

LESSONS FROM 10+ YEARS OF NUMERIC PHOSPHORUS CRITERIA

Wisconsin's Experience

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Phosphorus: Lessons from 10+ Years of Numeric Standards for Wisconsin's Waters

<https://pconference.wordpress.com/>



Three Components:

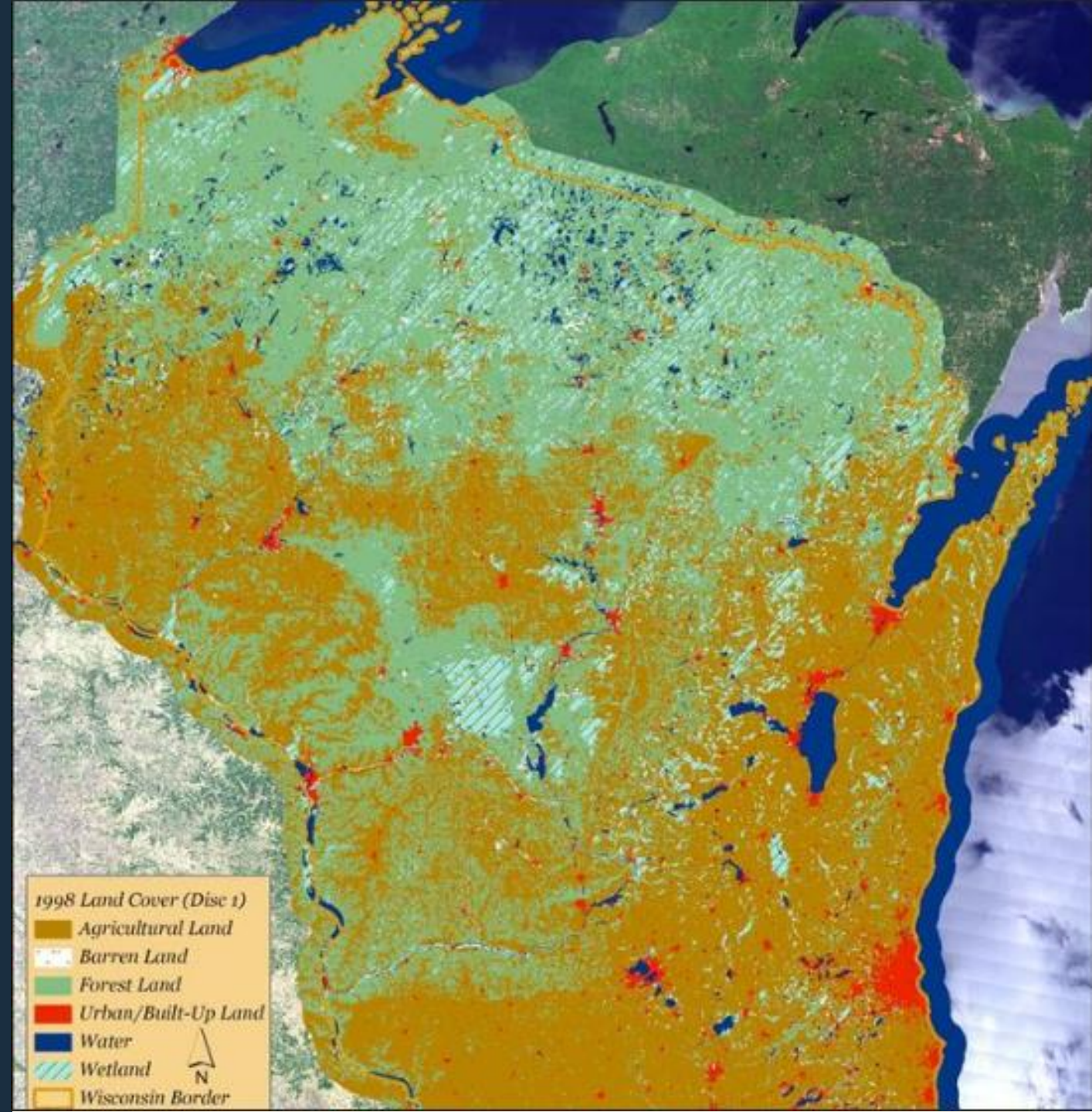
- Development of Numeric Criteria and TMDLs
- Point Source Implementation
- Looking Ahead

- Opportunity for questions and discussion after each component



FOR WISCONTEXT:

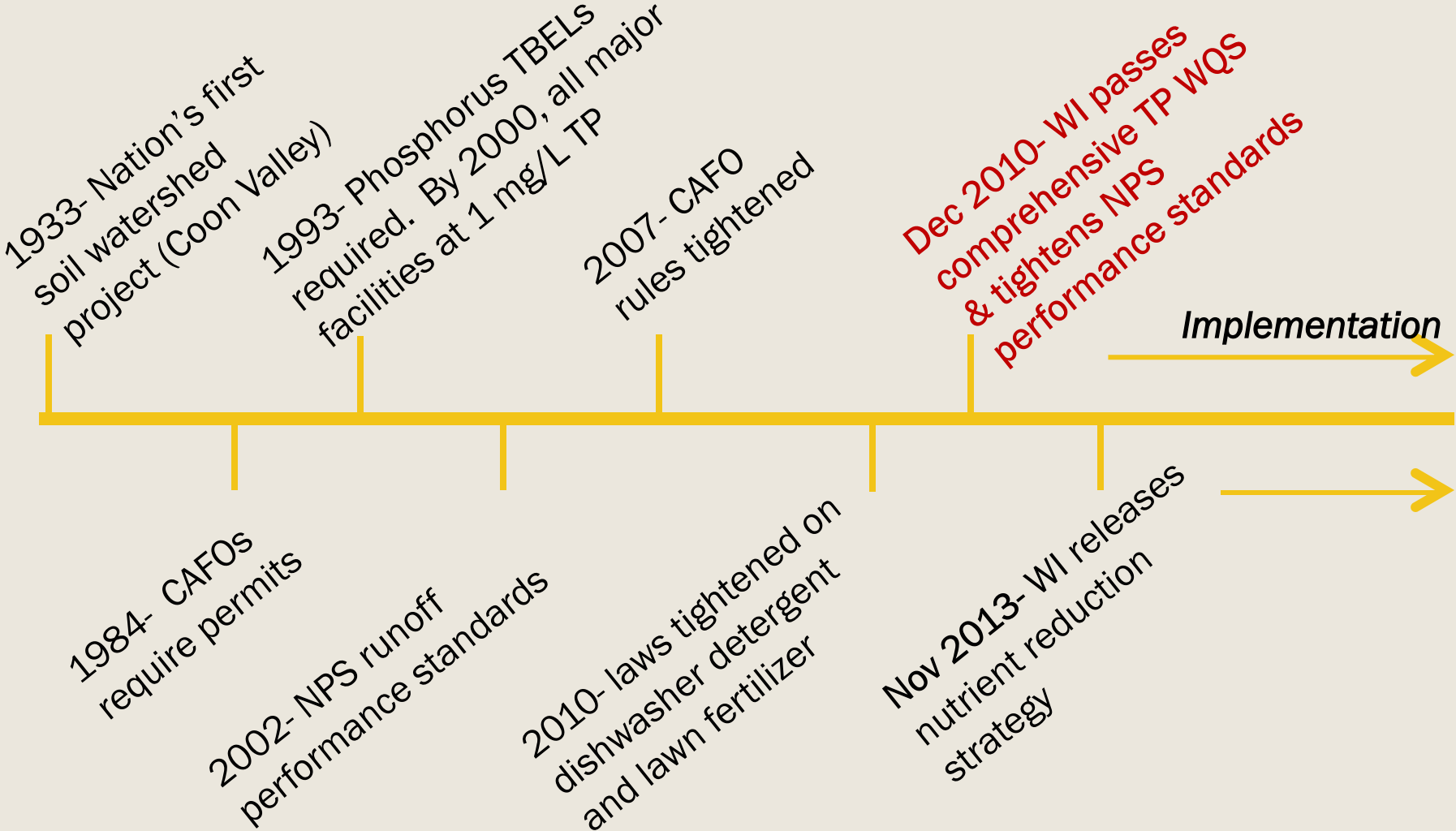
- Water-rich state:
 - 84,000 stream miles
 - 1,000 great lakes shoreline miles
 - 1,000,000 acres of inland lake
- ~750 surface water dischargers (individual permits)
- ~70% agricultural land use
- Strong ag lobby
- Environmental NGOs also strong



The image features a light teal background with two dark blue L-shaped brackets. One bracket is positioned in the top-left corner, and the other is in the bottom-right corner. Centered between these brackets is the text "ADOPTION OF CRITERIA" in a dark blue, sans-serif font, arranged in two lines.

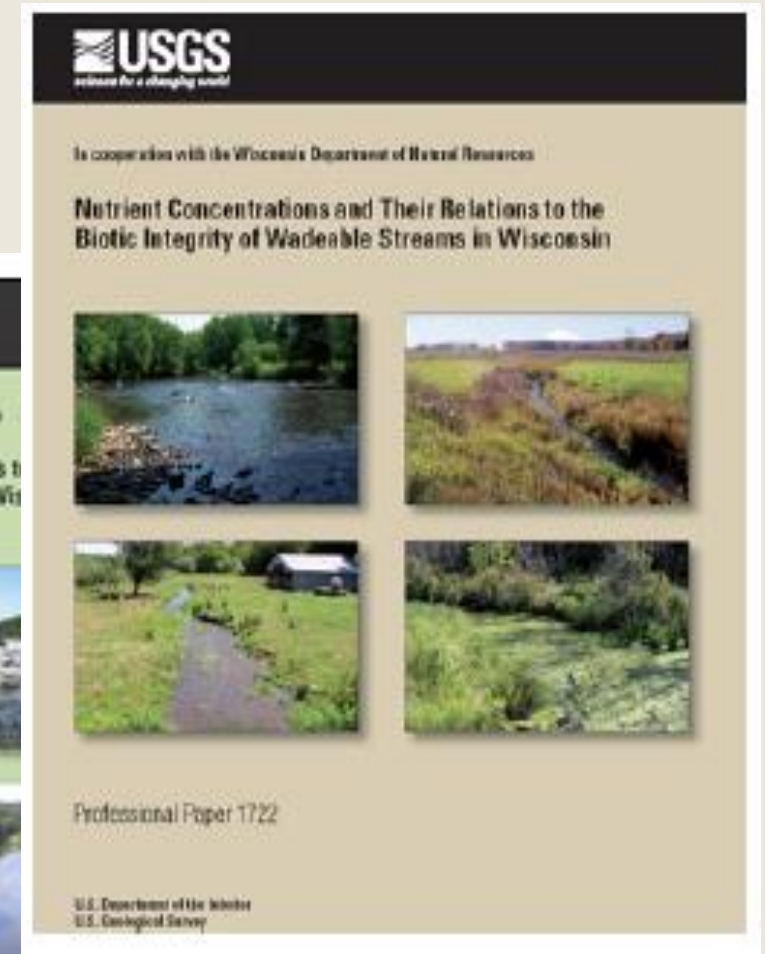
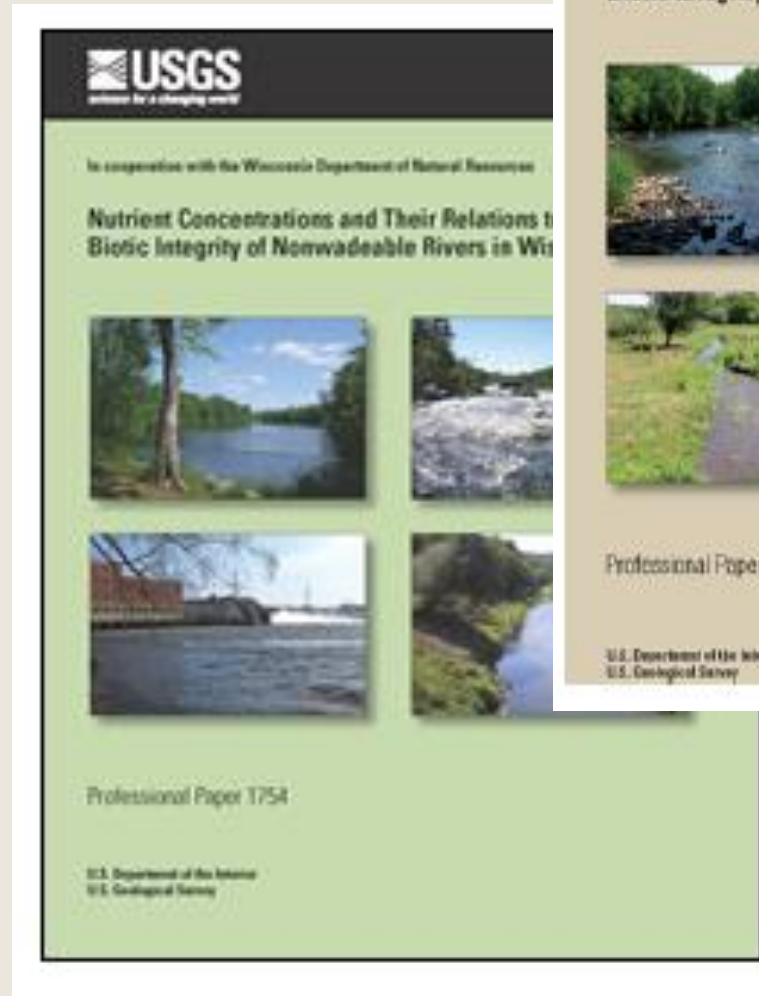
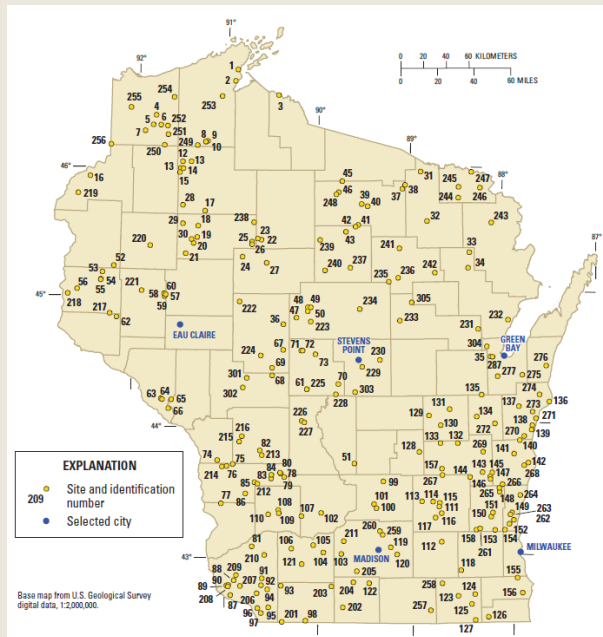
ADOPTION OF CRITERIA

History of Phosphorus Regulations in WI

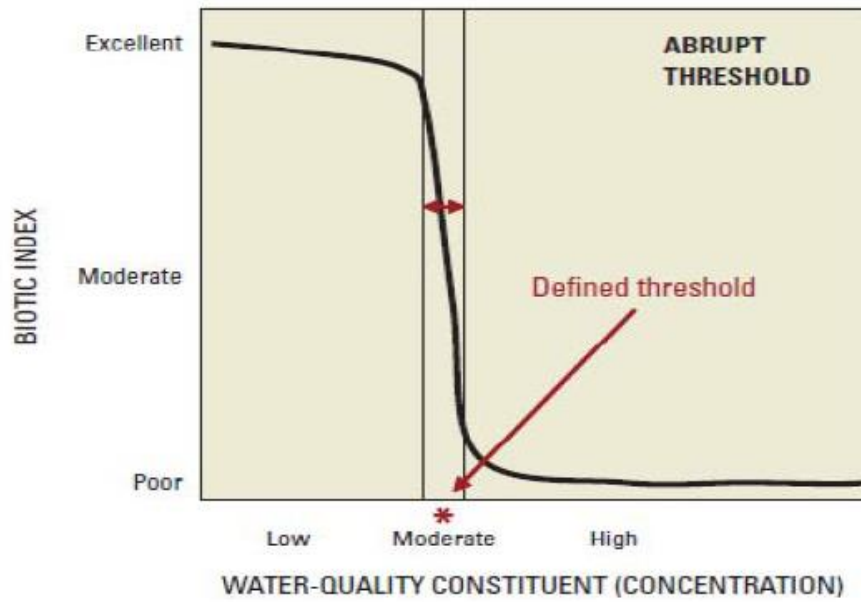


Development of Numeric Nutrient Criteria

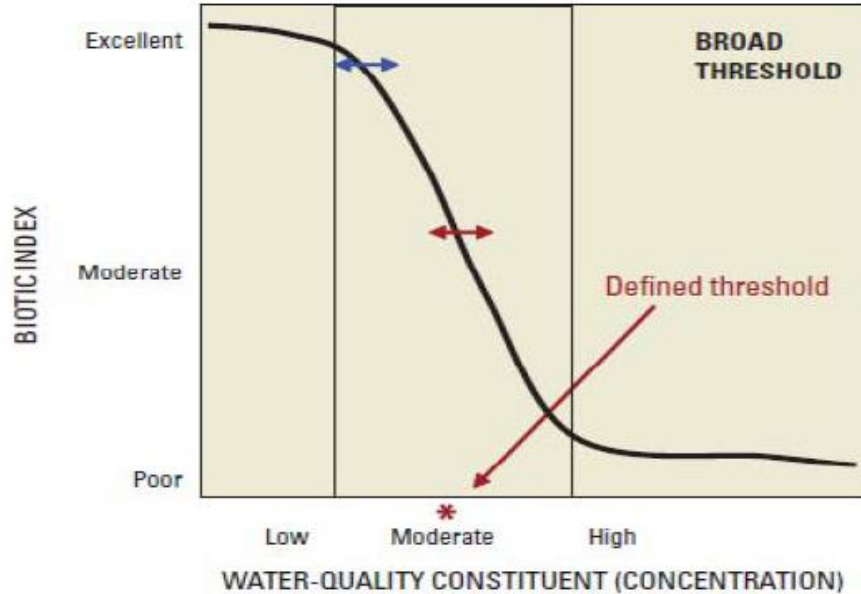
- In 2001, Wisconsin DNR initiates a 5-year study with USGS to evaluate nutrients (both phosphorus and nitrogen) and determine thresholds for potential numeric criteria.



A.

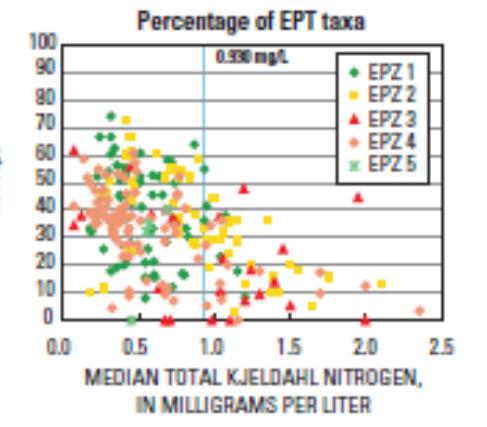
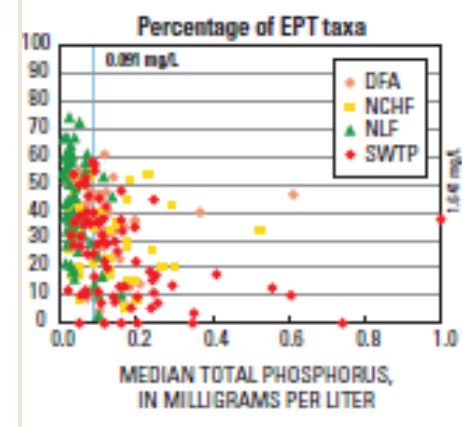
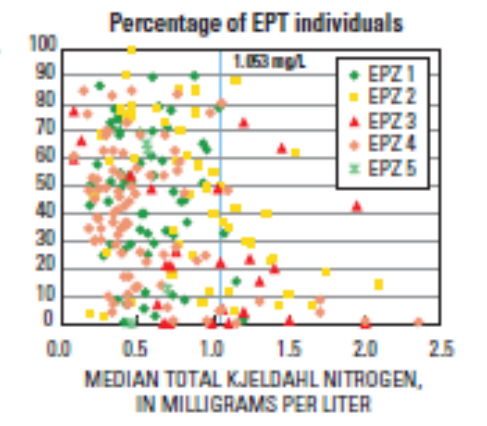
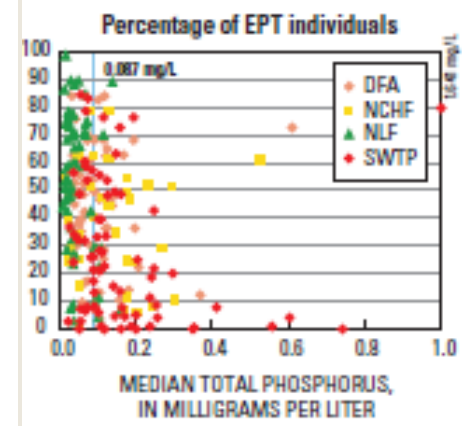
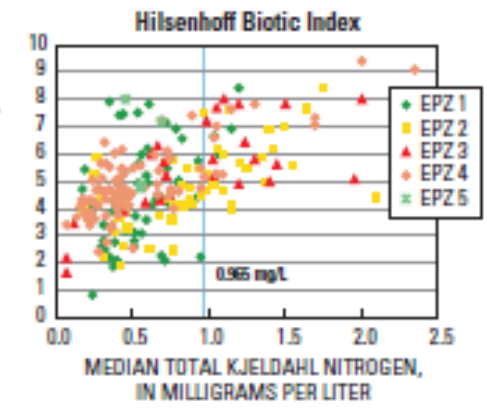
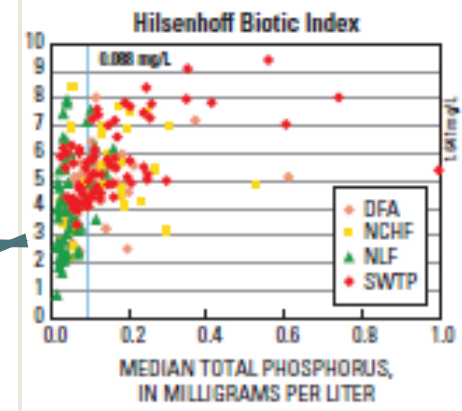


B.



Break Point Analysis

- EXPLANATION**
- ↔ First indication of biotic effects
 - ↔ Most rapid change in biotic index
 - * Defined threshold/breakpoint



Criteria Move Ahead



- 2009: Environmental groups notified U.S. EPA of lawsuit over lack of progress in development of numeric criteria in Wisconsin. As part of settlement agreement, numeric criteria must be completed by end of 2010.
- Adoption of standards was done on a very tight timeline
- “I'm sure none of you can understand the time limitations we faced. There was a very limited "political" window. If I missed the deadline by one day the entire effort would have crumbled”
-Jim Bauman, former DNR staffer
- A change in administration was expected, this would limit DNR's abilities
- “Tetrattech (EPA's contractor) beat us up technically. They did not like the competition from USGS and wanted states to contract with them for analyses.”
- After scramble encompassing less than a year, standards were submitted to EPA and approved in December of 2010



Rivers

100 $\mu\text{g/L}$



Streams

75 $\mu\text{g/L}$



Reservoirs

- Not Stratified = 40 $\mu\text{g/L}$
- Stratified = 30 $\mu\text{g/L}$



Inland Lakes

Ranges from 15-30 $\mu\text{g/L}$



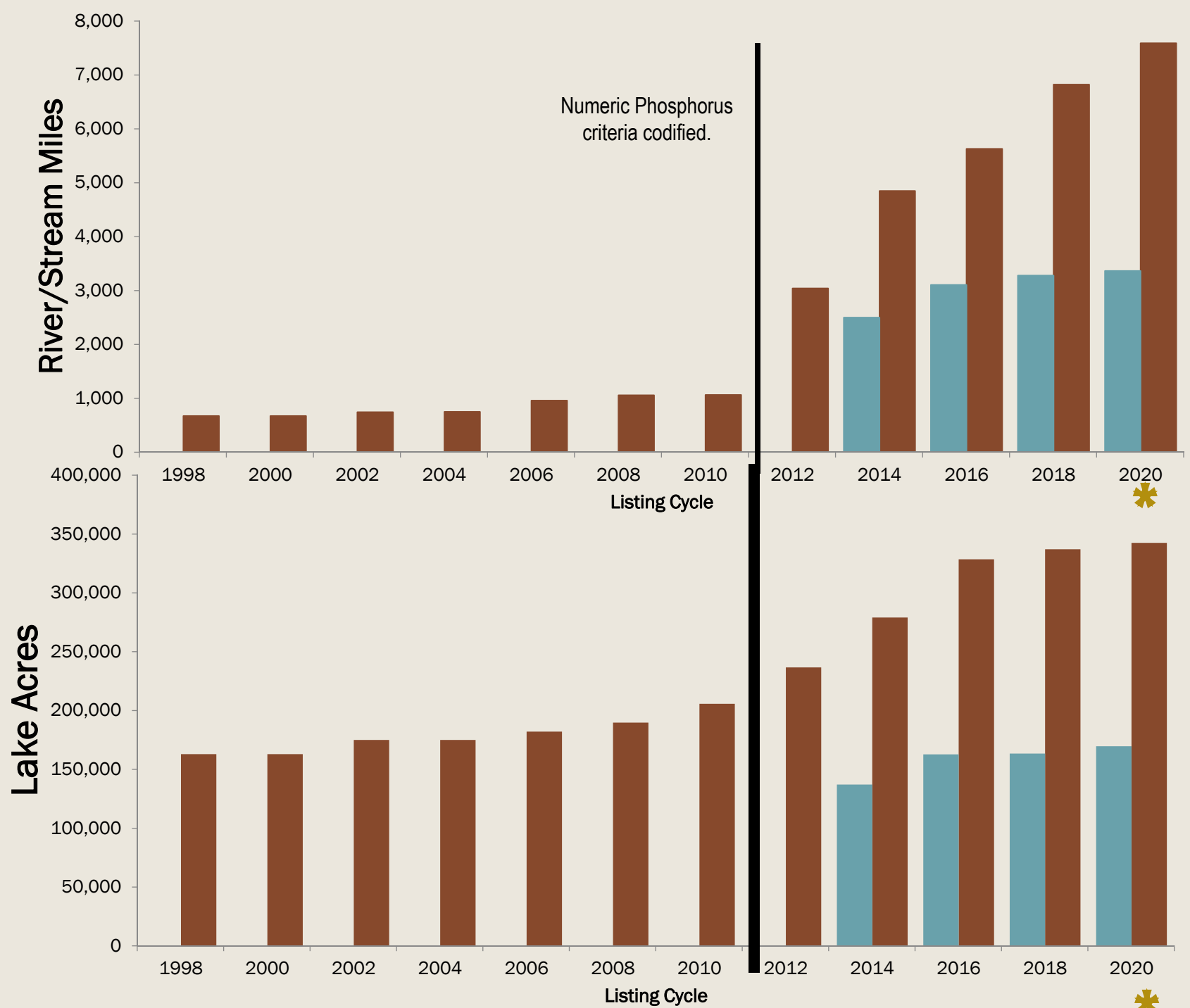
Great Lakes

- Lake Michigan = 7 $\mu\text{g/L}$
- Lake Superior = 5 $\mu\text{g/L}$

Phosphorus Listings by Cycle

Amount (by size) listed each cycle (cumulative).

- Listed
- Supporting Use(s)



Impact on Listing & Delisting

■ Optics

“Wisconsin’s waters are all dirty and unusable!”

“Our waters are getting worse!”

“Tourists won’t want to use an impaired lake!”

Green Bay Press Gazette. HOME NEWS BUSINESS JOBS USA TODAY 53° M

Number of polluted waters in state, counties continue to rise

CT Feb. 24, 2016

Wisconsin DNR adds more than 200 lakes and rivers to impaired waters list

List includes nearly 1,300 bodies of

BY CHUCK QUIRMBACH, WISCONSIN PUBLIC RADIO

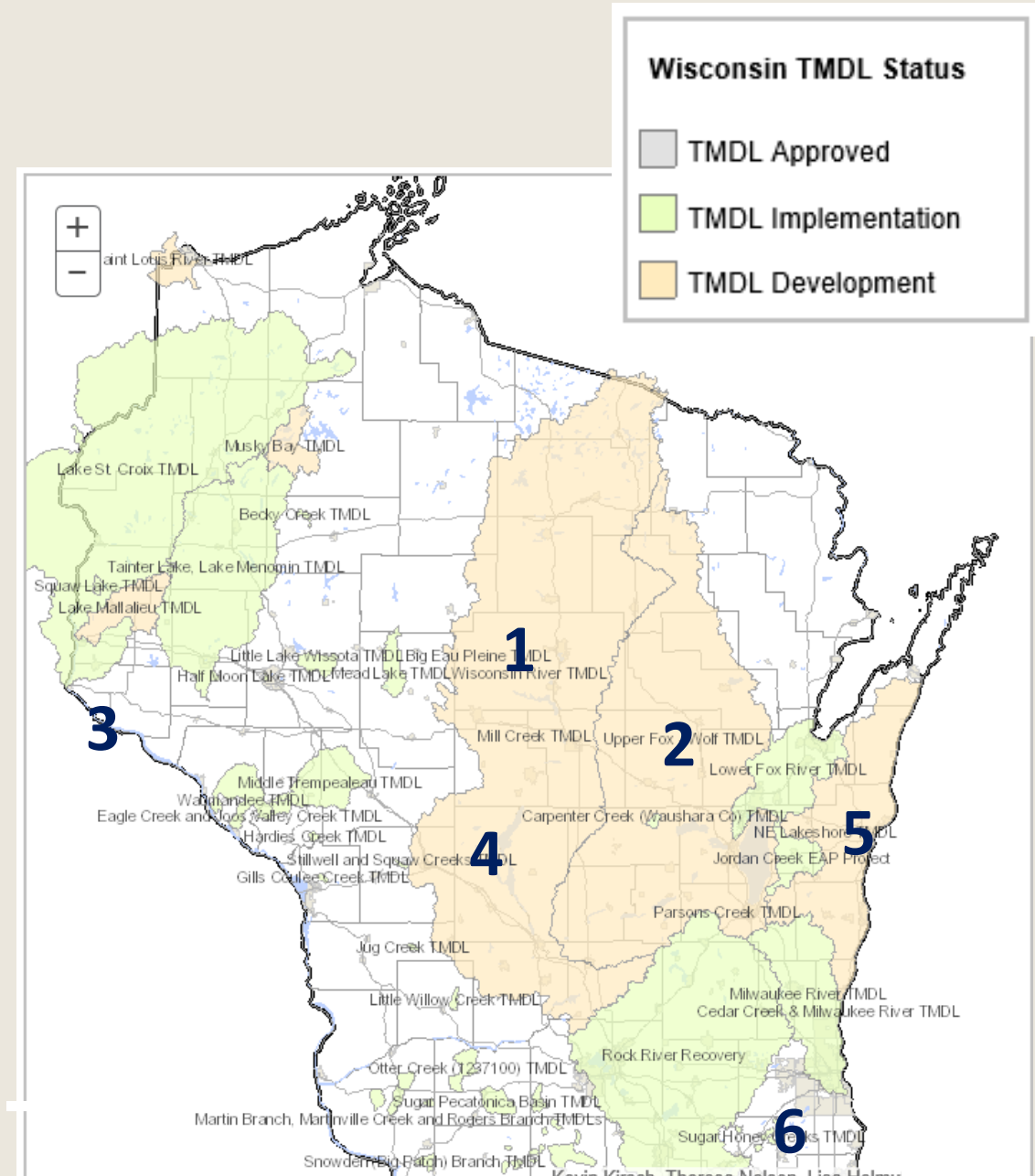
DOOR COUNTY PULSE | THE WATER HEADLINES NATURE OUTDOOR

Wisconsin Finds 240 More Impaired Waterways

By Jackson Parr, Peninsula Pulse – November 22nd, 2017

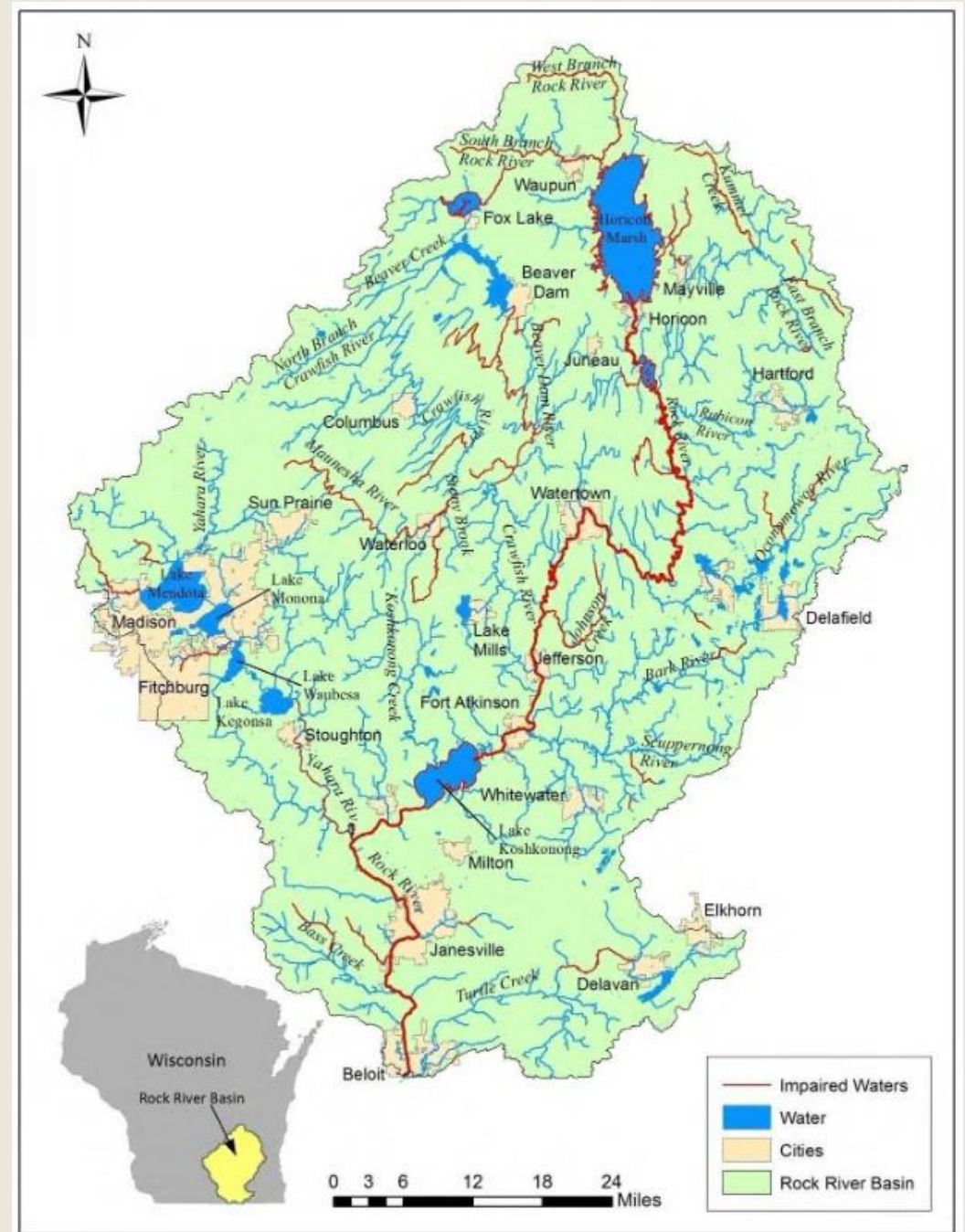
Impact on TMDLs: Phosphorus Dominated

1. Wisconsin River Basin - TP
Approved April 2019.
2. Upper Fox-Wolf Basin – TP & TSS
DNR reviewing and responding to public hearing comments.
3. Lake Pepin (Led by MN) - TP and TSS
4. Wisconsin River Basin – BOD
Collecting low flow DO and BOD samples
5. NE Lakeshore TMDL – TP and TSS
Requested by State Legislature. Currently collecting monitoring and modeling data. EPA contractor support for watershed modeling.
6. Fox-Illinois Basin – TP and TSS
Currently scoping project and examining what additional monitoring data needs to be



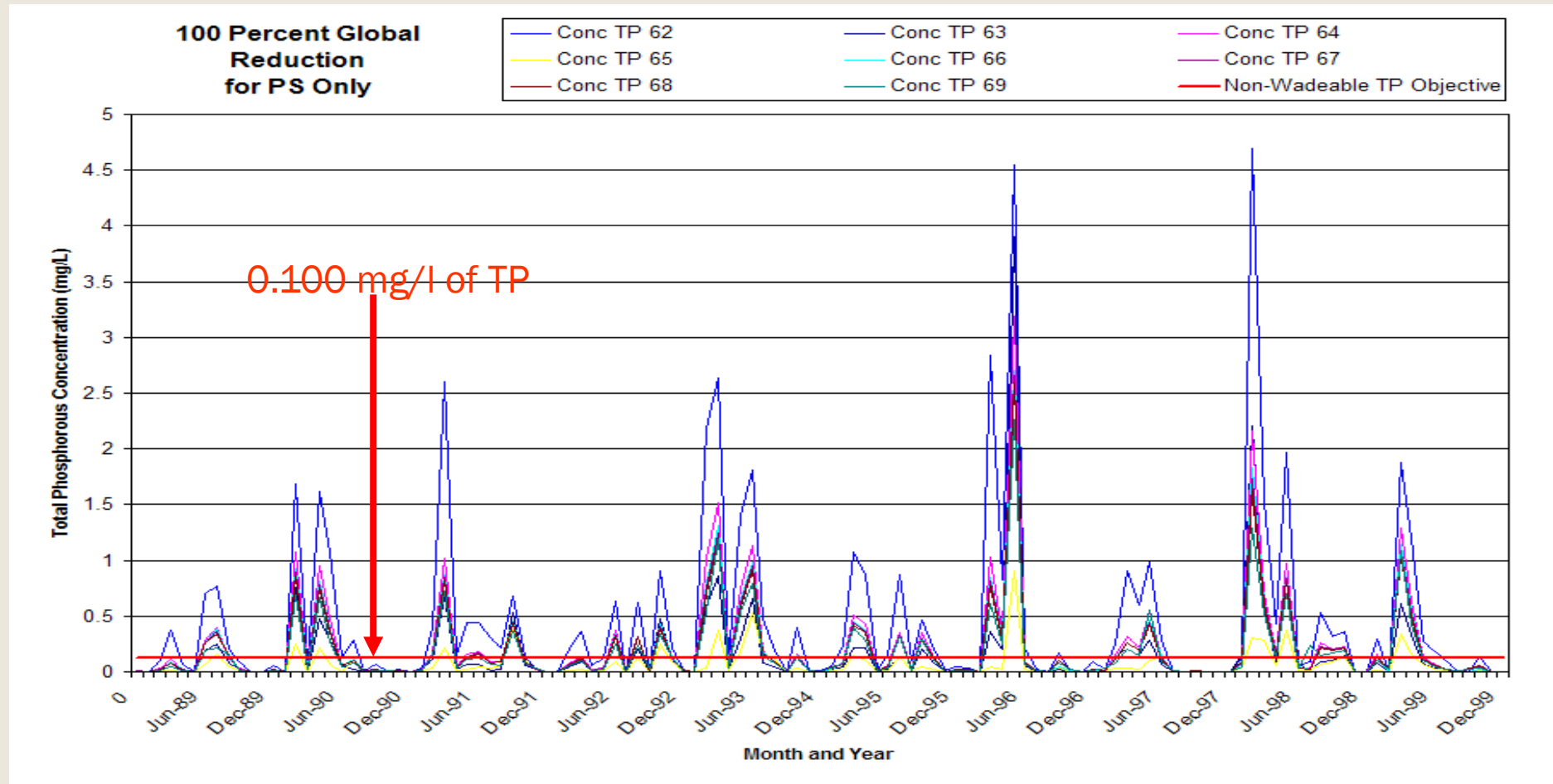
Rock River TMDL

- First TMDL after numeric criteria promulgated (2012)
- Addressed formally listed “impaired” waters
 - *Rock River mainstem*
 - *Two or three larger tributaries*
- Did not address exceedances on smaller tributaries
 - *Many dischargers received restrictive local limits AND wasteload allocations*
- TMDL provides limited value for many dischargers



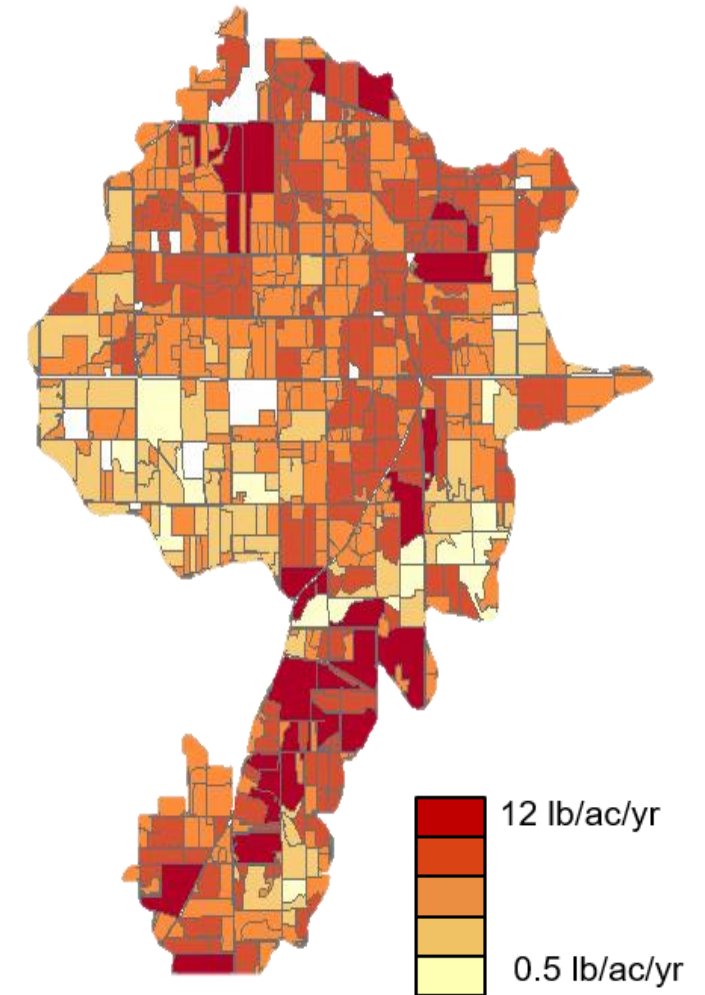
Expression of Nutrient Criteria in TMDLs

- The numeric criteria specific in code lack frequency and duration. This led to the first draft TMDL utilizing the criteria to have allocations set to meet the criteria 100% of the time.



Total Maximum Daily Load (TMDL) Development

- Following the Rock River effort, subsequent TMDLs have improved
- All calculations done at localized subbasin scale
 - *Every small stream has a numeric criterion*
- Includes a detailed agricultural assessment using Snap Plus to define edge-of-field loading values
- All sources assigned the same % reduction from baseline
- Edge-of-field agricultural targets resemble a WQBEL for crop fields



0 15 30 60 Miles

Wisconsin DNR, 2022



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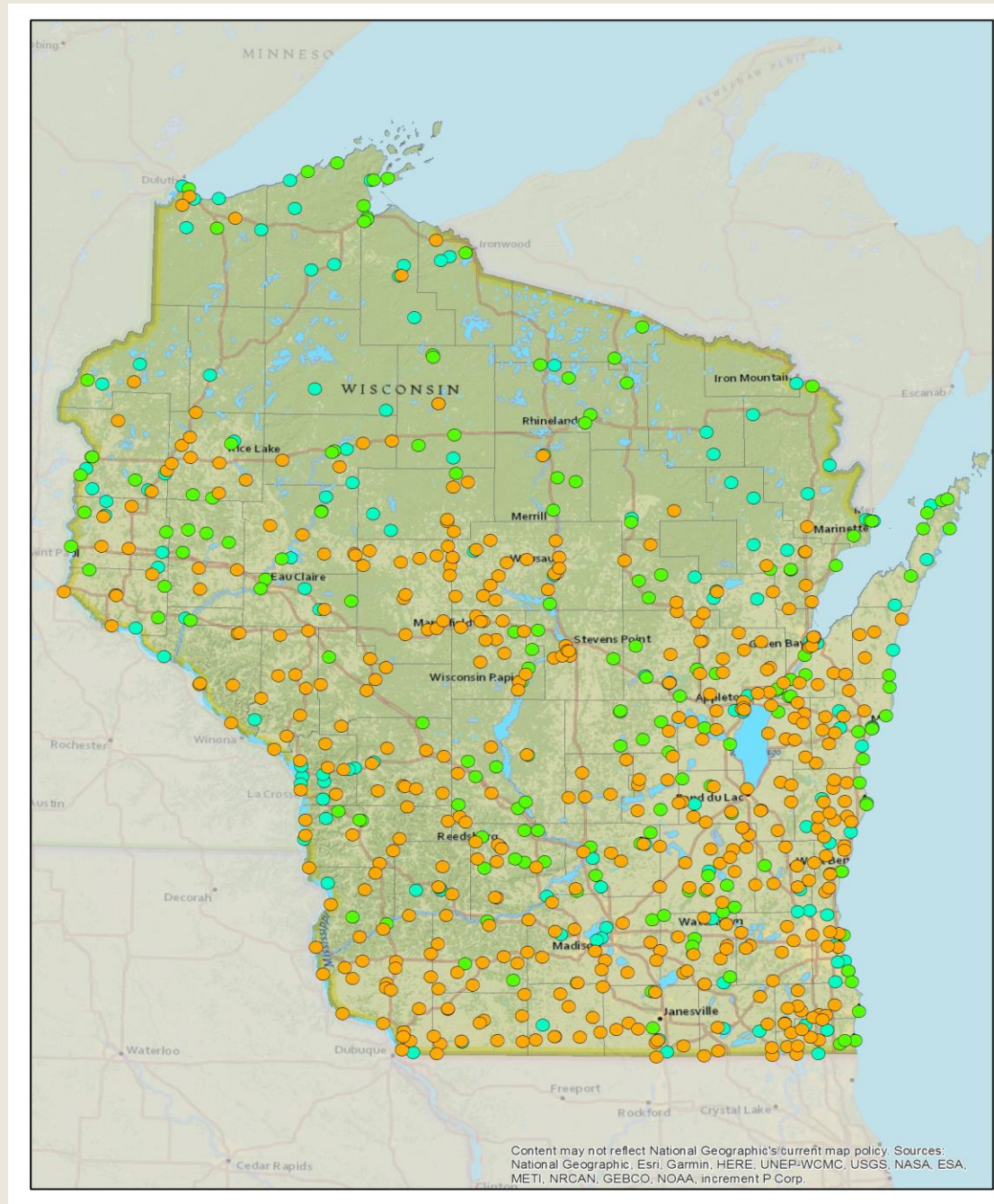
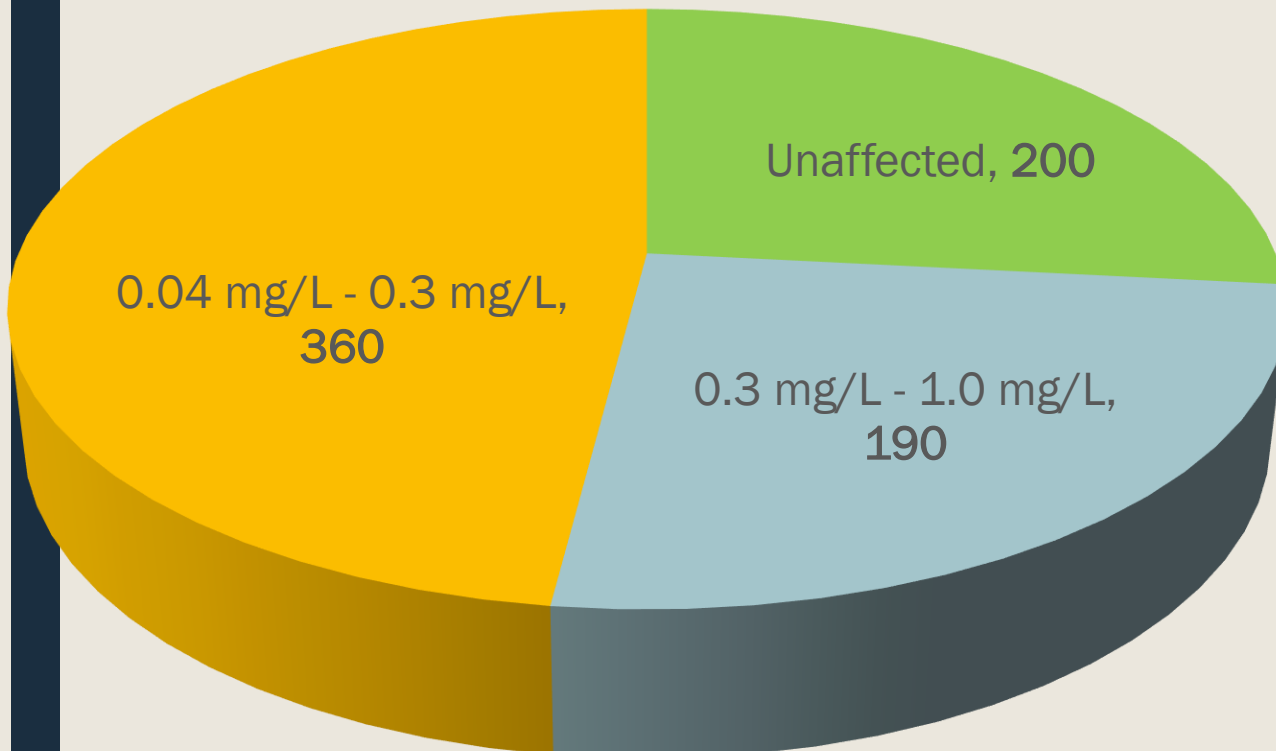
POINT SOURCE IMPLEMENTATION

Water Quality Based Effluent Limits: Total Phosphorus

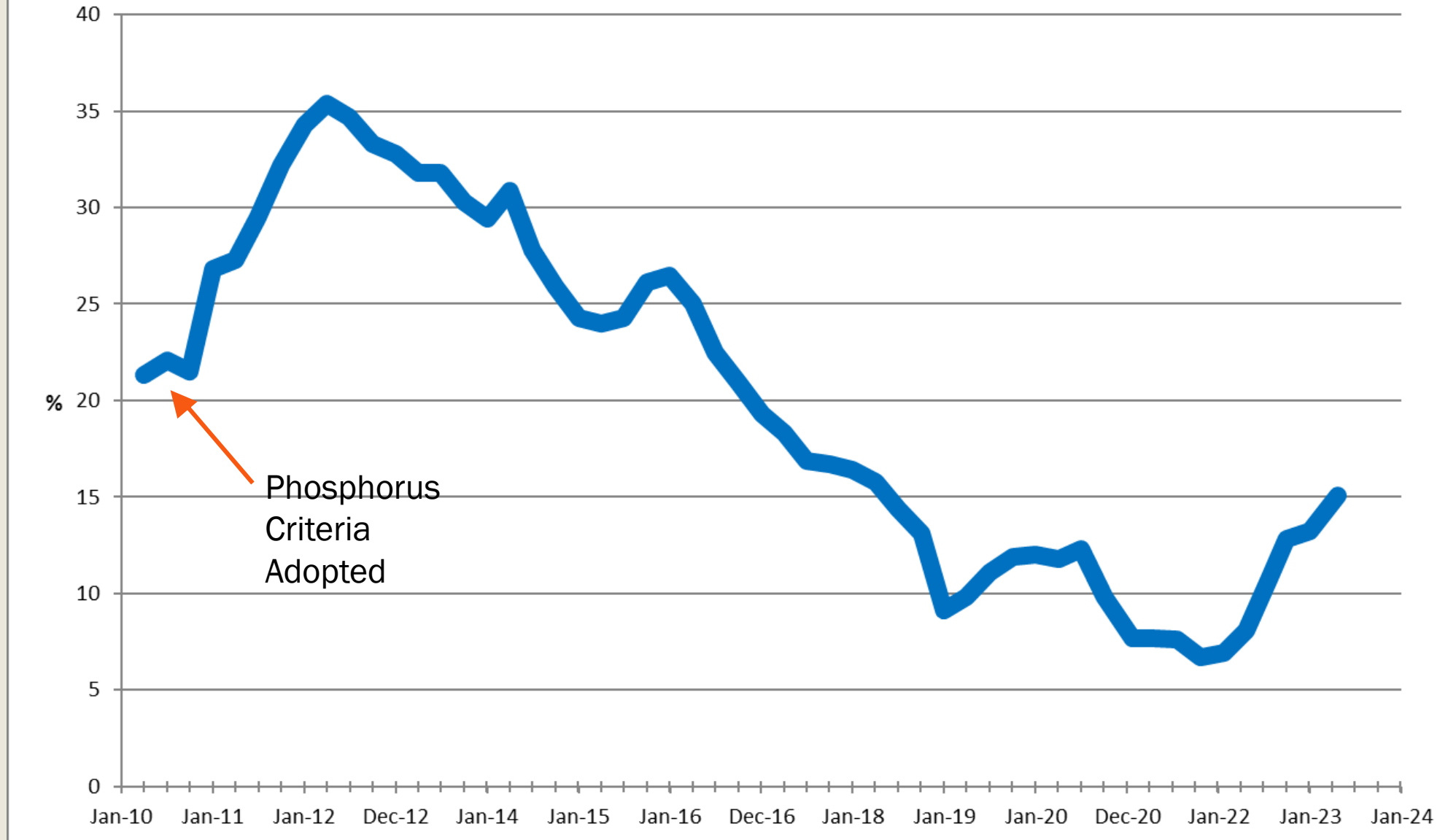
Permitted Facilities:

- 750 surface water dischargers

Phosphorus WQBELs Statewide: Pre-TMDL



STATEWIDE BACKLOG



Following adoption of numeric criteria, the backlog sharply rose and permits (~20-30) were contested

Phosphorus Compliance Schedules and Options

- Negotiated extending compliance schedules beyond the permit term; typically 7 to 9 years.
- Provides additional time to consider compliance options including adaptive management and water quality trading.

Timestep	Item
Year 1	Evaluate: Can WQBEL be met through operational change?
Year 2	Evaluate: Can WQBEL be met through minor upgrade?
Year 3	Evaluate: Major upgrade, trading, AM, variance
Year 4	Select compliance option, apply for variance if needed
Year 5	Permit reissued with selected compliance option or variance
Year 6	Implement selected compliance option (ASAP)
Year 7	Maximum timeframe for compliance (minor upgrade / trading)
Year 8	Construction of tertiary filtration only
Year 9	Complete construction of tertiary filtration

Calculation of WQBELs in NR 217 (Point Source Implementation Rule):

- Created during December 2010 rulemaking
- Data Needed:
 - *In-stream P concentration*
 - *Effluent P concentration*
 - *Effluent and stream flow*
- Uses a very conservative mass balance equation to calculate a WQBEL (NR 217.13) using low flow conditions and assuming no other sources:

$$\text{Limit} = [\text{WQC} * (\text{Qs} + (1-f) \text{Qe}) - (\text{Qs} - f \text{Qe}) * \text{Cs}] / \text{Qe}$$

TMDL Derived Limits vs NR 217.13 Limits:

Typical Phosphorus
Limits:

NR 217.13 Limits =
0.075 mg/L

WLA concentration
equivalent = 0.2 – 0.3
mg/L

- Typically less stringent than NR 217.13 calculated WQBEL because of allocations to other sources and more realistic flows.
- We can assume nonpoint source control
- TMDL-derived limits can be included in a WPDES permit in lieu of NR 217.13 limits if locally protective
- This creates a race to cover the state in TMDLs before initial compliance schedules end
- Antibacksliding may preclude realizing higher TMDL-based limits
- *If nonpoint reductions do not occur, then the TMDL derived WQBEL must be replaced with the more stringent NR 217.13 derived limit.*

Expression of TP Limits

- 122.45 (d)- All permit limitations, including those necessary to achieve water quality standards, shall unless **impracticable** be stated as:
 - *Maximum daily and average monthly discharge limitations for all dischargers other than publicly owned treatment works; and*
 - *Average weekly and average monthly discharge limitations for POTWs.*
- Impracticability demonstration approved 4/30/2012
 - *Allows 6-month average limits and monthly average limitations in limits < 0.3 mg/L*
- Operators are comfortable with lower limits when subject to longer averaging periods

Permitting Flexibilities are Essential

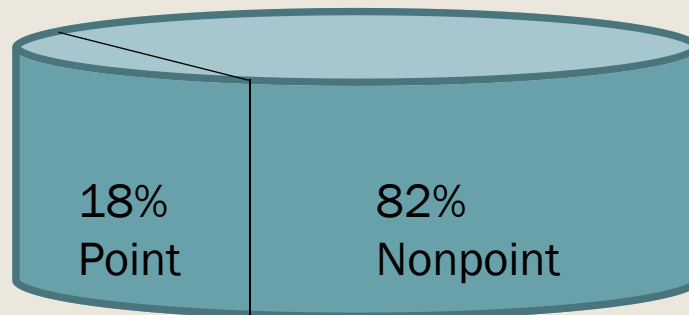
- Present possible solutions in tough situations – this goes a long ways!
- There is hope, because:
 - *Extra time may be granted under a variance*
 - *TMDL may raise effluent limits*
 - *Site-specific criterion may be adopted*
 - *Trading may be affordable*
 - *Adaptive management may be viable*
 - *Technology may improve*
 - *What about regionalization?*
 - *SRF funds could help...*



Water Quality Trading – point to nonpoint

- A tool for point source compliance; not a nonpoint panacea
- Typically it is more cost-effective to complete a minor facility upgrade first
- Reaches a wider breadth of nonpoint situations than traditional nps programs
- Allows communities to look at pollutant loads through a common lens
- WHO coordinates the project with landowners makes a huge difference

Phosphorus sources statewide:



Draw a wider circle: see a range of attitudes

“can we save the world?”

“can we game the system?”

- Watershed-based compliance offers many synergies:
 - *Carbon, habitat, wellhead protection, pollinators, recreation, aesthetics, flood resilience, farm profitability, ag efficiencies*
- And so many bad ideas (for credit):
 - *Plow under existing buffers so we can reestablish these buffers to trade*
 - *Riprap streambanks that were not actually eroding*
 - *Credits across watershed lines, local impairments not addressed*
 - *Well these condos do load less P than prior corn-soy fields...*
 - *Waterfowl deterrents, aquatic plant harvesting, algae-killing robots?*
 - *Trucking manure to Iowa?*

Water Quality Trading Clearinghouse



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Simplifying Water Quality Trading in Wisconsin.

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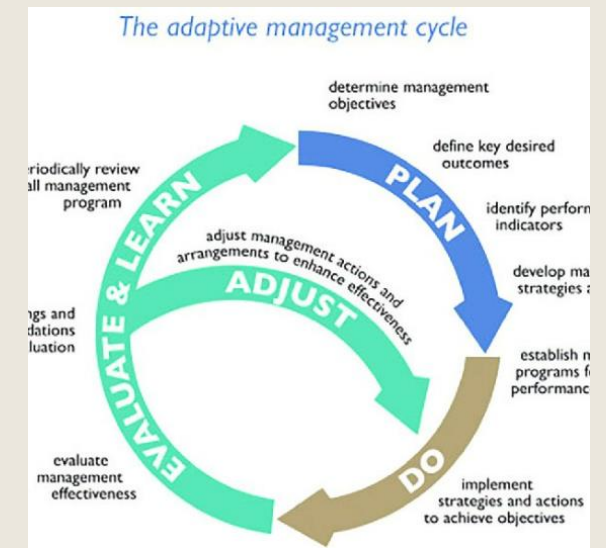


NR 217 Adaptive Management

- Discharger-led initiative to restore the watershed to the phosphorus criterion...
Or...
- Discharger-led initiative to delay imposition of WQBELs for ~15 years...
- A handful of facilities are not meeting permit-required milestones for nonpoint implementation. The stepped enforcement process begins...



Permitting flexibilities still need enforceable permit conditions



Water Quality Standards Variances

- Work early and often with your EPA Regional Staff
- Try to categorize facilities or situations for highest attainable condition purposes
- There are many more options once nonpoint source offsets are recognized as a component of HAC and the path to final compliance
- Require minor upgrades when possible
 - *Manage the “stranded assets” paradigm*



What can we expect from our small wastewater treatment plants?

- Minor upgrades to treat phosphorus
 - *Biological Treatment (some cases)*
 - *Chemical Phosphorus Removal (can fit with nearly all facilities)*
 - Shallow stabilization ponds and recirculating sand filters have challenges
- How low can we go?
 - *Lagoons: ~0.8 mg/L or lower*
 - *Mechanical plants: 0.4 mg/L or lower*
- Watch effluent toxicity when small facilities start trying to drive effluent phosphorus as low as possible

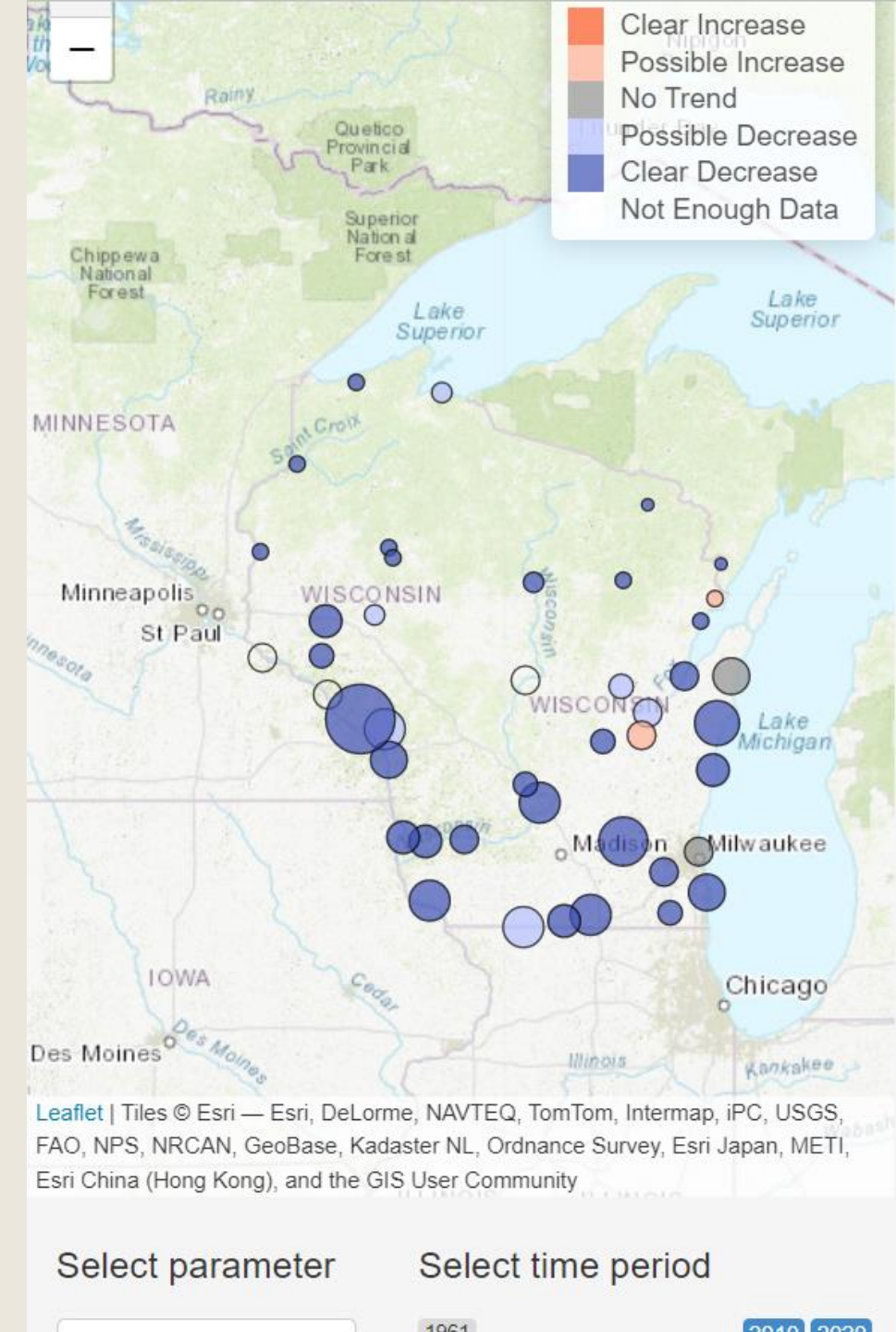
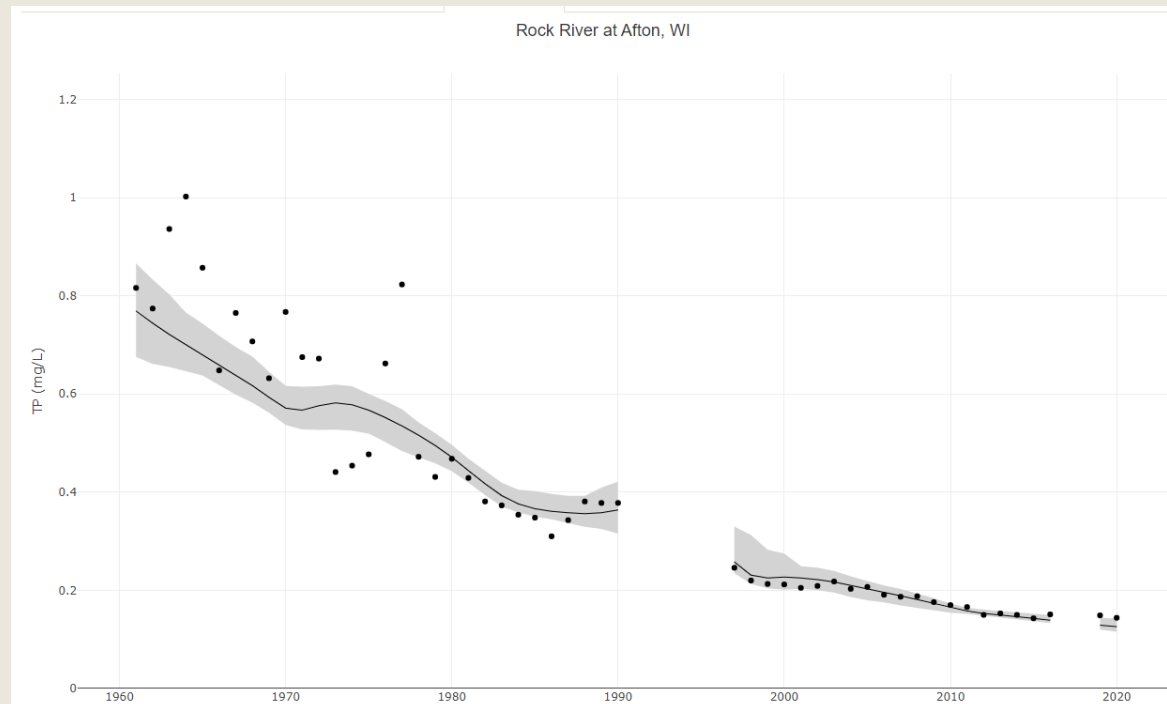




LOOKING AHEAD

Phosphorus WQ Trends

- Long Term Trends Data via the Shiny App
- [WI LTT Rivers \(shinyapps.io\)](https://wisconsin.dnr.shinyapps.io/riverwq/)
<https://wisconsin.dnr.shinyapps.io/riverwq/>



Outcomes of the February 7th Phosphorus Conference

- In-person Attendance: 255 (!)
- Accademia, Environmental NGOs, Agencies, Regulated Entities/Groups, Lake Associations, and more
- Talks and panels by agencies, researchers, municipal utilities
- Common themes:
 - *Waterways have not recovered – most are not meeting the phosphorus criterion*
 - *There are still some knowledge gaps: Accounting for tile lines, frozen ground, great lakes nearshore dynamics*
 - *There are still some policy and regulatory gaps: County-level regulation could be stronger, Ag performance standards too weak and disconnected from TMDLs*
 - *Point source nutrient programs are well received*



Focus shifts to nonpoint

- UW policy recommendation: undertake rulemaking for targeted performance standards addressing cropland
 - *Are cities, villages, and industries likely to support this after making significant investments in phosphorus control themselves?*
 - *Regulatory gap now extremely stark and well publicized*
- *Point source control alone is unlikely to affect sufficient change in agricultural watersheds. That does not preclude the relevance of point source control – it’s just that point sources will be the first ones controlled.*
- Transformative landscape change is needed to achieve phosphorus criteria
 - *Grass-based agriculture could lead the way*
 - *Empower farmers, producer-led watershed groups, and restore “land ethic” (no finger-pointing)*

THANK
YOU!



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