

Phosphorus Implementation Annual Update

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2/19/2026



Highlights for WPDES/phosphorus:

- Trends in IPV/MDV/AM/WQT
- Notes on the Multi-discharger Variance Renewal
- Adaptive Management – A Time of Transition
- Water Quality Trading's Significant Momentum
- Phosphorus Total Maximum Daily Load (TMDL) Update

Statewide Phosphorus Criteria: Adopted 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 $\mu\text{g/L}$

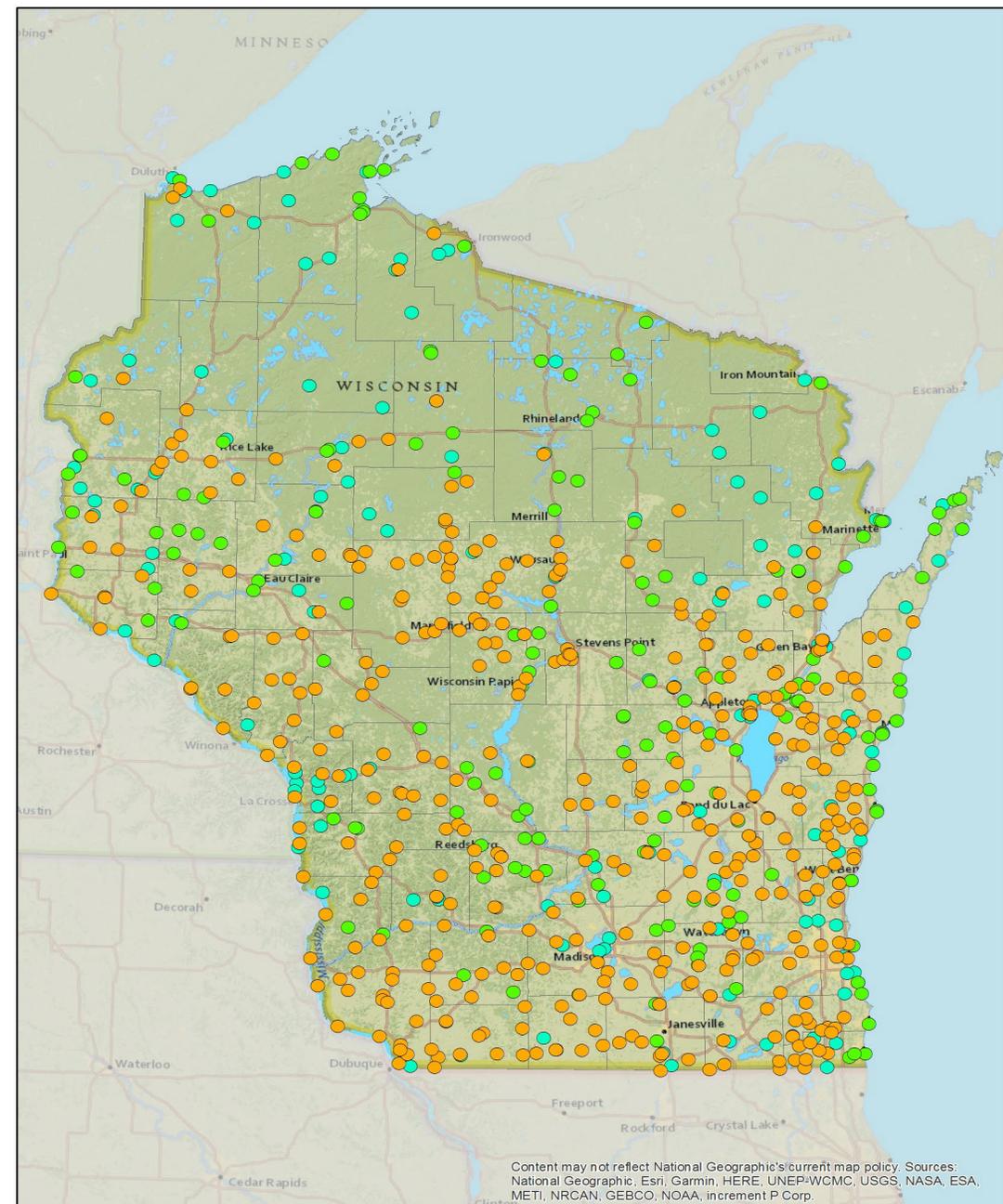
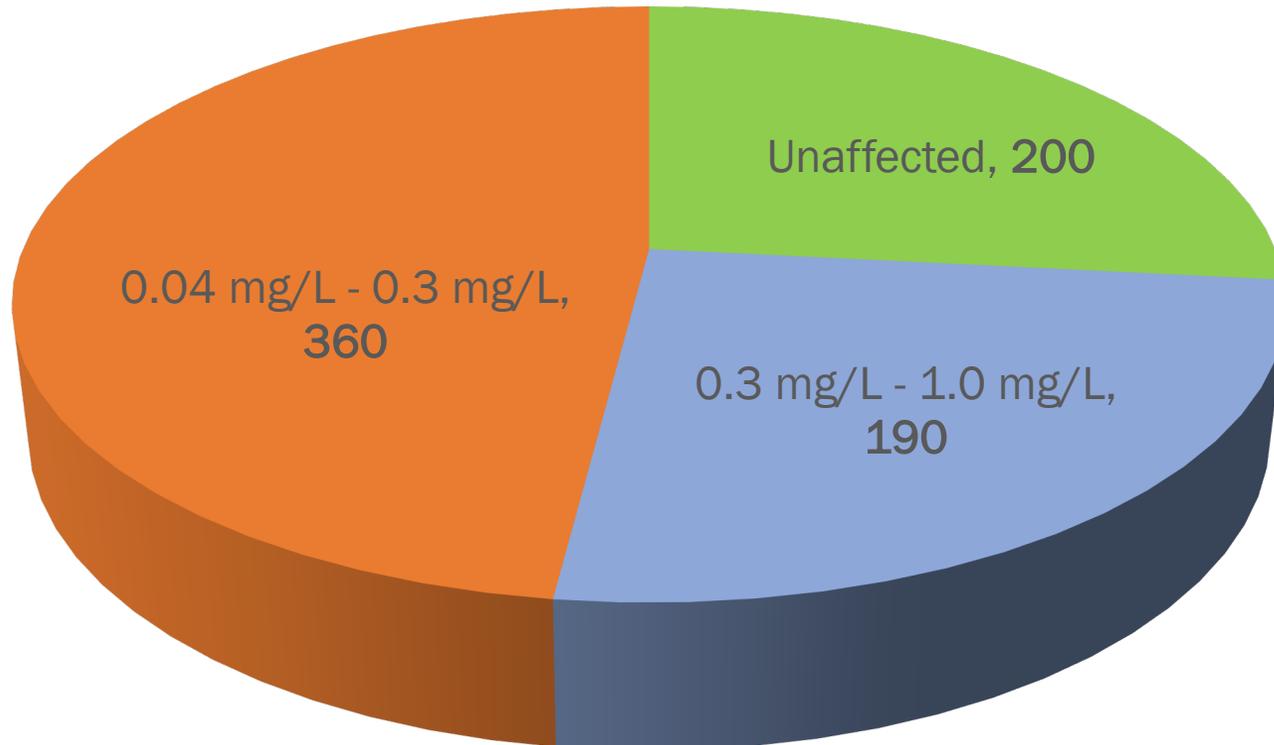
- Growing Season Median Value (rivers & streams)
- Summer Average Value (lakes & reservoirs)

Water Quality Based Effluent Limits: Total Phosphorus

Permitted Facilities:

- 750 surface water dischargers

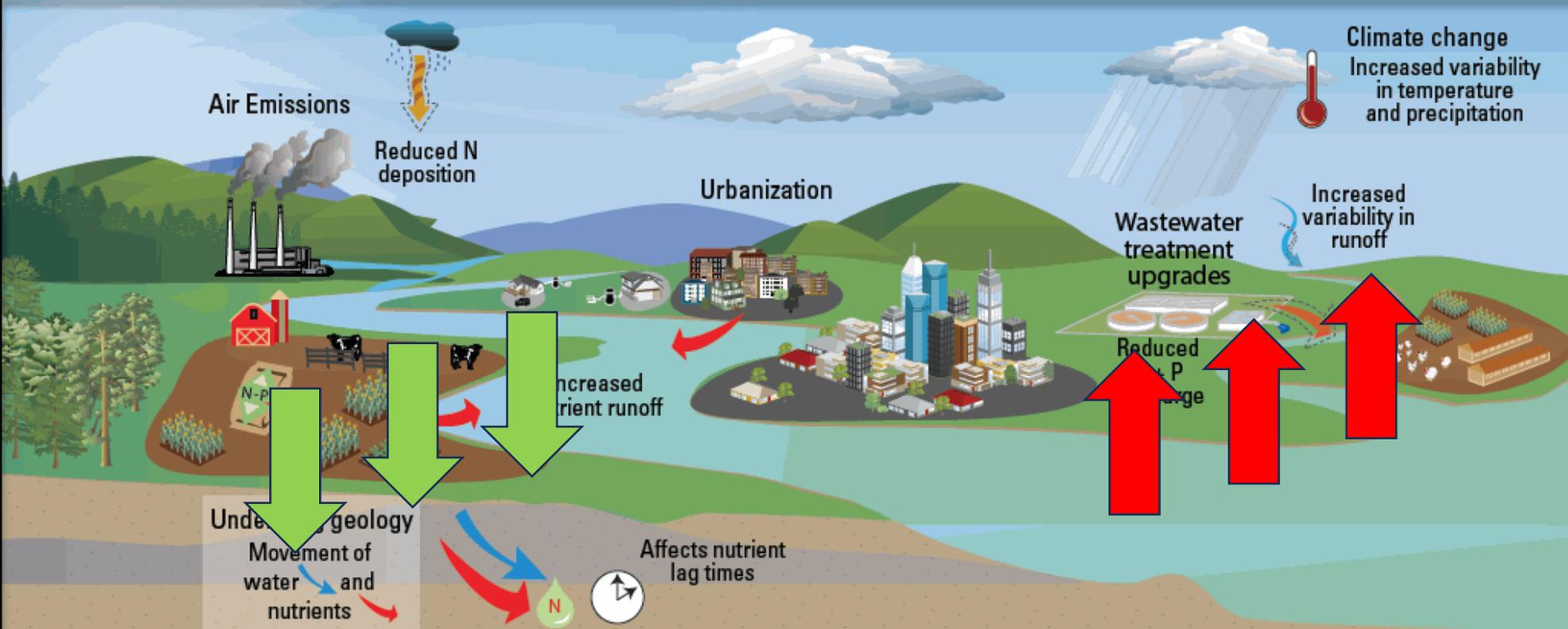
Initial Phosphorus WQBELs Statewide



Regulatory Flexibilities Required

To make phosphorus regulations manageable for dischargers, the State has developed compliance and variance options:

- Water Quality Trading (s. 283.84, Wis. Stats.)
 - Pound-for-pound pollutant offset
- Adaptive Management (s. NR 217.18, Wis. Adm. Code)
 - Effort to achieve the criterion in the discharger's receiving water
- Multi-discharger Variance (s. 283.16, Wis. Stats)
 - Delayed effectiveness of limits when economic hardship would occur
 - Make a watershed phosphorus offset (self-directed or via County LCD)
- Individual Variance (s. 283.15, Wis. Stats)
 - Delayed effectiveness of limits for economically challenged communities



Regulating nutrients benefits from a broader paradigm for water pollution control

Factors affecting sources of nutrients

-  Air emission reductions from power plants resulting in decreased nitrogen deposition from the air.
-  Wastewater-treatment plant upgrades resulting in decreased nitrogen and phosphorus loadings.
-  Land conversion from pasture to cropland resulting in intensive nutrient application (for example, fertilizer and animal manure).
-  Urbanization: Population growth and urban development resulting in losses of forested and agricultural land.

Factors affecting delivery of nutrients

-  Climate change resulting in more variable precipitation and temperature, which affects runoff and the delivery of nutrients to streams
-  Lag times (the length of time between nutrient input to the landscape and delivery into streams) are affected by groundwater age, underlying geology, sediment movement, phosphorus storage in sediments and riparian buffer age.

Diagram: USGS

Hyer, K.E., Phillips, S.W., Ator, S.W., Moyer, D.L., Webber, J.S., Felver, R., Keisman, J.L., McDonnell, L.A., Murphy, R., Trentacoste, E.M., Zhang, Q., Dennison, W.C., Swanson, S., Walsh, B., Hawkey, J., and Taillie, D., 2021, Nutrient trends and drivers in the Chesapeake Bay Watershed: U.S. Geological Survey Fact Sheet 2020-3069, 4 p., <https://doi.org/10.3133/fs20203069>.

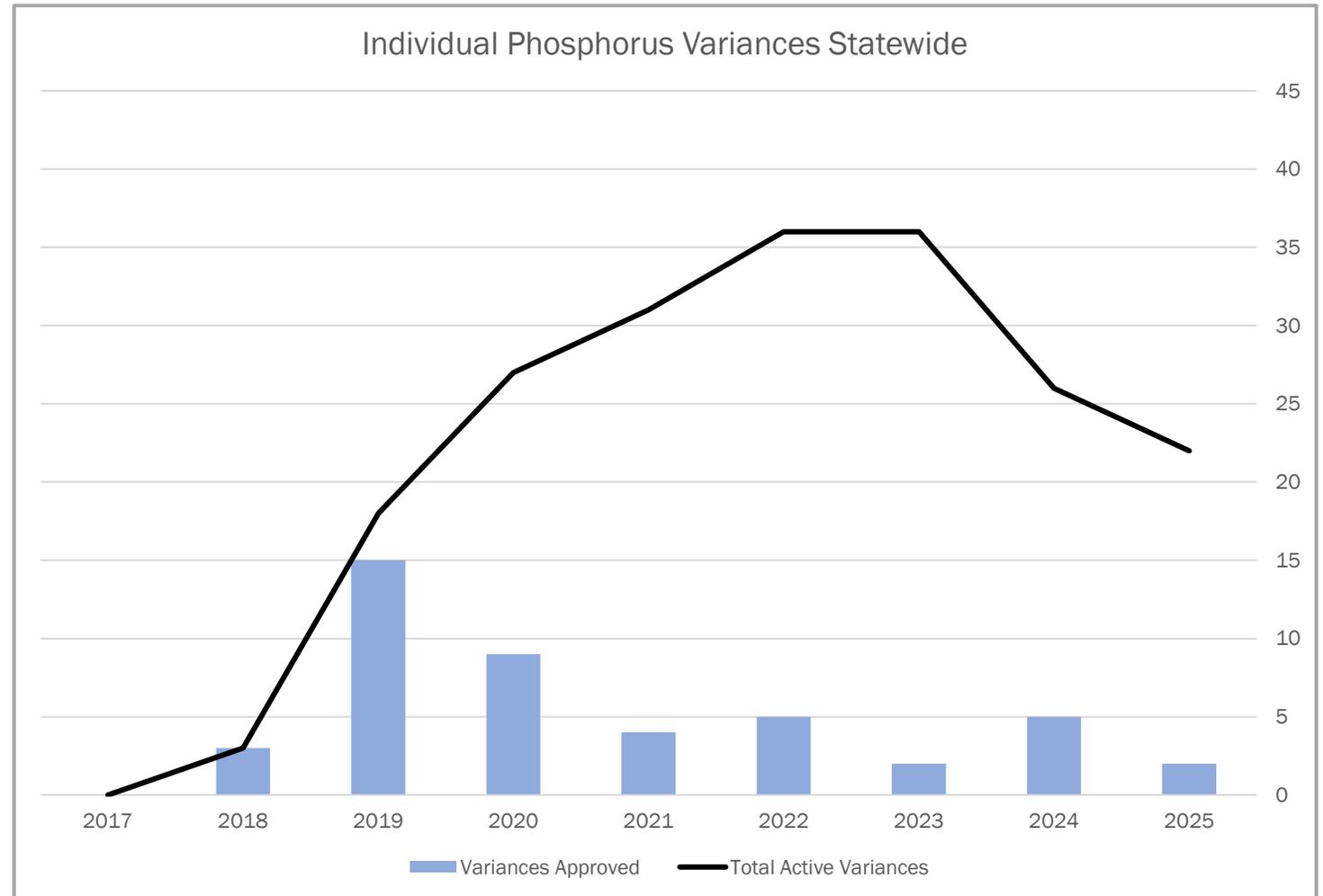
Individual Phosphorus Variances

- DNR and EPA work closely together for each variance issuance
- Site specific pollutant minimization program
- Most common focus: search for WQT, minor facility upgrades



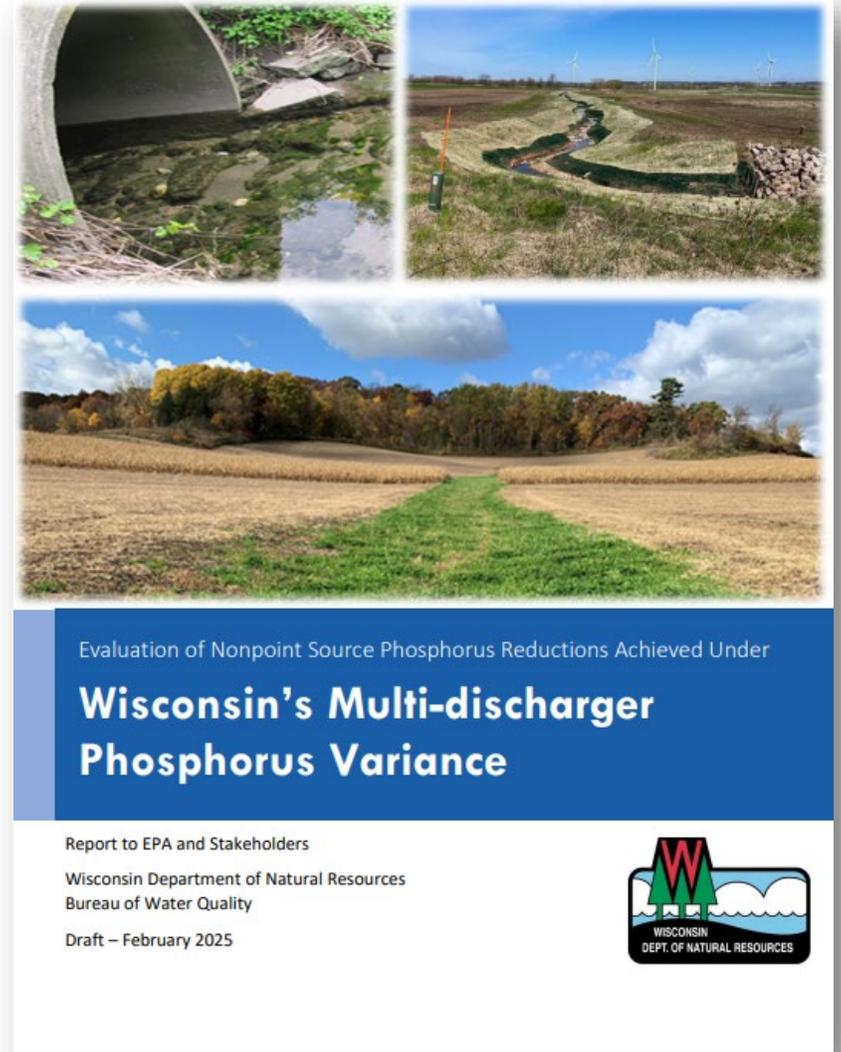
Individual Phosphorus Variances

- Program “topped out” at 36 total IPV’s
- >1/3 reduction in total variances between 2023 and 2025
- Success stories abound



Multi-Discharger Variance

- Phosphorus multi-discharger variance renewed through 2035
 - 200 Permittees still need a phosphorus compliance solution
 - \$900 million in capital costs for tertiary filtration upgrades
- Evaluation of phosphorus reductions
 - Counties have used funding effectively to reduce nonpoint/ag phosphorus (~20,000 lbs/yr)
 - In-plant treatment/optimization is more effective than predicted
 - median monthly average for all MDV facilities is ~0.4 mg/L
 - Discharge exceeds WQBELs by ~25,000 lbs/yr



MDV Reauthorization – What’s new?

- Updated secondary indicator scores
 - No major shifts in the eligibility landscape
 - Counties with higher “2% MHI” eligibility threshold: Brown, Sauk, Walworth, Washington, Waukesha
- Optimization Schedule changed to “Optimization and Compliance Planning”
 - Continue to evaluate phosphorus compliance options
 - Complete a financial alternatives analysis (per new EPA guidance)

4.1 Phosphorus Schedule - Optimization and Compliance Planning

The permittee is required to optimize performance and undertake compliance planning to control phosphorus discharges per the following schedule.

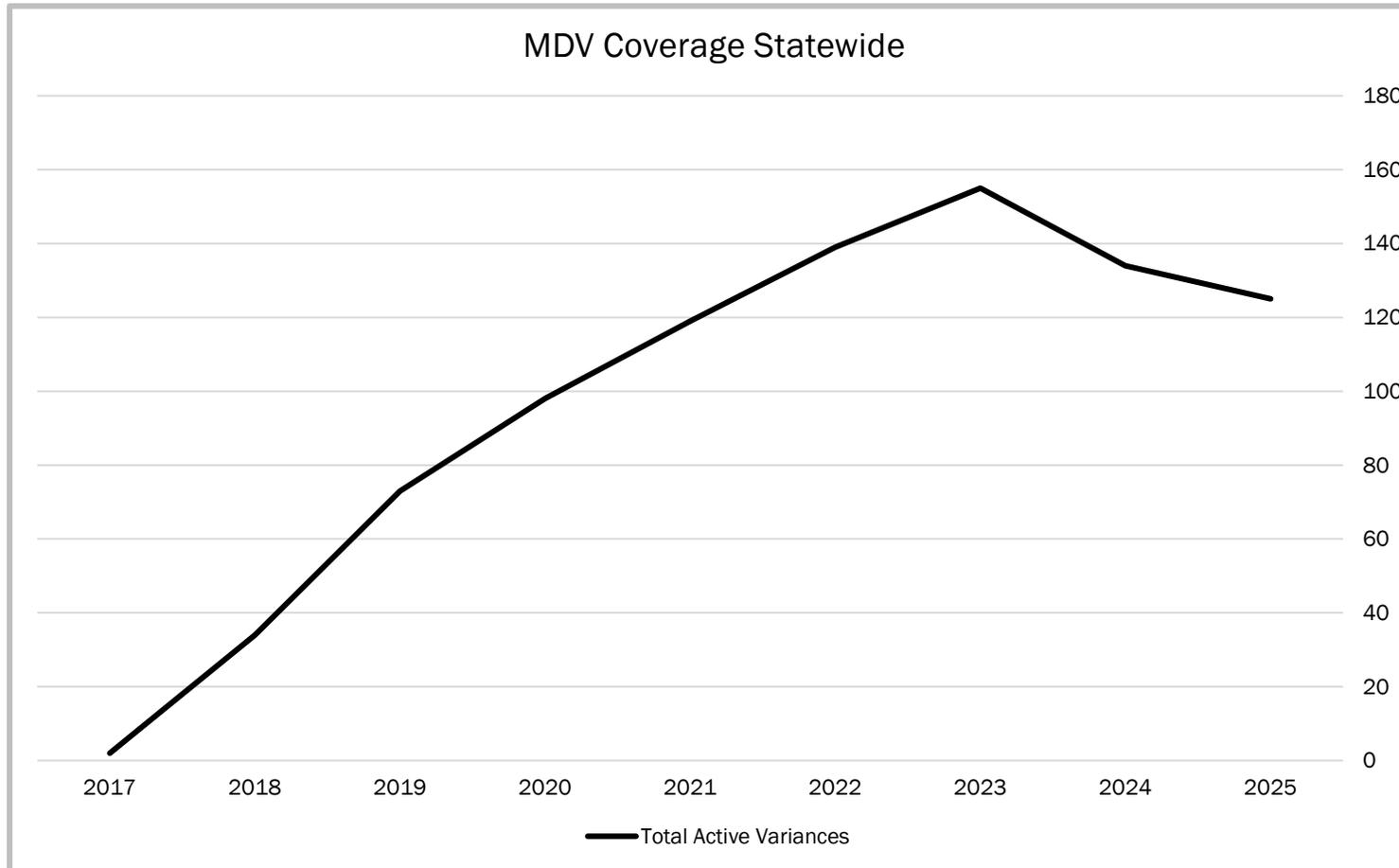
Required Action	Due Date
<p>Optimization and Compliance Alternatives: The permittee shall implement a phosphorus discharge optimization plan to control phosphorus discharges to the greatest extent practicable. Submit a progress report that summarizes the approach to phosphorus removal at the facility, the resulting concentration and mass loading for the last 12 month period, and any changes that were or are needed to optimize removal of phosphorus by the due date.</p> <p>The permittee shall also evaluate alternative phosphorus compliance options such as water quality trading and adaptive management. The progress report submitted on the date due shall also detail any outreach activities undertaken to evaluate these options, any communications with credit generators, brokers/clearinghouse, and any potential water quality trading or adaptive management projects that may lead to compliance with phosphorus WQBELs.</p> <p>Financial alternatives evaluation: If the permittee intends to seek a renewed variance at the end of this permit term, the permittee may complete a financial evaluation to support ongoing variance eligibility. The report must evaluate financial mechanisms that have the potential to make compliance with phosphorus WQBELs economically feasible. Include an assessment of the feasibility and financial outcomes of the following opportunities: variable rate structures, grants through USDA or other sources, and DNR’s Clean Water Fund Program. The assessment of the DNR’s Clean Water Fund program should take into account subsidized interest rate loans, principal forgiveness, and other options as outlined in EPA’s March 2024 Financial Capabilities Assessment Guidance, Appendix C.</p>	03/31/2027

Optimize Treatment

Look for a water quality trade

Financial feasibility of compliance

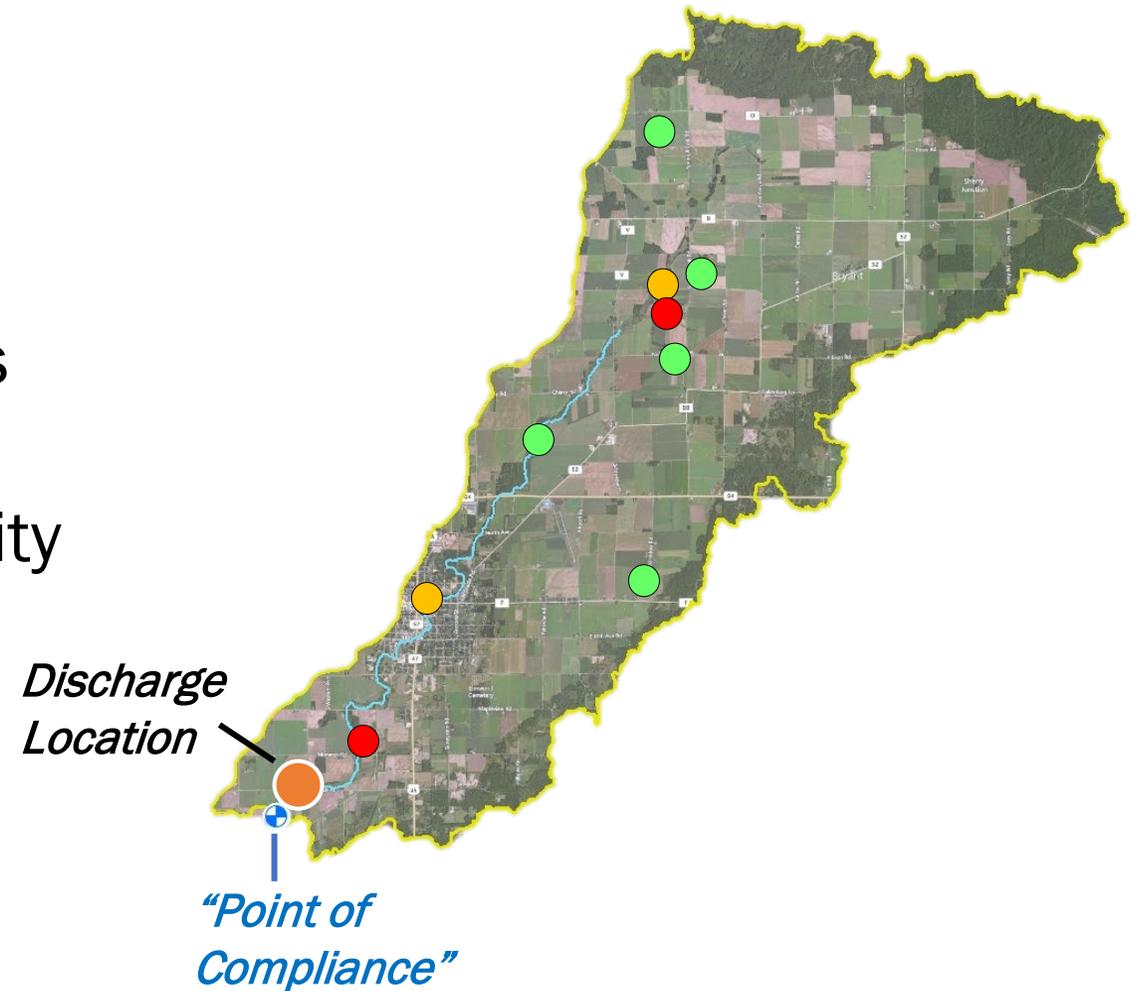
Multi-Discharger Variance



- ~25 MDV facilities have complied with phosphorus WQBELs
 - Water quality trading
 - Less-stringent TMDL limits
 - Optimized w/chemical phosphorus removal
 - Constructed tertiary filtration

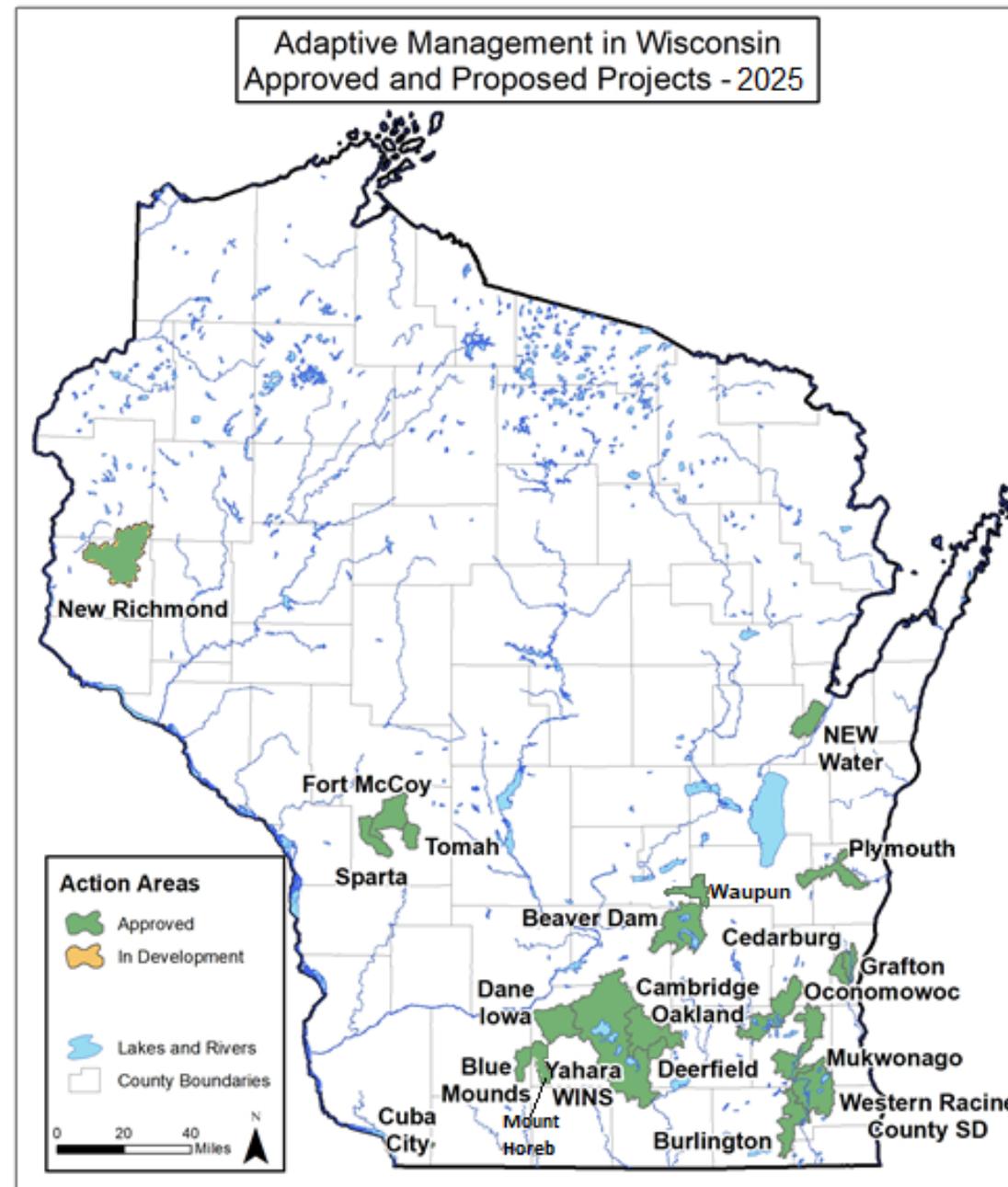
NR 217 Adaptive Management – What is it?

“Adaptive management allows wastewater facilities to work with point and nonpoint phosphorus sources to achieve the phosphorus criterion in the receiving water and thereby avoid making a major facility upgrade.”



Adaptive Management Participants

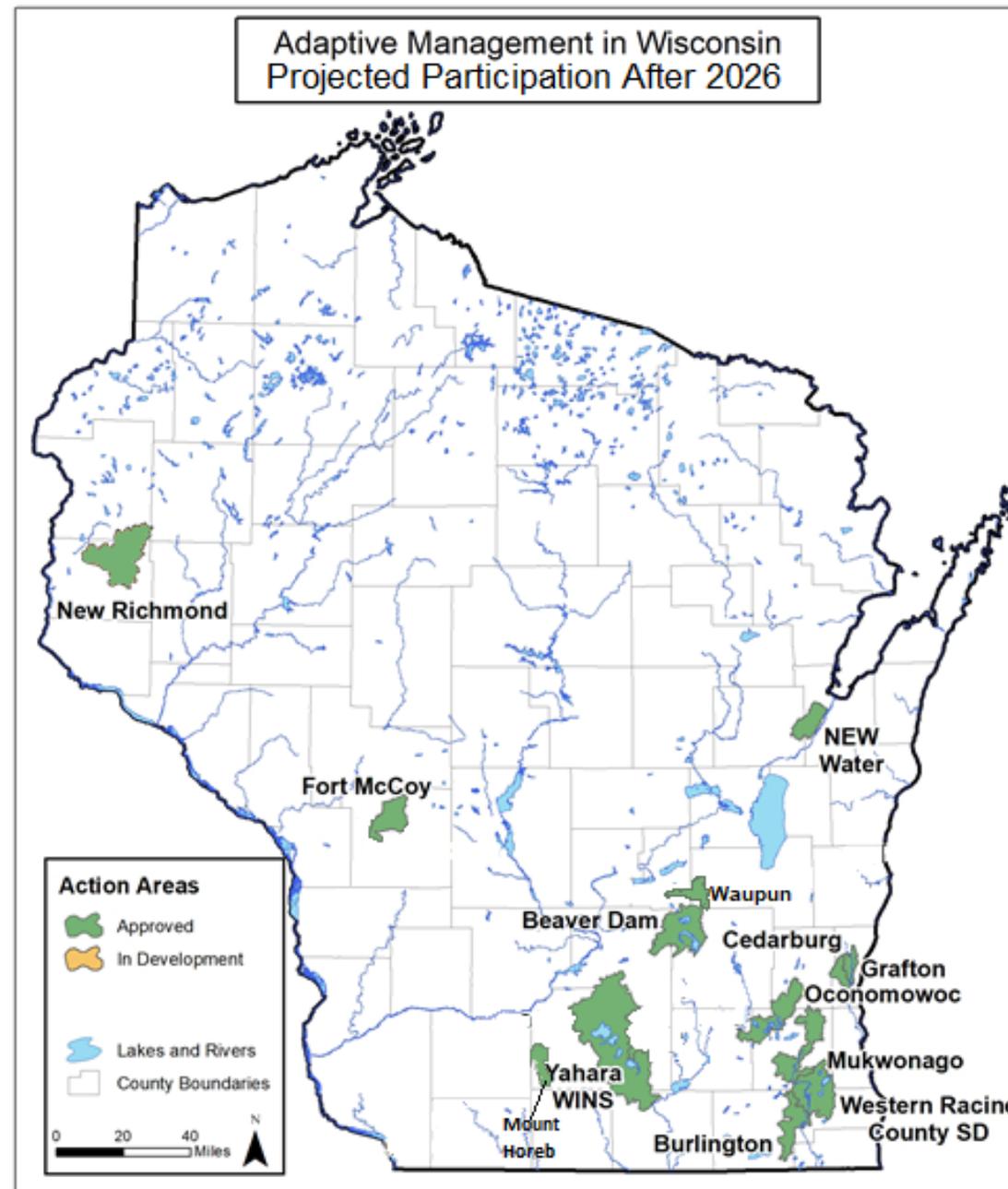
- 22 municipalities statewide
- Varying degrees of funding and momentum



Adaptive Management Participants (projected)

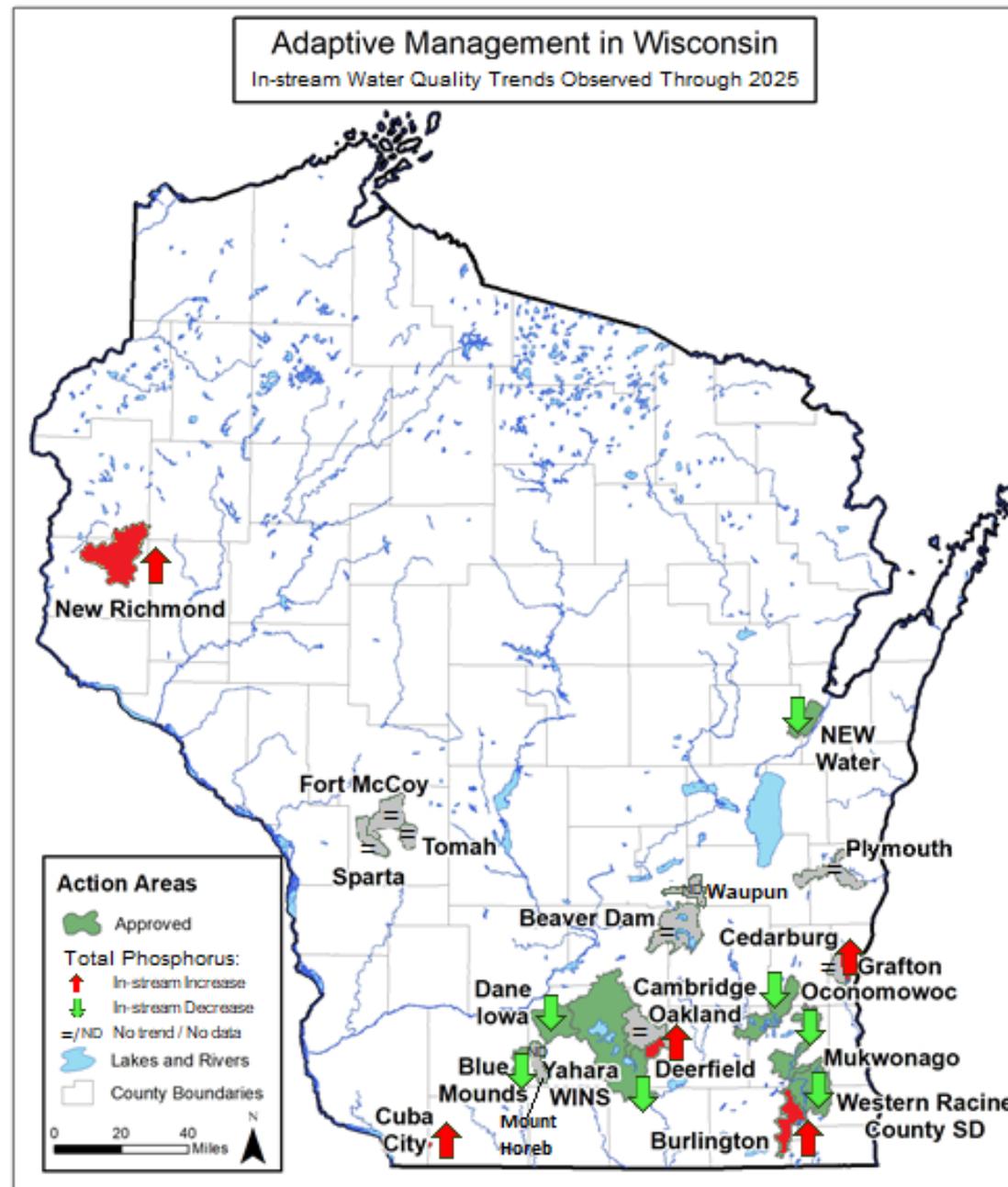
Some permittees are leaving AM:

- Water quality trades
- Failure to implement the AM plan
- Less stringent TMDL limits



What are we seeing for progress statewide?

- All permittees track in-stream phosphorus concentrations
- Many now have 5+ years of in-stream data
- General trends aren't always definitive or indicative of current level of investment/effort



Adaptive Management – A Time of Transition

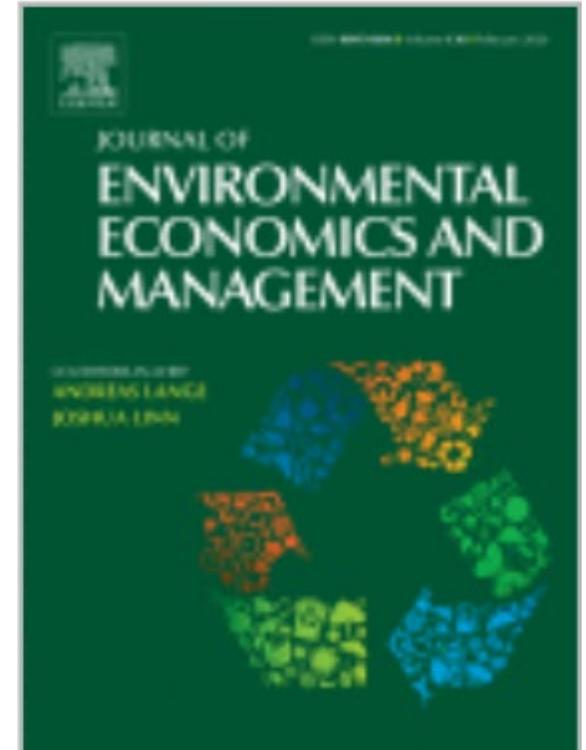
- Second permit terms under adaptive management
 - Did water quality improve?
 - Were adaptive management actions implemented?
 - Are partners still on board?



Water Quality Trading

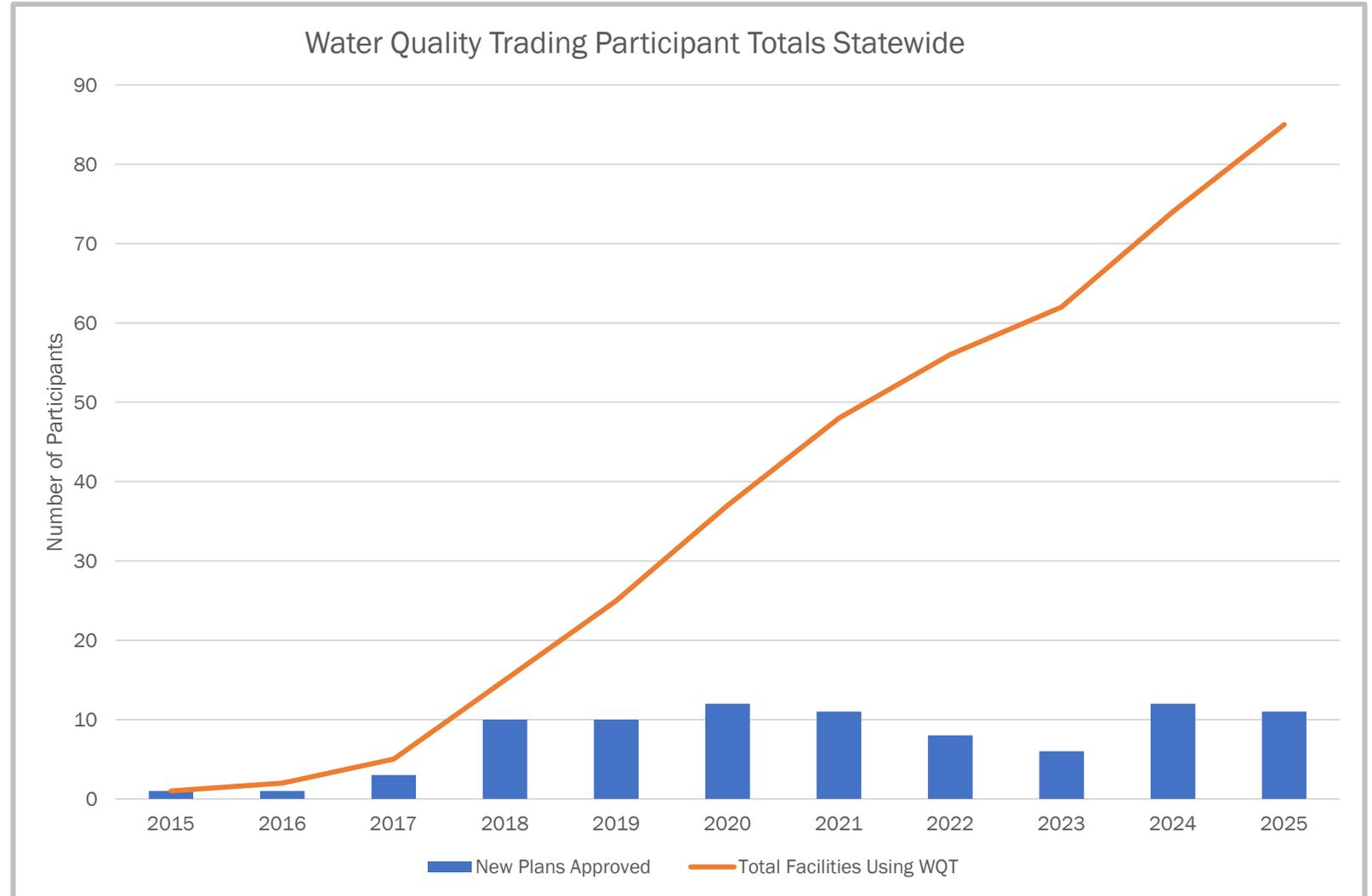
The differential benefits of market-based water pollution control policy (Raff et al., 2026)

- Compared in-stream water quality responses (total phosphorus) upstream and downstream of regulated point sources (n=63)
- Technological upgrades yield a 31% in-stream phosphorus reduction
- Water quality trades yield a 22% in-stream phosphorus reduction
- Upgrades require \$34,000 for each 0.01 mg/L of in-stream reduction
- Trades require \$6,000 for each 0.01 mg/L of in-stream reduction
- Wisconsin dischargers, in aggregate, save \$6,400,000 per year due to water quality trading
- The author suggests trade ratios may be too low



Water Quality Trading

- Steady adoption
- A total of 85 permittees have complied with phosphorus limits via trading
- DNR typically approving 10+ new trades per year
- 10+ currently under development



Water Quality Trading Guidance Updates

Timeline:

- Draft released in March of 2025
- Public comment thru June of 2025
- Significant comments received
- Revised document to be public noticed soon

Changes:

- Some aspects simplified (Appendix H Table)
- New practices: How to model/document baseline
- Template WQT plan and WQT agreement
- Generalized some aspects to accommodate MS4s

Management Practice	Uncertainty Factor ¹	Applicable Technical Standard	Method for Calculating Pollutant Load Reductions	Notes
Agricultural Practices				
Whole Field Management: Requires an approved nutrient management plan, filter strips/buffer strips ² , grassed waterways ³ , conservation or no till ⁴ , and cover crops. Additional practices as deemed by NRCS or county conservationist may be required to protect against mobilization and delivery of pollutants.	1	WI NRCS 590, 393, 332, 412, 345 329, 340 and 330		Requires an approved WI NRCS 590 nutrient management plan (NMP) that meets both the soil test-P and PI requirements. Requires a draw down strategy for nutrient concentrations that are above University of Wisconsin-Extension soil fertility recommendations. Due to the higher uncertainty of cover crops being successfully established after harvesting corn grain, water quality trading plans should not rely upon cover crops following corn grain.
Forage Production – Rotational Grazing	1.5	WI NRCS 528	SnapPlus or equivalent field scale model ⁵ (See SnapPlus Appendix D for modeling guidance)	Grass/hay crop established and maintained to provide continuous protection to soil surface; tillage prohibited. Unrestricted livestock access to surface waters prohibited, per s. NR 151.08(5)(a), Wis. Adm. Code. Water crossings must be designed to maintain bed and bank stability.
Forage Production – Mechanical Harvest	1.5	WI NRCS 512	Any shifting of pollutant loads to other fields must be subtracted from calculated reductions.	Grass/hay crop established and maintained to provide continuous protection to soil surface; tillage prohibited. Water crossings must be designed to maintain bed and bank stability. Unrestricted livestock access to surface waters prohibited, per s. NR 151.08(5)(a), Wis. Adm. Code. Requires an approved WI NRCS 590 nutrient management plan (NMP) that meets both the soil test-P and PI requirements. No mechanical application of manure, biosolids or industrial wastes allowed on snow-covered or frozen ground or areas with high groundwater or tile drainage.
Prairie Restoration	1	WI NRCS 327		Establishment of native prairie vegetation to provide continuous cover and maximize infiltration.

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Minnesota Stormwater Manual:
https://stormwater.pca.state.mn.us/index.php?title=Stormwater_management_for_solar_projects_and_determining_compliance_with_the_WQDES_construction_stormwater_permit
 Hydrologic Response of Solar Farms:
 "Hydrologic Response of Solar Farms", Lauren M. Cook, S.M. and Richard H. McCuen, Journal of Hydrologic Engineering/Vol. 18, No. 5, May 1, 2013. © ASCE, ISSN 1084-0699/2013/5-530-541
 Great Plains Institute "Photovoltaic Stormwater Management Research and Testing (PV-SMaRT) Potential Stormwater Barriers and Opportunities".
<https://www.betterenergy.org/wp-content/uploads/2021/10/PV-SMaRT-Barriers-and-Best-Practices.pdf>

Modeling Options
 For areas of the site not covered by the WQDES permit (i.e. areas not graded, disturbed, or used for solar panels and supporting infrastructure), credits can be calculated by comparing the existing land use to the final land use condition. In most cases it is anticipated that this will entail converting agricultural land to some sort of perennial vegetation. The baseline level of pollution loading for an agricultural setting can be calculated using SnapPlus. The pollutant loading associated with a perennial vegetation scenario can also be calculated using SnapPlus. The difference between the two scenarios' pollution loading can be used as a pollution reduction that is eligible for generating water quality trading credits.

For areas covered under the WQDES permit, credits are generated by reducing pollutant loads beyond the pollution loading that would otherwise occur when meeting the WQDES permit requirements. This can be quantified by using SnapPlus to model baseline compliance with permit requirements to define the applicable credit threshold.

Solar Panels: The impervious area created by solar panels are not accounted for in the SnapPlus model. However, by adequately disconnecting the impervious area created by the solar panels, the cumulative effect of imperviousness can be minimized. This is possible because the impervious area of the solar array directly discharges to a vegetated pervious area underneath the next-downslope panel.

Figure L1: Profile of solar panel array providing impervious area disconnection
 (Ohio EPA, Guidance on Post-Construction Storm Water Controls for Solar Panel Arrays)

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impairment and restore natural ecological function (Cendrero, et al., 2022; Lundberg, et al., 2021; Palmer, et al., 2010). Streambank stabilization projects that simply serve to "patch" eroding banks may fail to address the underlying causes of streambank erosion and are likely to redirect erosive energy to other parts of the stream. In cases such as this, a "streambank stabilization" project may actually degrade water quality and habitat of the receiving water (FERWG, 1998). Such a project would fail to meet water quality improvement requirements under s. 283.84(1m)(a), Wis. Stats. and would not be eligible to generate pollutant trading credits.

Streambank erosion, whether natural or anthropogenic, is a symptom reflective of the (im)balance of the geologic and hydraulic/hydrologic driving variables that influence stream stability, fluvial process, and morphology (Figure F1 below, adapted from Lane, 1955; Stone, et al., 2015). Changes in these driving variables, whether at the local, landscape, or watershed scale, may destabilize the dynamic equilibrium in a graded river and drive fluvial system response to accommodate changing water and sediment regimes in the stream system.

"Graded River": In a graded river the channel slope has adjusted such that it provides the flow velocity and bed surface texture required to transport the mixed-size load supplied from upstream. The representative water discharge does not affect the equilibrium representative flow velocity, bed shear stress, and bed surface texture. (Bloom, et al., 2016)

Figure F1: The transport of water and sediment in a stream is a dynamic equilibrium between driving and resisting forces (adapted from Lane, 1955). Changes in watershed hydrology that significantly alter water and sediment loading to streams can cause complex, systemic changes that may include streambank erosion as a symptom.

The spatial scales of perturbations that result in instability for a given stream reach can vary from acute, local, riparian scale to chronic, watershed/basin scale. Similarly, temporal scale perturbations that influence fluvial processes and channel stability can occur in minutes (e.g. landslide, earthquake, etc.), span years (e.g. riparian pastures, transportation projects) or even millennia (e.g. glacial rebound, base-level eustasy) (Figure F2 –

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Example 1: Ephemeral Gully Erosion:

Figure M1: Ephemeral Gully Erosion Dimensions Diagram, adapted from https://efwg.ca.gov/andca.gov/references/public/NO/gully-ephemeral_erosion.pdf

Example 2: Classic Gully Erosion:

Figure M2: Classic (permanent) Gully Erosion Dimensions Diagram, adapted from https://efwg.ca.gov/andca.gov/references/public/NO/gully-ephemeral_erosion.pdf

Gully Documentation in WQT Plans:
 To support the pollutant load quantification, water quality trading plans that propose credit generation via gully stabilization should provide the following documentation that supports calculation inputs:

- A map should show the location of each gully on the field and define the length of each gully. The map should also define where soil samples were taken.

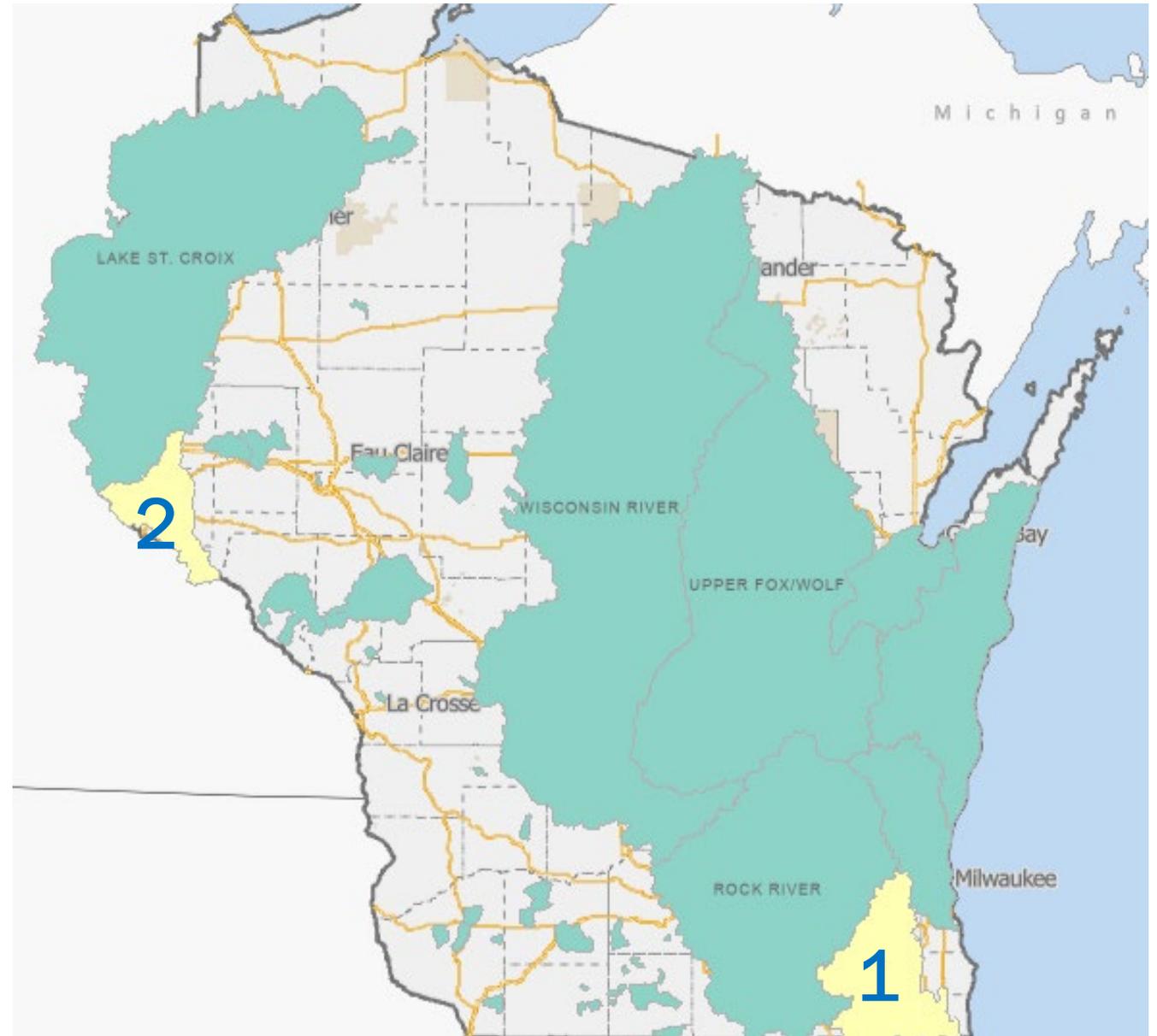
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Status of TMDLs

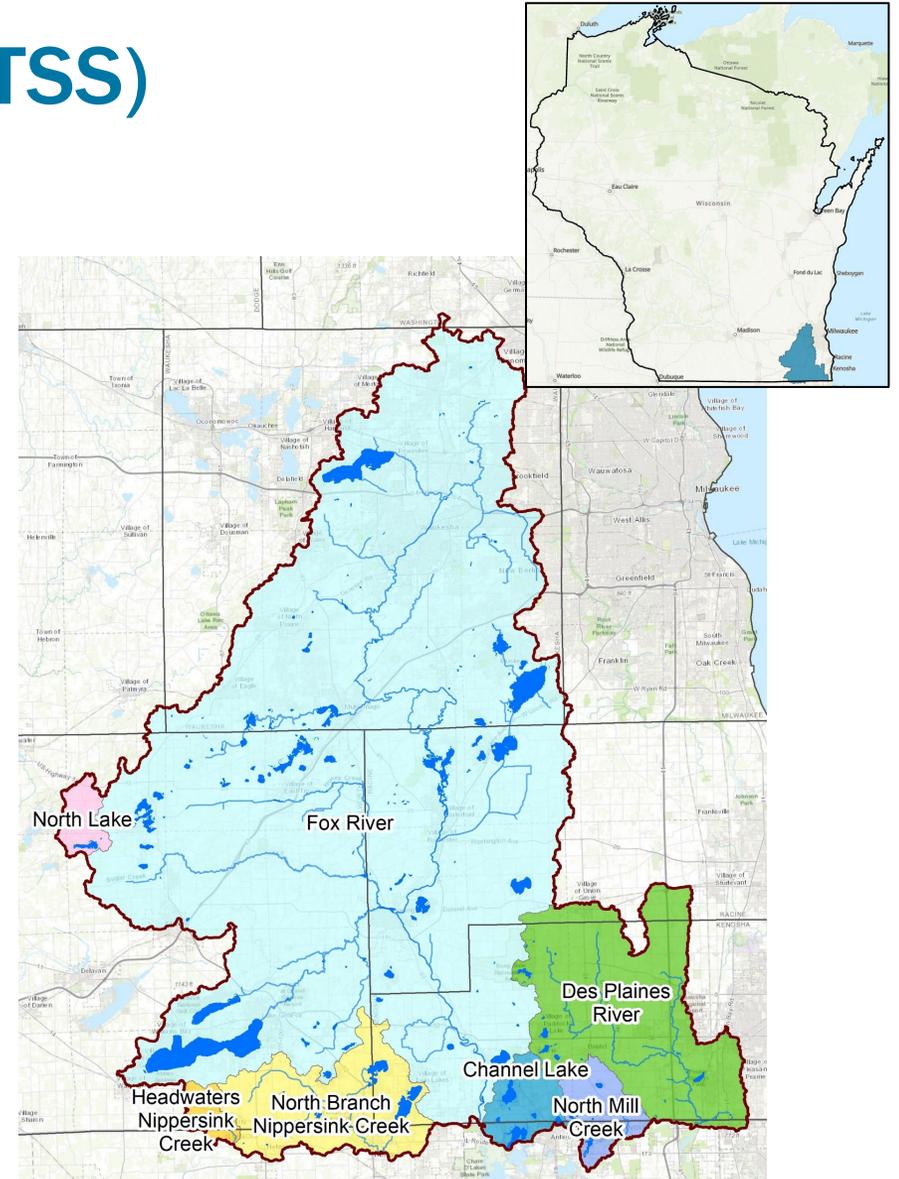
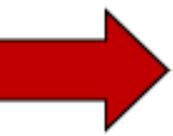
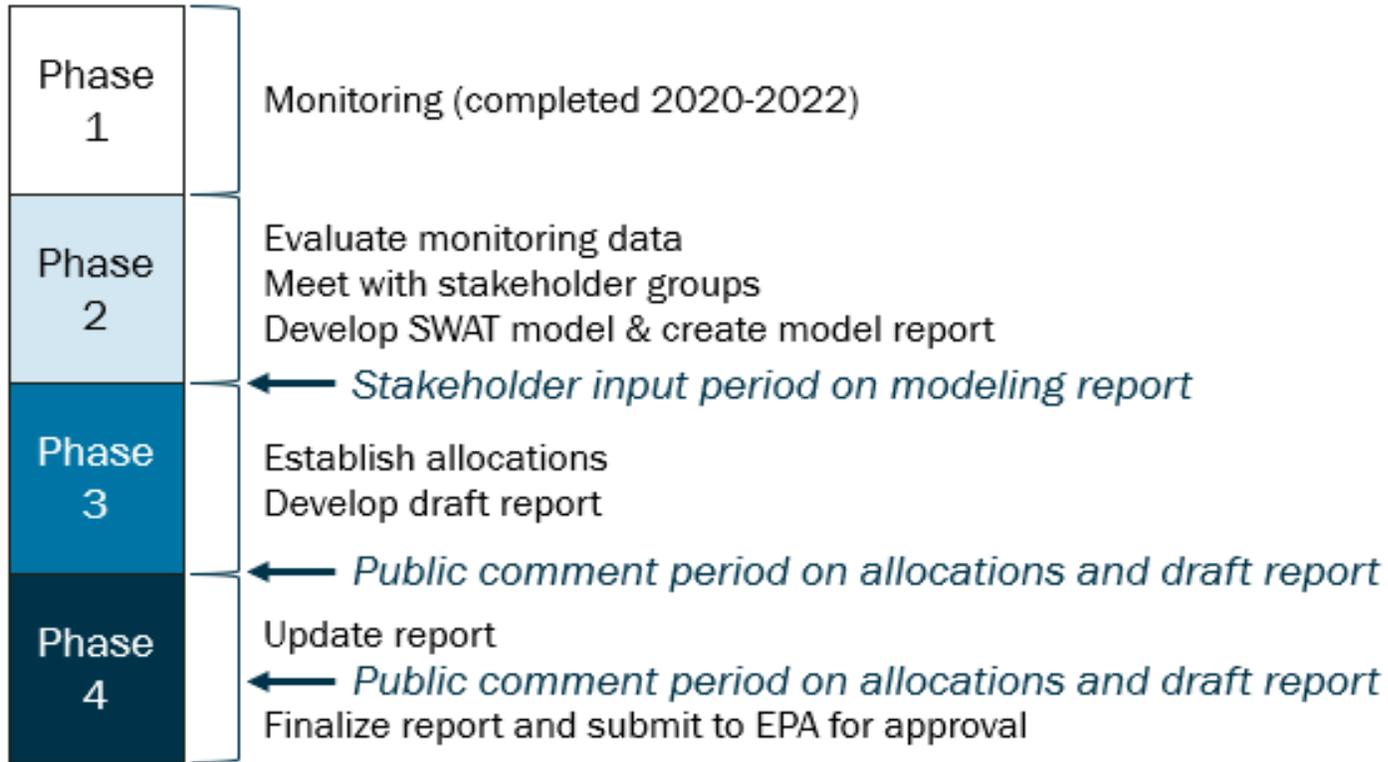
Total Maximum Daily Load(s)
Watershed Studies

-  Under Development
-  Completed and in Implementation

1. Fox-Illinois Basin TMDL
2. Lake Pepin TMDL



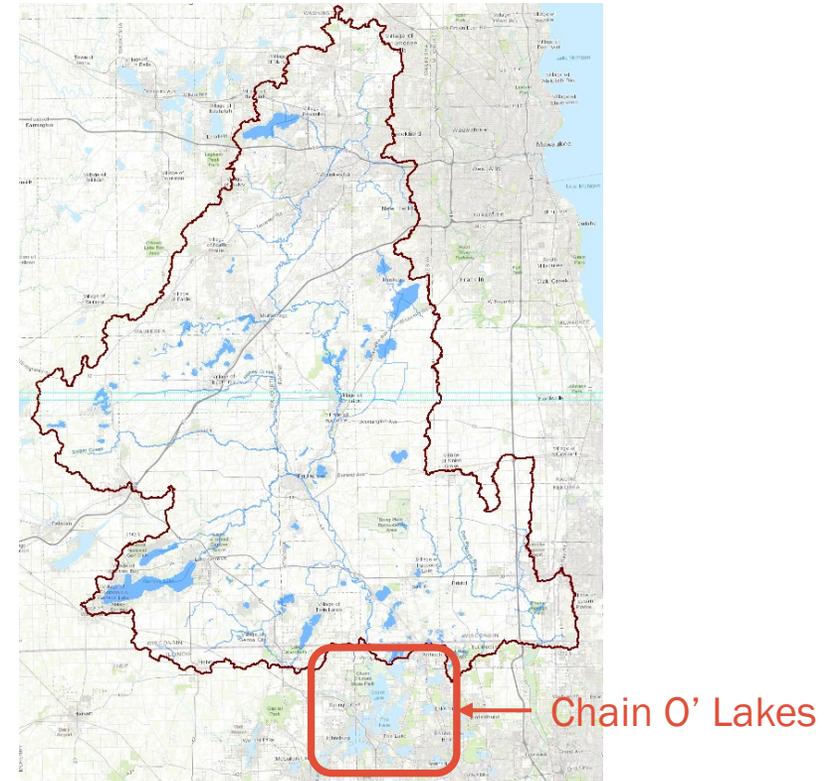
Fox-Illinois Basin TMDL (TP and TSS)



Public comment period being scheduled for Spring 2026.

Fox-Illinois Basin TMDL (TP and TSS)

- Illinois EPA has U.S. EPA approved TMDL for the Chain O'Lakes.
- The WI Fox River is 99% of the drainage area for Grass Lake which has a TP criterion of 0.05 mg/L.
- Reductions to meet downstream water quality criteria in the Chain O'Lakes drives most allocations and associated reductions.

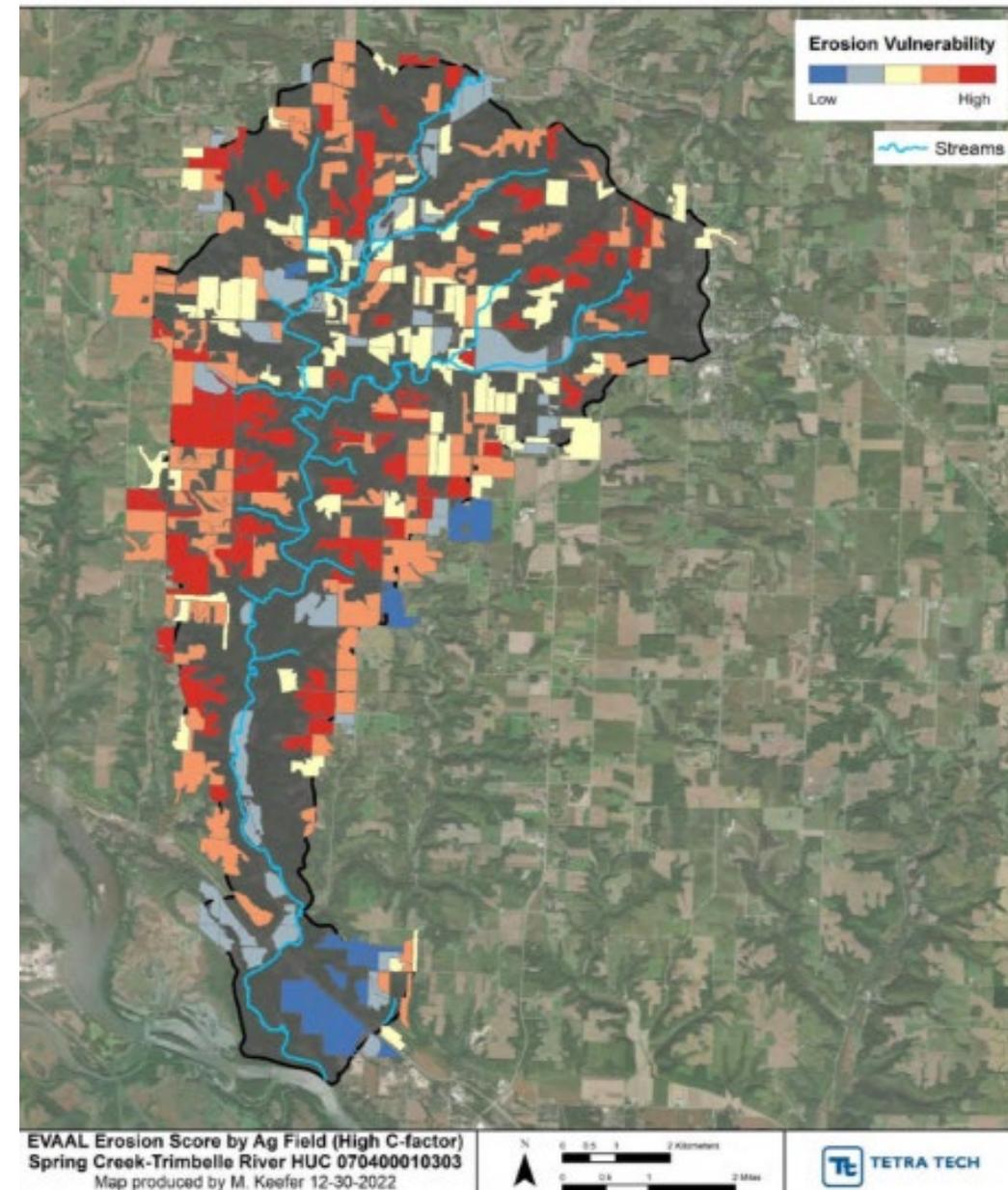


TMDLs for 26 lakes having total phosphorus impairments
(based on the 0.05 mg/L criterion)

Lake Pepin TMDL (TP)

DNR completed edge-of-field analysis and an EVAAL analysis was performed on select watersheds to identify fields with higher potential to deliver pollutants.

TMDL Subbasin	TMDL Subbasin Name	HUC12	HUC12 Name	County Name(s)	TP Baseline (lbs./ac/yr)	TMDL % Reduction	TP Target (lbs./ac/yr)
1	Trimbelle River—mile 19.0 to headwaters	70400010301	Goose Creek- <u>Trimbelle River</u>	Pierce, St. Croix	4.4	20.0	3.52
2	Rush River—mile 34.3 to headwaters	70400010501	Village of Baldwin-Rush River	St. Croix	4.7	23.7	3.54
3	Rush River—mile 25.9 to mile 34.3	70400010502	Town of Martell-Rush River	Pierce, St. Croix	3.5	20.0	2.80



Next TMDL Project(s)

Potential TMDL Projects for 2026-2032

1. Buffalo-Trempealeau
2. Sugar-Pecatonica
3. Southeast Lakeshore

2022 - 2032 Vision for the Clean Water Act Section 303(d) Program
Wisconsin's Water Quality Restoration and Protection
Prioritization Framework - "Vision 2.0"



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Next TMDL Project(s)

Potential TMDL Projects for 2026-2032

Sugar-Pecatonica

A two-to-three-year monitoring initiative in the Sugar-Pecatonica to start this year with additional TMDL development activities and outreach slated to begin in 2027.

2022 - 2032 Vision for the Clean Water Act Section 303(d) Program
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OFF THE RECORD"