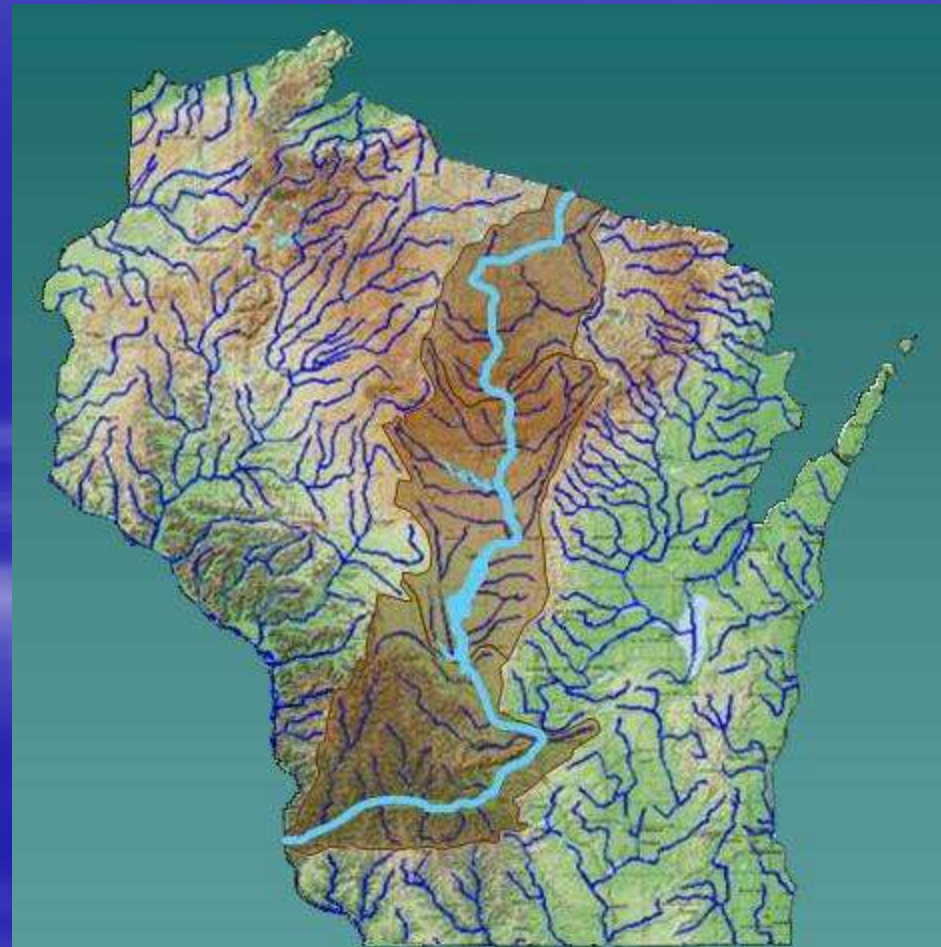


Monitoring for Phosphorus and Developing TMDLs for Reservoirs in the Wisconsin River Basin

Ken Schreiber
Wis. Dept. of Natural
Resources



Wisconsin River TMDL

- What is a TMDL?
- Study scope
- Monitoring strategy
- Sampling results
- Timeline



What is a TMDL?

- TMDL = Total Maximum Daily Load
- A TMDL is the amount of a pollutant a waterbody can receive before exceeding water quality standards.
- Focus of Wis. River TMDL is phosphorus



What is a TMDL?

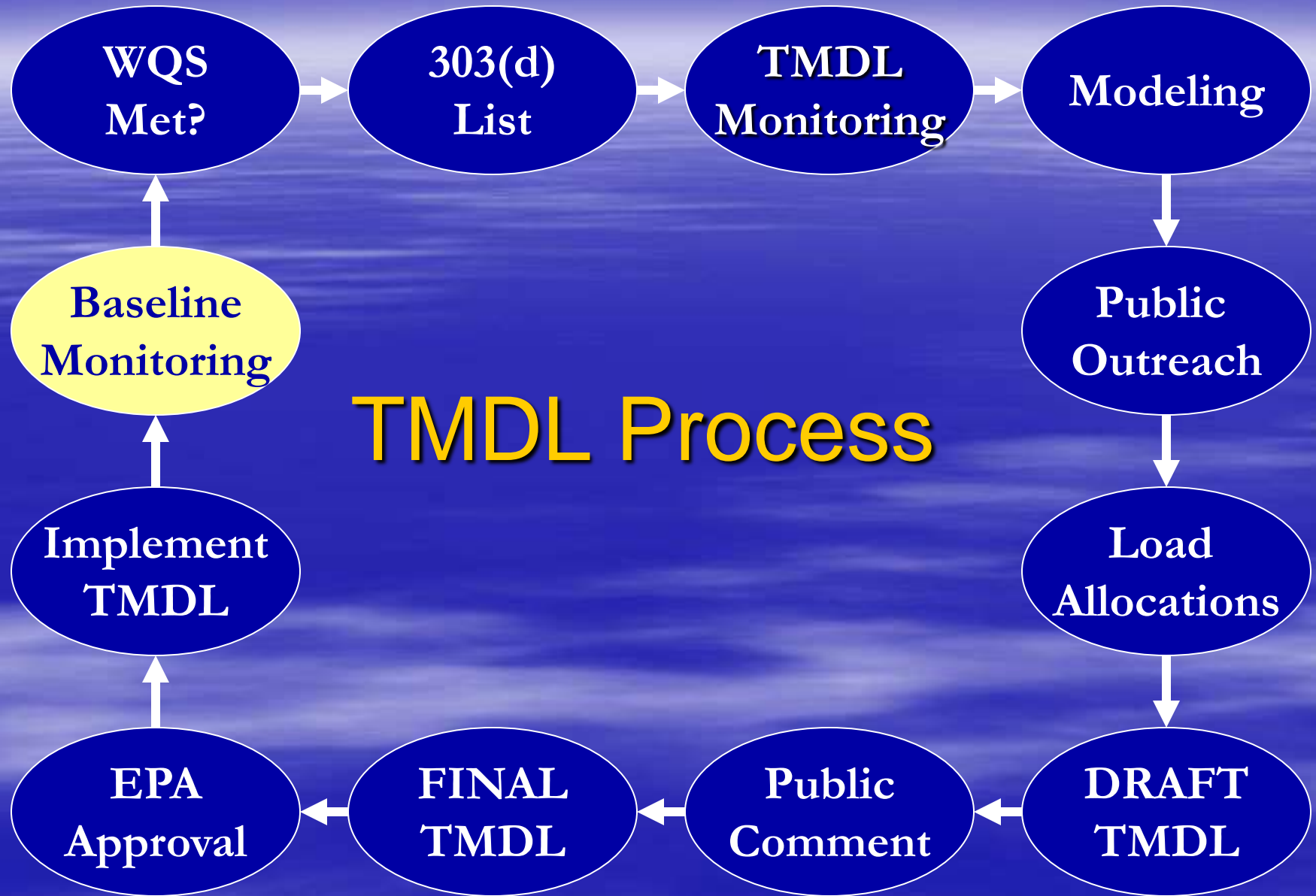
$$\text{TMDL} = \text{LA} + \text{WLA} + \text{MOS}$$

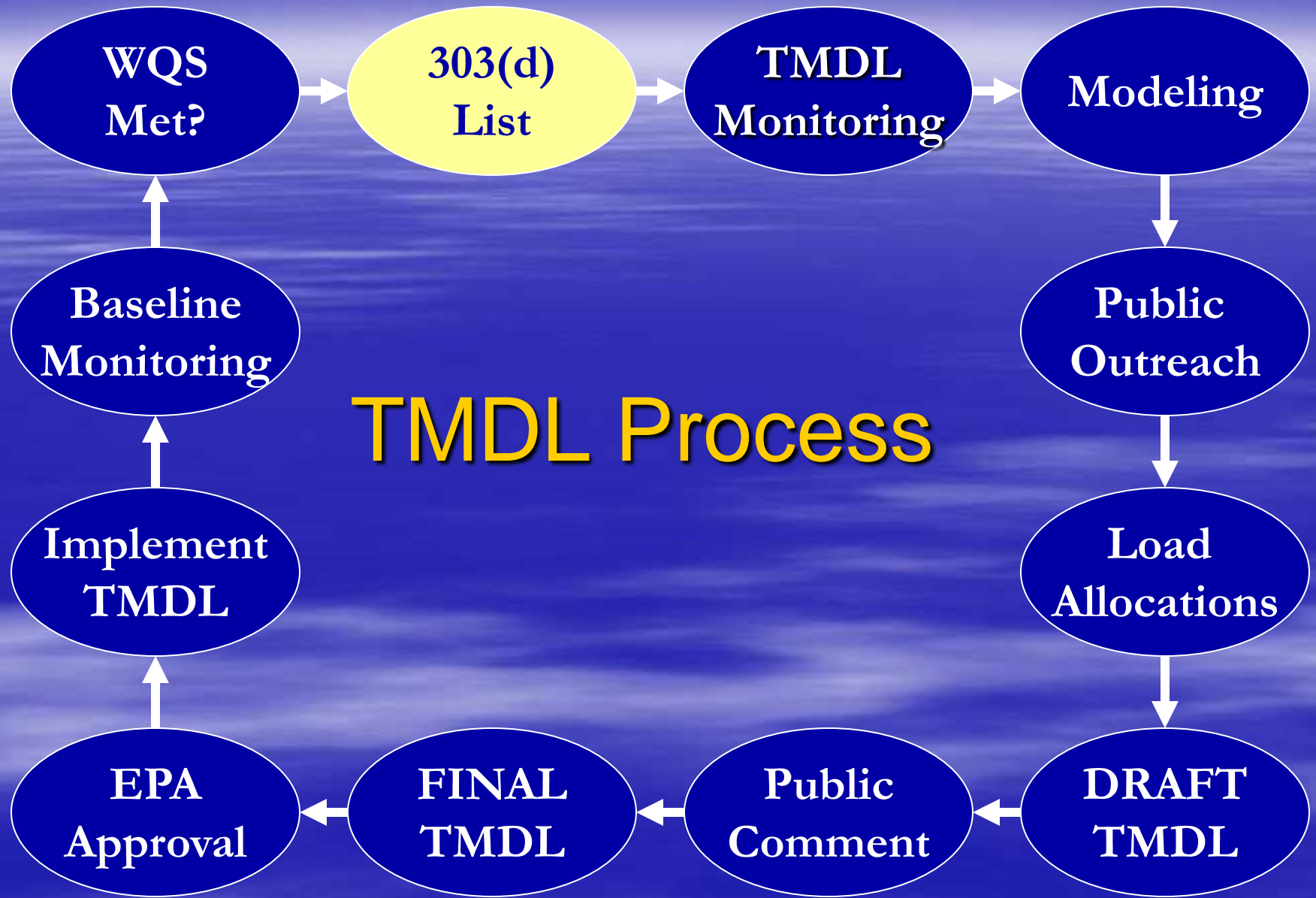
LA = Load Allocation
(Nonpoint Sources)

WLA = Wasteload
Allocation (Point Sources)

MOS = Margin of Safety

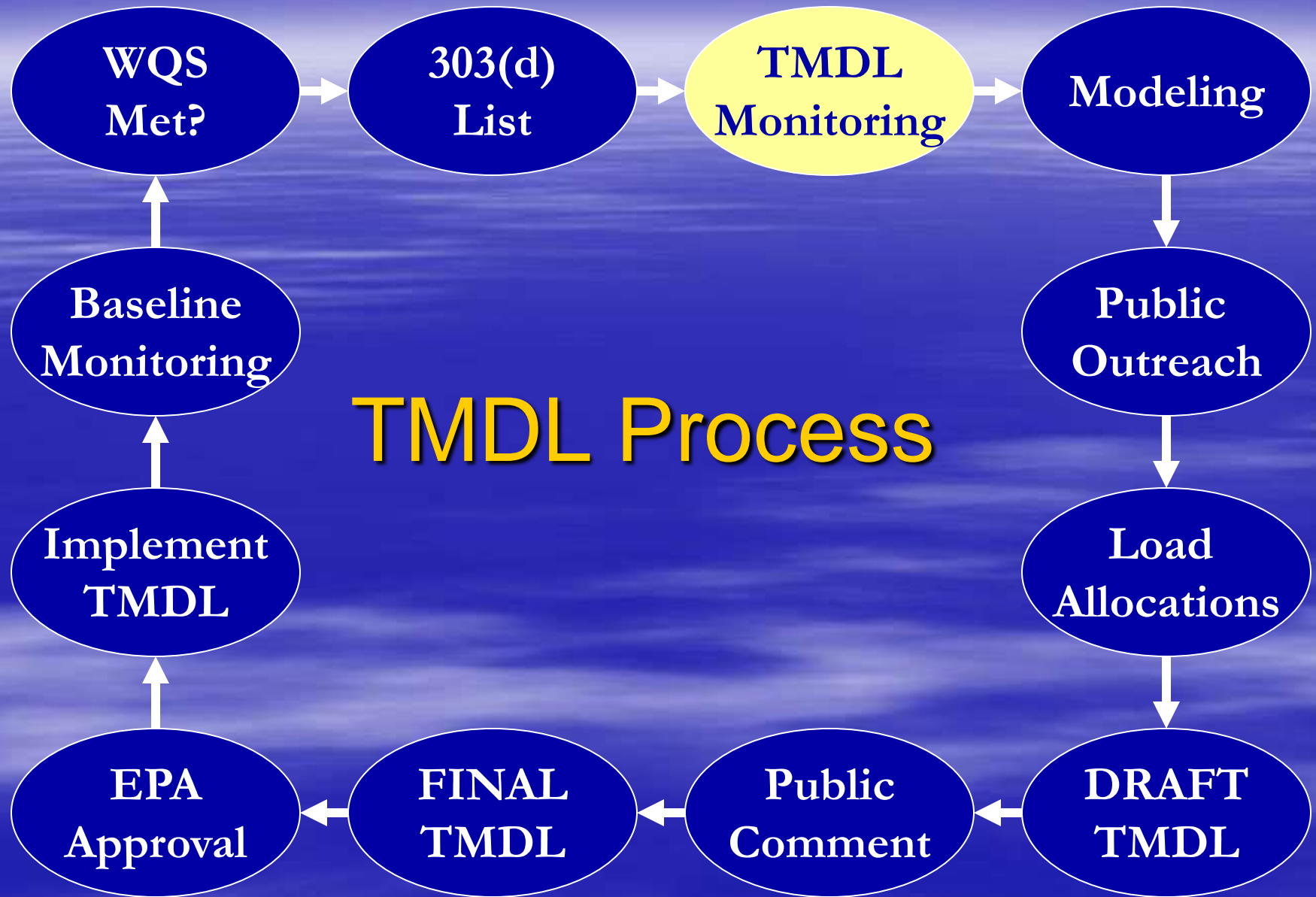






Wisconsin River Basin Impaired Water (303d) Listings

Waterbody	Impairment	Pollutant
Big Eau Pleine Flowage	Low DO, Eutrophication	Phosphorus
Mill Creek	Low DO	Phosphorus
Petenwell Flowage	Low DO, Eutrophication	Phosphorus
Lake Dexter	Eutrophication	Phosphorus
Castle Rock Flowage	Low DO, Eutrophication	Phosphorus
Lake Wisconsin	Low DO, Eutrophication	Phosphorus



TMDL Process

Wisconsin River TMDL Water Quality Study

Objectives:

- Collect water quality information from major tributary inflows, Wisconsin River main stem and major impoundments.
- Measure background, point and nonpoint source loads to the Wisconsin River from Tomahawk to the Prairie du Sac dam.
- Develop watershed and reservoir/river models to forecast water quality responses to loading reduction scenarios.
- Develop technically sound TMDLs for the major Wisconsin River reservoirs.

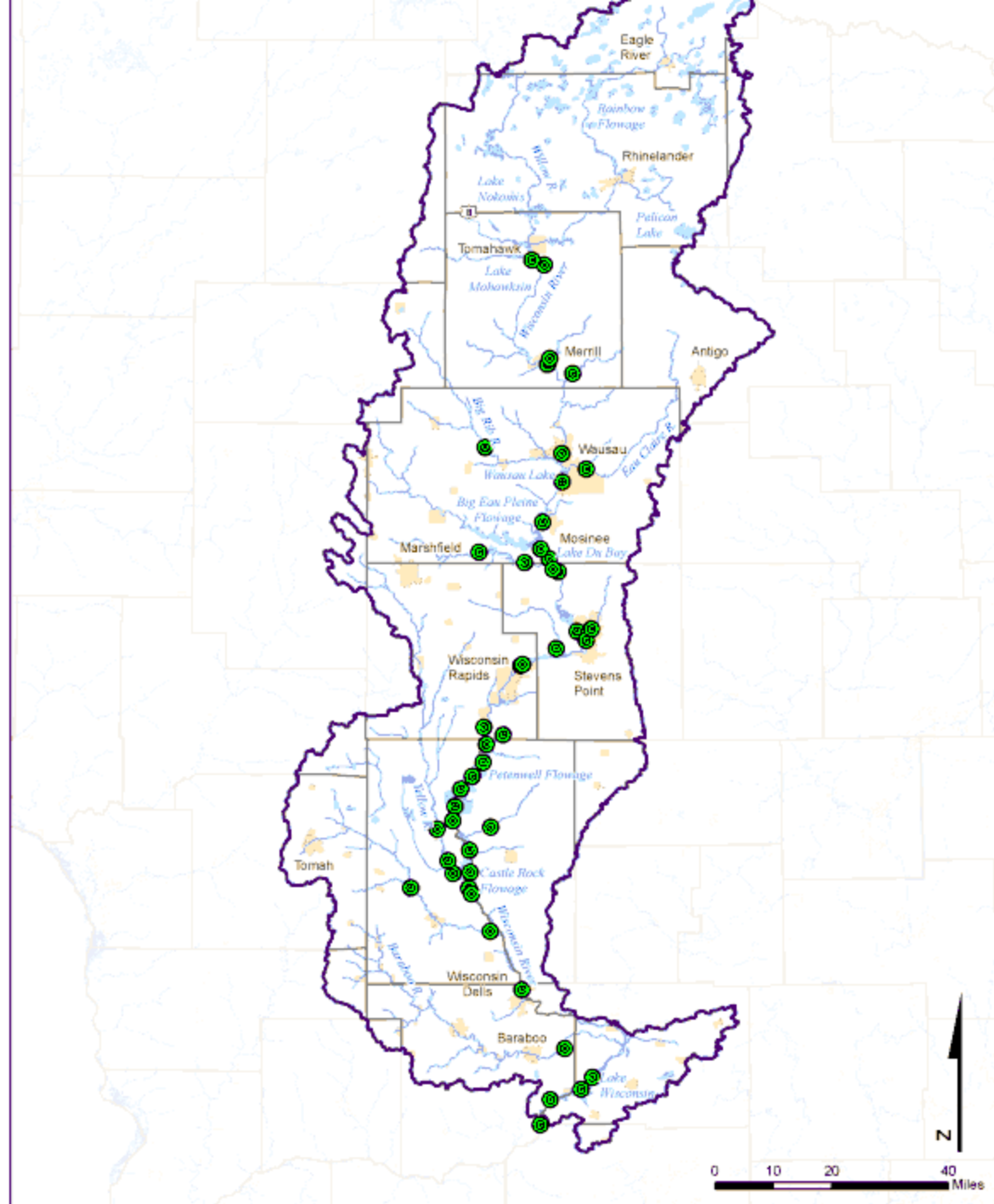
Wisconsin River TMDL Water Quality Monitoring Strategy

- Sample Wisconsin River, major tributaries and reservoirs for three years beginning in November 2009.
- Collect semi-monthly samples from river and stream sites year round.
- Collect semi-monthly samples from reservoirs during April-September (growing season).
- Begin model development after first 2 years of monitoring.

Wisconsin River TMDL

Water Quality Monitoring Stations

13 Wis. River sites
16 Tributary sites
19 Reservoir sites



Wisconsin River Sites

- Below Tomahawk dam
- Below Merrill dam
- Below Brokaw
- Below Lake Wausau
- Below Mosinee dam
- Below DuBay dam
- Below Stevens Point dam
- Below Biron Flowage
- Below Nekoosa
- Below Petenwell dam
- Below Castle Rock dam
- Wisconsin Dells
- Below Lake Wisconsin

Wisconsin River Tributary Sites

- Prairie River
- Spirit River
- Pine River
- Eau Claire River
- Plover River
- Rib River
- Big Eau Pleine River
- Little Eau Pleine R.
- Mill Creek
- Tenmile Creek
- Yellow River
- Big Roche Cri Creek
- Lemonwier River
- Baraboo River

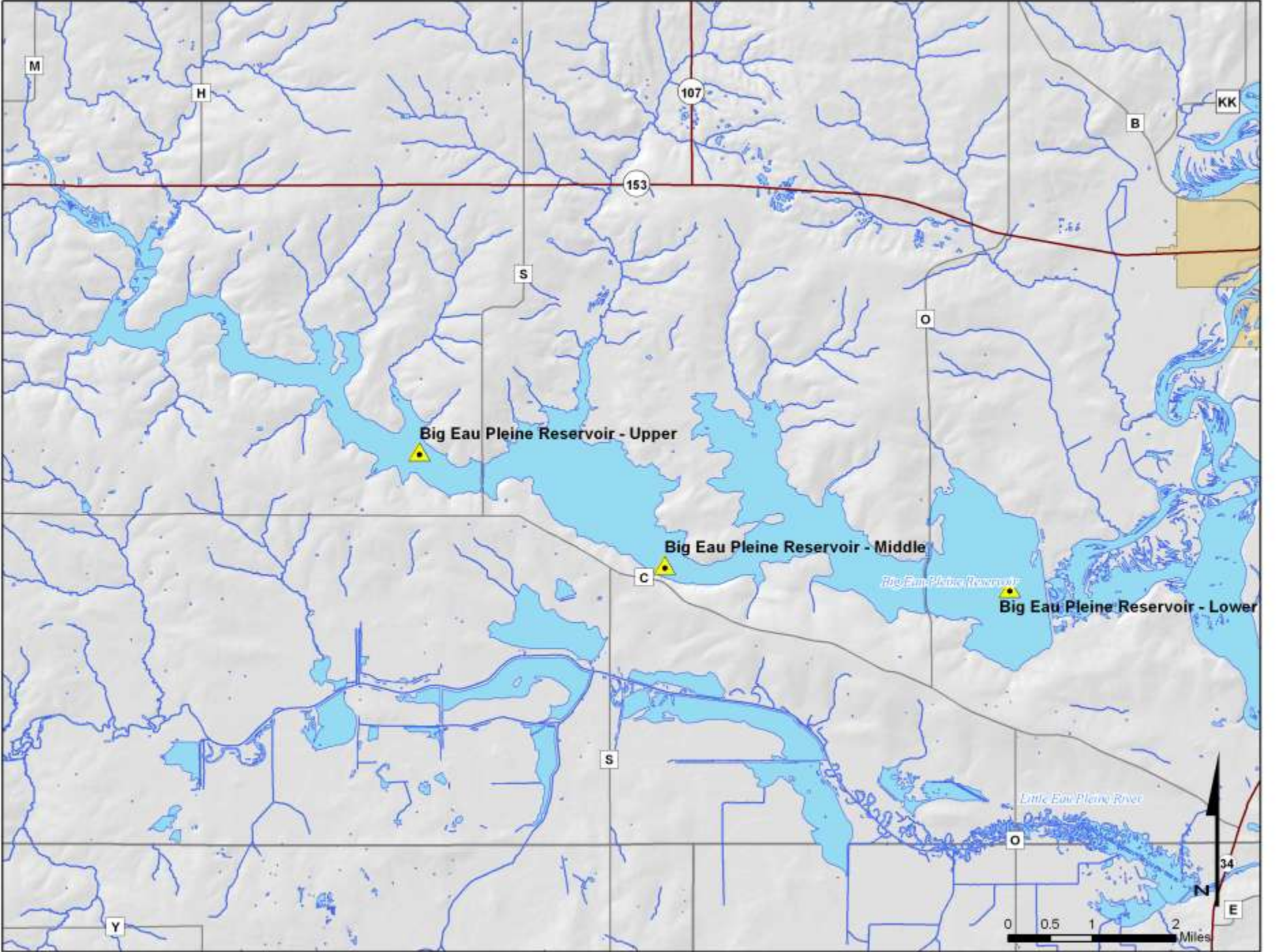


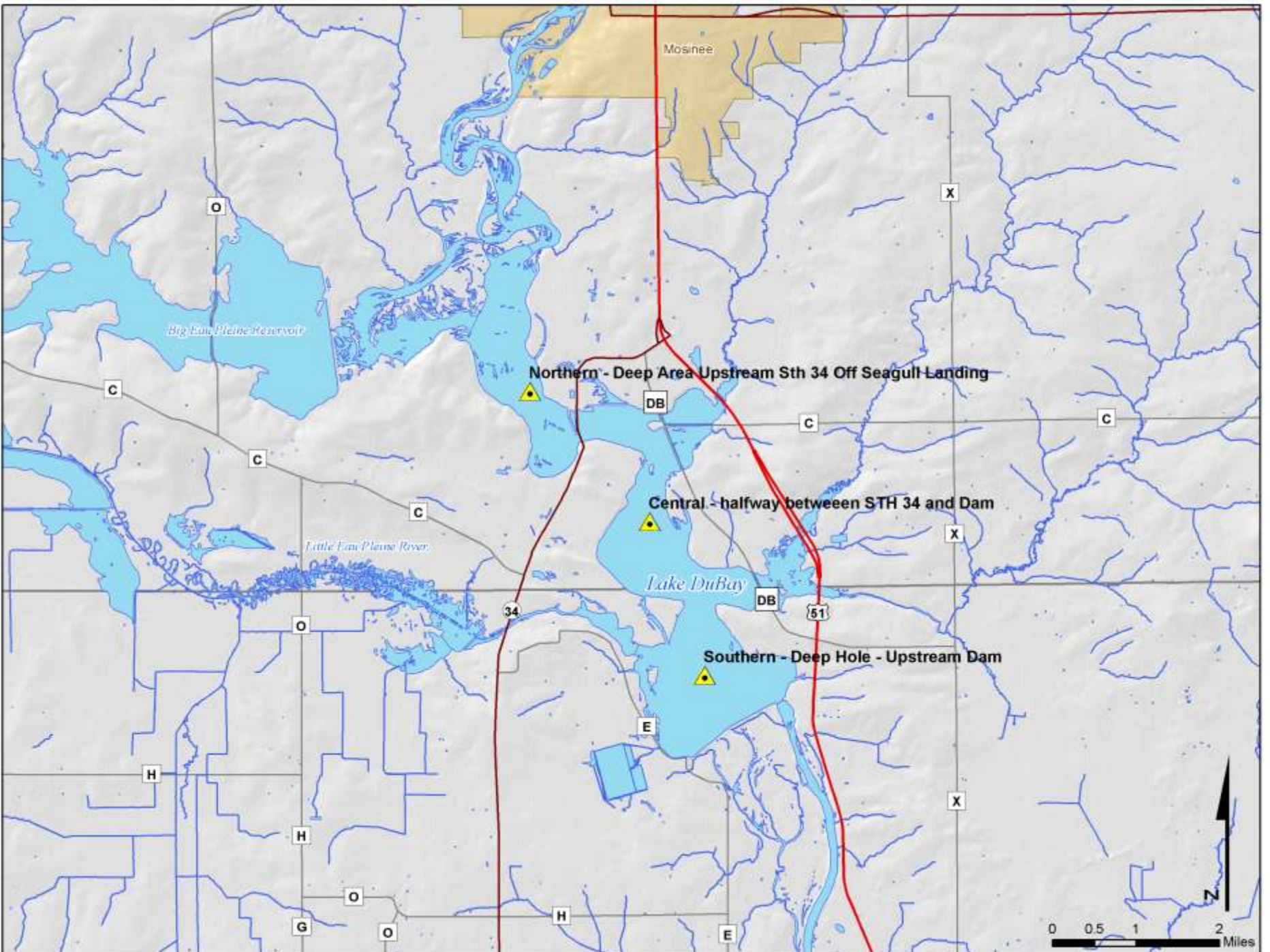
Reservoir Sites

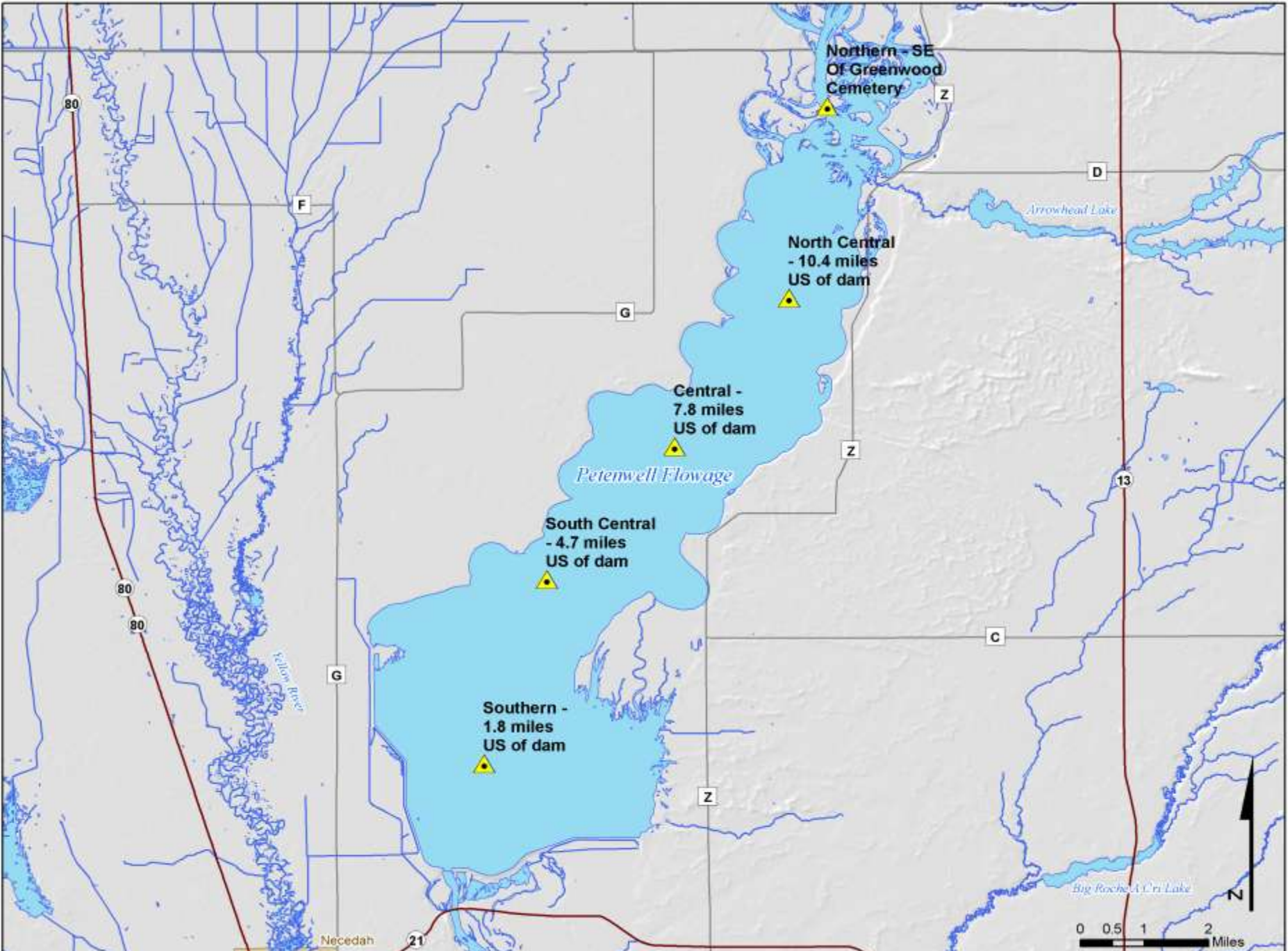
- Big Eau Pleine Reservoir (3 sites/3 depths)
- Lake DuBay (3 sites/2 depths)
- Petenwell Flowage (5 sites/1- 3 depths)
- Castle Rock Flowage (5 sites/1- 3 depths)
- Lake Wisconsin (3 sites/ 2 depths)

Water Chemistry Parameters for Reservoir Sites

- Total Kjeldahl-N
- Nitrate-N
- Ammonia-N
- Soluble P
- Total P
- Total suspended solids
- Chlorophyll a
- Algae ID and biovolume
(Petenwell & Castle Rock)







Northern - SE
Of Greenwood
Cemetery

North Central
- 10.4 miles
US of dam

Central -
7.8 miles
US of dam

South Central
- 4.7 miles
US of dam

Southern -
1.8 miles
US of dam

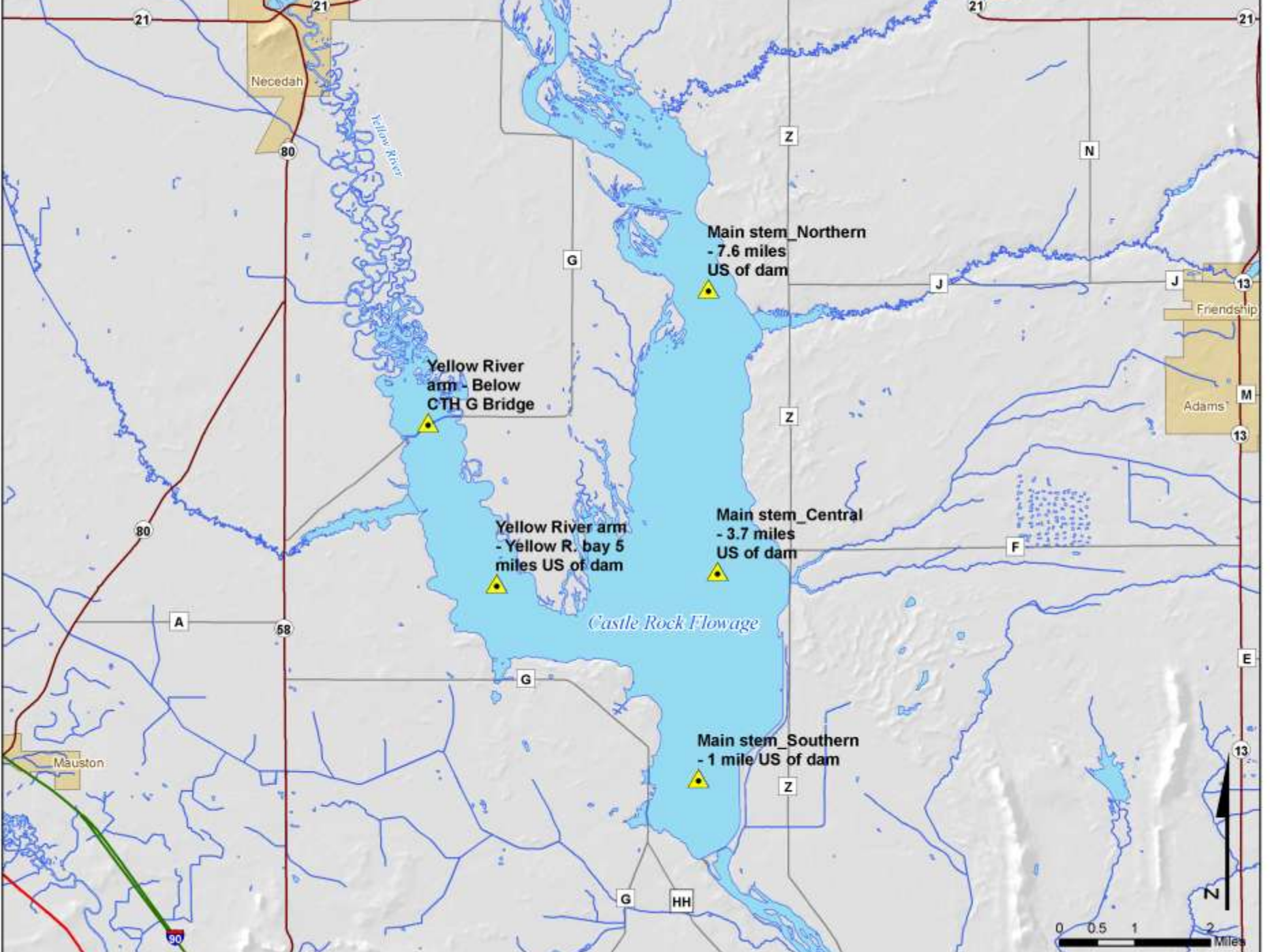
Petenwell Flowage

Arrowhead Lake

Big Rocks A.C. Lake

0 0.5 1 2 Miles





Necedah

Yellow River

Main stem_Northern
- 7.6 miles
US of dam

Yellow River
arm - Below
CTH G Bridge

Friendship

Adams

Yellow River arm
- Yellow R. bay 5
miles US of dam

Main stem_Central
- 3.7 miles
US of dam

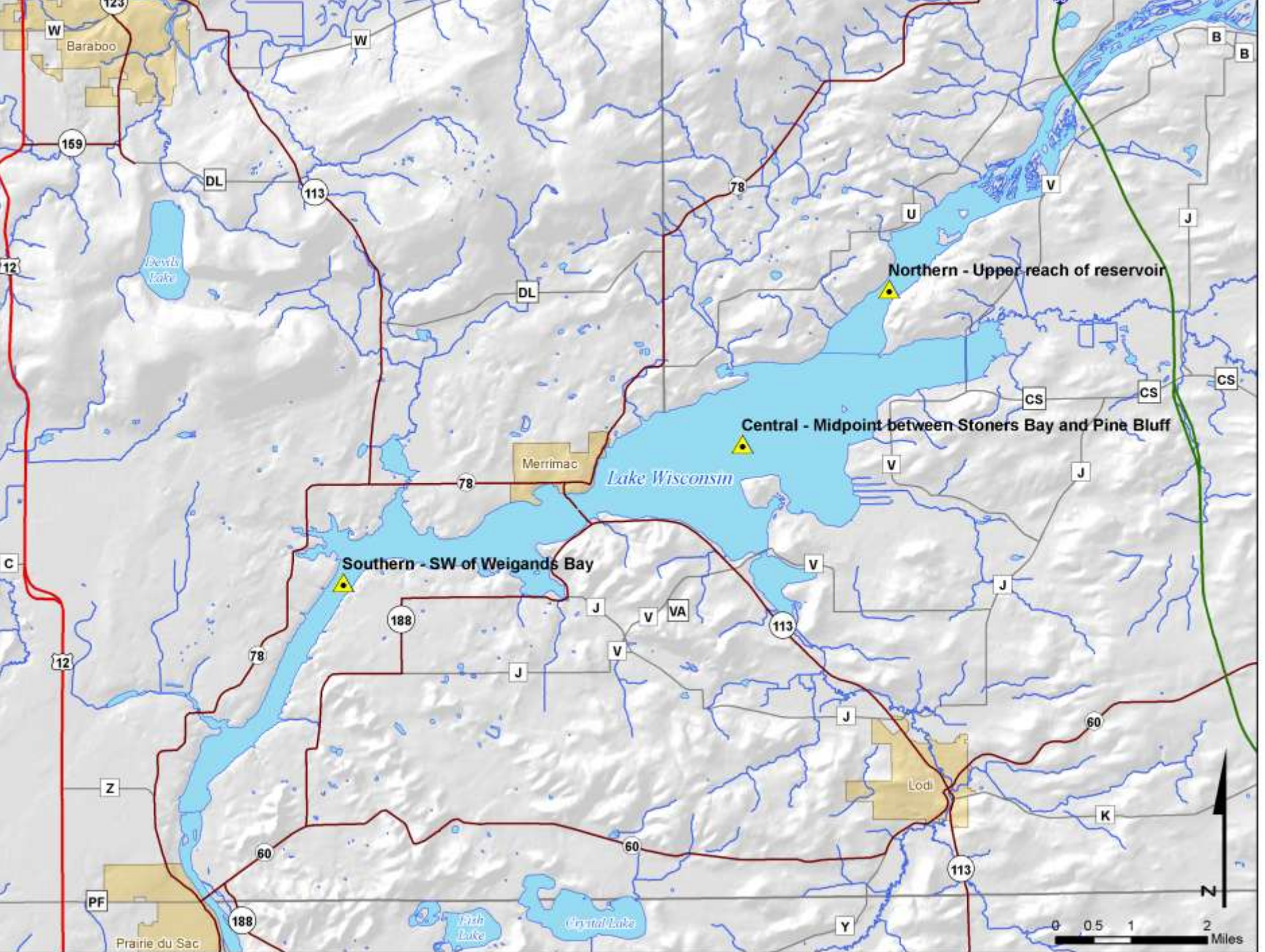
Castle Rock Flowage

Mauston

Main stem_Southern
- 1 mile US of dam

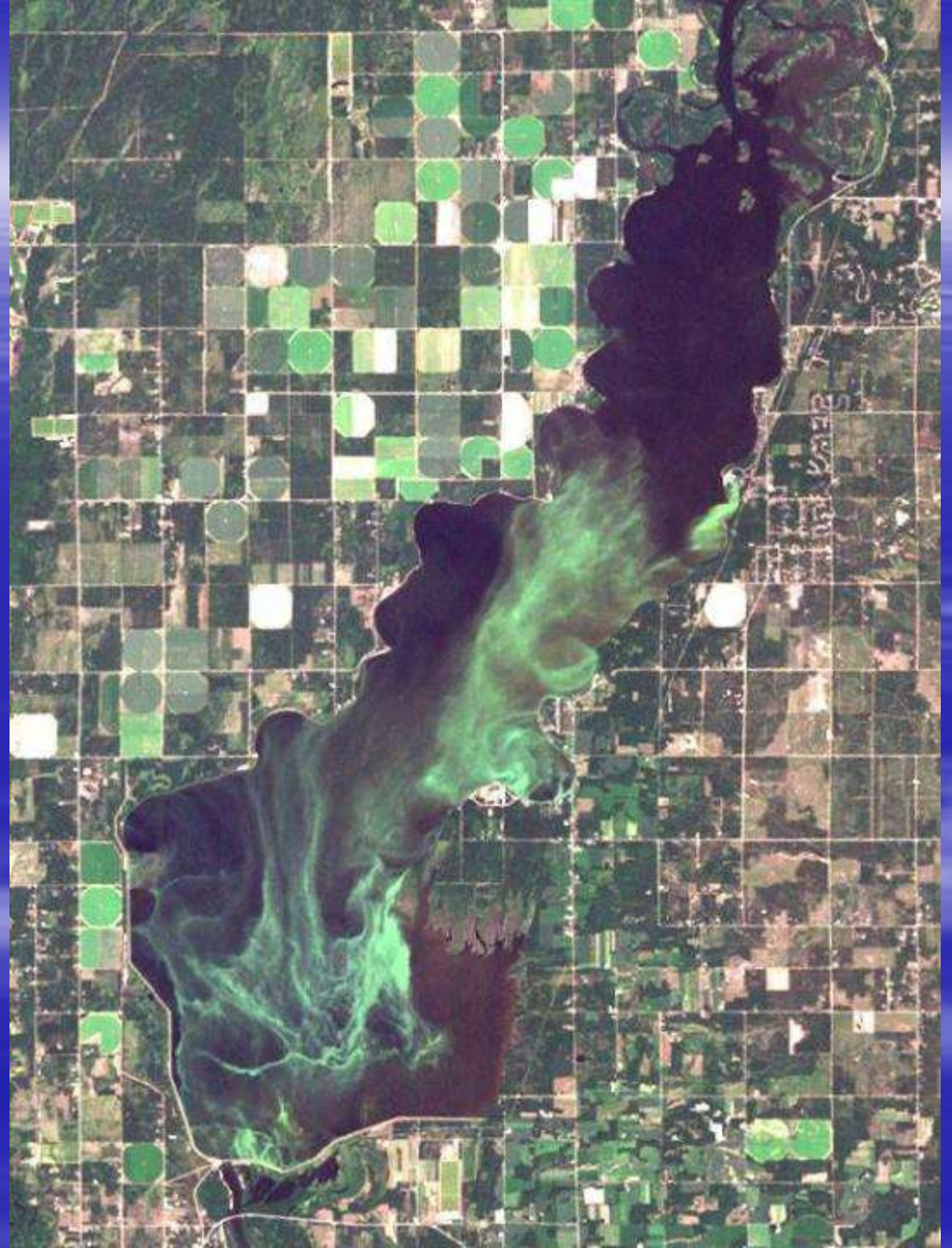
0 0.5 1 2 Miles

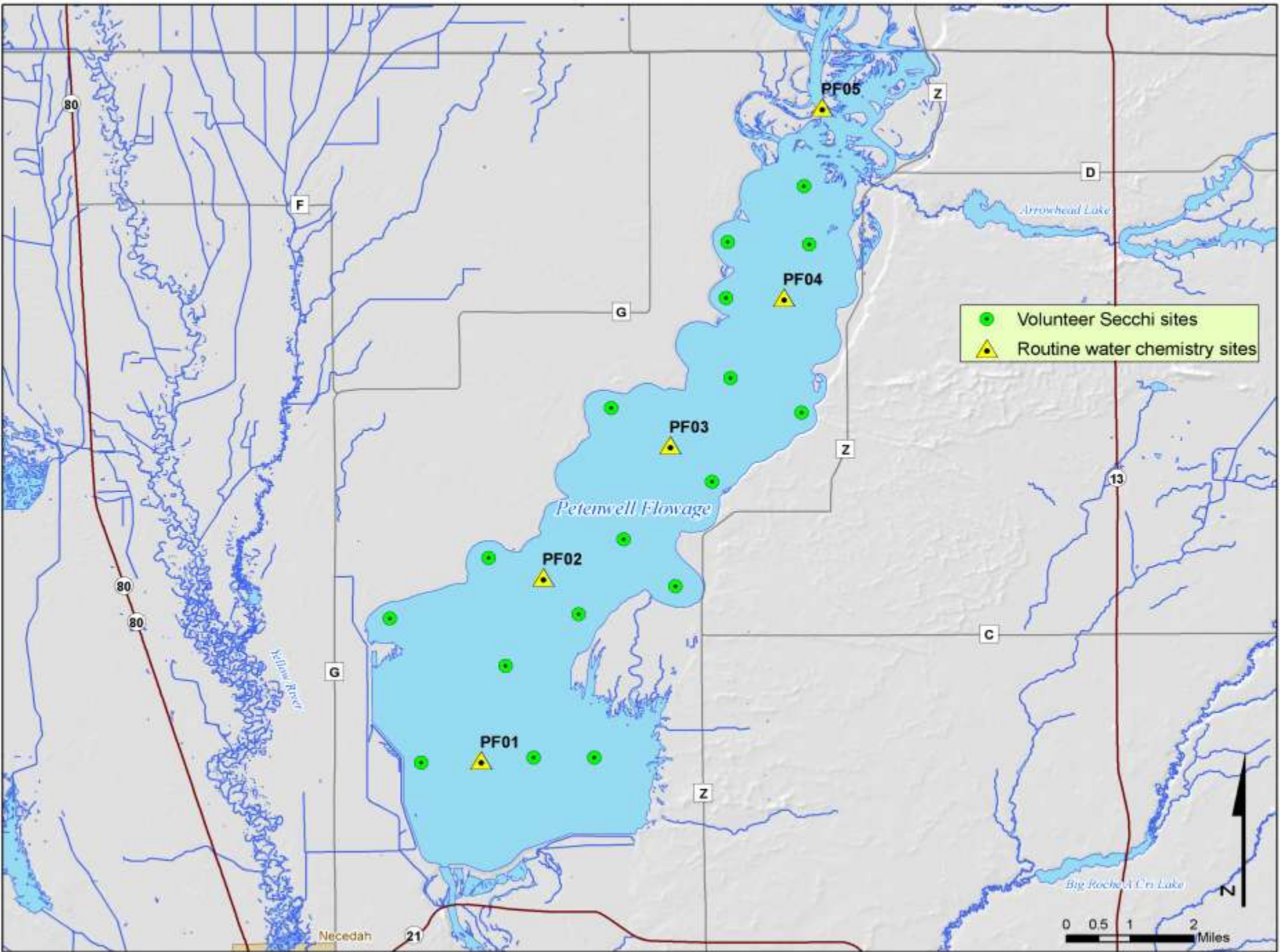
N

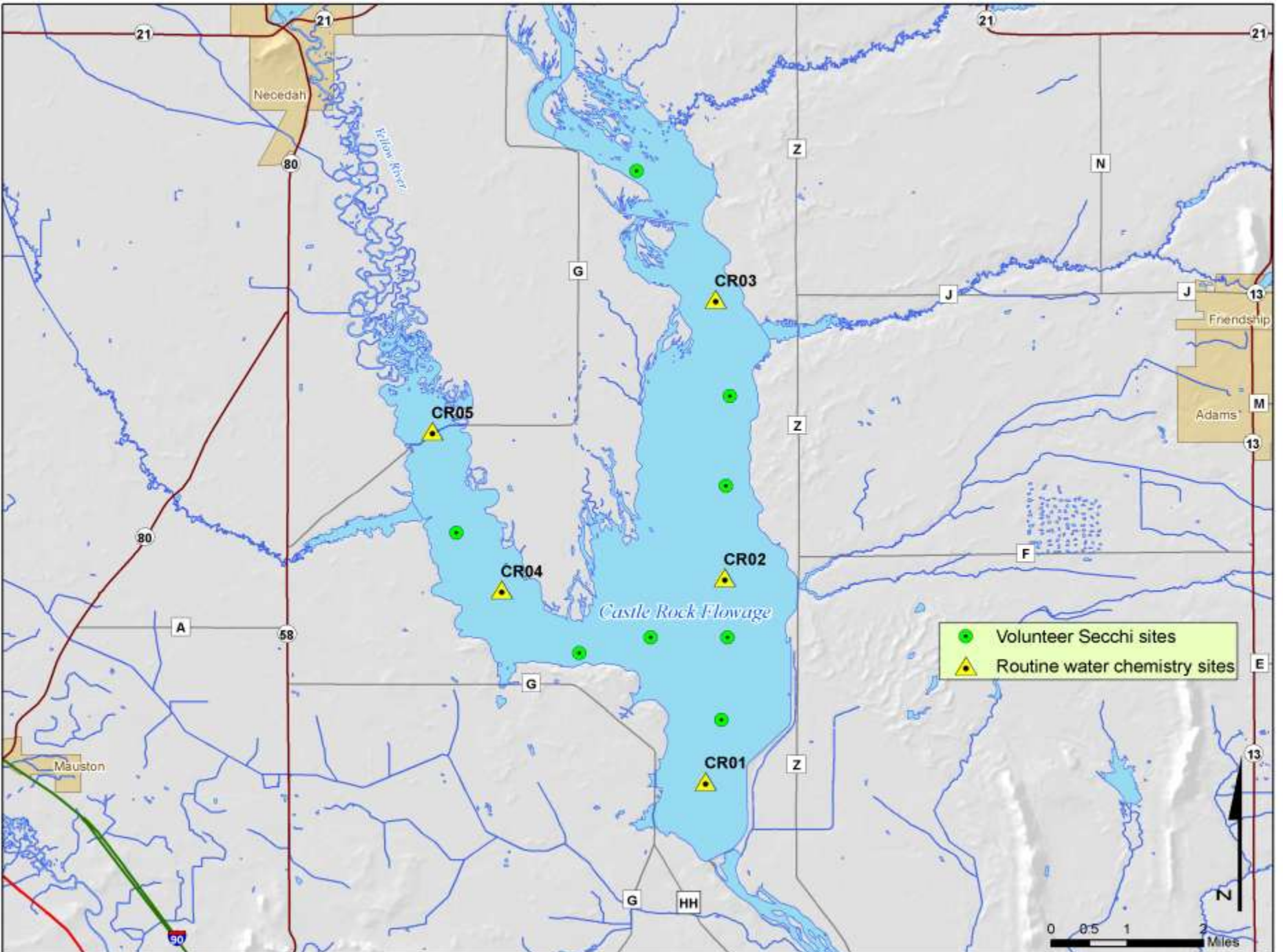


Petenwell Flowage

Algae Bloom Variability







Phosphorus Criteria

Rivers and Streams

Named rivers – 100 $\mu\text{g/L}$

- Wisconsin River - downstream of Rhinelander
- Lemonweir River - downstream of New Lisbon
- Baraboo River - downstream of La Valle

Other rivers/streams in this study - 75 $\mu\text{g/L}$

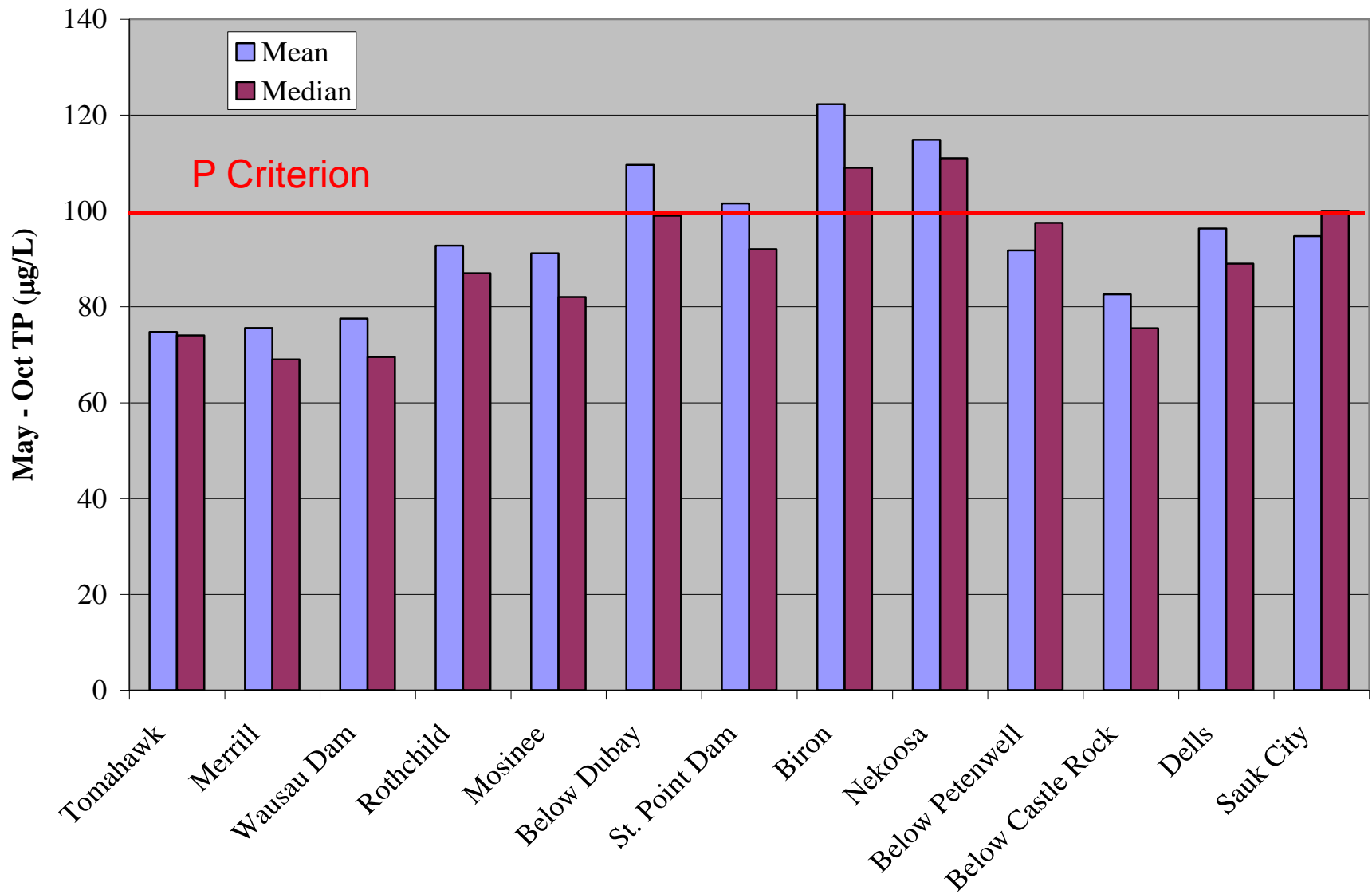
Lakes and Reservoirs

Reservoirs

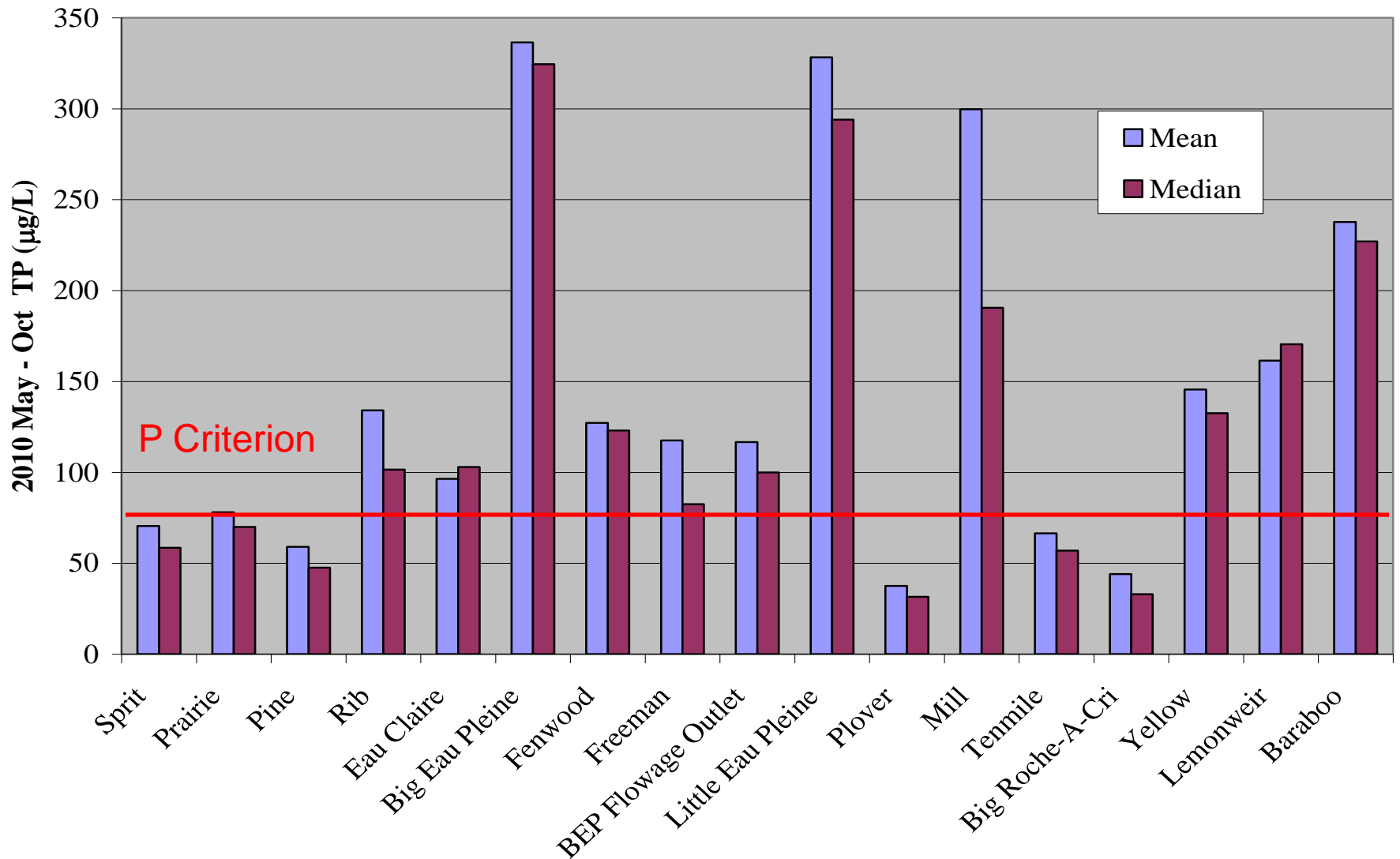
- Stratified Reservoirs - 30 $\mu\text{g/L}$
 - Big Eau Pleine
- Unstratified Reservoirs - 40 $\mu\text{g/L}$
 - Lake Dubay, Petenwell and Castle Rock

Some Monitoring Results....

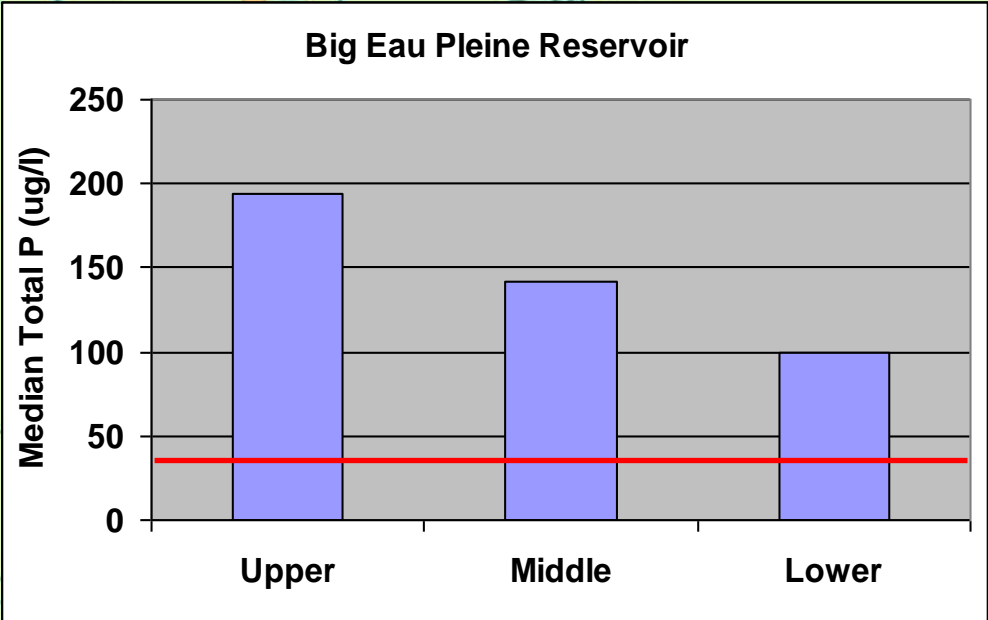
Wisconsin River Mainstem



Wisconsin River Tributaries



Big Eau Pleine Reservoir



Big Eau Pleine

Fenwood

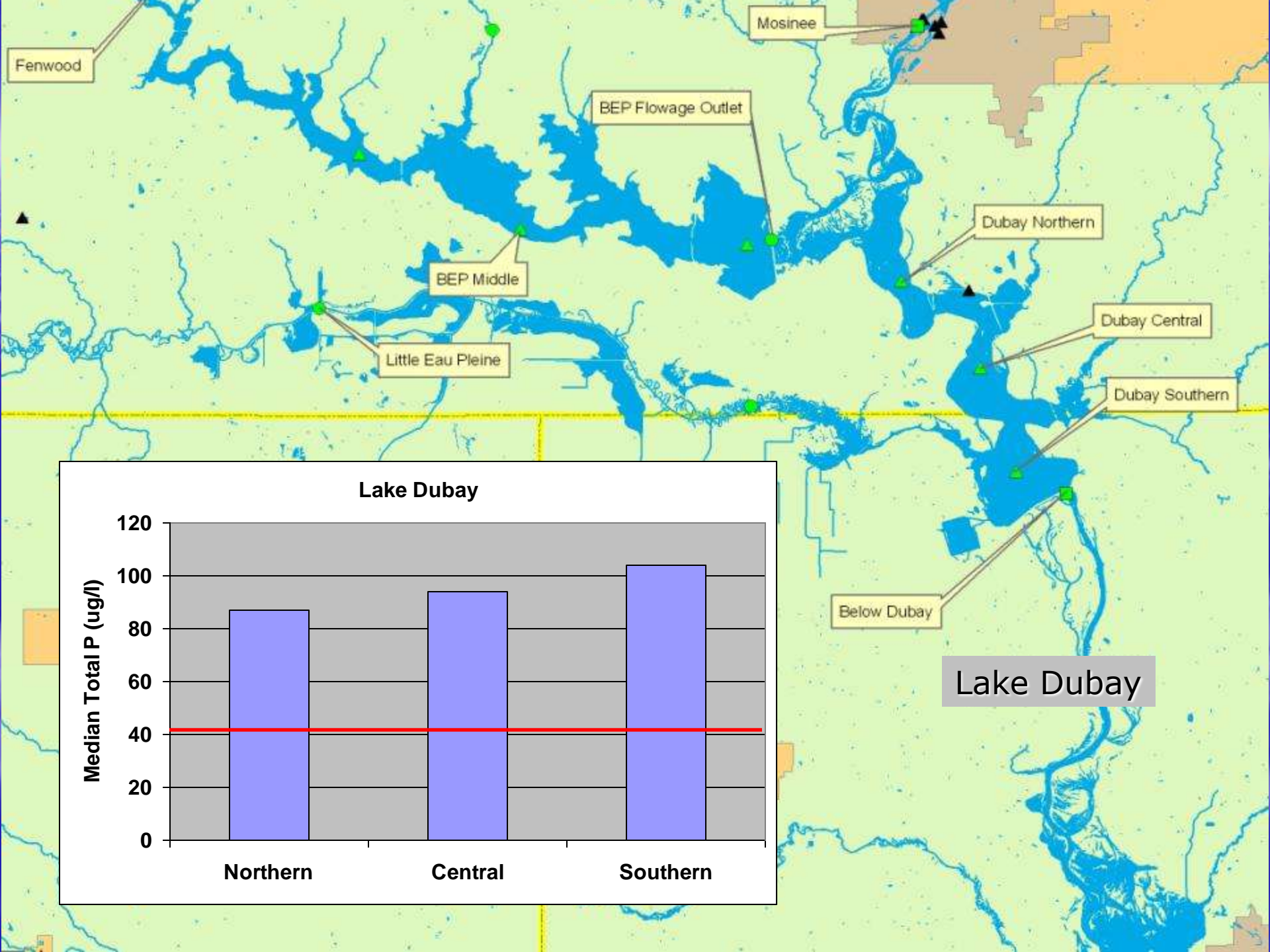
Freeman

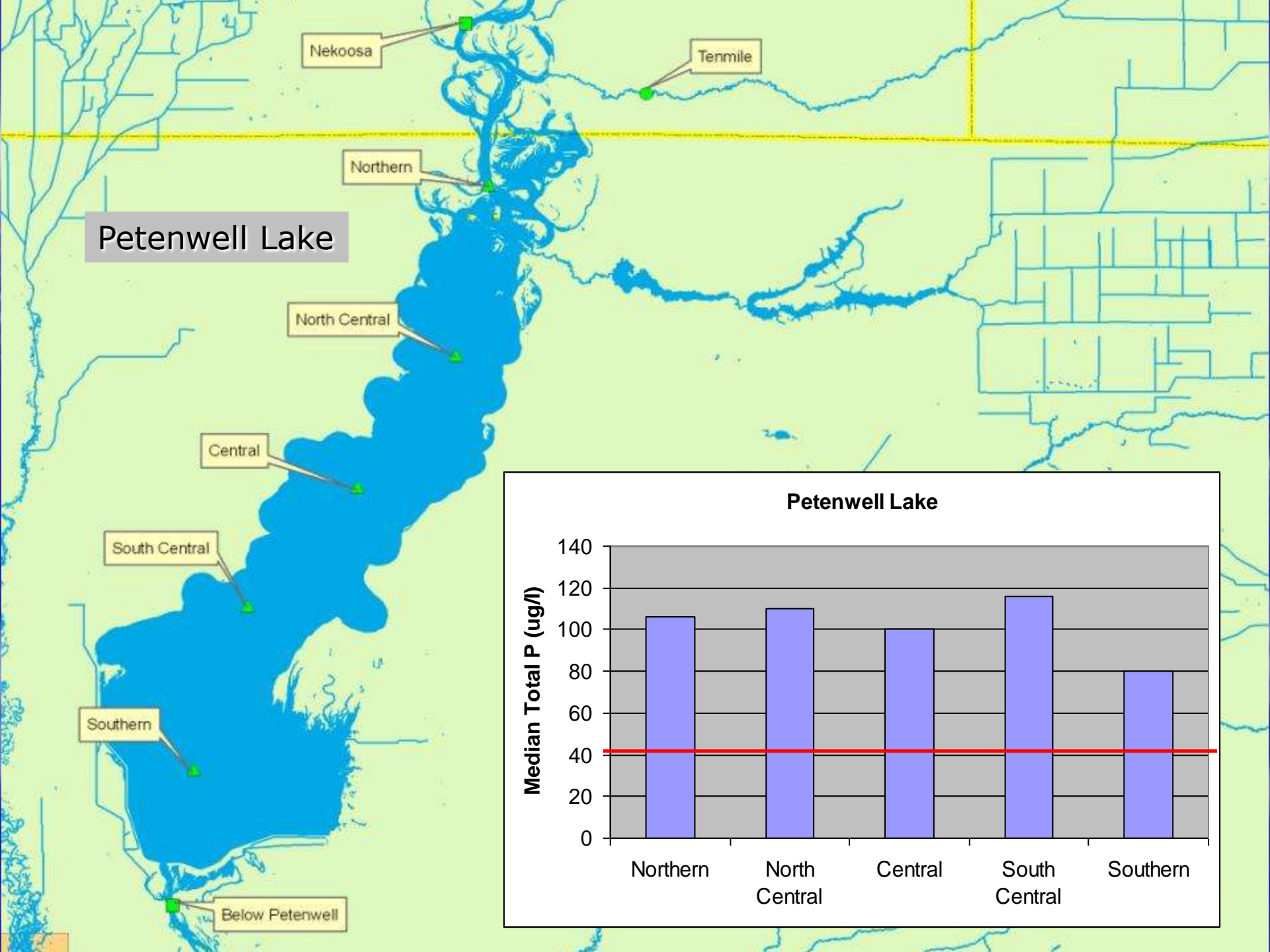
BEP Flowage Outlet

BEP Upper

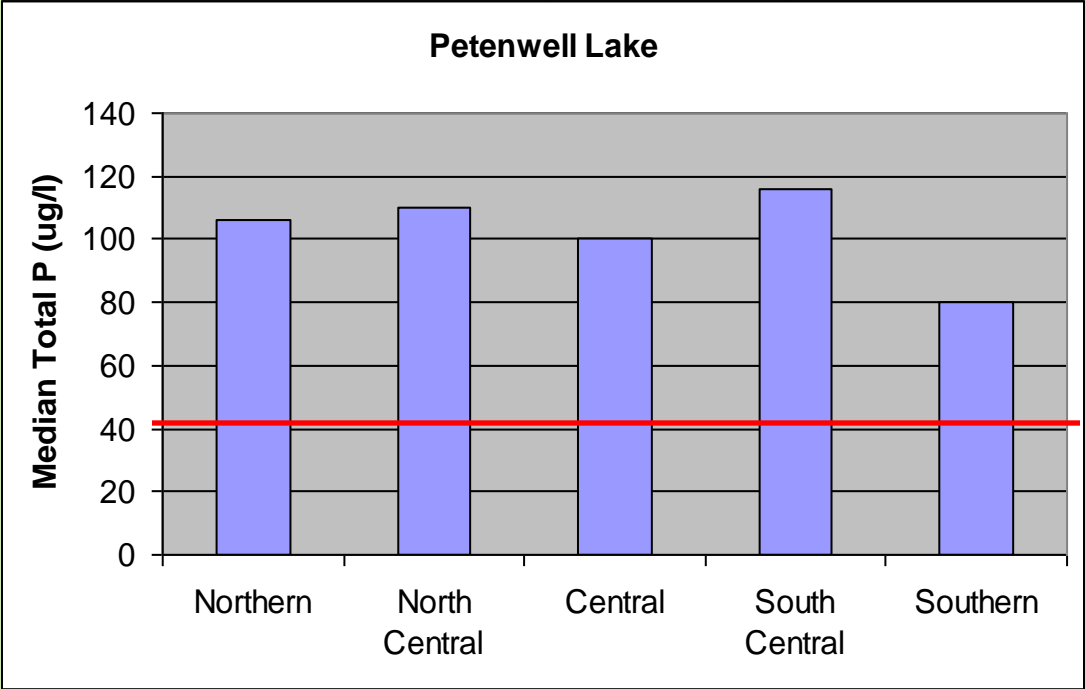
BEP Middle

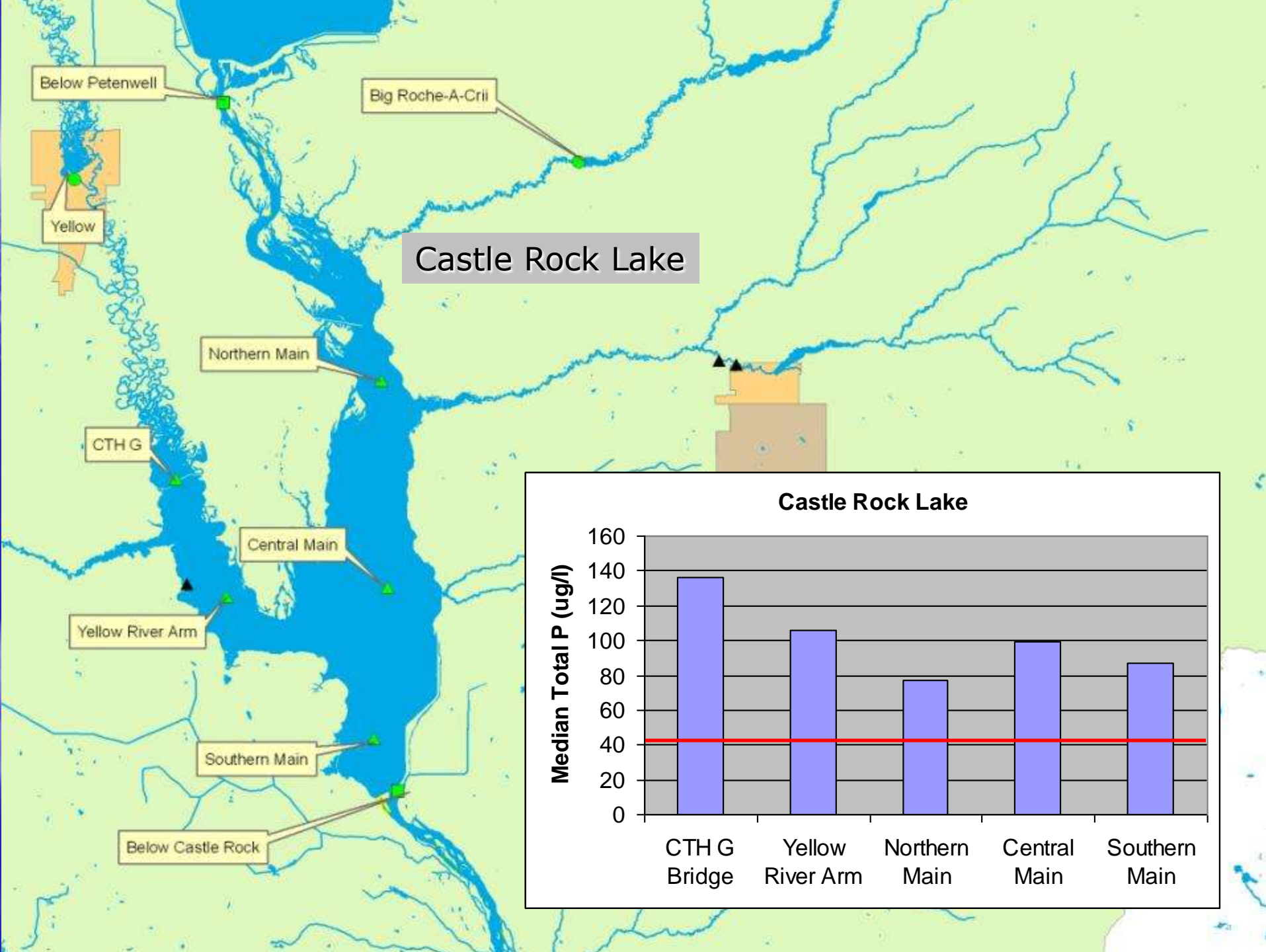
BEP Lower

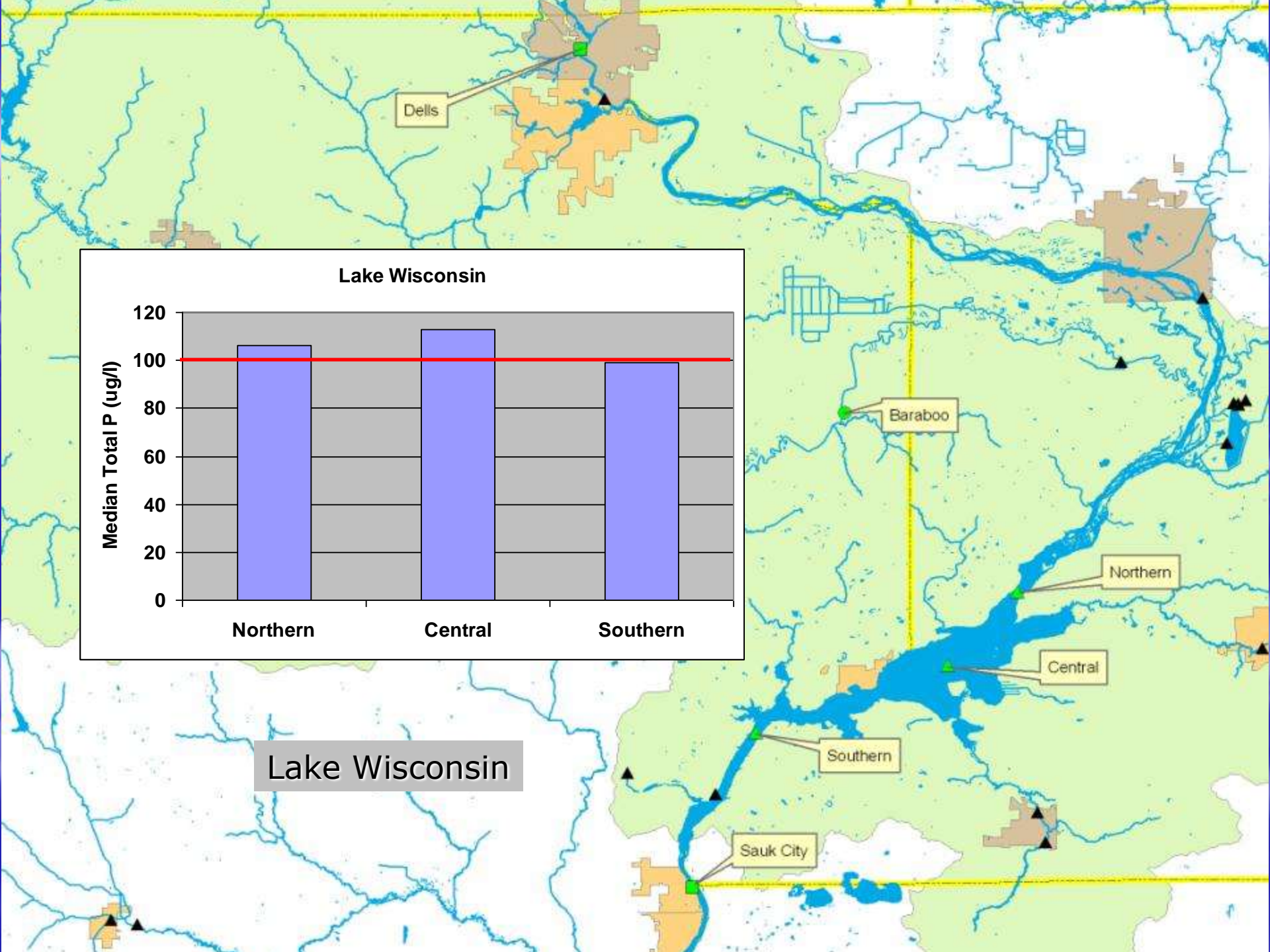




Petenwell Lake

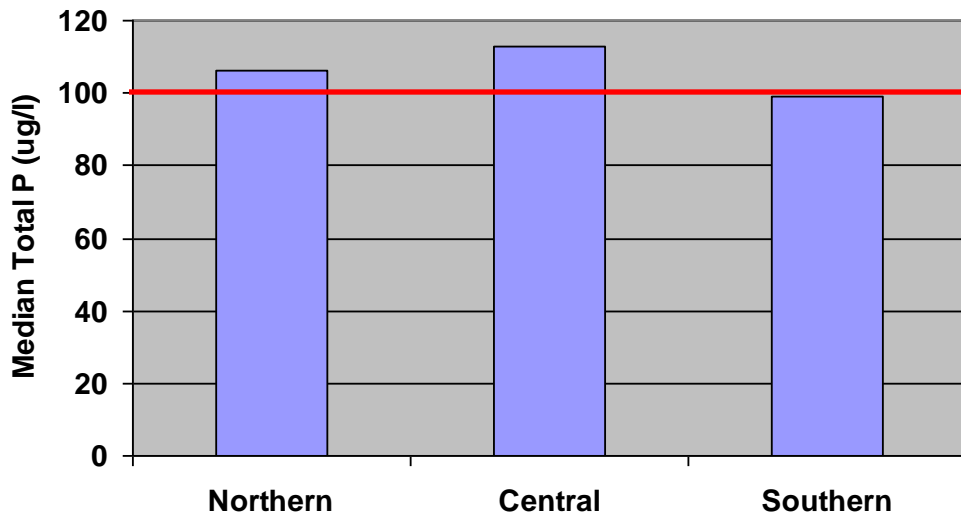






Dells

Lake Wisconsin



Baraboo

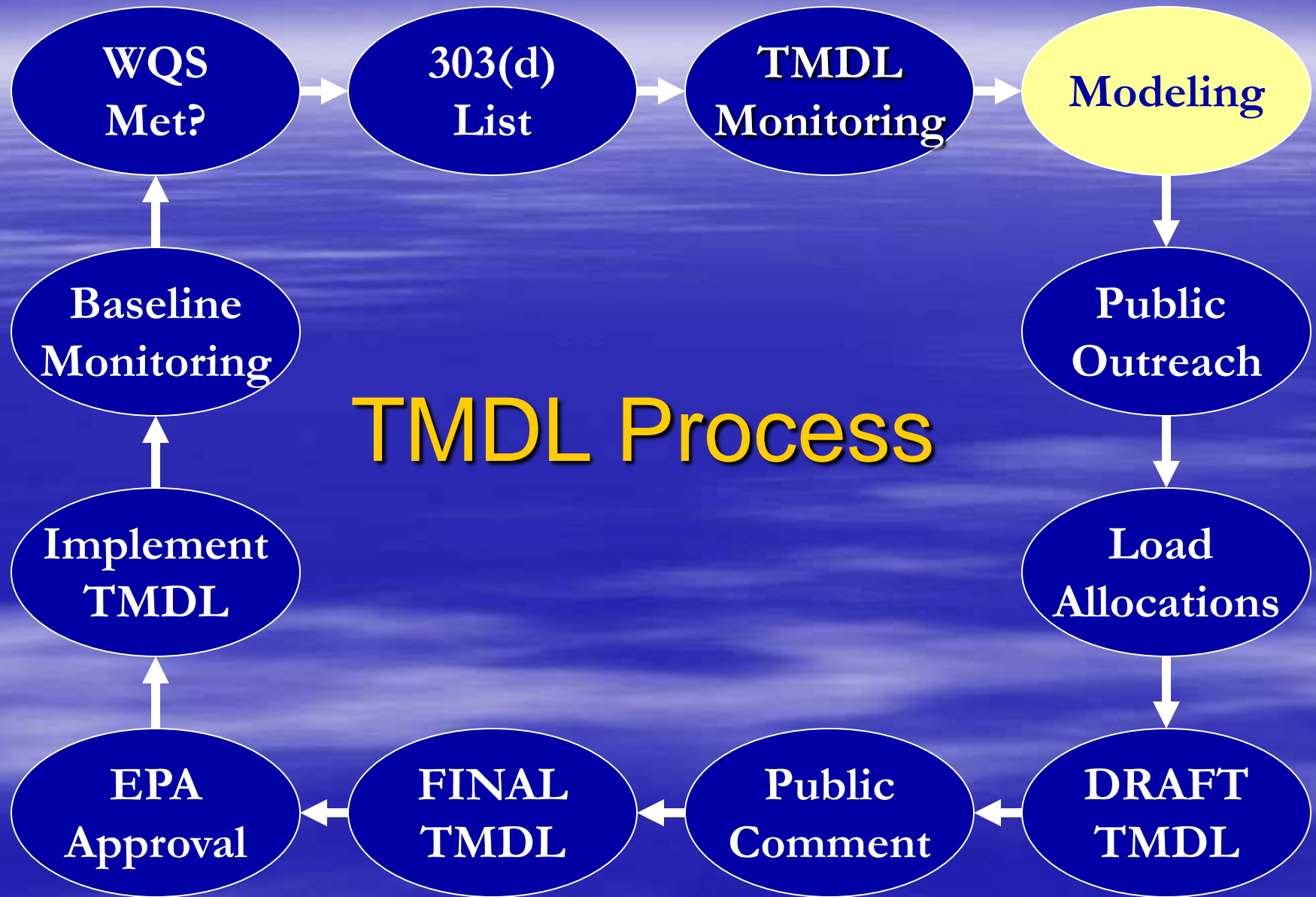
Northern

Central

Southern

Sauk City

Lake Wisconsin

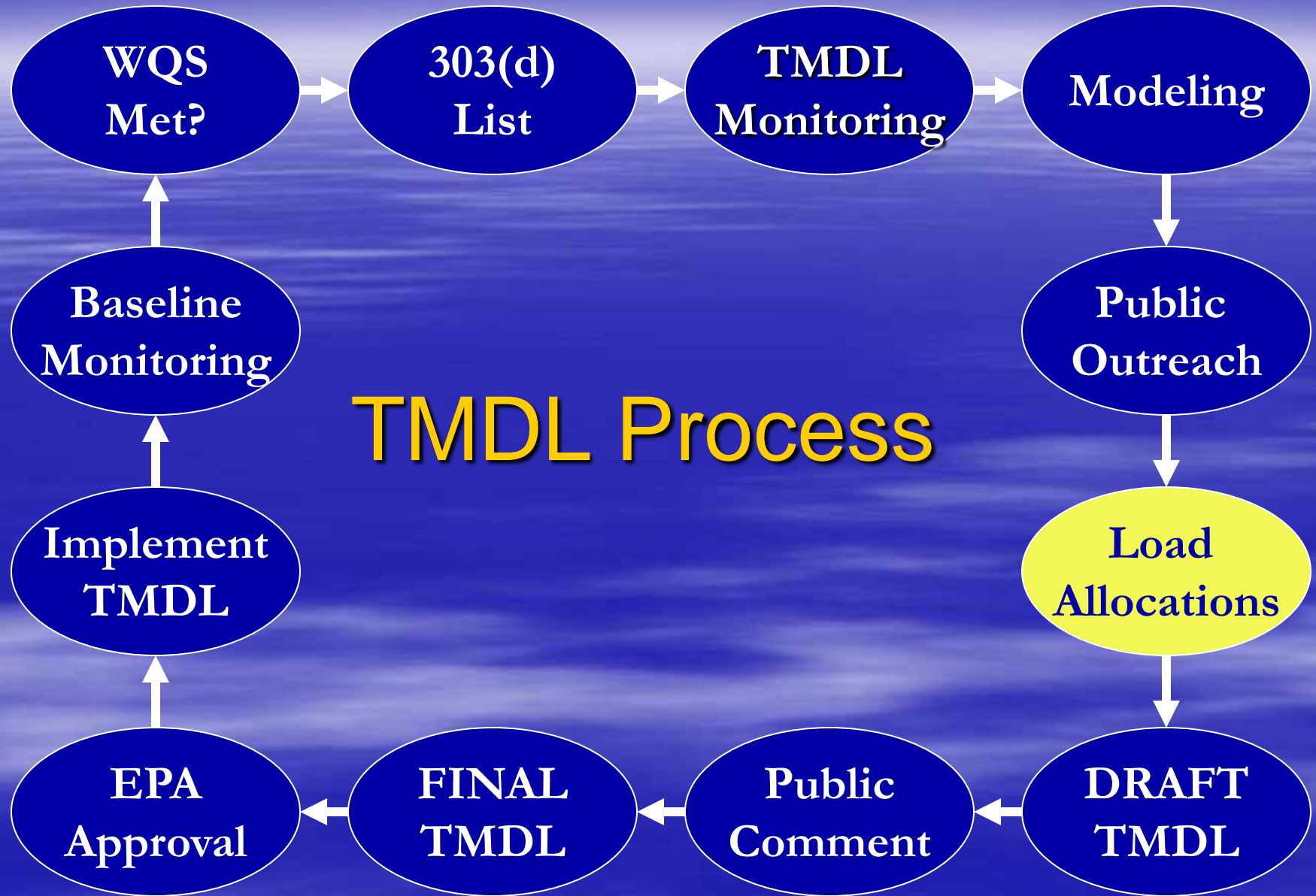


TMDL Process

Modeling

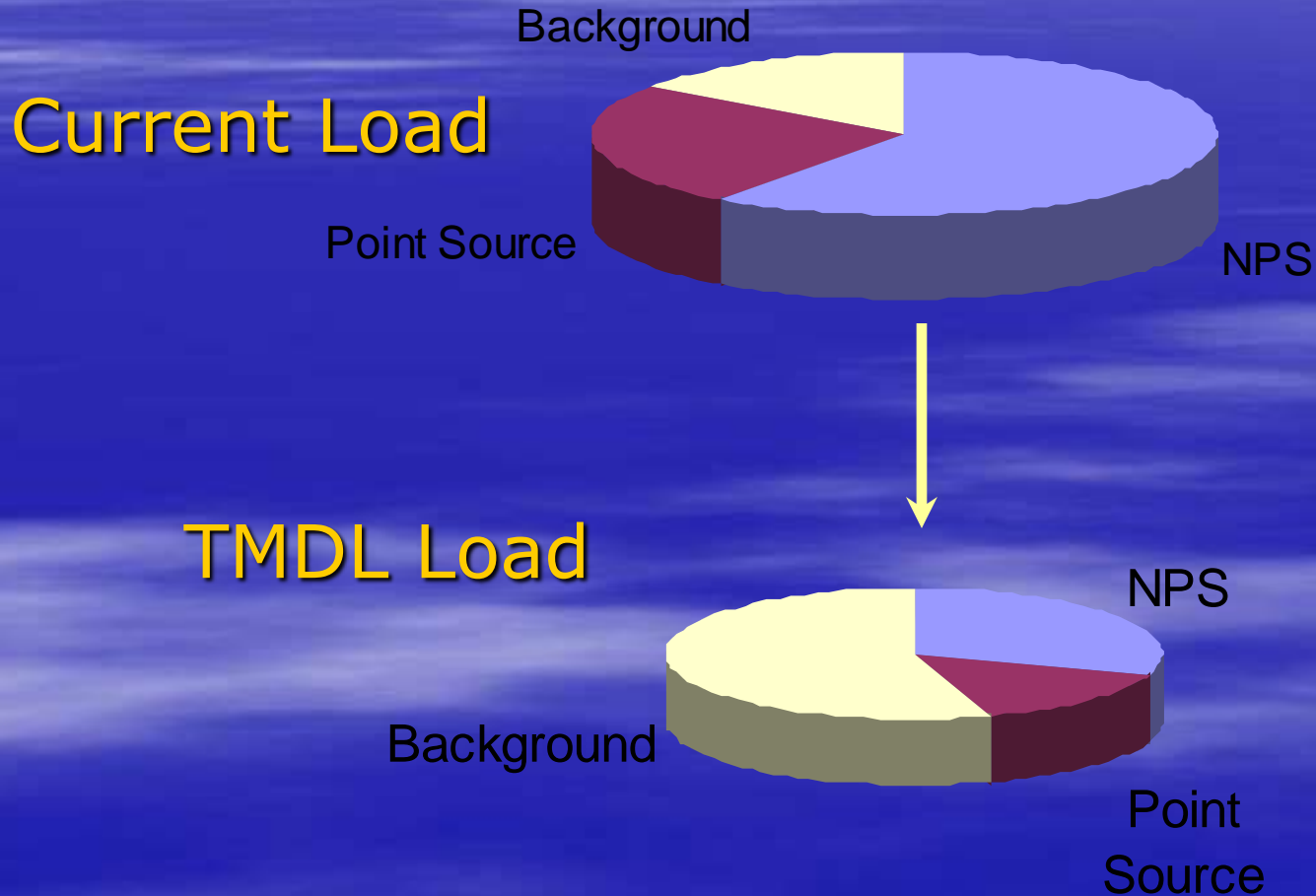
After two years of monitoring:

- Reservoir model (BATHTUB)
- River and reservoir model (CE-QUAL-W2)
- Land use model (SWAT)
- Field scale model (Wis. P Index)

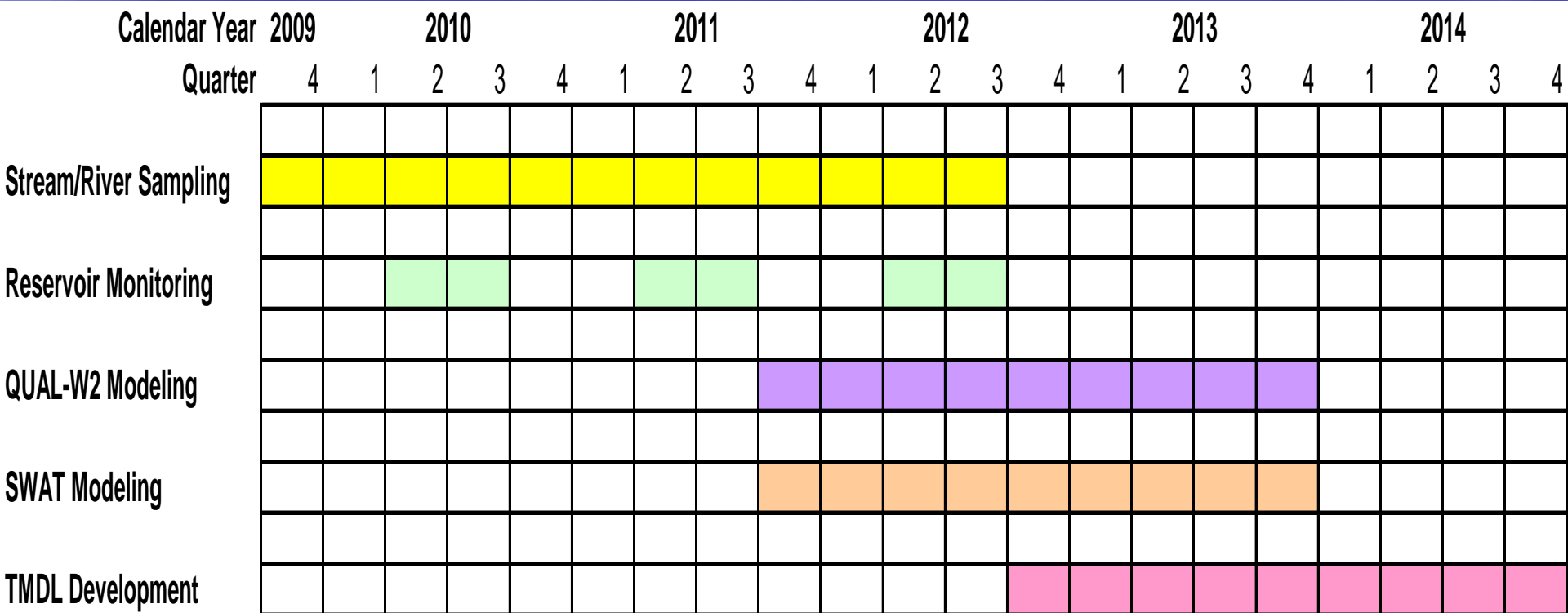


TMDL Process

TMDL Load Allocation



Wisconsin River TMDL Timeline





Wisconsin River

Water Quality Partnership

Wis. DNR

Petenwell and Castle Rock Stewards

Adams, Juneau, Wood, Portage and Marathon Co. LCDs

River Alliance of Wisconsin

Big Eau Pleine Citizens Organization

Big Eau Pleine Task Force

US Army Corps of Engineers

US Geological Society

Environmental Protection Agency

Wisconsin Valley Improvement Corporation

Wisconsin River Power Company

University of Wisconsin– Stevens Point

Questions?