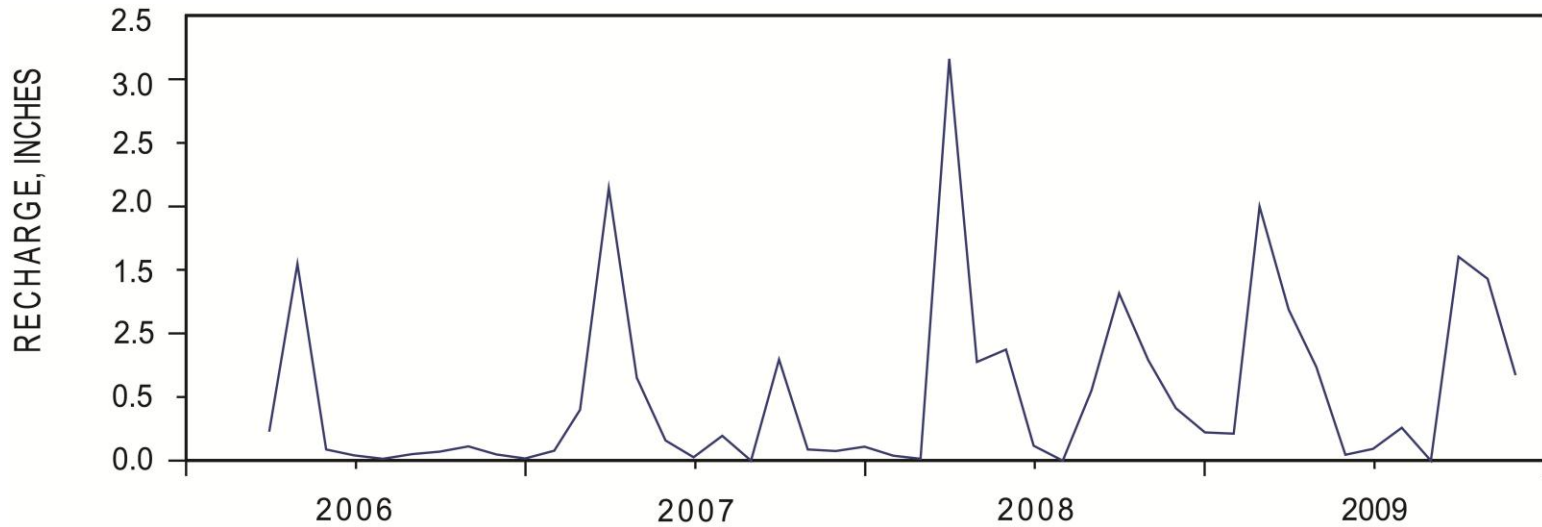


Stoney Brook Watershed Hydrologic Study



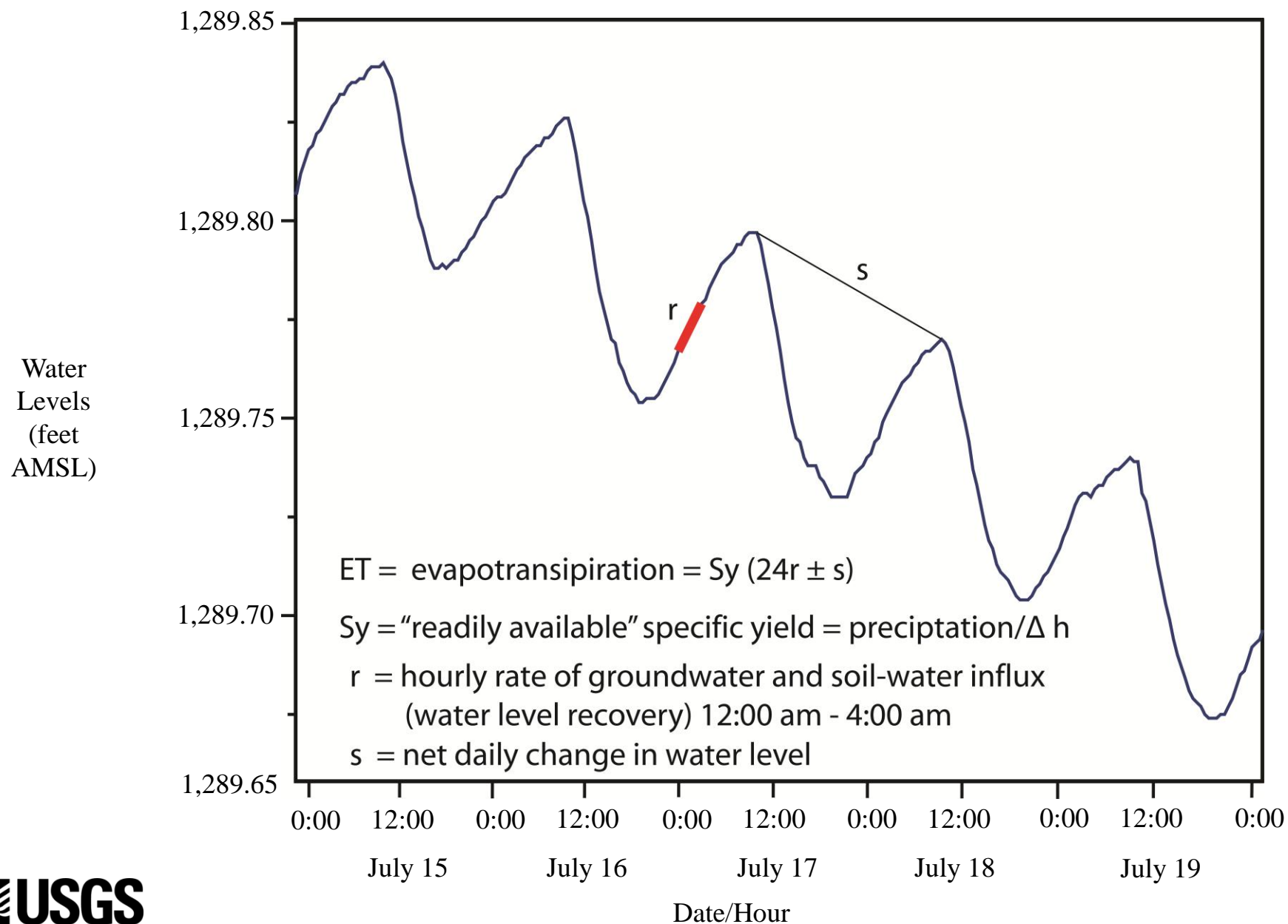
# Stoney Brook Watershed – Monthly Recharge Estimates and Precipitation

## Recharge Estimates from Baseflow Analysis of Streamflow



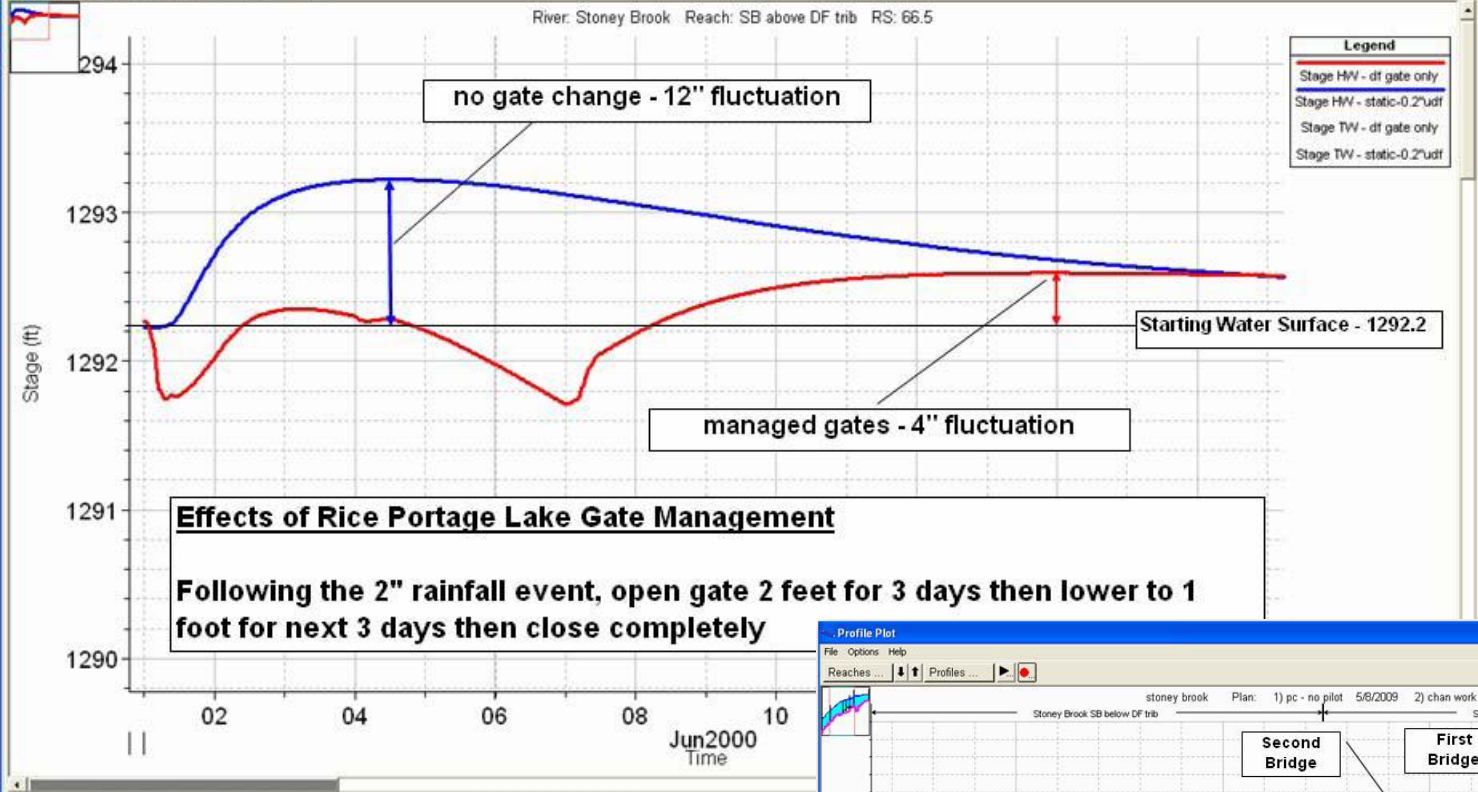


# Estimating Evapotranspiration from Groundwater levels - Monitoring Well 1

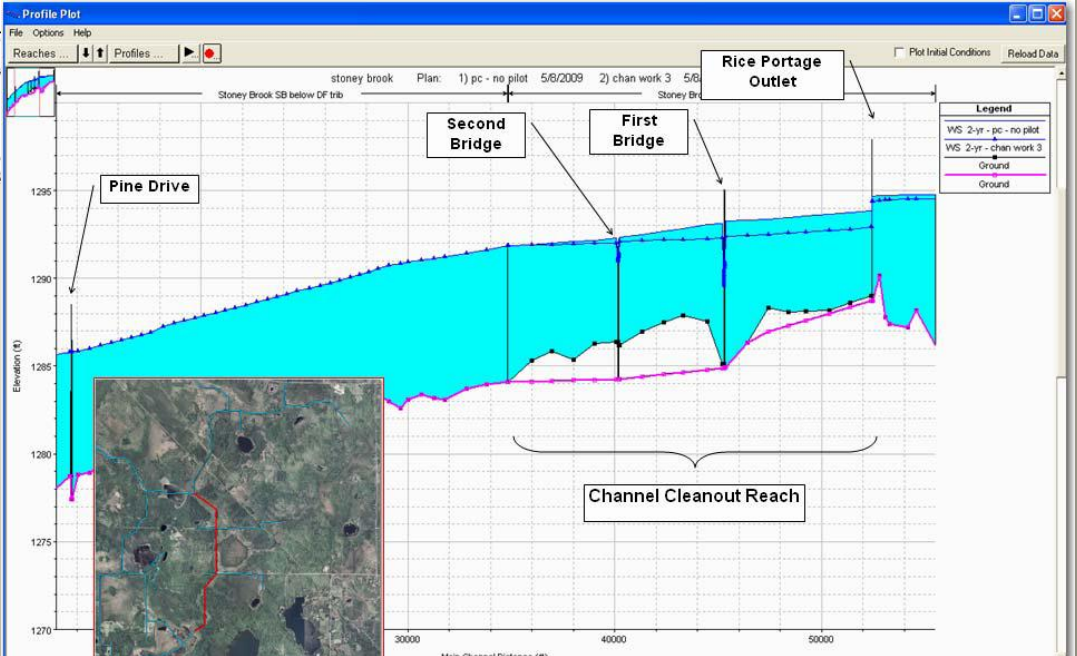




Time Series	Maximum	Time at Max	Volume(acre-ft)
1 static-0.2'udf:HW Stage	1293.22	04Jun2000 1330	
2 static-0.2'udf:TW Stage	1291.39	04Jun2000 1030	
3 static-0.2'udf:Flow	27.90	04Jun2000 1200	611.03



**HECRAS modeling informs water level management; ditch channel maintenance; potential restoration**



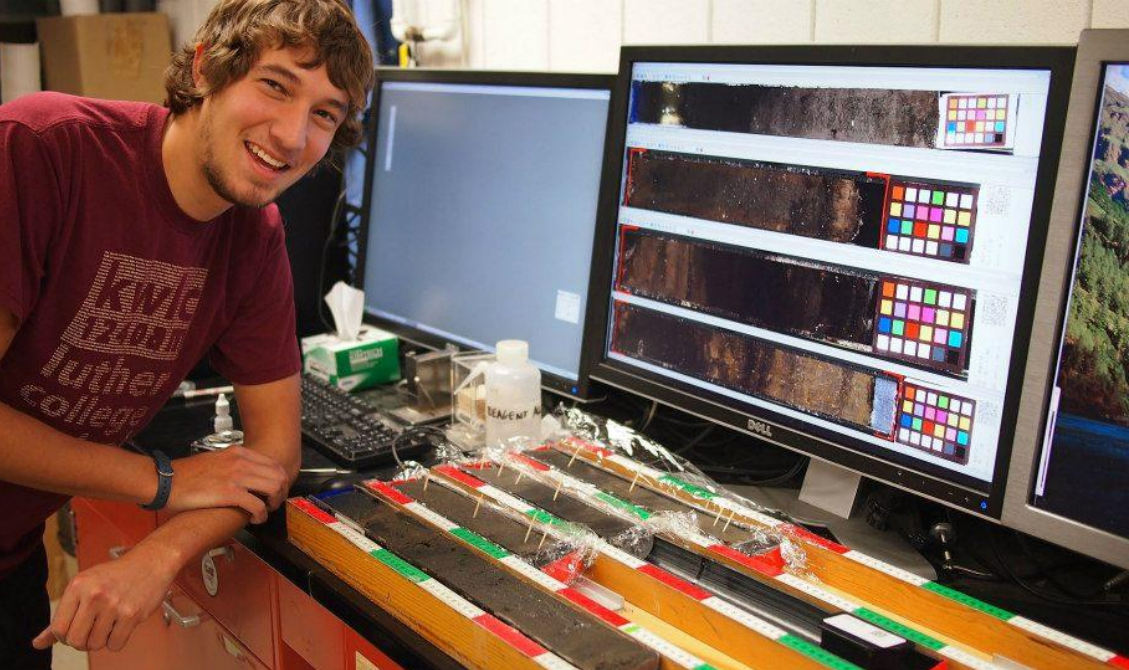




Lake sediment coring,  
paleoanalysis





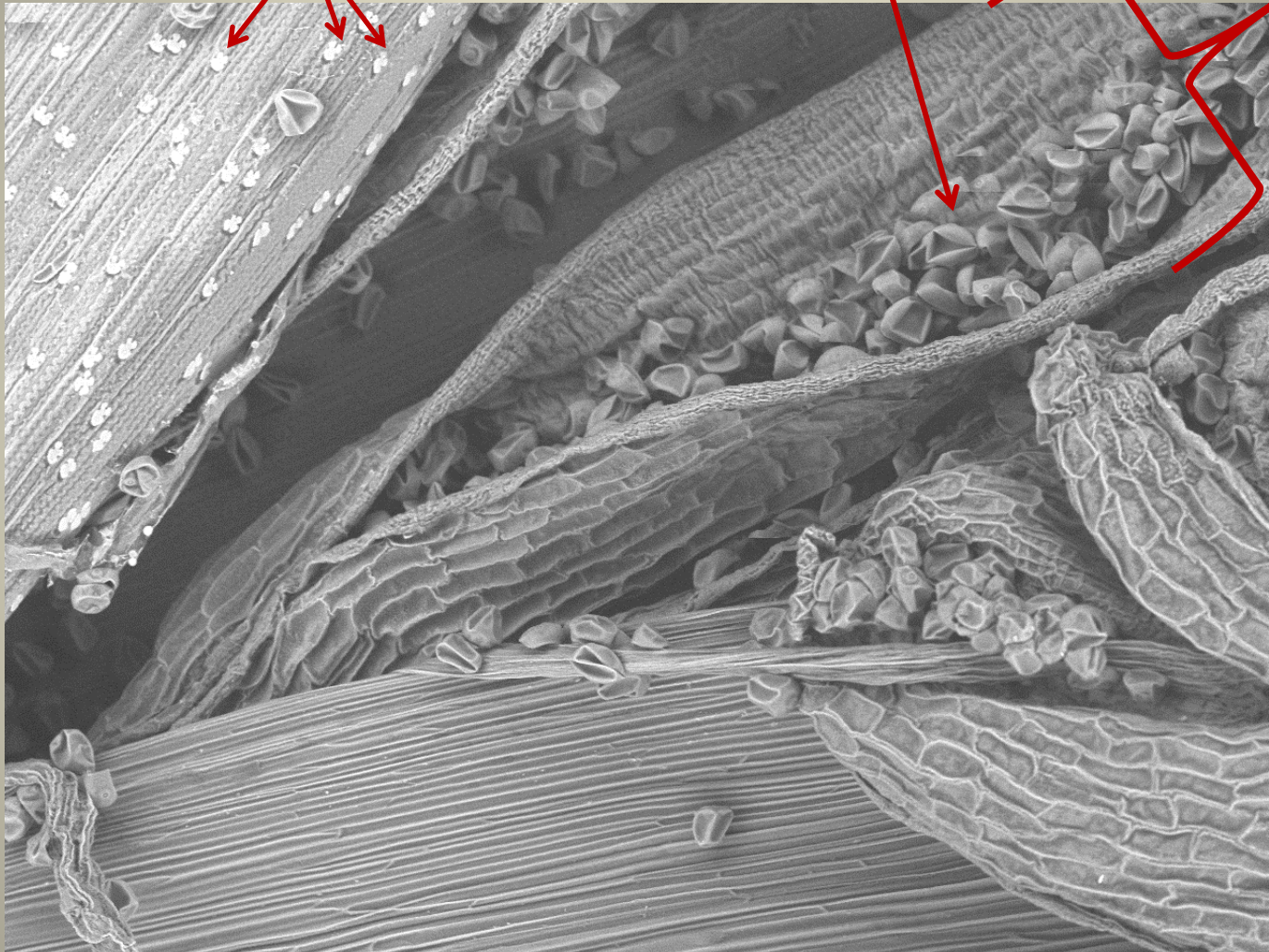




Phytoliths: silicified plant cells

Pollen

Floret



Wild rice flowers

2011/08/30 10:07 D2.4 x180 500 um

LacCore, University of MN

Photomicrograph by Matthew Weingart



P-2029

# TRACING THE HISTORY OF FOND DU LAC RESERVATION'S WILD RICE (ZIZANIA PALUSTRIS) LAKES THROUGH PHYTOLITHS

Authors: Sheldon Misquadee, Misty Rose Peterson, and Robert Thompson

Sponsoring Institution: Fond du Lac Band of Offshore Natural Resources, Fond du Lac Tribal and Community College, LaCrosse, University of Minnesota, NSF, NCED-REU



**Abstract:**  
Wild rice (Zizania palustris) is a native grass that grows in shallow water. It is a staple food for many Native American tribes. The history of wild rice in the Fond du Lac Reservation is being traced through phytoliths.

## Dead Fish Lake



## Perch Lake



## Rice Portage



## Results:

We found that surface levels of the lakes had few phytoliths, in strong contrast to the pebbles deposited lower in the lakes. The deposition of glass phytoliths mirrors that of pollen, and is thought to represent the abundance of wild rice in each of the lakes when rice is thought to decline. Dates representing open water increased. Taken together, this data may represent an increase in water depth which may inhibit the growth of rice.

**Method:**  
To trace a historical record of wild rice in the Fond du Lac Reservation, we collected sediment cores from three lakes: Dead Fish Lake, Perch Lake, and Rice Portage. The sediment cores were analyzed for phytoliths using scanning electron microscopy (SEM). The phytoliths were identified and counted. The sediment cores were dated using radiocarbon dating. The results show that the abundance of phytoliths in the sediment cores is highest in the pebbles and lowest in the surface sediments. This suggests that the abundance of wild rice in the lakes has increased over time.



Sheldon Misquadee



**Statewide wild rice stand  
density annual overflights**







**Partners:  
Region 5  
Manoomin  
Consortium**

**EPA National Environmental  
Information Exchange Network**

**GoldSystems: AWQMS Database**

Fond du Lac Band of Lake Superior Chippewa  
Forest County Potawatomi Community  
Grand Portage Band of LSC  
Hannahville Indian Community  
Lac du Flambeau Band of LSC  
Lac Courtes de Oreilles Band  
Lac Vieux Desert Band of LSC  
Little Traverse Bay Band of Odawa Indians  
Little River Band of Ottawa Indians  
Lower Sioux Indian Community  
Menominee Indian Tribe of Wisconsin  
Mille Lacs Band of Ojibwe  
Nottawaseppi Huron Band of the Potawatomi  
Prairie Island Indian Community  
Red Cliff Band of Lake Superior Chippewa  
Red Lake Band of Chippewa  
Bad River Band of Lake Superior Chippewa  
Sault Ste. Marie Tribe of Chippewa Indians  
Sokaogon Chippewa Community  
St. Croix Chippewa Indians of Wisconsin  
1854 Treaty Authority

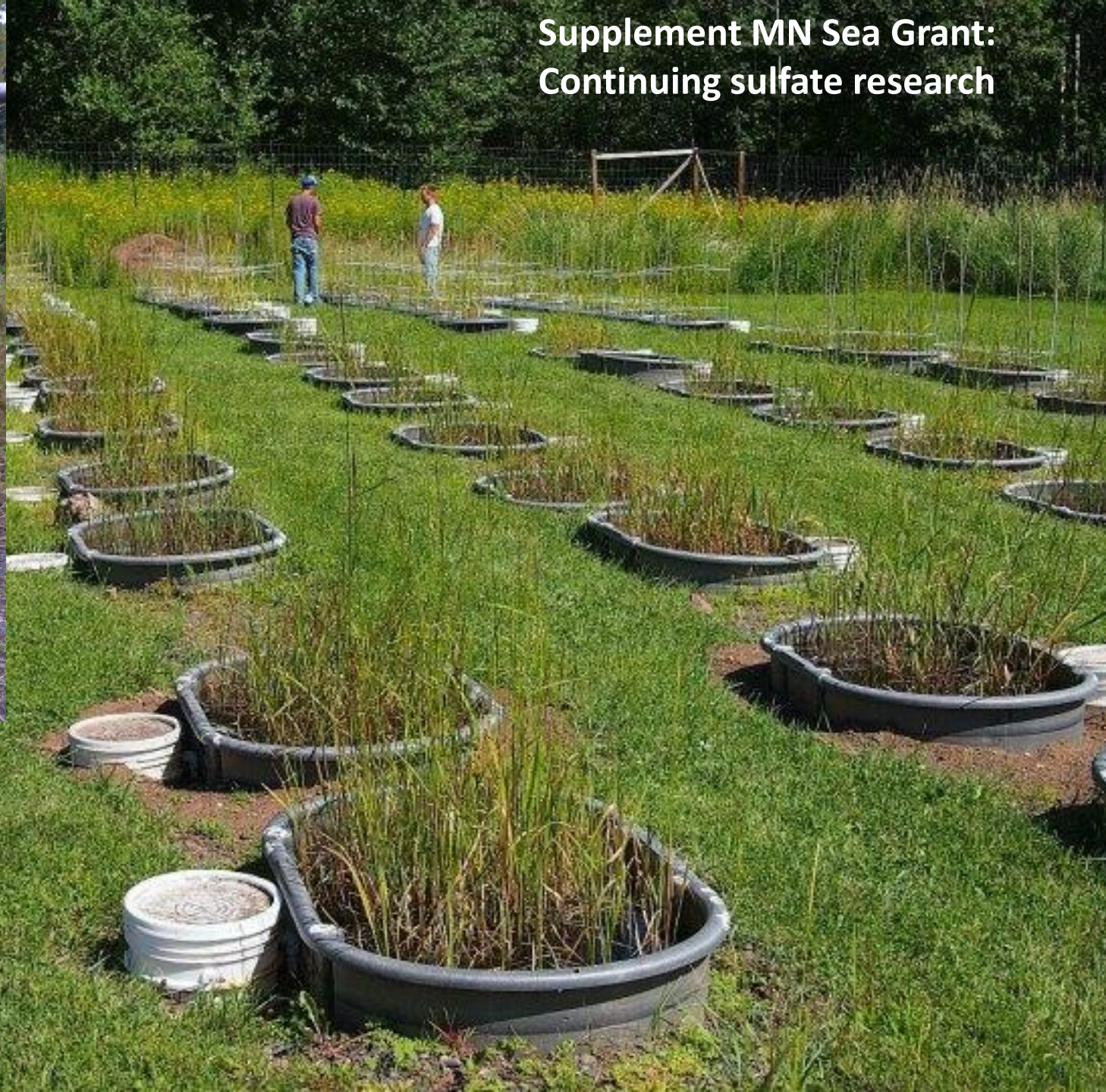


## Wild Rice Stand Density, Biomass Surveys





**Supplement MN Sea Grant:  
Continuing sulfate research**





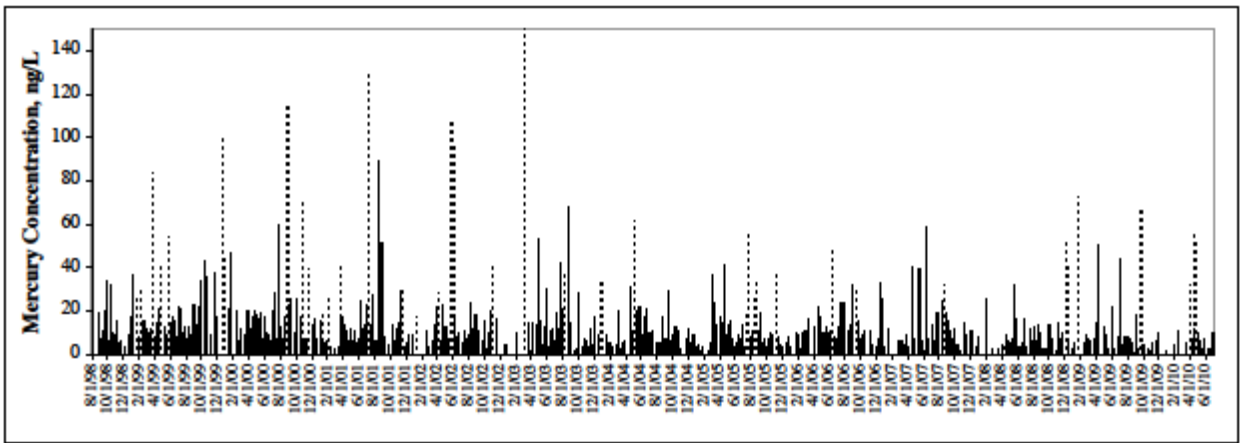


Figure 1. Weekly concentrations of total Hg in precipitation collected near Cloquet, MN. Dotted bars represent events of less than 0.1 cm precipitation depth.

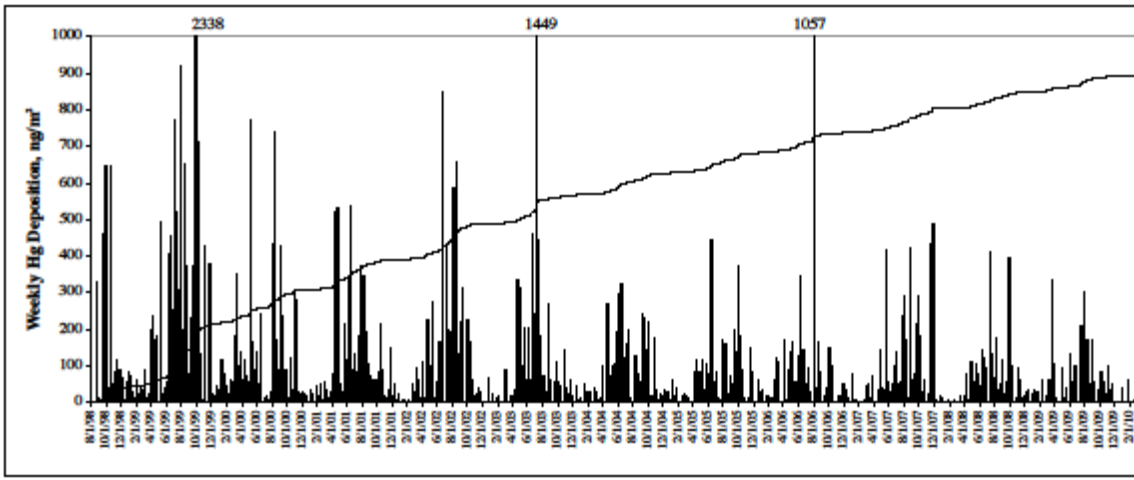


Figure 2. Weekly (bars) and cumulative (line) wet deposition of total Hg collected near Cloquet, MN.

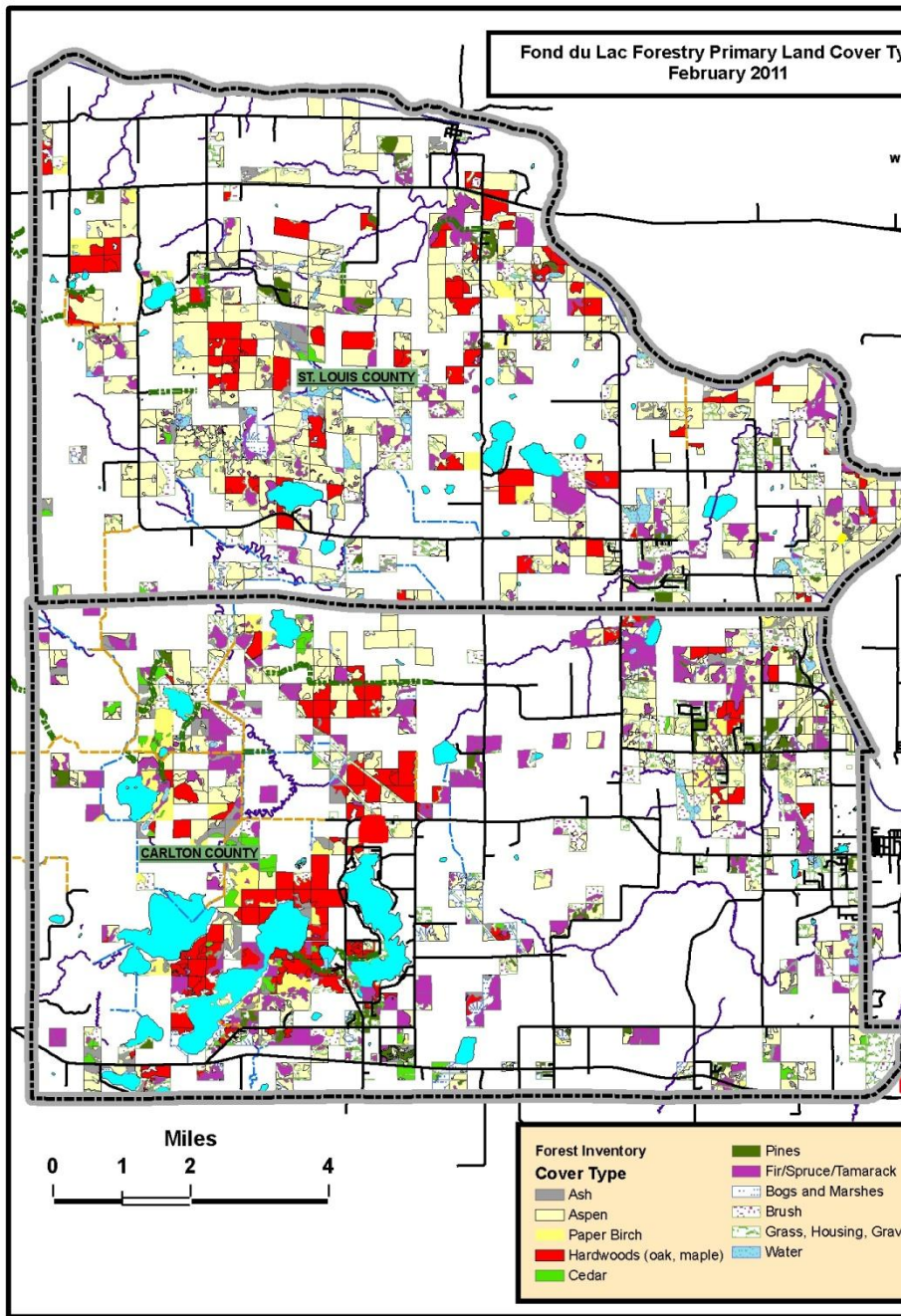


Mercury weekly wet deposition monitoring since 1997



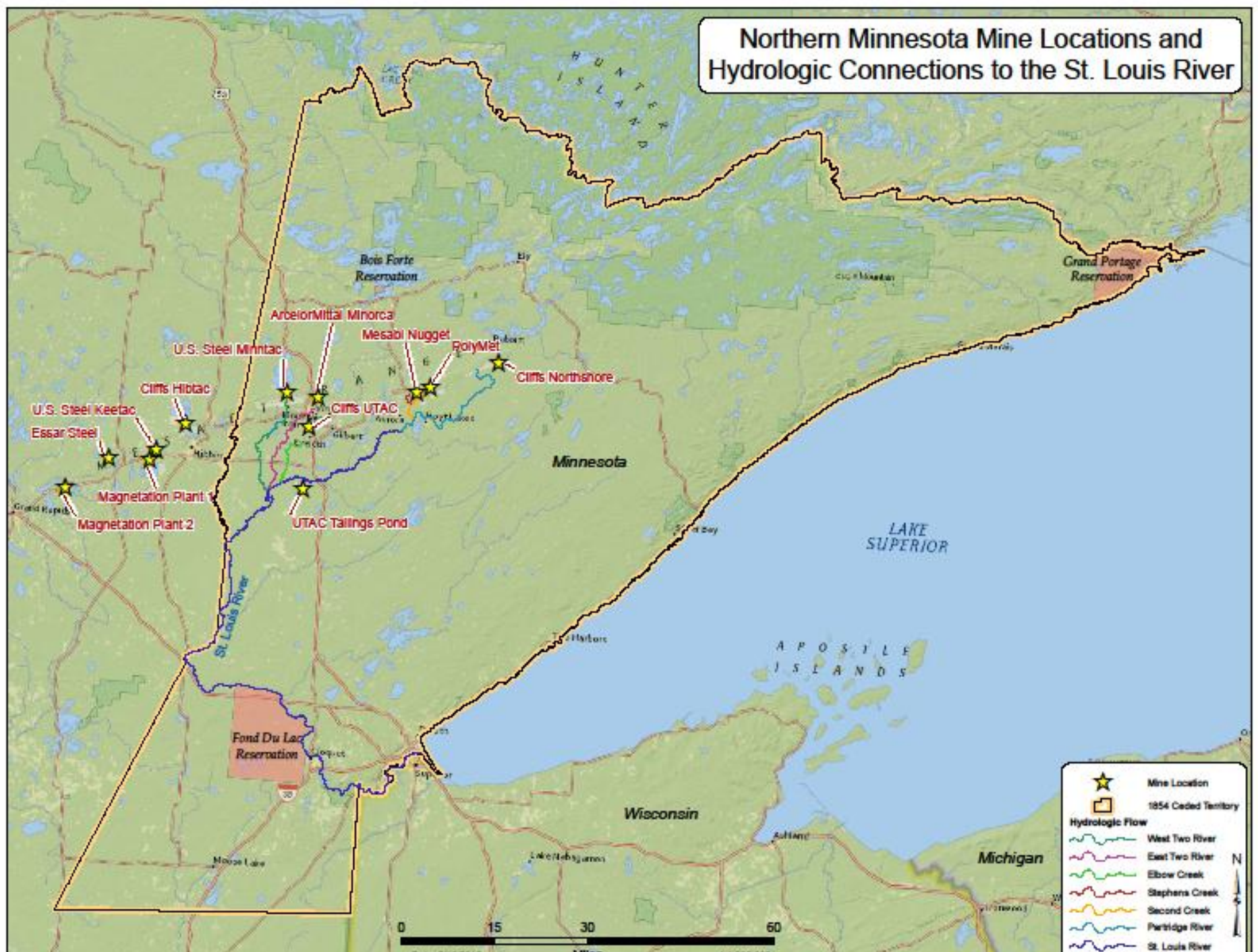








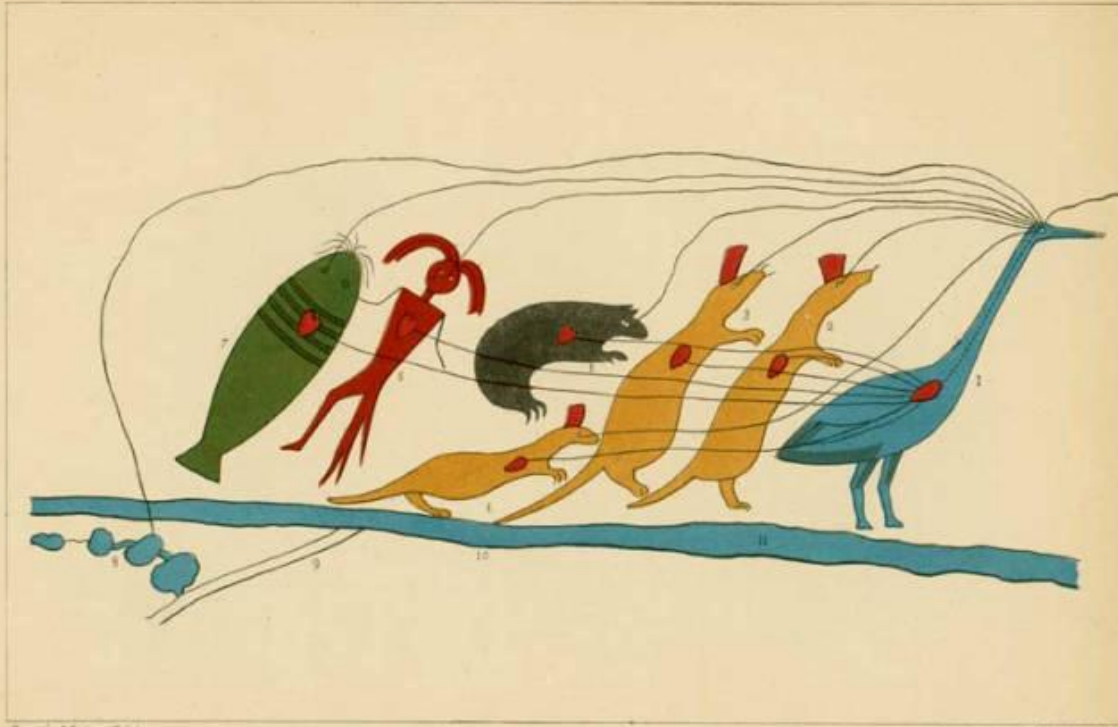
# Northern Minnesota Mine Locations and Hydrologic Connections to the St. Louis River



	Mine Location
	1854 Ceded Territory
<b>Hydrologic Flow</b>	
	West Two River
	East Two River
	Elbow Creek
	Stephens Creek
	Second Creek
	Pertridge River
	St. Louis River

0 15 30 60 Miles  
 Date: 3/16/2013 1:1 200,000





Drawn by S. Eastman, U.S.A.

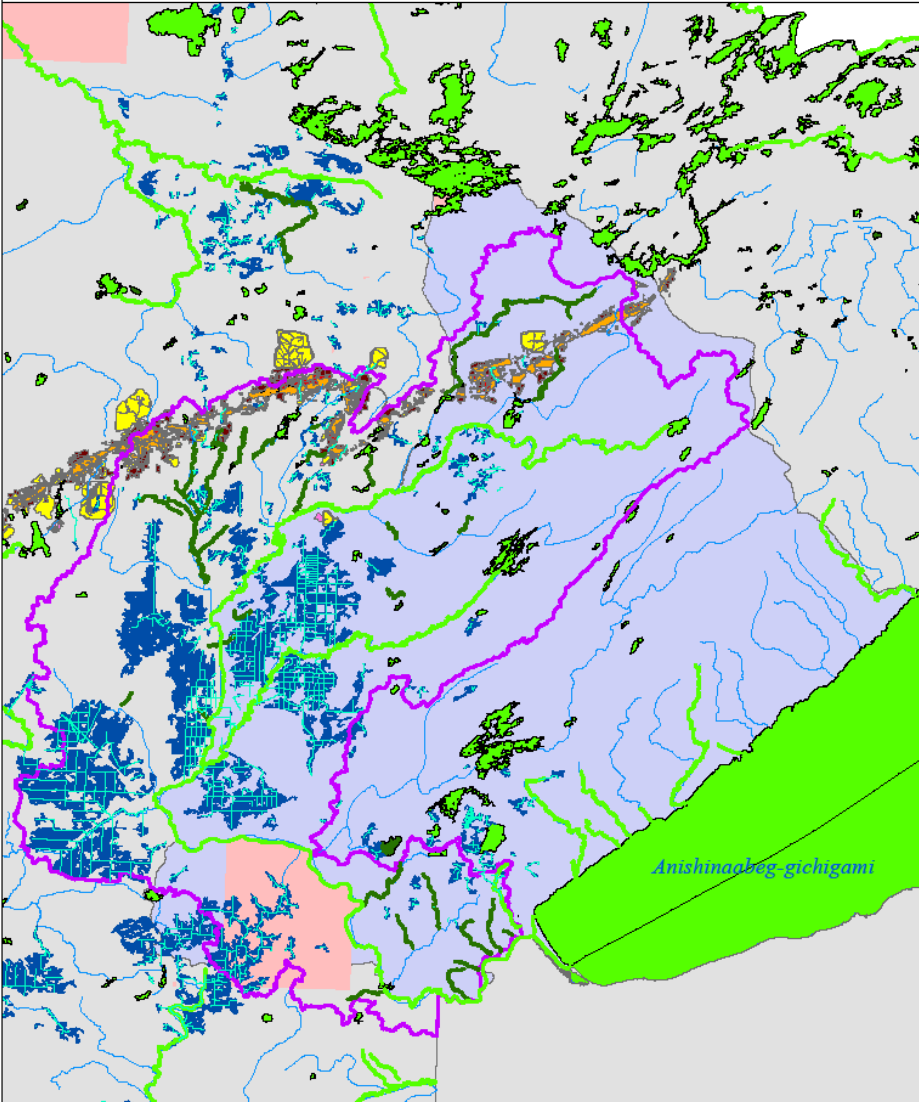
Printed in London by G. S. Taylor, Pall Mall.

SYMBOLIC PETITION OF CHIPPEWA CHIEFS,  
presented at Washington, January 28<sup>th</sup> 1849, headed by Oshcabawis of Monomonecan, Wisconsin.

**Tribal Cumulative Effects Analysis  
NorthMet Mining Project and Land Exchange  
September 2013**

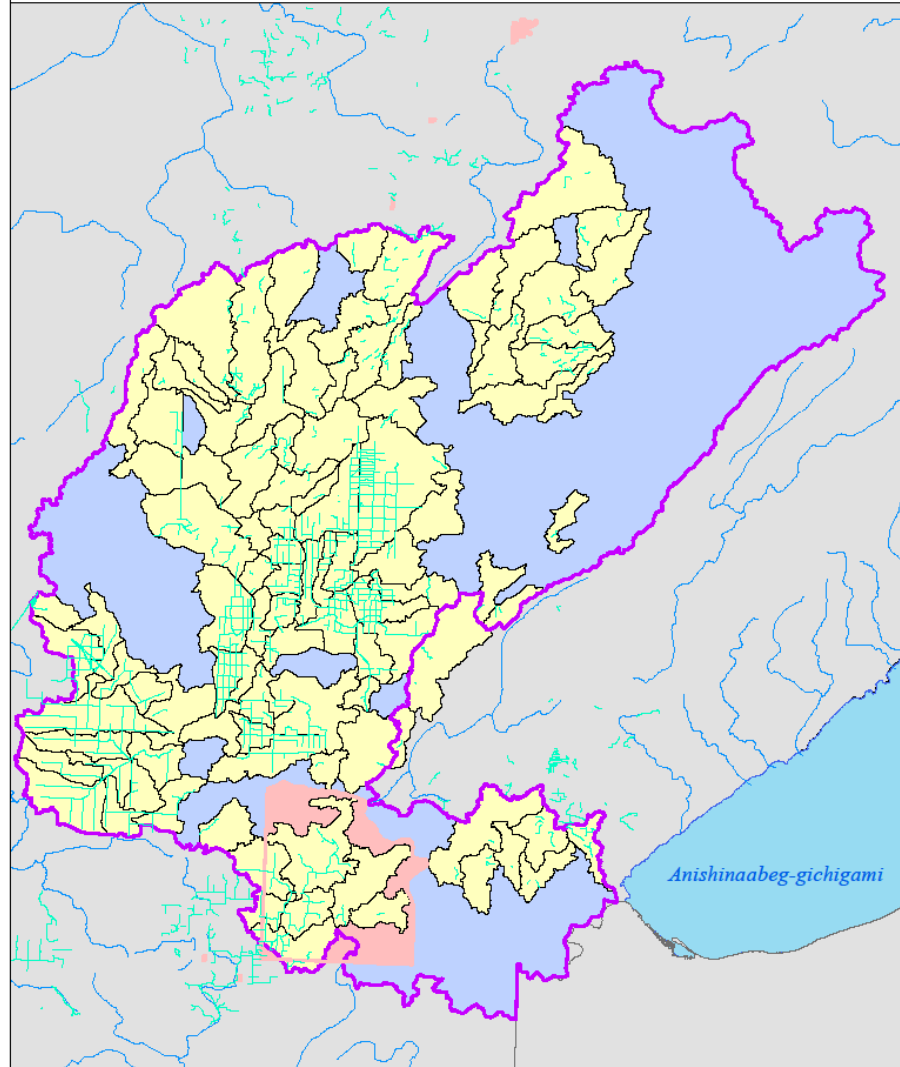


# St. Louis River Watershed and Tribal Historic District: Cumulative Hydrologic Impacts



Hydrography	Mining Features	Tribal Land
<ul style="list-style-type: none"> <li><span style="border: 1px solid purple; display: inline-block; width: 15px; height: 10px; margin-right: 5px;"></span> St. Louis River Watershed</li> <li><span style="border-bottom: 1px solid cyan; width: 15px; margin-right: 5px;"></span> Drainage Ditches</li> <li><span style="background-color: blue; width: 15px; height: 10px; margin-right: 5px;"></span> Wetland Impacted by Drainage Ditches</li> <li><span style="border-bottom: 1px solid green; width: 15px; margin-right: 5px;"></span> Impaired Streams - 2010 List</li> <li><span style="border-bottom: 1px solid darkgreen; width: 15px; margin-right: 5px;"></span> Impaired Streams - 2012 List</li> <li><span style="background-color: lightgreen; width: 15px; height: 10px; margin-right: 5px;"></span> Impaired Lakes - 2010 List</li> <li><span style="background-color: darkgreen; width: 15px; height: 10px; margin-right: 5px;"></span> Impaired Lakes - 2012 List</li> </ul>	<ul style="list-style-type: none"> <li><span style="background-color: red; width: 15px; height: 10px; margin-right: 5px;"></span> in-pit stockpiles</li> <li><span style="background-color: pink; width: 15px; height: 10px; margin-right: 5px;"></span> other related features</li> <li><span style="background-color: orange; width: 15px; height: 10px; margin-right: 5px;"></span> pits</li> <li><span style="background-color: brown; width: 15px; height: 10px; margin-right: 5px;"></span> stockpiles</li> <li><span style="background-color: yellow; width: 15px; height: 10px; margin-right: 5px;"></span> tailings basins</li> </ul>	<ul style="list-style-type: none"> <li><span style="background-color: lightblue; width: 15px; height: 10px; margin-right: 5px;"></span> Tribal Historic District</li> <li><span style="background-color: lightcoral; width: 15px; height: 10px; margin-right: 5px;"></span> Tribal Reservation</li> </ul> <p style="font-size: small;">Tribal land boundaries are representations and may not be the actual legally binding boundaries.</p>

# St. Louis River Sub-watershed impacted by Ditching



Hydrography	Tribal Land
<ul style="list-style-type: none"> <li><span style="border-bottom: 1px solid cyan; width: 15px; margin-right: 5px;"></span> Drainage Ditches</li> <li><span style="background-color: yellow; width: 15px; height: 10px; margin-right: 5px;"></span> Watershed Impacted by Drainage Ditches</li> <li><span style="border: 1px solid purple; display: inline-block; width: 15px; height: 10px; margin-right: 5px;"></span> St. Louis River Watershed</li> <li><span style="border-bottom: 1px solid blue; width: 15px; margin-right: 5px;"></span> Major River</li> </ul>	<ul style="list-style-type: none"> <li><span style="background-color: lightcoral; width: 15px; height: 10px; margin-right: 5px;"></span> Tribal Reservation</li> </ul> <p style="font-size: x-small;">Tribal land boundaries are representations and may not be the actual legally binding boundaries.</p>



## Specific conductance downstream of mine point discharges (1990-2013)

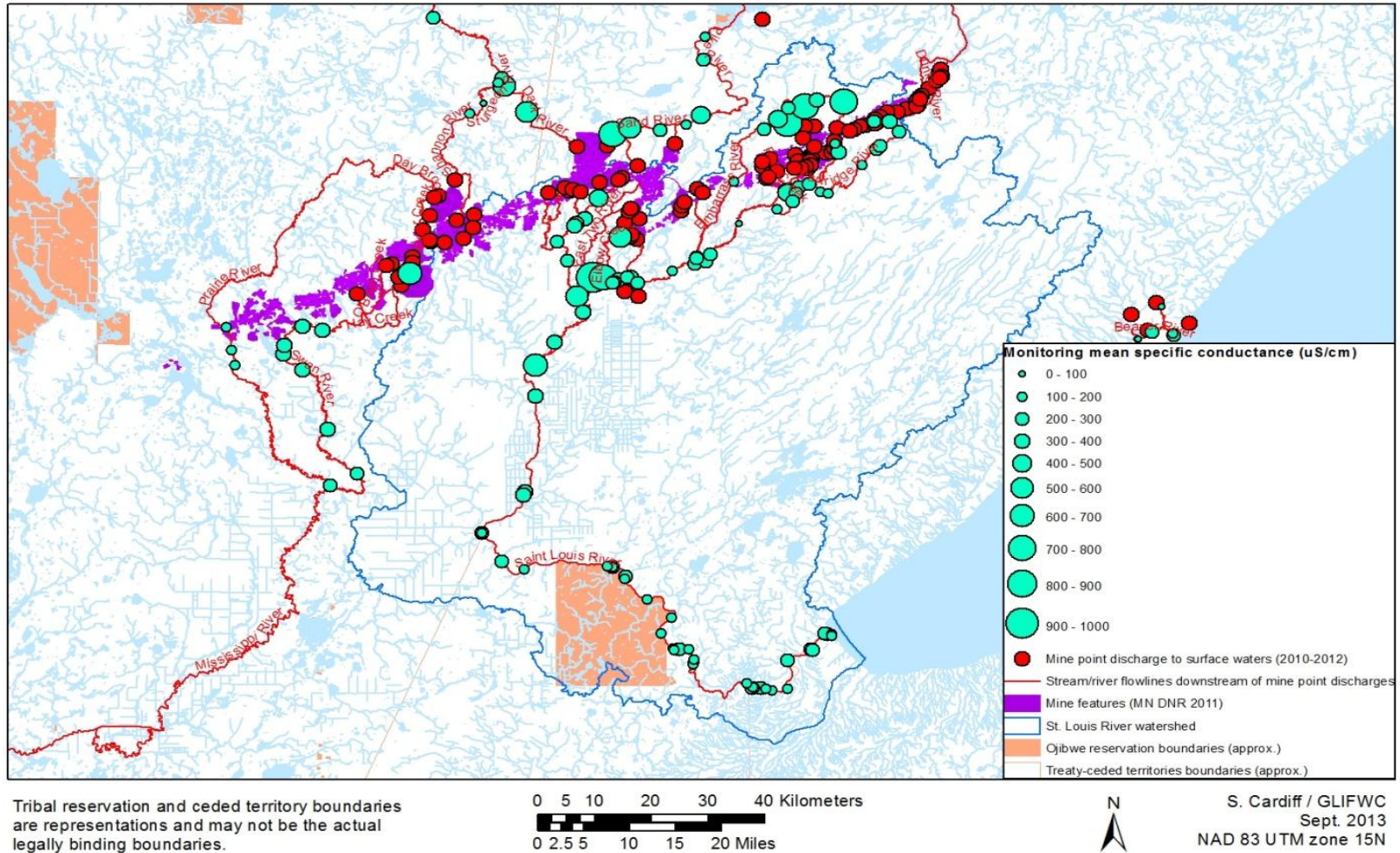
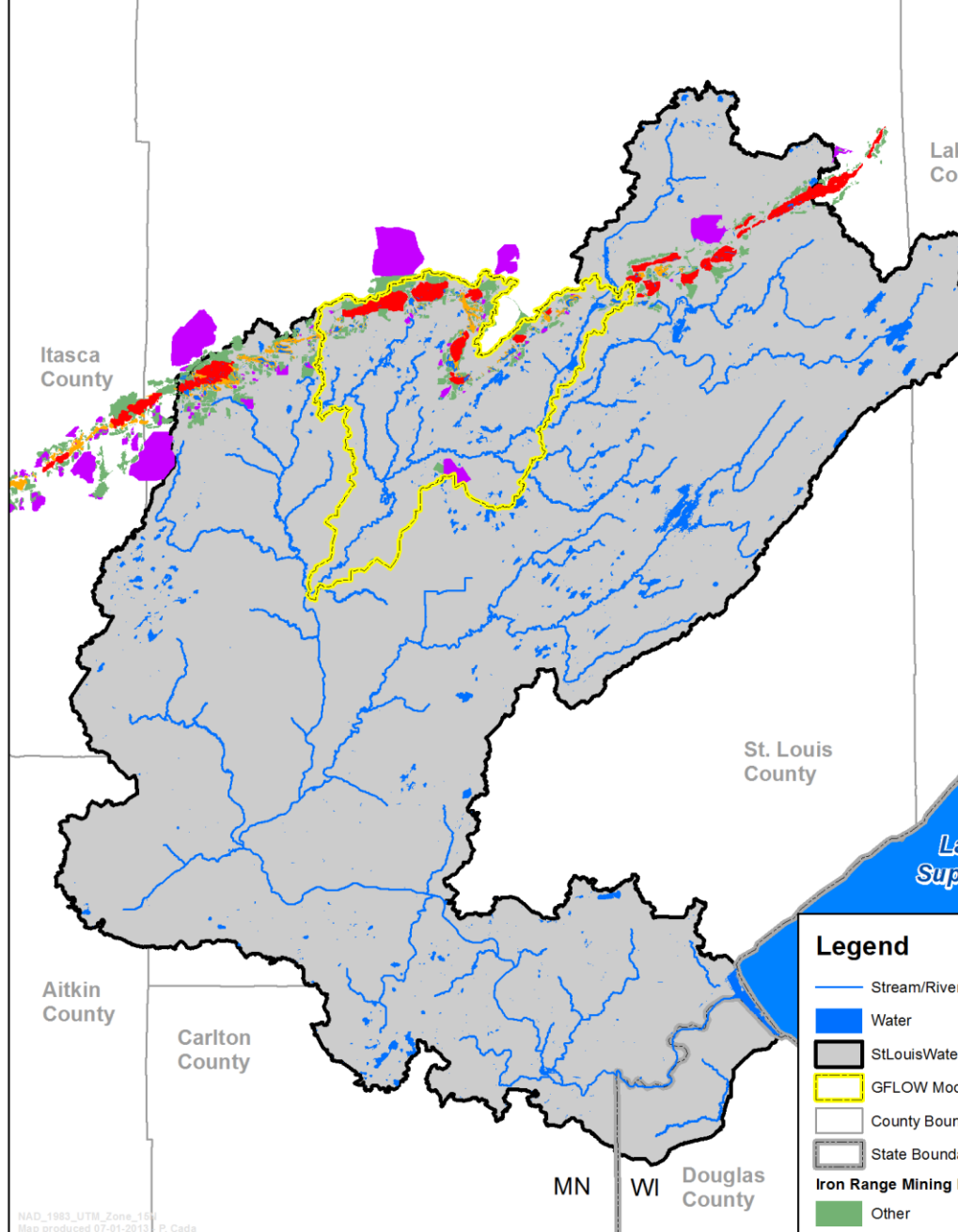
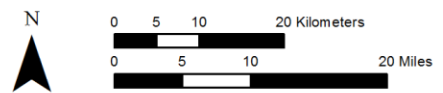


Figure 4. Mean specific conductance measurements at monitoring stations downstream of mine point discharges were inversely related to distance downstream from mine point discharge sites.



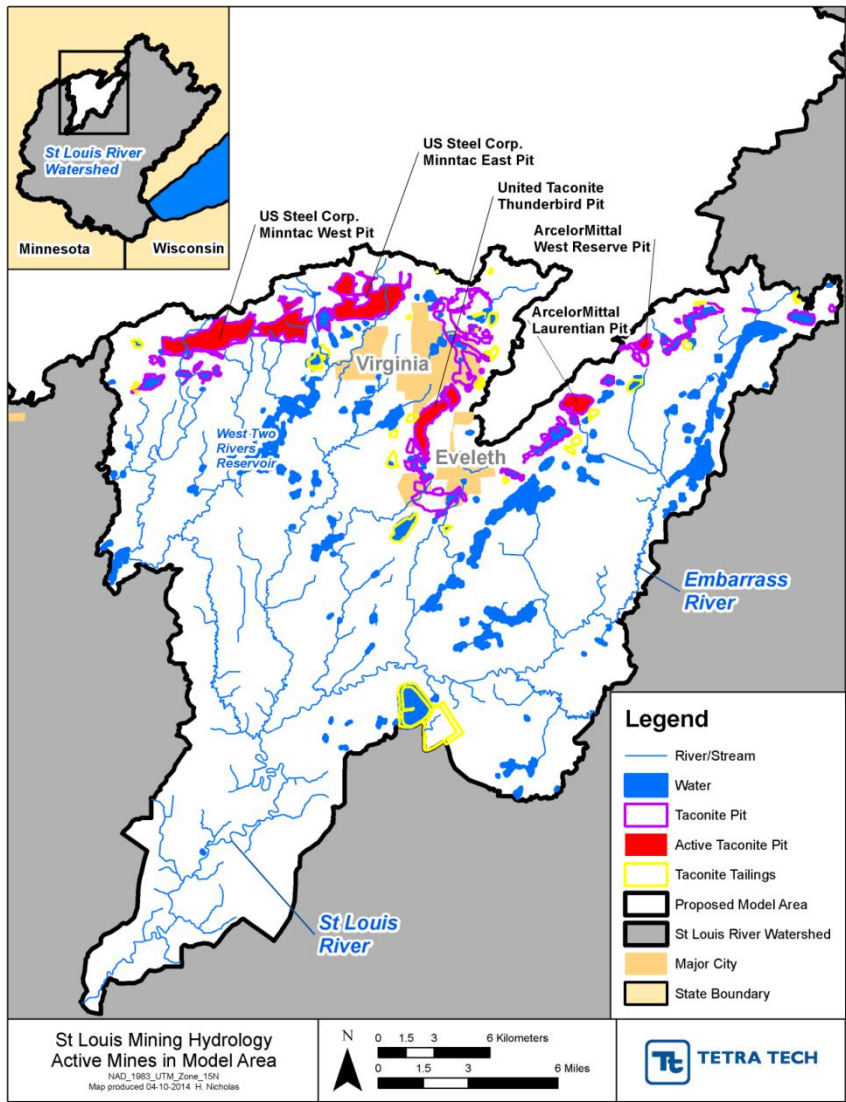


NAD\_1983\_UTM\_Zone\_15N  
Map produced 07-01-2013 J. P. Cade



### Legend

- Stream/River
- Water
- StLouisWatershed
- GFLOW Model Extent
- County Boundary
- State Boundary
- Iron Range Mining Features**
- Other
- Natural Ore Pit
- Taconite Pit
- Taconite Tailings



### St. Louis Mining Hydrology Active Mines in Model Area

NAD\_1983\_UTM\_Zone\_15N  
Map produced 04-10-2014 H. Nicholas



### Legend

- River/Stream
- Water
- Taconite Pit
- Active Taconite Pit
- Taconite Tailings
- Proposed Model Area
- St. Louis River Watershed
- Major City
- State Boundary



# Extend GFLOW modeling to eastern Iron Range





Entering The  
Lake Superior  
Basin

St. Louis River Watershed

Migwiich!

A RUFFY  
Migwiich  
State Park Service  
Adopt, UCC