Strategies to Achieve Phosphorus Reduction Targets for Lake Erie
A White Paper

Developed by the National Wildlife Federation, the Lake Erie Foundation, the Nature Conservancy, and the Ohio Environmental Council

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Introduction

As harmful algal blooms continue to impact Lake Erie, multiple agencies, producers, researchers, and other stakeholders continue to invest in programs and research to understand the science and meet nutrient reduction goals under Annex 4 of the Great Lakes Water Quality Agreement, a binational agreement between the U.S. and Canada. The State of Ohio recently released an update to Ohio's Domestic Action Plan (DAP) for Lake Erie. The DAP includes comprehensive information about current programs with a focus on the H2Ohio program. The State of Ohio DAP update will be incorporated into the federal DAP later in 2024 along with updates from Indiana and Michigan.

Additional investment, or redirection of current funding, is needed in Ohio to meet the nutrient reduction targets. We will lay out the evidence that current programs are not enough to meet the Annex 4 targets. We will explore different programmatic paths that might be taken to meet this need.

Recent Findings

Status of water quality conditions

Despite significant efforts and investments, we have yet to see nutrient reductions in the Maumee River Basin. Overall loads remain well above the target levels and ecosystem objectives of Annex 4 of the Great Lakes Water Quality Agreement.

Ohio does report small potential declines in soluble reactive phosphorus (SRP) in the past three to four years when flow variability is accounted for ("flow-normalized loads"). However, these years experienced lower than average flows and the techniques used to adjust or normalize the flows may mask what's happening with SRP. To date, there is no statistically significant decline.

Ohio annually reports water quality findings and results can be found in the following recent releases:

- Update to the Ohio Domestic Action Plan (https://lakeerie.ohio.gov/planning-and-priorities/02-domestic-action-plan)
- Harmful Algal Blooms in Lake Erie 2023 Forecast (https://www.youtube.com/watch?v=ZlnXV69vcHU)
- Western Lake Erie Tributary Water Monitoring Summary 2022 (https://lakeerie.ohio.gov/planning-and-priorities/03-wms/wms)

The update to the Ohio DAP estimates that Ohio needs to achieve an annual load goal of ≤1.5 million pounds of phosphorus to meet the Annex 4 nutrient target goal. To meet that target, Ohio calculates that phosphorus needs to be reduced by 1 million pounds (using the 2008 baseline phosphorus level for the Maumee River). Ohio takes the next step and estimates the amount of phosphorus expected to be reduced for planned and completed projects in the H2Ohio program using reference values for

anticipated phosphorus reductions. The projected amount of reductions totals 449,500 pounds of phosphorus, roughly halfway towards the 1-million-pound reduction goal. Using reference values can be a useful tool for perspective in understanding approximate progress.

However, we note that there can be wide variability in field runoff values based on numerous local conditions. Soil types and hydromorphologic conditions vary in the Maumee River Basin and it is unknown if the fields enrolled in H2Ohio are representative of the fields leaking phosphorus. Using reference values across the large geographic area of the 24 counties in northwestern and north central Ohio targeted by H2Ohio highlights the need to include important caveats.

Current implementation

Since its inception in 2021, the H2Ohio program has achieved impressive results with outreach and enrollment with agricultural producers. Ohio reports that 35% of the cropland in the WLEB has enrolled in the H2Ohio program, with 1.4 million acres enrolled to complete Voluntary Nutrient Management Plans (a key tool to identify specific on-field practices) and 2.2 million acres enrolled in overwintering cover, manure incorporation and placement practices. We applaud the producers, SWCDs, technical service providers and leaders of ODA for their efforts to implement H2Ohio.

And while we have the estimates for planned and completed projects under the H2Ohio program, we do not know the amount of phosphorus that has been— or will be— reduced from these fields directly by H2Ohio practices. Eligibility for participation in the H2Ohio program is open to producers in 24 counties in northwestern and north central Ohio (with plans for the program to be offered statewide). The 35-40% of fields in northwest and north central Ohio enrolled in H2Ohio may or may not be the fields of greatest phosphorus run-off. As a 100% voluntary program, we do not know what percent of high phosphorus fields are enrolled. We also do not know what part of the 35-40% that are enrolled have only implemented Nutrient Management Plans, and not any other conservation practices. The purpose of this paper is to applaud the broad uptake of H2Ohio and recommend a suite of new ideas to complement the current Domestic Action Plan program.

The H2Ohio program has also achieved great success in the implementation of the wetlands component of the program. We applaud the investment the State of Ohio is making in the monitoring of wetlands with the LEARN program. Over time, the results from this effort will yield critical information about nutrient fluctuations in wetlands and the potential for additional nutrient reductions.

New developments in understanding phosphorus runoff

<u>Application of commercial fertilizer is trending down</u>

The purchase of commercial fertilizer has been trending down since the highest use period in the early to mid-1990s as reported by Ohio State University (https://ohioline.osu.edu/factsheet/anr-0143). The most recent five-year period of date (2018-2022) represents a 33% decrease in purchased fertilizer. The amount of available manure in NW Ohio has increased in the same five-year time period. However, the amount of manure that is land applied and the amount of nutrients in that land-applied manure can be variable and is difficult to quantify. Part of that challenge is that manure is stored and there is no available data on how much of stored manure is land applied annually. There is also no accessible data about where manure from unpermitted facilities is applied (or potentially over-applied) or on the soil test levels where manure is applied, potentially resulting in more phosphorus available for runoff. While there are rules in place governing manure management plans and manure handlers, the lack of available data on land application from manure from unpermitted facilities is a significant data gap.

Unpacking Legacy P

It is widely accepted that soils with elevated phosphorus levels have an increased risk of P runoff. There has been much discussion about the potential to reduce nutrient runoff from these areas. The debate has focused on the amount or extent of fields with high soil test phosphorus and what gains could actually be achieved by focusing on these areas. Parallel to this debate, is the concern that identifying these areas is challenging and the perception of compromising the privacy protections for proprietary soil test data. We will clarify recent research results on the prevalence of high soil test areas and later discuss the opportunities we see to identify these zones and fields while ensuring proprietary protections remain intact.

For purposes of this white paper, we rely on the 2021 study *A Public-Private Partnership to Locate Fields for Implementation and Monitoring of Best Management Practices to Treat Legacy Phosphorus.* (*Brooker MR, D'Ambrosio J, Jones MML, Kalcic M, King KW, LaBarge G, Panchalingam T, Roe BE, Schwab ER, Soldo C, Stoltzfus ND, Wilson RS, Winston RJ and Martin JF (2021).* Front. Sustain. Food Syst. 5:742817. doi: 10.3389/fsufs.2021.742817). Given the basin wide analysis by the researchers we consider this paper to be a definitive study of soil test phosphorus in the WLEB. There are varying definitions of what constitutes "legacy", this paper uses the term elevated-P for those soil tests >100mg P kg^{-1} soil alleviating the need to define the age of the phosphorus in the field.

Discussions of elevated-P areas refer to a variety of percentages for soil samples, fields, zones, the number of samples as well as the percentage of the share of the elevated-P load from the Maumee River. These percentages, however, are separate and distinct from one another. It is easy to conflate any of these references when discussing percentages for elevated-P areas. Having a shared understanding of the extent of the Maumee River Basin with elevated-P will be important to guiding policy makers and stakeholders alike in identifying optimal program options.

The Brooker paper describes the project team's methods of utilizing soil test data provided by ag retailers to identify the project area for a public-private partnership watershed project. Their methods in collecting soil test data while maintaining anonymity provide unique insights for how this data could be accessed and will be discussed later in this paper. Their analysis of the extent of soils with elevated-P provides the most extensive analysis of the extent of elevated-P soils in the WLEB.

The key finding showed that:
Thirteen percent (926/6,970) of fields had at least one elevated-P zone.
These are the areas that are disproportionately contributing higher amounts of P runoff. While not an overwhelmingly large percentage, larger gains in nutrient reduction could be achieved by focusing on these areas. Practices focused on these areas could achieve loading targets more quickly and with fewer resources.

Drawdown of Soil Test Phosphorus

It may take decades with no P application before fields with higher STP values return to the agronomic range of 20-50 ppm. A study in the mid-Atlantic coastal plain soils estimates soils could take 18 to 44 years to return to optimum P concentrations (Fiorellino, N., Kratochvil, R. and Coale, F. Long-Term Agronomic Drawdown of Soil Phosphorus in Mid-Atlantic Coastal Plain Soils. Agron. J. 109:455-461 (2017) doi:10.2134/agronj2016.07.0409).

At the 2023 State of the Science Conference Greg LaBarge characterized the drawdown of soil test levels as taking many years, ranging from .5 up to 2 ppm per year. For soils with soil test values 100 ppm or greater, it will take many years to achieve the optimal range of 40-60 ppm.

SWAT model results

The most recent SWAT modeling in the Maumee River basin using an ensemble approach (utilizing five separately developed SWAT models with different subroutines, data and other factors) concluded that widespread adoption of bundled practices and greater adoption rates are needed to meet nutrient targets (*Evaluating Management Options to Reduce Lake Erie Harmful Algal Blooms Using an Ensemble of Watershed Models*, 2020. Available at https://kx.osu.edu/search?topics=Harmful%20Algal%20Blooms). The modeling results indicate we need to greatly increase the percentage of fields (more than 70%) with more than one practice to come close to the phosphorus reduction target for Lake Erie. No single practice will get us close to reduction goals but rather a combination of best management practices is needed along with much greater adoption rates. The models used in this analysis continue to be refined and rerun to provide improved understanding about pathways to reach the goal. To date, however, model results remain consistent in the conclusion that a combination of multiple practices and much greater adoption rates are necessary.

A recent report by the Ohio Environmental Council and the Alliance for the Great Lakes, *The Cost to Meet Water Quality Goals in the Western Basin of Lake Erie* (https://theoec.org/wp-content/uploads/2023/02/AGL.OEC_.Cost-to-Meet-Water-Quality-Goals-in-the-Western-Basin-of-Lake-Erie.FinalReport.pdf) analyzes four BMP scenarios using modelling results and calculates the cost of each scenario over twenty years. The report identifies the sizeable gap between current spending and the projected funding needed to achieve reduction targets. Michigan and Ohio would need to both increase adoption of conservation practices and increase spending on those practices by $40-65 million and $170-250 million annually, respectively, to meet water quality objectives in the Western Basin of Lake Erie. The report states that meeting the 40% phosphorus reduction goal is possible but will require significant, sustained additional funding, along with major increases in conservation practice adoption, and in some cases shifting the types of conservation practices.

Call for Action

The need to do more, the need to adapt.

The Ohio DAP acknowledges that more needs to be done to meet Annex 4 nutrient target goals. The plan discusses the Maumee River basin SWAT modeling and its results that more widespread adoption is needed as well the need for multiple practices in one location. The plan mentions that time is needed for education and outreach and for projects to move through the proposal, design, and construction phases of getting practices installed. The plan goes on to discuss the uncertainty about whether practices will have an immediate effect or if there is a lag time needed for nutrients to be removed from the system.

The authors of this paper agree that getting practices in and on the ground is a major endeavor and we congratulate the H2Ohio program staff on successful enrollment achievements. H2Ohio funded practices began installation in 2022 and we agree that two crop rotations may not be enough time to see nutrient reductions resulting from this program. However, observations of HAB blooms over the last 15 years demonstrate that years with low rainfall precipitation in the spring result in smaller blooms.

These observations provide evidence that once phosphorus is no longer being delivered to the lake, the lake will respond quickly.

Widespread approaches with current programs are simply not enough to reduce the amount of phosphorus entering Lake Erie to meet water quality targets. Expanding the percentage of fields in the H2Ohio program from 35% to 70% will likely still not meet the goals set for phosphorus reduction. We understand the pressure on the programs to be widely available rather than target funding to limited areas. **Ohio needs to develop policies and programs that allow us to utilize limited public funding towards areas that can achieve greater nutrient reduction results to accelerate progress towards the goal.**

Adaptive Management

All the public agencies in the U.S. and Canada under the Great Lakes Water Quality Agreement have committed to use an adaptive management approach with the Lake Erie nutrient reduction targets. The agencies have established a framework for planning, monitoring, and decision-making. The authors support the framework and the efforts in establishing comprehensive and integrated monitoring networks to inform the understanding of ecosystem responses to management actions. These efforts need to be ongoing and rigorous. We also believe it is time to honor the commitment to adaptive decision-making and the time is now to begin adapting our management actions.

The promise of adaptive management is that we will course correct as we learn new information. It is time to course correct. We believe we have sufficient information to adapt our programs now to respond to the current reality of no significant decline in nutrient loading. Adaptive management needs to be leading future programmatic changes to H2Ohio and other programs. Allowing for additional time will simply not be enough to meet the reduction targets.

Policy/Program Opportunities

The suite of policy and program opportunities below are meant to complement the programs described in the current Domestic Action Plan. This list is intended to explore a wider range of approaches than current efforts. With no significant nutrient reductions to date, the time is now to adapt our decision-making with additional approaches to meet Ohio's nutrient reduction goals.

The list is neither comprehensive nor detailed in scope. The list can and should prompt additional options for how we might shift away from conventional cost share program design and identify opportunities to better target public funding and be accountable for water quality outcomes. We invite thoughtful dialogue about the pros and cons of new approaches as part of a broad public policy discussion with producers, policy specialists and impacted stakeholders.

We remain committed to privacy protection for producers and the data and information about their individual farm operations. We seek innovative approaches that respect that protection while directing public funding to areas most likely to achieve demonstrable nutrient loading reductions. There have been increasing calls for more accountable outcomes from public funding support in the agricultural sector. We believe we can achieve both privacy and accountability if we are willing to adapt our programs with new approaches. We need to allow and encourage flexibility and experimentation in ways that have not yet been tested.

The Role of Agricultural Retailers/Manure Applicators

The authors of this paper met with several agricultural retailers to discuss their role in providing planning, fertilizer sales, and implementation services to their clients. Agricultural retailers in Ohio range widely in size and in the scope of sales and services they provide. They do, however, offer a unique opportunity for connecting nutrient management needs with options for addressing those needs. Retailers may be working with clients who receive cost share payments for conservation practices, but retailers do not receive any portion of those payments. The absence of any compensation to the retailers eliminates any motivation for retailers to encourage more or different practices on fields that may be contributing to high phosphorus runoff. We believe the retailer/client relationship presents an opportunity for connecting technical knowledge about individual field needs with cost share programs in the interest of scaling up implementation. Let's allow for compensation to retailers that provide advice, design and/or implementation services on practices to incentivize more phosphorus reduction beyond what current business models can achieve. With current outreach efforts potentially reaching a plateau in recruiting new farmers for program sign-ups, agricultural retailers can be one path towards further outreach and adoption of practices.

Agricultural retailers cultivate value with their client base by building trust and guarding information about their fields. Acknowledging data privacy needs, retailers represent an untapped resource in connecting producers with information about incentives for conservation practices for improved nutrient management. The site-specific knowledge of their customers' fields provides insight into where practices could be the most beneficial. Maintaining the business-client relationship and not compromising data privacy or infringing on that relationship with additional unknown (and potentially untrusted) conservation professionals will be key. Programs could leverage this relationship by compensating retailers for connecting incentive program information with their customers in ways that have yet to be tried.

Not all retailers are interested in designing nutrient management practices, but many are interested in providing information to their customers about opportunities beyond the services they currently provide.

As discussed above, little is known about where the manure from unpermitted livestock operations gets land applied representing a significant data gap. We believe we can begin to address this concern by expanding incentives to include the development of manure management plans for medium-sized livestock facilities. Certified Livestock Managers (CLMs) routinely handle manure from permitted facilities and are subject to record-keeping and inspections as part of the permit program. By supporting manure management plans from unpermitted facilities, we can better support land application of manure in areas that can utilize the nutrient content.

<u>Target elevated-P areas.</u>

Elevated-P areas provide a significant opportunity to achieve greater P reductions in a shorter amount of time increasing the likelihood of achieving targets. The challenge is reaching those fields with cooperative farmers while maintaining producer privacy and eliminating any risks for producers to feel singled out.

- Allow cost share programs to include a "finder's fee" for agricultural retailers where connections are made that result in program sign-ups.
- Direct additional compensation towards retailers with the ability to design and implement specific practices.
- Update language in ORC 940.42* (see below for recommended language) to ensure data privacy extends to client data of agricultural retailers.

- Apply the successful model of widespread adoption of nutrient management plans to providing incentives manure management plans for medium/unpermitted livestock facilities. This approach has the added benefit of bringing consistency to the customer base of Certified Livestock Managers.
- Support identification of elevated-P fields with greater P runoff for additional practices such as P filters. Increase cost share payments for priority practices such as subsurface placement. Allowing flexible program standards for these management actions will encourage more experimentation and contribute to the knowledge base about their effective use.
- Ensure appropriate prohibitions are in place to prevent the creation of new elevated-p fields.

Revise the cost-share incentive framework.

There is an opportunity to evolve the traditional cost share payment structure of a payment per practice approach. The outreach and education approach for engaging producers to participate in these programs is useful for widespread, basinwide approach to implementation. The time is now to adapt and identify new ways to incentivize producers to achieve greater reductions more quickly.

- Allow for an opt-in provision for farmers to allow the installation of edge of field monitoring systems to include eligibility for higher cost share payments.
- Revamp incentives for practices in elevated-P zones. This may include full cost coverage for design and implementation in prioritized areas. The utilization of the MyFarms farm management software in the H2Ohio program should provide opportunities to direct cost share funding to critical areas and accelerate adoption.
- Increase payments for greater numbers of participants/acres in a defined hydrologic area, also referred to as agglomeration.
- Identify options to incentivize the implementation of stacked practices. Many studies and modeling results conclude that multiple practices for a given field or operation are necessary.
- Development nutrient management plans funded under the H2Ohio program is a signature achievement of the H2Ohio program. These plans represent the beginning of a pathway towards nutrient reduction. The program now needs to identify options and incentives for bringing these plans into implementation.

Water Management

The H2Ohio program has prioritized water management practices to assist with slowing down water movement across the basin. The Ohio DAP reports that 1.2 million acres are enrolled by these practices. We support the focus given to date on water management and yet more needs to be done. In addition to dedicating more resources to scale up these practices, we encourage:

- Incorporate hydrologic analyses as part of watershed plans to address water holding capacity needs during high rainfall events.
- Increase the use of watershed models such as ACPF to identify locations for structural practices that address water management.

Implement tracking of conservation practices

With significant investment being made in the Western Lake Erie Basin (WLEB) to stem nutrient runoff, little is known about adoption rates, continuity of practices and overall trends of implementation. The heightened emphasis on nutrient loading and harmful algal blooms makes the need for understanding trends in agriculture pivotal as Ohio seeks to determine the efficacy of education and incentive programs, especially the H2Ohio program. The Ohio Ag Conservation Initiative has developed a program to survey (and resurvey) 8-digit HUCs on a periodic cycle to develop trends over time on the continuity

of conservation practices. This program needs investment to secure ongoing implementation and provide critically needed information about conservation practices. Ohio needs data and information about conservation practices to enable correlation with water quality trends.

- Develop statistically reliable data on the adoption of conservation practices over time and communicate that to the public and decision-makers.
- Replicate data collection every two to four years to develop longitudinal trends on the adoption of conservation practices in critical watersheds.

Implement a risk assurance-insurance program.

- Provide a safety net for producers against yield loss with the installation of conservation practices.

Research

- The State of Ohio and the research community have made significant investments in research about nutrient loading and harmful algal blooms positioning Ohio at the forefront of using science to drive action. We recommend an additional focus be placed on research to identify methods and crops that can accelerate drawdown in elevated-P areas.

*Ohio Revised Code 940.42

(A) Data or records of a person's agricultural operations, conservation or water quality improvement practices, or proposed utilization of such practices collected or maintained by the department of agriculture, a soil or water conservation district, an institution of higher education, ***agricultural retailers,*** as defined in section 3345.12 of the Revised Code, or any other state agency are not a public record subject to disclosure under section 149.43 of the Revised Code.

(B) The department may share such data or records with state agencies and institutions of higher education, as defined in section 3345.12 of the Revised Code, for the purpose of water quality research if all of the following apply:

(1) The data or records of conservation or water quality improvement practices are aggregated.

(2) The aggregated data or records do not include any information that identifies an individual.

(3) The aggregated data or records include a description of the conservation or water quality improvement practices.

(4) The aggregated data or records identify the watershed, by the watershed's hydrologic unit code, where the conservation or water quality improvement practices are being or have been utilized.