MOVING FORWARD: LEGAL SOLUTIONS TO LAKE ERIE'S HARMFUL ALGAL BLOOMS

A Report Commissioned by
Lucas County, Ohio Board of County Commissioners
April 2015

VERMONT LAW SCHOOL · LEX PRO URBE ET ORBE

WATER AND JUSTICE PROGRAM

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COLLEGE OF LAW
THE UNIVERSITY OF TOLEDO

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Front Cover (Top): Lake Erie Islands. This was taken from atop the Perry's Victory and International Peace Memorial in the village of Put-In-Bay on South Bass Island. The view is facing North Looking at Middle Bass Island. (Photo by Lake Erie Coastal Ohio, Inc., 2005)

Front Cover (Bottom): Taken across the street from Lake Erie Center August 28, 2011, showing Microcystis in water mixed with the invasive algae Lynbya on the shore (brown stuff). Lynbya, like Microcystis, is a blue-green cyanobacteria. (Photo by Carol A. Stepien, Ph.D., August 28, 2011)

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LUCAS COUNTY

Lucas County, Ohio April 15, 2015

The Lucas County Commissioners believe it is our duty and obligation to protect the health of Lake Erie today and for future generations, and take our stewardship of the lake seriously. Lake Erie provides fresh drinking water for millions, and is a vibrant source of recreation and economic prosperity to the region. Lucas County sits at the mouth of the Maumee River – the largest tributary to Lake Erie. The Maumee River watershed encompasses 8,316 square miles, extending from Ft. Wayne, Indiana, north into Michigan, as far south as Mercer and Auglaize Counties in Ohio, and includes agricultural, suburban, and urban regions. The western Lake Erie basin is an internationally recognized stop-over habitat for migratory birds, and contains more edible freshwater fish than the other Great Lakes combined.

The shallowest and warmest of the Great Lakes, Lake Erie is uniquely vulnerable to environmental change. In recent years, Lake Erie has witnessed the growth of harmful algal blooms, the challenge of invasive species, hypoxia in the central basin, and other environmental events which degrade the health of the lake. In August, 2014, harmful algal blooms caused a "do not drink" advisory to be issued by the City of Toledo, resulting in over 400,000 people being without fresh drinking water for 2 ½ days. Water quality monitoring points to nutrient pollution as a significant cause of harmful algal blooms. While factors leading to nutrient pollution are complex, potential solutions are even more so. Some proposed solutions are voluntary, some regulatory, and some legislative. All merit consideration.

The challenge of nutrient pollution is not new: in the 1960's Lake Erie was infamously declared "dead." Local, regional, federal, and international efforts to clean up Lake Erie ultimately led to the 1972 Federal Clean Water Act and the 1972 Great Lakes Water Quality Agreement, signed by the United States and Canada. Through public advocacy, jurisdictional cooperation, and broad stakeholder participation from governments, agriculture, industry, and the public, Lake Erie waters again were safe for drinking, recreation and as a habitat for abundant wildlife. But the lake is again under threat from nutrient pollution.

Moving Forward: Legal Solutions to Lake Erie's Harmful Algal Blooms is an in-depth analysis of the legal tools available to address water quality issues, and examines how other regions are grappling with similar challenges. This report provides a framework for success in restoring and maintaining the health of Lake Erie. The 2014 Lake Erie Water Crisis is a call to action for all. We cleaned up Lake Erie once before; we can, and must, do it again.

The Lucas County Board of Commissioners, Lucas County Ohio

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INTRODUCTION

Lake Erie provides drinking water to over 11 million people. It is the world's 11th largest lake in surface area, and supports a multi-state and international economy, generating $12 billion a year and over 100,000 jobs. Lake Erie sustains a natural ecosystem, and is home to more consumable fish than all the other Great Lakes combined, particularly in the warm, shallow waters of the Western Basin. It is a public treasure and deserves protection for present and future generations.

In recent years, Lake Erie has experienced severe harmful algal blooms (HABs) with increasing frequency, negatively impacting fishing, recreation, businesses, and other resources that are vital to the health and economic prosperity of local communities. In August 2014, the problem reached crisis proportions when elevated levels of a toxin produced by HABs were detected in The City of Toledo's municipal water supply, resulting in a "do not drink" advisory that left more than 400,000 people in Northwest Ohio and Southeast Michigan without access to safe drinking water for more than 2 ½ days.

Lucas County, Ohio lays at the western edge of Lake Erie, at the mouth of the Maumee River – the largest tributary to the Great Lakes. The Maumee River watershed encompasses 8,316 square miles and three states – Ohio, Indiana, and Michigan. This region has long been working on conservation and management practices to prevent HABs; however, the 2014 Water Crisis was a call to action for numerous agencies, governmental jurisdictions, scientists, and community members. The Lucas County Commissioners have commissioned this report to add to the legal body of knowledge, and to provide legal solutions for the HABs problem in Lake Erie.

This report begins with the premise that Lake Erie is a priceless public resource, and analyzes through a legal lens the persistent water pollution issues that cause HABs in Lake Erie and provides recommendations aimed at combating the HABs problem.

EXECUTIVE SUMMARY

Nutrient loading, particularly from phosphorus, is a key contributor to the HABs problem in Lake Erie. This is not the first era in which HABs have plagued Lake Erie; they were a severe problem in the 1960s and 1970s. But as a result of the Clean Water Act, the Great Lakes Water Quality Agreement, and increased environmental awareness, phosphorus loading was halved in Lake Erie during the 1970's and 1980's primarily by reducing point-source pollution through stringent regulations.[1] Despite this early success, phosphorus loading has increased steadily due to increased nutrient pollution from a variety of diffuse nonpoint sources, including but not limited to agricultural activities. The lack of regulation over nonpoint sources is the root of the problem. While the National Pollutant Discharge Elimination System (NPDES) permit program has proven effective for point sources, federal law provides no direct regulatory authority over nonpoint source nutrient pollution. State governments,

[1] *Lake Erie Binational Site: A Primer on Phosphorus in Lake Erie*, ENVIRONMENTAL PROTECTION AGENCY, http://www.epa.gov/greatlakes/lakeerie/primer.html (last updated July 2, 2012).

including Ohio, have traditionally shied away from nonpoint source pollution control. Today an estimated 75% of the phosphorus reaching Lake Erie is due to nonpoint source pollution.[2]

It is time to address non-point source pollution with the same firm commitment that our nation undertook over 40 years ago to rein in point source pollution. This report illuminates how a successful effort could be approached, by examining both the available legal tools under state and federal law, and by analyzing how nutrient pollution has been addressed in other parts of the country.

HABs are extreme growths of toxic algae, comprised of cyanobacteria, which typically form in the summer and have become pervasive in Lake Erie in recent years. HABs are detrimental to the aquatic ecosystem and pose a toxic threat to humans, affecting the liver, nervous system, and skin. HABs also harm local tourism, recreation and deplete property values because of their odor and aesthetics. Lake Erie, especially the western basin, is particularly susceptible to HABs due to its shallow waters.

Nutrient pollution is not unique to Lake Erie, as water bodies in many parts of the nation suffer from HABs. Although some small-scale success stories demonstrate that nutrient pollution can be abated, overall the largely voluntary, piecemeal approach of the last 40 years has not addressed the problem. From Chesapeake Bay to Lake Champlain, to Lake Erie, nonpoint source nutrient pollution continues to degrade waters, impacting recreation, swimming, drinking water and aquatic life. Agricultural run-off is the leading cause of nonpoint source pollution, but home sewage treatment systems and loss of wetlands, along with other factors play a role.

State governments, supported by the U.S. Environmental Protection Agency (EPA), and with the cooperation of local stakeholders, have developed a number of approaches over the last decade to try to address nutrient pollution on a watershed scale. New approaches include the development of Total Maximum Daily Load (TMDL) plans at the watershed level with firm pollution reduction targets, mandated reductions in point sources, watershed-based nutrient trading regimes, and best management practices (BMPs) mandated through state and local regulations.

However not all approaches have yielded success. For example, nutrient trading with nonpoint polluters has yet to be implemented to significantly reduce nutrient pollution. Voluntary "best management practices" are not a panacea and require significant funding and monitoring. There is no simple, single legal solution to the nutrient pollution problem in Lake Erie. Whatever approaches are selected, nutrient pollution can only be successfully abated through legally binding requirements that address all sources of nutrient pollution throughout the entire western Lake Erie basin, including the Maumee watershed in parts of Michigan and Indiana as well as Ohio. Broad stakeholder participation from all sectors, including governments, agriculture, municipal treatment plants and the affected public is critical. So too is input from the scientific community and on-going data collection.

[2] JEFFREY G. MILLER, ANN POWERS AND NANCY LONG ELDER, INTRODUCTION TO ENVIRONMENTAL LAW CASES AND MATERIALS ON WATER POLLUTION CONTROL 797 (2008).

Vermont Law School's Water and Justice Program and the University of Toledo's College of Law Legal Institute of the Great Lakes offer a critical analysis of the myriad of approaches to nonpoint source nutrient pollution, in Ohio and beyond, and provide recommendations for realistic solutions to HABs which best serve the needs of Lucas County and Lake Erie in this report. Nonpoint source pollution is the most vexing water pollution problem we face, and to solve it will require government willingness to take difficult steps toward developing meaningful and enforceable approaches. This report provides a framework and recommendations for tackling the pervasive problem of nutrient loading and HABs in Lake Erie. The report is divided into six sections, which are summarized below. We conclude with a detailed list of recommendations.

Part I -- Lake Erie's Geomorphology, HABs and Climate Change

The geology and hydrology of Lake Erie are well studied. So too are the basic causes of its nutrient pollution problem, though continued refined data collection about the sources of pollution will support better solutions. The lake's shallow depth, prevailing climatological conditions and surrounding land uses make Lake Erie particularly susceptible to HABs like those that occurred in 2011 and 2014. Potential impacts to drinking water, boating, fishing, property values and the ecological health of the lake are well documented. The consensus on predictions related to human-caused climate disruption in the Lake Erie Basin concludes that HABs will increase in frequency and intensity because of significant increased warming, increased high intensity precipitation events, changes in wind patterns and other changes affecting weather patterns in the basin. Thus planning for long-term pollution reduction must consider future changes in rainfall, temperature and wind patterns.

Part II -Overview of Federal and State Regulatory Structures

We begin with an overview of the federal Clean Water Act and Ohio state water pollution control laws, in which the distinction between "point" source and "nonpoint" source is critical. The federal Clean Water Act and its Ohio analog regulate discharges of pollutants to waters from point sources via NPDES permits. Key sources of phosphorus such as municipal sewage plants, urban stormwater runoff, concentrated animal feeding operations, and some home sewage treatment systems are regulated point sources subject to the permitting system administered by the EPA based in federal law. Although more can be done to reduce phosphorus loading from point sources, the permit system has been relatively successful in reducing phosphorus loading into Lake Erie from point sources because permits command specific pollution controls and discharge limits.

By contrast, nonpoint sources of phosphorus such as runoff from most agricultural activities are virtually unregulated by the Clean Water Act, which instead relies on planning and incentive programs to encourage voluntary reduction of nonpoint source pollution. Although the Clean Water Act provides tools such as Total Maximum Daily Loads (TMDLs), watershed plans and water quality standards for the regulation of nonpoint sources, to the extent there is any mandatory regulation of nonpoint sources, it must be at the state level. However, EPA has considerable expertise, financial incentives and oversight capabilities to actively assist states that choose to exercise their own authorities.

Ohio, like many other states, is light on mandatory regulation of nonpoint sources. Regarding agricultural activities, the Ohio General Assembly has given some authority to regulate pollution from manure to the Ohio Department of Natural Resources (ODNR) and the Ohio Department of Agriculture (ODA); some authority to regulate pollution from biosolids to the Ohio Environmental Protection Agency (OEPA); and most recently limited authority over the application of commercial fertilizer to the ODA. Local health boards have some authority to regulate home sewage treatment systems that are not point sources subject to OEPA regulation.

Part III -- Other Legal Structures to Address Multi-State Pollution

Nutrient pollution in Lake Erie originates both inside and outside of Ohio; therefore Ohio cannot solve the HABs problem by itself. The Maumee River watershed, the largest source of nutrient pollution to western Lake Erie, encompasses parts of Michigan, Indiana and Ohio. Therefore an entity with legal authority to regulate nutrient pollution in multiple states is necessary if HABs are to be eliminated. The federal-state cooperative model embodied in the Chesapeake Bay TMDL is one option as outlined in this report, but we explore other options as well, including creating another federal agency and a multi-state commission created by an interstate compact. Among the potential models evaluated are the Tennessee Valley Authority and the Delaware River Basin Commission. Ultimately, addressing the HABs problem in Lake Erie will be more dependent on the regulatory powers the entity is provided than on the form of the entity.

Part IV -- Nutrient Trading and Other Programs to Address Nonpoint Source Pollution

Nutrient trading is a market-based mechanism that allows polluters to buy pollution allowances from sources that use innovative techniques to reduce those sources' pollution rather than reduce the polluters' own pollution. Nutrient trades can occur between point source discharges like municipal sewage plants, and between non-point sources such as agricultural operations. In either case a polluting entity reduces its nutrient pollution and sells the credits, within a framework that is designed to improve the overall quality of a waterbody.

The EPA supports nutrient trading (also referred to as Water Quality Trading) to reduce nonpoint source pollution and achieve water quality standards, though EPA does not regulate such programs. The EPA has a comprehensive policy on Water Quality Trading and outlines integral aspects of successful trading programs. In addition to the programs spurred by the Chesapeake Bay multi-state agreement and Executive Order, more than 40 other programs have been conceptualized nation-wide, though few are actually functioning. While widely promoted as a solution to nonpoint source pollution, nonpoint source nutrient trading has been successfully implemented only in a handful of small watersheds; the total number of actual trades is miniscule. We found successful programs in California, North Carolina and Ohio, but all are operated on a small scale.

From a policy standpoint, Water Quality Trading is an attractive, market-based "win-win" approach. However, we found many technical and logistical hurdles which must be overcome

before nonpoint source nutrient trading will be successful. Trading areas must be geographically designed to achieve measurable reductions, baseline and post-trading water quality monitoring must be included, appropriate units of trading need to be developed and best management practices to reduce nutrient pollution must be defined and verified. Nonpoint source nutrient trading requires a large funding stream to fund the BMPs, verify their completion and monitor their effectiveness. Given these difficulties and the limited scale at which trading has been successful, a nutrient trading program alone will not solve Lake Erie's nutrient problem.

We also found numerous other successful EPA-sponsored nutrient reduction efforts based on implementing BMPs in individual watersheds and small lakes. Successful efforts involved federal/state cooperation, a targeted small lake or watershed with a detailed plan, a wide variety of stakeholder buy-in, and considerable taxpayer funding.

Part V --The Chesapeake Bay Executive Order and TMDL

The Clean Water Act requires states to prepare Total Maximum Daily Loads (TMDLs) for impaired waterbodies, which establishes a pollution "budget" that limits both point and nonpoint source pollution to allow a waterbody to support its designated uses. More than 47,000 TMDLs have been completed across the country, though none are as large or complex as the Chesapeake Bay TMDL. Because the Chesapeake Bay TMDL is a multi-state effort aimed at reducing nutrient pollution in a large water body, we critically reviewed the TMDL to see if a similar effort could work in Lake Erie, since even the western Lake Erie watershed spans parts of Ohio, Michigan and Indiana.

Although previous efforts to clean up the Chesapeake Bay failed, strong political relations and cooperation over the last thirty years made this watershed-based interstate TMDL possible. The TMDL was strengthened by an Executive Order, an effective and powerful tool that allows the President to direct the actions and policies of executive agencies and officials without Congressional mandate. Executive Order 13508, issued in May 2009, directs federal agencies to focus on the protection and restoration of the Chesapeake Bay by directing EPA to prepare a multi-state TMDL and incentivizing and mandating the affected states to cooperate. However, because EPA cannot regulate non-point source pollution even after approving a TMDL, the affected states entered into their own Agreement to develop individual, legally binding Watershed Implementation Plans to reduce nutrient pollution in their state.

EPA expects full implementation of the Chesapeake Bay TMDL by 2025, with interim targets to achieve a 60% reduction in nutrient pollution by 2017. But new regulatory schemes are rarely met without opposition; EPA was sued by farm lobbies for overstepping its authority and by some environmental groups opposed to nutrient trading. EPA prevailed, though a case is still on appeal. Despite litigation and continued opposition from farm groups and point source polluters, Bay jurisdictions have implemented the nutrient reduction requirements stemming from their Agreement and the TMDL. Some have initiated a nonpoint source nutrient trading program, and employed a variety of other measures like further point source controls, stormwater controls and mandatory improvements in farming and land use practices.

The Chesapeake Bay Executive Order and TMDL can serve as a valuable model for addressing nutrient pollution in Lake Erie. Lake Erie, like the Bay, is a large multi-state waterbody of immense economic and cultural value to residents. Both suffer from widespread nutrient pollution, with agricultural run-off a leading cause. The Chesapeake Bay approach embodies federalism under the Clean Water Act at its finest; a strong mandate, technical and financial support from President Obama and EPA, with states retaining wide latitude to reduce pollution through state-created Watershed Implementation Plans. Bay states, knowing that voluntary efforts failed, appear committed despite enormous pressure from industry to abandon regulatory efforts. However the ultimate success of the Executive Order and TMDL remains to be seen. EPA's 2014 interim evaluation found significant reductions in nutrient loadings, but that stronger efforts would be needed to meet the 60% reduction milestone in 2017.

VI. -- Funding Sources

Finally, we identify grant funding opportunities available from federal and Ohio governments that can be used for projects to address nutrient pollution to Lake Erie and its tributaries. We emphasize that the most effective programs for reducing nutrient pollution require significant and steady funding streams; even small watershed clean-up requires millions of dollars. Fortunately many funding sources are available to address nutrient pollution.

RECOMMENDATIONS

The following is a summary of key recommendations from our Report. A more detailed list of recommendations appears at the end of the Report:

- Efforts to reduce nutrient pollution in Lake Erie must be legally mandated, for nonpoint sources as well as point sources, and must apply to all states in the Lake Erie watershed.

- Successful nutrient reduction efforts will require buy-in and participation from the affected stakeholders, including agriculture, industry, the public, and local, state and federal governments.

- On-going data collection regarding the sources of nutrient pollution throughout the watershed and long term monitoring of the success of nutrient reduction efforts, are necessary for whatever legal means are used to combat HABs.

- The Chesapeake Bay Executive Order, multi-state Agreement and EPA-approved TMDL affords a potential multi-state model for solving the nutrient pollution problem in Lake Erie.

- Water quality trading programs could be part of the solution to the nutrient pollution problem in the Lake Erie basin, but such programs must be carefully designed and implemented to be successful. To date such programs have not led to attainment of water quality standards in large watersheds.

- Continued research by the scientific community, and consideration of long-term climate change projections for the Lake Erie basin should inform the legal efforts that are undertaken.

- The Ohio General Assembly should enact legislation (1) establishing a goal of a 40% reduction in phosphorus loading to Lake Erie from Ohio sources; (2) mandating that OEPA, ODNR and ODA regulate point sources and nonpoint sources in Ohio to achieve that phosphorus loading reduction goal; and (3) providing the agencies with additional statutory authority to regulate key phosphorus sources if necessary.

- The Ohio General Assembly should enact legislation restricting the application of phosphorus-containing fertilizer on lawns.

- The Ohio General Assembly should enact legislation authorizing the regulation of farming operations to abate degradation of waters in the Lake Erie watershed by commercial fertilizer.

- The Ohio General Assembly should amend the definition of "concentrated animal feeding facility" to include medium CAFOs as well as large CAFOs.

- OEPA should establish by rule a more stringent phosphorus effluent limit for publicly owned treatment works (POTWs) in the Lake Erie basin with a design flow of 1 million gallons per day or more.

- OEPA should apply a discharge limit for total phosphorus to a broader class of POTWs in the Lake Erie basin.

- OEPA should require more NPDES permit holders in the Lake Erie basin to at least monitor for phosphorus.

- OEPA should include more "green" infrastructure requirements in NPDES permits for POTWs and municipal separate stormwater systems within the Lake Erie basin.

- OEPA should more aggressively use its enforcement authority under ORC chapter 6111 against property owners whose home sewage treatment systems (HSTS) lack an NPDES permit and are contributing significant pollution to surface waters.

- OEPA should develop numeric water quality criteria for total phosphorus applicable to rivers and streams in the Lake Erie basin.

- ODNR should designate as in distress the Maumee River watershed, pursuant to Ohio Admin. Code 1501:15-5-20.

- ODNR should issue new rules establishing a minimum set of mandatory best management practices, applicable to all farming operations, designed to reduce phosphorus pollution to waters of the state.

- ODA should craft strong regulations to carry out the mandate of Senate Bill 150 for a fertilizer applicator certification program.

- Local boards of health in the Lake Erie basin should more aggressively use their enforcement authority against public nuisance HSTS that are significantly contributing to phosphorus pollution.

- Local boards of health in the Lake Erie basin should consider imposing more stringent standards when permitting the installation, alteration or operation of HSTS in order to minimize phosphorus pollution.

I. BACKGROUND

A. Description of the Problem: Science and Lake Hydrology

1. Introduction

The Lake Erie–Lake Saint Clair Drainage Basin provides water for over 10.6 million people.[3] Increased nutrient loading from fertilizers, livestock waste, urban run-off, antiquated septic systems and sedimentation from erosion contribute to drastic decline in surface water quality within the basin, putting immense stress on public water supplies [Figure 1]. Hypoxia and harmful algal blooms (HABs) within Lake Erie have increased both spatially and temporally over the past 20 years.[4] These occurrences are the result of increased nutrient loading and changing weather patterns and have contributed majorly to the degradation of surrounding water supplies. More than 1.8 billion gallons of water are used per day within the basin for public and domestic water supply. Of that 1.8 billion, 88% of the water used is surface water drawn from Lake Erie and its surrounding waterbodies.[5]

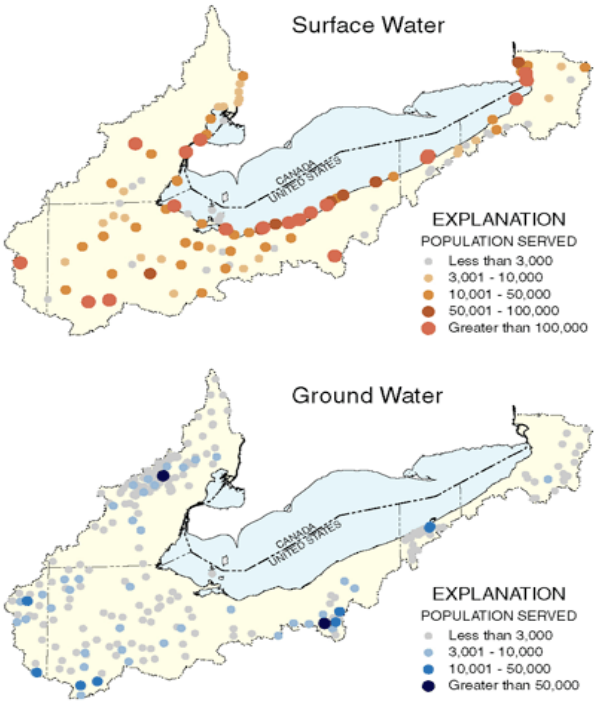

Figure 1. USGS Public Water Usage Explanation[6]

[3] Myers, D.N., Thomas, M.A., Frey, J.W., Rheaume, S.J., and Button, D.T., *Water Quality in the Lake Erie-Lake Saint Clair Drainages Michigan, Ohio, Indiana, New York, and Pennsylvania, 1996–98*, 1203 U.S. GEOLOGICAL SURVEY CIRCULAR 35, 3 (2000), *available at* http://pubs.usgs.gov/circ/circ1203/pdf/circ1203.pdf.
[4] Yuntao Zhou et al., *Spatial and Temporal Trends in Lake Erie Hypoxia, 1987–2007*, 47 ENVTL. SCI. & TECH. 899, 905 (2012).
[5] Myers, D.N., Thomas, M.A., Frey, J.W., Rheaume, S.J., and Button, D.T., *Water Quality in the Lake Erie-Lake Saint Clair Drainages Michigan, Ohio, Indiana, New York, and Pennsylvania, 1996–98*, 1203 U.S. GEOLOGICAL SURVEY CIRCULAR 35, 4 (2000), *available at* http://pubs.usgs.gov/circ/circ1203/pdf/circ1203.pdf.
[6] *Id.*

2. Harmful Algal Blooms

HABs consist of cyanobacteria most commonly known as blue-green algae. These seasonal blooms are extremely detrimental to the aquatic ecosystem, in addition to posing a toxic threat to humans. The toxins produced by HABs affect the liver, nervous system, and skin of humans.[7] Excess nutrients are undoubtedly responsible for the increase in HABs within Lake Erie since the early 2000s. Lake Erie began to experience HABs from sewage discharge throughout the 1960s and 1970s but regulation of point source pollution under the Clean Water Act (CWA) dramatically improved water quality. Despite complete eradication of blooms in the mid-1980s, in 2011 Lake Erie faced record-breaking HABs.[8]

In Lake Erie, HABs are seasonal, with the worst events most common in the summer months, due to increased temperatures. The recent, large-scale algal blooms occurring within Lake Erie have been attributed to agricultural practices and climate factors. Climatological changes, such as increased springtime precipitation events, affect the presence of HABs.[9] This was affirmed in the summer of 2012 when widespread drought across North America resulted in relatively smaller blooms. HABs cause drastic alterations to aquatic habitat and disrupt ecosystem functions.[10] These algal blooms result in massive kills of both farmed and wild fish, as well as other organisms.[11] Large-scale kills can result in the death of millions of fish, as well as millions of dollars lost to local economies.[12]

The severity of these blooms has intensified in the last decade. In 2011, the largest algal bloom in Lake Erie's history occurred.[13] Abnormally high spring precipitation events and warm temperatures created ideal bloom conditions that resulted in HABs covering more than 5,000 square kilometers (more than 3,000 square miles).[14] In 2013, Ohio residents in Carroll Township were told not to drink water from Lake Erie. Another serious HAB in 2014 caused widespread drinking water contamination in western Lake Erie, including municipal water for 400,000 people in Lucas County. The HAB problem today differs from that of Lake Erie's past. Sewage plants are now subject to National Pollutant Discharge Elimination System (NPDES) permitting, which regulates the quantity and concentration of effluent discharge. Since the sources of these modern algal blooms are not uncontrolled discharges from sewage

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[7] Gilbert et al., *The Global, Complex Phenomena of Harmful Algal Blooms*, 18 OCEANOGRAPHY 136, 147 (2005).
[8] International Joint Commission, *A Balanced Diet for Lake Erie: Reducing Phosphorus Loadings and Harmful Algal Blooms, Report of the Lake Erie Ecosystem Priority* 5 (2014), *available at* http://www.ijc.org/files/publications/2014%20IJC%20LEEP%20REPORT.pdf.
[9] Yuntao Zhou et al., *Record-breaking Lake Erie Hypoxia During 2012 Drought*, 49 ENVTL. SCI. & TECH. 800, 800-07 (2015).
[10] Anderson et al., *Harmful Algal Blooms and Eutrophication; Nutrient Sources, Composition, and Consequences*, 25 ESTUARIES 704, 726 (2002).
[11] *Id.*
[12] Gilbert et al.*, The Global, Complex Phenomena of Harmful Algal Blooms*, 18 OCEANOGRAPHY 136, 147 (2005).
[13] Anna M. Michalak et al., *Record-setting Algal Bloom in Lake Erie Caused by Agricultural and Meterological Trends Consistent with Expected Future Conditions*, 110 PROCEEDINGS OF THE NAT'L ACAD. OF SCI. 6448, 6452 (2013).
[14] *Id.*; International Joint Commission, *A Balanced Diet for Lake Erie: Reducing Phosphorus Loadings and Harmful Algal Blooms, Report of the Lake Erie Ecosystem Priority* 5 (2014), *available at* http://www.ijc.org/files/publications/2014%20IJC%20LEEP%20REPORT.pdf.

plants, as was the issue in the 1960s and 1970s, the source of the problem has shifted to other unregulated sources of phosphorus.

3. Hypoxia in Lake Erie

Lake Erie has been suffering from several ecologically harmful conditions that have severely impacted the quality of the water available for urban consumption. These conditions can occur naturally, but their recent abundance and intensity have been exacerbated by anthropogenic influences. Hypoxia is among these conditions affecting Lake Erie. Hypoxia occurs when a waterbody is oxygen deprived to such an extent that photosynthesis within the water is restricted, causing the decomposition of phytoplankton, among other organic matter. Phosphorous and Nitrogen loading from agricultural sources, as well as urban sources, stimulate phytoplankton growth.[15] The majority of the contributing nutrients that stimulate this growth come from nonpoint sources within the watershed, making regulating these discharges difficult.

Lake stratification consists of three phases: winter stratification, spring turnover, and summer stratification. Changing temperatures and wind help the lake to "turn over," which results in overall lake mixing.[16] This process is incredibly important to lake health by preventing large build ups of organic matter from forming on the lake bottom. Hypoxia is present in the deeper parts of a waterbody where the water column is stratified by layers of temperature; warmer, more oxygenated water exists at the surface and colder, less oxygenated water exists within the bottom layers.[17] The sunlight that penetrates the shallower, more heavily oxygenated layers and the decomposition of the bottom-dwelling material in deeper layers, promote the production of excessive amounts of organic materials and the rapid depletion of oxygen within the waterbody.[18] The decomposed material then settles to the bottom of the lake, which inhibits mixing within the lake's water column. This results in oxygen levels below 2 mg/L, and forces the lake into a state of hypoxia by creating "dead zones."[19]

These dead zones have such low levels of oxygen that most aquatic life cannot survive. Dead zones severely impact fish health and populations raising public concern.[20] Oxygen rates within the Lake have slowly been declining since the 1950s. The duration of this hypoxia has expanded. Historically, this period occurred within the summer months; however, more recent hypoxic conditions are starting earlier and lasting longer, while also occurring in a greater area

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[15] OCEAN STUDIES BOARD AND WATER SCIENCE AND TECHNOLOGY BOARD ET AL., CLEAN COASTAL WATERS: UNDERSTANDING & REDUCING THE EFFECTS OF NUTRIENT POLLUTION 31-36 (2000); Kelly E. Arbuckle and John A. Downing, *The Influence of Watershed Land Use of Lake N: P in a Predominantly Agricultural Landscape,* 46 LIMNOLOGY & OCEANOGRAPHY 970, 975 (2001).

[16] *Lake Stratification and Mixing*, U.S. ENVTL. PROTECTION AGENCY, http://www.epa.state.il.us/water/conservation/lake-notes/lake-stratification-and-mixing/lake-stratification.pdf.

[17] International Joint Commission, *A Balanced Diet for Lake Erie: Reducing Phosphorus Loadings and Harmful Algal Blooms, Report of the Lake Erie Ecosystem Priority* 5 (2014), *available at* http://www.ijc.org/files/publications/2014%20IJC%20LEEP%20REPORT.pdf.

[18] *Id.*

[19] Yuntao Zhou et al., *Spatial and Temporal Trends in Lake Erie Hypoxia, 1987–2007*, 47 ENVTL. SCI. & TECH. 899, 905 (2012).

[20] Gertrud K. Nürnberg, *Quantified Hypoxia and Anoxia in Lakes and Reservoirs*, 4 SCI. WORLD J. 42, 54 (2004).

of the Lake.[21] A large disconnect exists between established water quality management objectives and the capability to regulate the sources of pollution that degrade water quality.[22] The consequences of this disconnect are exacerbated by human presence, especially the unregulated human contribution of phosphorus.

Today, algal mats threatening Lake Erie's western basin thrive both as free floating and bottom mats, while shoreline blooms inhabit the eastern basin [Figure 2]. These algal blooms are not only a threat to the health of the ecosystem and those humans and animals exposed to them, but also to the industrial and municipal water intakes around the Lake.[23] Amongst various studies that have explored the overall impacts of HABs, two major conclusions have been made pertaining to HABs: (1) both constant and spontaneous nutrient contribution will promote bloom development and (2) the management of nutrient inputs to a waterbody can potentially greatly decrease the size and occurrence of the blooms.[24]

[21] Yuntao Zhou et al., *Spatial and Temporal Trends in Lake Erie Hypoxia, 1987–2007*, 47 ENVTL. SCI. & TECH. 899, 905 (2012).
[22] Michael Mallin et al., *Factors Contributing to Hypoxia in Rivers, Lakes, and Streams*, 51 LIMNOLOGY & OCEANOGRAPHY 690, 701 (2006).
[23] International Joint Commission, *A Balanced Diet for Lake Erie: Reducing Phosphorus Loadings and Harmful Algal Blooms, Report of the Lake Erie Ecosystem Priority* 5 (2014), *available at* http://www.ijc.org/files/publications/2014%20IJC%20LEEP%20REPORT.pdf.
[24] John Heisler et al., *Eutrophication and Harmful Algal Blooms: A Scientific Consensus* 8 HARMFUL ALGAE 3, 13 (2008).

4. Relationship Between Hypoxia and Harmful Algal Blooms

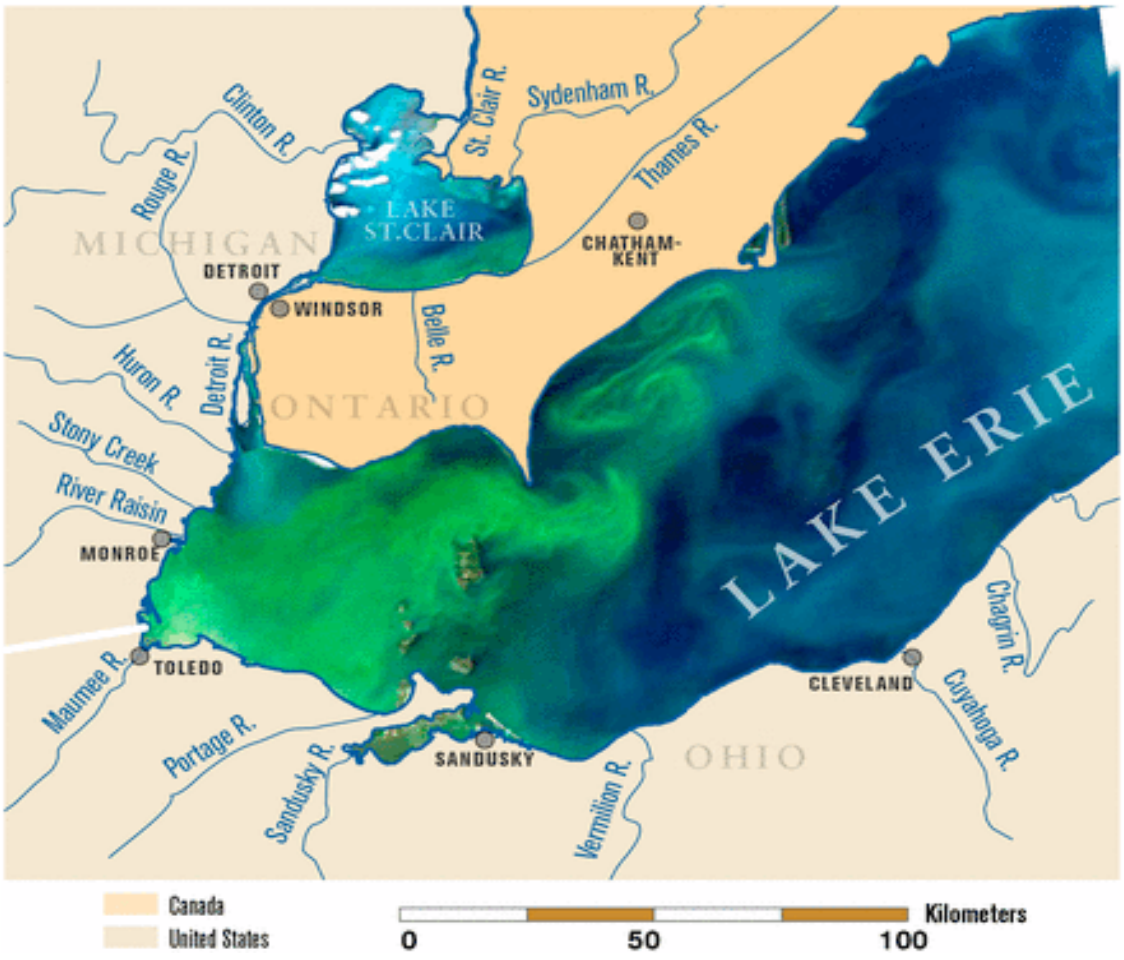

Figure 2. MODIS Image of HAB in Lake Erie During September of 2011[25]

While studies indicate that hypoxia and HABs may not be directly correlated (hypoxia has shown direct correlation to severe droughts),[26] they both depend on temporal nutrient loading and river discharge. For example, the extreme precipitation events in 2011 produced an immense HAB and a fairly small hypoxic zone. However, 2012, a year of widespread drought, produced an extremely large hypoxic zone and a small HAB.[27] This does not mean that HABs and hypoxia are unaffected by one another.

Hypoxic conditions within a waterbody may increase the potential for the creation of HABs. Waterbodies with extreme hypoxic conditions can stimulate the additional release of

[25] Anna M. Michalak et al., *Record-setting algal bloom in Lake Erie caused by agricultural and meterological trends consistent with expected future conditions*, 110 PROCEED. OF THE NAT'L ACAD. OF SCI.6448, 6452 (2013).
[26] Yuntao Zhou et al., *Record-breaking Lake Erie Hypoxia During 2012 Drought*, 49 ENVTL. SCI. & TECH. 800, 800-07 (2015).
[27] *Id.*

phosphorus from sediment within the waterbody; this is referred to as "internal loading." The increased release of phosphorus can further promote the growth of HABs in locations already struggling to prevent their existence.[28] Internal loading occurs three ways within Lake Erie: inter-basin transfers, water column recycling, and release of phosphorus from sediment.

Temporal nutrient loading is predicted to be very influential on the size of both HABs and hypoxic zones.[29] Late spring and early summer loading tends to result in larger hypoxic zones, while earlier spring loading increases the frequency and size of HABs. This correlates with the influence of river discharge. Increased rates of discharge tend to occur in the early spring, and will contribute to the production of larger HABs and smaller hypoxic zones. The greatest stream discharge is found in February, March, and April, while August, September, and October generally produce the lowest stream discharges, when groundwater comprises the majority of the flow.[30] Though not causal, fluctuations in precipitation rates can create a cyclical pattern in the presence of HABs and hypoxia. As a result this can compound the nutrient loading and produce more intense and frequent HABs in Lake Erie.

B. Harmful Algal Blooms: an Interstate Problem

Lucas County's severe water quality issues within the past year are only one example of the serious effects on domestic, municipal, recreational, and economic water supplies. Lake Erie borders Ohio, New York, Pennsylvania, Michigan, and Ontario, Canada. New York, Pennsylvania, and Michigan are experiencing their own dilemmas caused by nutrient loading into Lake Erie, depicting the intensity of this large-scale, interstate issue.[31] The severe HABs that have plagued western Lake Erie are a perfect example of the interstate nature of the problem. For example, the Maumee River watershed, discussed further in Section C(1), the leading contributor of nonpoint source nutrient pollution, spans three states.[32]

1. New York

Within the Niagara River/Lake Erie watershed, located in western New York, the water quality also suffers from the industrial and remedial activities within Lake Erie.[33] The New York shoreline of Lake Erie within the watershed has been assessed as poor, due mostly to agricultural and other nonpoint contributions of excess pollutants and nutrients, as well as urban sewer and stormwater overflows.[34] Of the waterbodies within the Niagara River

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[28] International Joint Commission, *A Balanced Diet for Lake Erie: Reducing Phosphorus Loadings and Harmful Algal Blooms, Report of the Lake Erie Ecosystem Priority* 5 (2014), *available at* http://www.ijc.org/files/publications/2014%20IJC%20LEEP%20REPORT.pdf.
[29] *Id.*
[30] Myers, D.N., Thomas, M.A., Frey, J.W., Rheaume, S.J., and Button, D.T., *Water Quality in the Lake Erie-Lake Saint Clair Drainages Michigan, Ohio, Indiana, New York, and Pennsylvania, 1996–98*, 1203 U.S. GEOLOGICAL SURVEY CIRCULAR 35, 3 (2000), *available at* http://pubs.usgs.gov/circ/circ1203/pdf/circ1203.pdf.
[31] *Lake Erie*, U.S. ENVTL. PROTECTION AGENCY, http://www.epa.gov/greatlakes/lakeerie/ (last updated Mar. 27, 2015).
[32] *See* discussion *infra*, Section I.C.1.
[33] *Niagara River/Lake Erie Watershed*, N.Y.S. DEP'T OF ENVTL. CONSERVATION http://www.dec.ny.gov/lands/48024.html (last visited Apr. 6, 2015).
[34] *Id.*

watershed, 34% were listed as impaired [Figure 3].[35] Impaired waterbodies fail to meet state standards designed to protect uses like drinking, fishing and swimming.

Many of the impaired waterbodies contain pollutants that impede upon the domestic, municipal, recreational, and economic uses of the water.[37] In 2009, 55,000 people used municipal water supplies within Niagara County, which are sourced from the Niagara River and Lake Erie, both of which are designated "areas of concern" due to their current and past contamination history.[38]

Within the watershed, five types of pollution are identified as threats to overall water quality. Toxic, sediment, nutrient, bacterial, and thermal pollution all lead to further degradation of

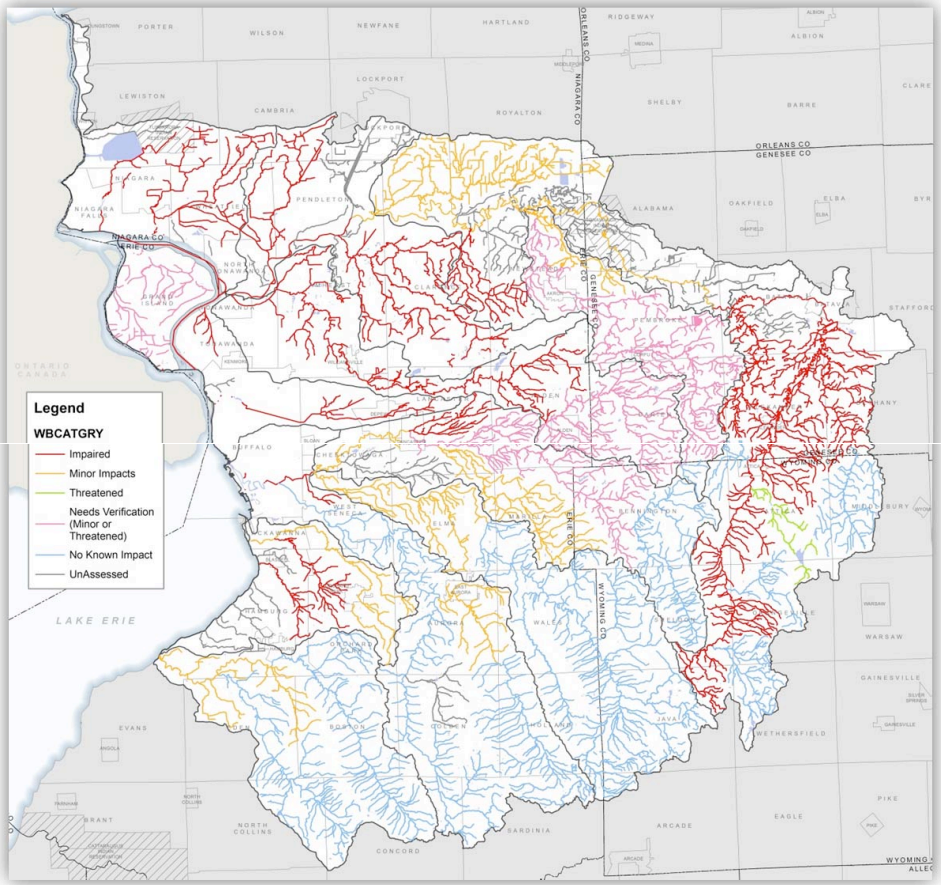

Figure 3. Niagara River Management Plan[36]

[35] *Healthy Niagara: Niagara River Watershed Management Plan*, BUFFALO NIAGARA RIVERKEEPER, 4-6 to 7 (2009), http://bnriverkeeper.org/wp-content/uploads/2009/11/Chapter-4-Water-Quality-FINAL.pdf.
[36] *Id.* at 4-4 (citation omitted).
[37] *See id.* at 4-1 (explaining water use helps to support a range of services).
[38] *Id.* at 4-13.

Lake Erie's water quality. Uncontrolled agricultural and other nonpoint source runoff cause all five of these types of pollution. Nutrient pollution contributes most to the growth of HABs and lake hypoxia, further indicating the dire need for regulation to control their discharge.

2. Pennsylvania

Pennsylvania maintains two water intakes in Lake Erie, one for the city of Erie and the other for North East Borough. The risk of contamination to these intakes is fairly low due to deeper water in the Pennsylvania section of the Lake. The water moves faster in these sections, although the water at Presque Isle Bay still has a fairly large risk of developing HABs since this area is shallow and prone to warmer temperatures.[39]

Presque Isle Bay is a popular recreational destination for Erie County. Within the Presque Isle State Park, 7 miles of beach run along the shore of Lake Erie, including one mile of public bathing beaches.[40] This area of the shore is monitored regularly to check on levels of *E. coli*, and recently, HABs. Environmental and weather data models are used to predict weather conditions that encourage potential outbreaks of *E. coli* and the growth of HABs.[41]

Thus far, beach closures have been the greatest influence of HABs in Pennsylvania. However, unregulated nonpoint runoff from agricultural sources will increase chances of intake contamination for vital municipal water sources.

3. Michigan

Michigan maintains two water intakes in Lake Erie: one used by the city of Monroe and one used by the Frenchtown Township. Both of these cities have their own treatment plants, but the water intakes, which are located north of Stony Point, are influenced by the influx of the Detroit River as it empties into Lake Erie. The Detroit River flows from north to south, which adequately protects the area from the algal blooms that form primarily in the southern portion of the Lake.

Both of the intakes are equipped with monitoring devices that measure blue-green algae, chlorophyll, and other parameters. These monitoring devices help to facilitate early detection of HABs that can potentially affect these water intakes. While past Lake Erie HABs have not spread far enough to reach and contaminate either of these intakes, without intervention there is potential for contamination should the HABs continue to increase in size and intensity.[42]

These intakes are particularly important due to the area's geologic formation. Monroe County was established on karst terrain, which lacks a confining layer near the surface, as well as

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[39] Megha Satyanarayana, *Officials Monitor Lake Erie Water Closely for Hazardous Algae*, TRIBLIVE.COM (Aug. 4, 2014, 10:33PM), http://triblive.com/state/pennsylvania/6556693-74/lake-erie-algae#axzz3VjY2sZq8.
[40] *Predictive Modeling of Bacteria Concentrations at Presque Isle State Park, Erie, Pennsylvania*, U.S. GEOLOGIC SURVEY, http://pa.water.usgs.gov/projects/waterquality/presque_isle/ (last updated Dec. 8, 2014).
[41] *Id.*
[42] *Current State of Harmful Algal Bloom Impacts on Michigan Drinking Water Supplies*, MICH. DEP'T OF ENVTL. QUALITY (2014), *available at* http://www.michigan.gov/documents/deq/deq-odwma-water-cdw-HAB_Impacts_467739_7.pdf.

surface sediment. Typically, this type of terrain does not provide for adequate groundwater recharge or filtration. Therefore, groundwater cannot be a reliable source of water for Monroe County due to both quantity and quality.[43] Although Michigan has not yet had its water supply affected by HABs, continued nutrient contribution to Lake Erie threatens surface and groundwater sources.

C. Why Are Harmful Algal Blooms Getting Worse in Lake Erie?

1. Lake Erie Hydrology

The general hydrology of Lake Erie contributes to its worsening hypoxia and HAB problem. Lake Erie is the shallowest and the smallest of all the Great Lakes.[44] It has a total surface area of 25,200 square kilometers (about 9,900 square miles) and an average depth of only 19 meters (62 feet).[45] The Lake is divided into three distinct basins with differing average depths: the western basin (7.4 meters or 24.1 feet); the central basin (18.5 meters or 60.1 feet); and, the eastern basin (24.4 meters or 79.3 feet).[46] Due to the Lake's shallowness, particularly in the western basin, the water warms rapidly in the spring and summer, and freezes over in the winter. The shallow depth allows rising air temperatures to easily influence the Lake's water temperature. In warmer years, stratification and increased surface temperatures are more likely to occur, thus favoring the growth and residence of HABs.

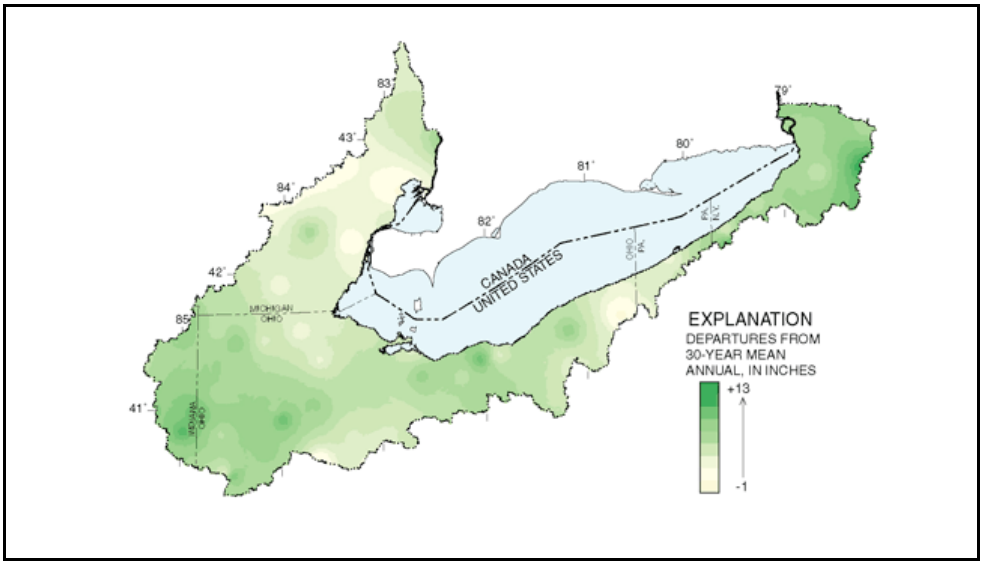

Figure 4. USGS Departures from Mean Annual Precipitation in the Lake Erie/St. Clair Drainage Basin[47]

[43] *Id.*
[44] International Joint Commission, *A Balanced Diet for Lake Erie: Reducing Phosphorus Loadings and Harmful Algal Blooms, Report of the Lake Erie Ecosystem Priority* 5 (2014), *available at* http://www.ijc.org/files/publications/2014%20IJC%20LEEP%20REPORT.pdf.
[45] *Id.*
[46] *Id.*

The geologic layout of the basin consists of glacial deposits from 20–200 feet thick that overlie limestone, sandstone, or shale bedrock [Figure 5]. These deposits are composed of sand, gravel, till, silt, and clay. Rainfall is slow to permeate the ground due to the abundance of clay, increasing the likelihood of runoff during high precipitation events.

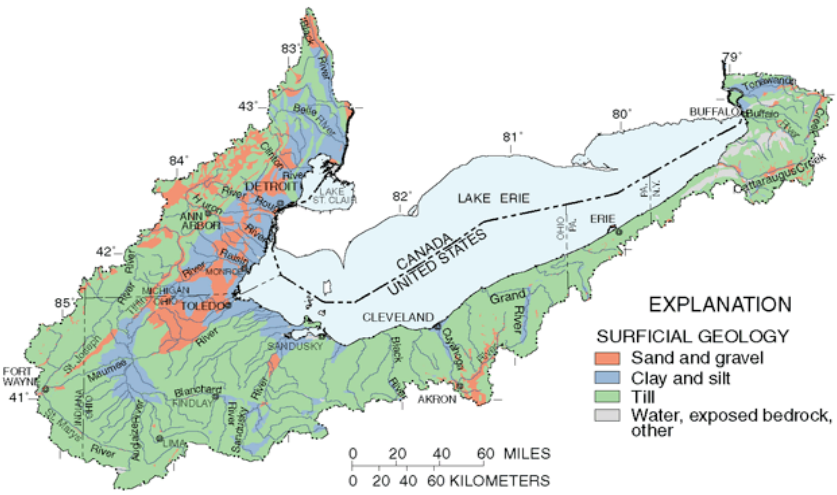

Figure 5. USGS Geologic Deposits of the Lake Erie/St. Clair Drainage Basin[48]

Basin-wide phosphorus loads to Lake Erie are unequally distributed. The western basin receives over 60% of the total phosphorus load of the Lake, while the central and eastern basins receive the remaining 40%. Loads vary among tributaries for phosphorus inputs, with the largest contributions coming from the Maumee, Detroit, Sandusky and Cuyahoga rivers.[49] In general, the phosphorus concentrations in the Lake decrease from west to east. The northern portion of the western basin receives waters from Lake Huron via the Detroit River. The Detroit River has lower concentrations of phosphorous and a greater volume of water. In contrast, the southern waters in the western basin are impaired primarily by the Maumee River Basin, which is lower in volume but higher in phosphorous concentrations.[50]

The single largest source of dissolved phosphorus in Lake Erie is the Maumee River. The Maumee River begins in Indiana and travels over 100 miles through Ohio to Lake Erie. The

[47] Myers, D.N., Thomas, M.A., Frey, J.W., Rheaume, S.J., and Button, D.T., *Water Quality in the Lake Erie-Lake Saint Clair Drainages Michigan, Ohio, Indiana, New York, and Pennsylvania, 1996–98*, 1203 U.S. GEOLOGICAL SURVEY CIRCULAR 35, 5 (2000), *available at* http://pubs.usgs.gov/circ/circ1203/pdf/circ1203.pdf.
[48] *Id.* at 4.
[49] International Joint Commission, *A Balanced Diet for Lake Erie: Reducing Phosphorus Loadings and Harmful Algal Blooms, Report of the Lake Erie Ecosystem Priority* 5 (2014), *available at* http://www.ijc.org/files/publications/2014%20IJC%20LEEP%20REPORT.pdf.
[50] *Id.*

Maumee River's watershed is the largest of all Great Lakes rivers and includes portions of Ohio, Indiana, and Michigan.[51] Land use within the Maumee watershed is predominantly agriculture, particularly corn–soybean crop rotations.[52] The Maumee River itself only contributes 5% of in-flow to Lake Erie's waters, but adds nearly 50% of the phosphorus loading for the entire Lake Erie basin.[53] This high level of concentrated dissolved phosphorus contributes a disproportionate share of the total amount in the Lake and generates HABs. Maumee River discharge creates HAB hot spots in the western basin of Lake Erie. Variances in the watershed's size, topography, geology, and land use patterns affect the differences in phosphorus loads across Lake Erie's basin.[54]

2. Predicted Climatic Variability Effects on Harmful Algal Blooms

Anthropogenically derived increases in atmospheric greenhouse gas concentrations have been implicated in climate variability and climate change. Future climatic change scenarios in the Great Lakes region predict rising temperatures and alterations in seasonal and inter-annual weather patterns. The Great Lakes region is already experiencing shorter winters, warming annual average temperatures, and increased frequency and intensity of high precipitation events.[55] Additionally, the Lake Erie ecosystem has experienced a systematic increase in hypoxic conditions and HABs.[56] Recent meteorological trends consistent with expected future conditions compound the impacts of current nutrient loading and favor future HABs in Lake Erie.

a. Precipitation, Extreme Events, and Runoff

Future climatic change scenarios predict shifting and more extreme weather patterns. The Great Lakes region is expected to experience an increase in the intensity and frequency of high precipitation events.[57] Recent climate scenario models show that larger rain events of precipitation amounts of 1.2 inches have the potential to be twice as frequent over the western Lake Erie basin.[58] An increase in precipitation events will result in increased nutrient loading from agricultural and urban runoff. These nutrients, specifically dissolved reactive phosphorus

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[51] *Great Lakes Area of Concern: Maumee River*, U.S. ENVTL. PROTECTION AGENCY, http://www.epa.gov/greatlakes/aoc/maumee/ (last updated June 18, 2013).
[52] International Joint Commission, *A Balanced Diet for Lake Erie: Reducing Phosphorus Loadings and Harmful Algal Blooms, Report of the Lake Erie Ecosystem Priority* 5 (2014), *available at* http://www.ijc.org/files/publications/2014%20IJC%20LEEP%20REPORT.pdf.
[53] *Id.*
[54] *Id.*
[55] G.W. Kling et al., *Confronting Climate Change in the Great Lakes Region: Impacts on our Communities and Ecosystems*, UNION OF CONCERNED SCIENTISTS & THE ECOLOGICAL SOCIETY OF AMERICA (2003) *available at* http://www.ucsusa.org/sites/default/files/legacy/assets/documents/global_warming/greatlakes_final.pdf?_ga=1.90401946.128942933.1428695818.
[56] T. B. Bridgeman, J.D. Chaffin & J.E. Filbrun *A Novel Method for Tracking Western Lake Erie Microcystis Blooms, 2002-2011,* 39 J. GREAT LAKE RES. 83, 89 (2013).
[57] *Global Climate Change Impacts in the United States*, U.S. GLOBAL CHANGE RESEARCH PROGRAM (2009), http://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf.
[58] Anna M. Michalak et al., *Record-setting Algal Bloom in Lake Erie Caused by Agricultural and Meterological Trends Consistent with Expected Future Conditions*, 110 PROCEED. OF THE NAT'L ACAD. OF SCI.6448, 6452 (2013).

(DRP), are conducive to HAB growth. As temperatures rise, precipitation events are expected to occur in late winter and early spring.[59] This shift can expand the period of nutrient runoff potential and intensify HAB conditions.

The Great Lakes region has experienced increases in both annual precipitation and high precipitation events since the 1930s. Since 1900, the total annual precipitation has increased by 10.8%.[60] During the last five years, the 10 rainiest days of each year contributed as much as 40% of the average annual precipitation,[61] suggesting that rain events may be less frequent but more intense. In the spring of 2011, Lake Erie experienced the most high precipitation events since 1975.[62] The precipitation in May 2011 was over 75% above the prior 20-year average for that month.[63] A survey of climate models projects the average annual precipitation in the Great Lakes region to rise 10–20% by the end of the century.[64] Nutrient runoff and HABs will only become more difficult to manage as frequent and intense precipitation events are projected to continue.[65]

b. Rising Temperatures

Rising air temperatures associated with climate change will also pose greater problems for managing HABs. A lake's water quality and ability to support organisms are affected by the extent to which the water mixes. The depth and size of a lake are important factors influencing the mixing process. Temperature also plays a key role in the mixing conditions of a lake's water column because it affects the water's density. Water density peaks at 39°F (4°C), though it is lighter at both warmer and colder temperatures.[66] Water masses of differing densities tend to become stratified within the water column. Lakes are divided into three zones: eplimnion (warmest surface layer), thermocline (transitional zone) and hypolimnion (coldest water on the bottom).[67] As lake ice melts in the spring the temperature of the lake will be more uniform from top to bottom. This change in temperature allows the lake to mix completely, providing dissolved oxygen to the bottom waters and bringing nutrients to the surface. As this water

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[59] *Id.*

[60] *Climate Change in the Great Lakes Region*, GREAT LAKES INTEGRATED SCIENCE ASSESSMENTS (2014), http://glisa.umich.edu/media/files/GLISA_climate_change_summary.pdf.

[61] Sarah C. Pryor et al., *Ch. 9: Did precipitation regimes change during the twentieth century? in* UNDERSTANDING CLIMATE CHANGE: CLIMATE VARIABILITY, PREDICTABILITY, & CHANGE IN THE MIDWESTERN UNITED STATES, 100, 100-112 (Sara C. Pryor ed., 2009).

[62] Anna M. Michalak et al., *Record-setting Algal Bloom in Lake Erie Caused by Agricultural and Meterological Trends Consistent with Expected Future Conditions*, 110 PROCEED. OF THE NAT'L ACAD. OF SCI.6448, 6452 (2013).

[63] *Id.*

[64] G.W. Kling et al., *Confronting Climate Change in the Great Lakes Region: Impacts on our Communities and Ecosystems*, UNION OF CONCERNED SCIENTISTS & THE ECOLOGICAL SOCIETY OF AMERICA (2003) *available at* http://www.ucsusa.org/sites/default/files/legacy/assets/documents/global_warming/greatlakes_final.pdf?_ga=1.90401946.128942933.1428695818.

[65] Schoof, J. T., S. C. Pryor, & J. Suprenant, 115 *Development of Daily Precipitation Projections for the United States Based on Probabilistic Downscaling*, J. GEOPHYSICAL RES., 1, 1-13 (2010).

[66] Bryon Shaw et al., *Understanding Lake Data*, BOARD OF REGENTS OF THE UNIVERSITY OF WISCONSIN SYSTEM (2004), http://www3.uwsp.edu/cnr-ap/weal/Documents/G3582.pdf.

[67] *Id.*

warms throughout the spring, it becomes less dense and summer stratification occurs. Increased air and water temperatures and water stratification, however, impede the vertical mixing process and encourage the growth of toxic cyanobacteria.

As global temperatures increase, winters may shorten, and lake waters may not reach the needed lower temperatures for the vertical mixing process. Additionally, recent mild winters have resulted in the reduction of ice cover, exposing more surface water and increasing water temperature.[68] As this trend persists, stratification will be intensified, making vertical mixing difficult. Without vertical mixing, dissolved oxygen can be depleted from lower depths causing hypoxic conditions. In severely hypoxic conditions, phosphorus becomes more soluble and is released from the bottom sediment. Precipitation and winds allow these nutrients to "escape" to the warmer surface waters stimulating HABs.[69]

After bloom initiation, increasing temperatures and quiescent conditions prolong the presence of HABs. The toxic cyanobacteria, *Microcystis*, tolerates higher temperatures than other non-hazardous phytoplankton.[70] The buoyancy of *Microcystis* allows it to rise to more favorable light and temperature conditions, which then foster the continued growth of HABs.[71] When *Microcystis* reaches the surface, it can take advantage of warming air temperatures by absorbing sunlight and further warming the water's temperature. Additionally, through the process of photosynthesis, increasing concentrations of carbon dioxide in the atmosphere will stimulate bloom growth. This positive feedback mechanism encourages the growth of HABs and promotes their competitive advantage among other aquatic species.[72]

The Lake Erie region has already experienced the effects of rising temperatures. In 2011, lake temperatures were 5° F (3° C) warmer than in the previous 10 years and 1.8° F (1° C) warmer than 2010 temperatures.[73] In the Great Lakes region, the number of days with snow cover of one inch or more has decreased by almost 30% since the 1980s.[74] In less than three decades, models predict spring and summer temperatures in the Great Lake region will likely be 3–4° F (1.5–2° C) above current averages.[75] Some climate models predict that by the end of this

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[68] Scudder D. Mackey, *Climate Change Impacts and Adaptation Strategies for Great Lakes Nearshore and Coastal Systems*, *in* CLIMATE CHANGE IN THE GREAT LAKES REGION: NAVIGATING AN UNCERTAIN FUTURE, 35, 35 (Thomas Dietz & David Bidwell eds. 2012).

[69] Guntram Weithoff et al., *Effects on Water-column Mixing on Bacteria, Phytoplankton and Rotifers Under Different Levels of Herbivory in a Shallow Eutrophic Lake,* 125 OECOLOGIA 91,100 (2000).

[70] Anna M. Michalak et al., *Record-setting Algal Bloom in Lake Erie Caused by Agricultural and Meterological Trends Consistent with Expected Future Conditions*, 110 PROCEEDINGS OF THE NAT'L ACAD. OF SCI. 6448, 6452 (2013).

[71] *Id.*

[72] *Impacts on Climate Change on the Occurrence of Harmful Algal Blooms*, U.S. Envtl. Protection Agency, (May 2013), http://www2.epa.gov/sites/production/files/documents/climatehabs.pdf

[73] *Id.*

[74] Jeffrey A. Andresen, *Historical Climate Trends*, *in* CLIMATE CHANGE IN THE GREAT LAKES REGION: NAVIGATING AN UNCERTAIN FUTURE, 19, 29 (Thomas Dietz & David Bidwell eds. 2012).

[75] G.W. Kling et al., *Confronting Climate Change in the Great Lakes Region: Impacts on our Communities and Ecosystems*, UNION OF CONCERNED SCIENTISTS & THE ECOLOGICAL SOCIETY OF AMERICA (2003) *available at* http://www.ucsusa.org/sites/default/files/legacy/assets/documents/global_warming/greatlakes_final.pdf?_ga=1.90401946.128942933.1428695818.

century, the Great Lakes region will warm by 5–12° F (3–7 °C) during the winter and by 5–20° F (3–11°C) during the summer months.[76] As temperatures continue to increase, these toxic cyanobacteria can grow larger in mass and live longer.

c. Shifting Winds

Climate change models predict shifting weather patterns and decreasing wind speeds over the continental United States.[77] Wind conditions greatly control a lake's circulation and mixing of tributary inputs by creating a current across the water's surface. Weaker winds contribute to low-magnitude currents; low-magnitude currents reduce lake circulation and can increase the residency of HABs. Simulations of Lake Erie's hydrodynamics show that the western basin monthly circulation is characterized by a broad west-to-east flow. Historically, Lake Erie experiences weaker winds during the summer months (May–August).[78] However, recent meteorological trends show an extended period of these weak currents (consistent with weaker winds) from late winter through summer (February–July). [79] In 2013, these weaker currents were consistent with increased residence times of HABs, up to 46% longer than in previous years.[80]

The increased presence of HABs is due in part to decreasing winds and their effect on post-bloom quiescent conditions that prevent flushing of nutrients out of the system. After HAB onset, *Microcystis* remains at the top of the water column and inhibits vertical lake mixing.[81] This creates a nutrient-rich and static environment that exacerbates HAB growth. Additionally, weaker wind speeds can lead to minimal mixing of Lake Erie's western and southern tributaries, thus reducing the dilution of nutrient-rich waters from the Maumee River.[82] The confluence of reduced wind speeds, post-bloom quiescent conditions, and minimal tributary mixing was cited as a factor to the Lake Erie's record-breaking HABs in 2011.[83]

d. Conclusion

Multiple factors contribute to water quality degradation in Lake Erie, and climate change will only exacerbate the effects of excessive nutrient loading. As the Lake continues to experience the serious and pervasive effects of phosphorus loading from agricultural and urban runoff, climate change will dramatically compound these impacts. Higher temperatures, increases in high precipitation events, and shifting winds favor the production of HABs, which threaten the

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[76] *Id.*
[77] Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, *Climate Change 2007: The Physical Science Basis* (Susan Solomon et al. eds., (2007), *available at* http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4_wg1_full_report.pdf.
[78] Anna M. Michalak et al., *Record-setting Algal Bloom in Lake Erie Caused by Agricultural and Meterological Trends Consistent with Expected Future Conditions*, 110 PROCEEDINGS OF THE NAT'L ACAD. OF SCI. 6448, 6452 (2013).
[79] *Id.*
[80] *Id.*
[81] *Id.*
[82] *Id.*
[83] *Id.*

health of Lake Erie and the people who rely on it. It is imperative that policy makers recognize the likelihood of an increased frequency of these meteorological conditions, and develop a comprehensive nutrient management plan for Lake Erie that addresses the potential impacts of climate change.

3. Land Use in the Watershed

Within the Lake Erie-Lake Saint Clair drainage basin, over 75% of the total land area is agricultural, 11% is urban, 11% is forested, and the remaining 3% of the land area is either wetland or open water (Figure 4).[84] The western portions of the basin cultivate corn, soybeans, and wheat, while the eastern part of the basin produces pasture and forage crops. Orchards and vineyards, the least common form of agriculture within the basin, is found mostly along the shores of Lake Erie.[85]

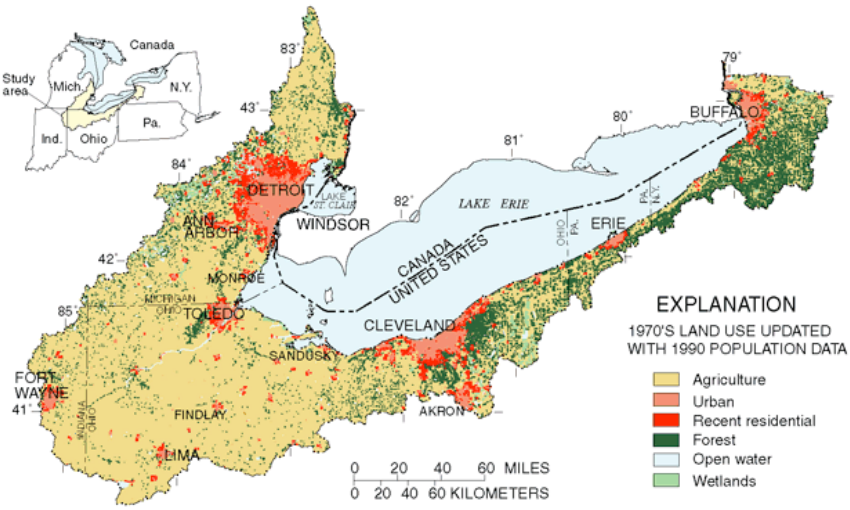

Figure 6. USGS Land Use Map for the Lake Erie/St. Clair Drainage Basin

Agricultural practices significantly degrade water quality through the leaching of pollutants and surface runoff. These pollutants are a result of chemicals used in agriculture, manure application, and sediment erosion.[86] More recent changes in farming practices have increased the concentration of highly potent DRP entering Lake Erie. Farmers are increasingly using no-till practices when planting crops and applying fertilizer, which reduces soil erosion and allows the phosphorus in fertilizer to remain at the soil's surface. This increases the chance of phosphorus runoff during precipitation events following fertilizer application. In order to

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[84] Myers, D.N., Thomas, M.A., Frey, J.W., Rheaume, S.J., and Button, D.T., *Water Quality in the Lake Erie-Lake Saint Clair Drainages Michigan, Ohio, Indiana, New York, and Pennsylvania, 1996–98*, 1203 U.S. GEOLOGICAL SURVEY CIRCULAR 35, 5 (2000), *available at* http://pubs.usgs.gov/circ/circ1203/pdf/circ1203.pdf.

[85] *Id.*

[86] Marc O. Ribaudo & Jessica Gottlieb, *Point & Nonpoint Trading–Can It Work?*, 47 J. AM. WATER RES. ASS'N. 5, 14 (2011).

accommodate larger equipment, farmers are applying fertilizer in late fall and early winter allowing phosphorus to remain present in high concentrations come spring's heavy precipitation. This increase in dissolved reactive phosphorus is the major contributor to the HAB problem in Lake Erie.

The discharge of wastewater treatment plants, construction activities, stormwater runoff and lawn and garden activities also contribute to phosphorus loading in Lake Erie. Though this urban runoff is a significant source of nonpoint nutrient loading, it is difficult to pinpoint the exact amount of phosphorus being discharged into Lake Erie.[87] According to the International Joint Commission, within the last 40 years, point source discharges to Lake Erie have "declined significantly."[88] Recent increasing high precipitation events, however, have resulted in greater frequency of municipal wastewater treatment bypass and combined sewer overflows (CSO).[89]

Lake Erie watershed is home to one of the largest sewage plants in North America.[90] The Detroit POTW has made great strides in its phosphorus reductions, serving an average of three million people and treating 27 million cubic meters per day of wastewater. Mirroring the efforts of many POTWs in the 1970s, the Detroit treatment plant eventually reduced its phosphorus concentrations by 90%. In 2000, a $1 billion program was introduced to further improve the phosphorus inputs of this system's CSOs.[91] More recently, concerns over funding and technology threaten Detroit's goals to reduce phosphorus loading. Though urban areas also have several diffuse sources that contribute to Lake Erie's nutrient loading, these sources are difficult to identify and costly to manage.

D. Consequences of Harmful Algal Blooms

1. Human Health

The cyanobacteria in HABs can produce harmful toxins, such as *Microcystis*. These toxins are present in Lake Erie and are most prominent in the western basin. The toxins in HABs are produced within the cells and are exposed when the cells break open,[92] which raise public health concerns for recreation and drinking water supplies. The World Health Organization has found that 100,000 cells/mL of *Microcystis* is a moderate human health risk; however there are no standards for cell or toxin concentration in the United States.[93] Exposure can occur from drinking water containing cyanobacteria and engaging in recreational activities

[87] International Joint Commission, *A Balanced Diet for Lake Erie: Reducing Phosphorus Loadings and Harmful Algal Blooms, Report of the Lake Erie Ecosystem Priority* 5 (2014), *available at* http://www.ijc.org/files/publications/2014%20IJC%20LEEP%20REPORT.pdf.
[88] *Id.*
[89] *Id.*
[90] *Id* at 31.
[91] *Id.* at 31.
[92] *Cyanobacteria and Cyanotoxins: Information for Drinking Water Systems*, U.S. EPA OFFICE OF WATER (July 2009), http://water.epa.gov/scitech/swguidance/standards/criteria/nutrients/upload/cyanobacteria_factsheet.pdf.
[93] *Id.*

within contaminated water.[94] Individuals recreating in HABs can experience skin irritation upon contact with these toxins. Reports have indicated that these toxins can aerosolize which increases the risk of exposure for those boating and jet-skiing.[95]

If water from an algal bloom is ingested, an individual may experience gastrointestinal discomfort and in very rare but severe cases, acute liver failure may occur.[96] Additionally, long-term exposure to low levels of *Microcystis* in drinking water may promote tumor growth and be more harmful than short-term acute exposure.[97] This exposure is troubling for the 11 million people that rely on Lake Erie for their drinking water. HABs and associated toxins are costly to municipal water treatment facilities and often become unmanageable, leaving communities without adequate drinking water supplies. Water treatment plants may be able to remove toxins from drinking water but the technology is costly and not readily available. The Toledo water crisis in August 2014 was not the first time an Ohio community was deprived of its public drinking water supply due to microcystin from HABs in Lake Erie. In September 2013, the drinking water treatment plant in Carroll Township, Ottawa County, was shut down for nearly 48 hours when elevated levels of microcystin were detected in the treated water. The microcystin was attributed to HABs in Lake Erie, from which Carroll Township draws its water supply. About 2,000 residents of Carroll Township were affected.[98]

2. Socio-Economic Impact

HABs pose detrimental impacts to the socio-economic conditions of the Lake Erie region. Algal blooms can be unsightly and diminish the aesthetic qualities of lakefront properties. Increased frequency and intensity of HABs may affect the overall property values of shoreline and nearshore homes. Additionally, the presence of HABs impacts the region's tourism industry, a substantial contributor to Ohio's revenues.[99] HABs can result in public health advisories or site closures. This can deplete the recreational value of the region, negatively impacting tourism and recreation. Highly publicized HAB effects, such as 2014's municipal water supply crisis, may discourage future tourism. Crucial to the region's economy, tourism may face detrimental impacts from increasing HABs.

Finally, increased HAB events could affect recreational and commercial fishing. The shallowness of the lake and its warming temperatures make it one of the most biologically

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[94] Juli D. Bressie, *Drinking Water as Route of Exposure to Microystins in Great Lakes Communitities*, NAT'L OCEANIC AND ATMOSPHERIC ADMIN., http://www.glerl.noaa.gov/pubs/annual/2009/2009-03.pdf (last visited Apr. 10, 2015), http://www.glerl.noaa.gov/res/Task_rpts/2009/epdyble06-1.html.

[95] Backer et al., *Recreational Exposure to Low Concentration of Microcystins During an Algal Bloom in a Small Lake*, 6 MARINE DRUGS SP. ED. MARINE TOXINS 389, 406 (2008).

[96] Juli D. Bressie, Drinking Water as Route of Exposure to Microystins in Great Lakes Communitities, NAT'L OCEANIC AND ATMOSPHERIC ADMIN., http://www.glerl.noaa.gov/pubs/annual/2009/2009-03.pdf (last visited Apr. 10, 2015), http://www.glerl.noaa.gov/res/Task_rpts/2009/epdyble06-1.html.

[97] *Cyanobacteria and Cyanotoxins: Information for Drinking Water Systems*, U.S. EPA OFFICE OF WATER (July 2009), http://water.epa.gov/scitech/swguidance/standards/criteria/nutrients/upload/cyanobacteria_factsheet.pdf.

[98] Tom Henry, *Carroll Township's Scare with Toxin a "Wake Up Call"*, TOLEDO BLADE, Sept. 15, 2013, http://www.toledoblade.com/local/2013/09/15/Carroll-Township-s-scare-with-toxin-a-wake-up-call.html.

[99] International Joint Commission, *A Balanced Diet for Lake Erie: Reducing Phosphorus Loadings and Harmful Algal Blooms, Report of the Lake Erie Ecosystem Priority* 5 (2014), *available at* http://www.ijc.org/files/publications/2014%20IJC%20LEEP%20REPORT.pdf.

productive of the Great Lakes.[100] Lake Erie is home to walleye and smallmouth bass fisheries that attract anglers from all over the country.[101] HABs can affect the health of the fisheries and cause a decline in fish populations. Furthermore, algal toxins can affect the safety of these fish for consumption. Increased HABs may result in less desirable catch and overall decline in population. These consequences could affect current and potential economic revenue from the recreational and sport-fishing industry.

E. Conclusion

Lake Erie's natural hydrology and current surrounding land uses support the presence of HABs. These existing factors, coupled with the threat of climate change, will only compound nutrient loading issues and increase the frequency and intensity of HABs in the Lake. In order to avert future public health concerns and economic consequences, policymakers should utilize existing legal mechanisms to improve water quality and reduce nutrient loading in Lake Erie.

[100] *Id.*
[101] *Id.*

II. FEDERAL AND OHIO WATER POLLUTION REGULATORY STRUCTURE

In 1972, Congress passed a major overhaul of the 1948 Federal Water Pollution Control Act known as the Clean Water Act (CWA).[102] The CWA sets out the bold purpose "to restore and maintain the chemical, physical and biological integrity of the Nation's waters."[103]

The CWA[104] broadly prohibits discharges of pollutants, including phosphorus, from "point sources" into waters of the United States, including Lake Erie and its surface water tributaries, without a permit.[105] Unpermitted discharges of phosphorus from a point source, or discharges of phosphorus from a point source in excess of the limits set forth in its permit, violate the CWA, and violators are subject to penalties and injunctive relief.[106] Regulation of discharges from point sources under the CWA and associated state law has been fairly effective, and the volume of phosphorus discharged from point sources in the Lake Erie basin has decreased markedly since the CWA was enacted in 1972.[107]

While the CWA governs point sources, its regulatory regime for nonpoint sources is less compulsory and more complex. The CWA relies on incentives and planning provisions to encourage voluntary reductions of nonpoint source pollution.[108] At the state level, Ohio Environmental Protection Agency (OEPA), Ohio Department of Natural Resources (ODNR), Ohio Department of Agriculture (ODA) and Ohio Department of Health all play roles in regulating key nonpoint sources of phosphorus into Lake Erie and its tributaries under various Ohio statutes. Overall, regulation of nonpoint sources has been much less effective than regulation of point sources. The amount of phosphorus entering Lake Erie and its tributaries from nonpoint sources now is far greater than the amount discharged from point sources.[109]

This section explains the current regulatory structure for nonpoint source pollution under the CWA and Ohio law relevant to the harmful algal blooms (HABs) problem in Lake Erie. Because in effect nonpoint sources are best described as pollution discharges that are "not point sources," it is important to briefly explore how point sources are defined and regulated.[110]

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[102] Pub. L. No. 92-500, 86 Stat. 816 (1972). Although the statute technically remains the Federal Water Pollution Control Act, most practitioners and commentators refer to it as the Clean Water Act.
[103] 33 U.S.C. § 1251(a) (2012).
[104] 33 U.S.C. §§1251-1387.
[105] *See* discussion *infra* Part II.A.
[106] *See* 33 U.S.C. § 1319 (2012).
[107] *See Ohio Lake Erie Phosphorus Task Force Final Report*, OHIO ENVTL. PROTECTION AGENCY, 12-15 (Apr. 2010), http://epa.ohio.gov/portals/35/lakeerie/ptaskforce/Task_Force_Final_Report_April_2010.pdf.
[108] *See* discussion *infra* Part II.B.
[109] *Ohio Lake Erie Phosphorus Task Force Final Report*, OHIO ENVTL. PROTECTION AGENCY, 17, 36 (Apr. 2010), http://epa.ohio.gov/portals/35/lakeerie/ptaskforce/Task_Force_Final_Report_April_2010.pdf. According to the Task Force, the most significant Ohio contributor to phosphorus loading to Lake Erie today is stormwater runoff from agricultural activities. *Id*. at 73.
[110] *What is Nonpoint Source Pollution?*, U.S. ENVTL. PROT. AGENCY, http://water.epa.gov/polwaste/nps/whatis.cfm (last updated Aug. 27, 2012); 33 U.S.C. § 1362(14).

A. Point Source Regulation

Section 301 of the CWA prohibits the discharge of any pollutant, except as in compliance with certain sections of the Act.[111] Phosphorus is a pollutant under the CWA,[112] and "discharge of a pollutant" means the addition of any pollutant to "navigable waters" from any "point source."[113] "Point source" is broadly defined to include any discernible, confined, and discrete conveyance, such as pipes or ditches.[114] Point sources include end-of-pipe discharges of effluent from publicly owned treatment works (POTWs) and industrial wastewater treatment plants.[115]

Most types of stormwater runoff are not regulated as point sources but rather as nonpoint sources.[116] However, certain types of stormwater runoff are regulated as point sources, including municipal stormwater, industrial stormwater, and construction sites.[117] The CWA specifically exempts "agricultural stormwater discharges and return flows from irrigated agriculture" from the definition of point source.[118] Concentrated animal feeding operations (CAFOs), however, are expressly defined as point sources.[119]

"Navigable waters," statutorily defined as "waters of the United States,"[120] encompasses more than just navigable-in-fact waters such as Lake Erie and its major tributaries. Although its outside parameters are less than clear, CWA jurisdiction extends to: relatively permanent bodies of water (such as seasonal streams) that are tributaries of navigable-in-fact waters, wetlands connected to navigable waters, and all other waters with a significant nexus to traditional navigable-in-fact waters.[121]

Essentially, discharges of pollutants into navigable waters from point sources without a CWA permit of some kind are unlawful. Disposal of dredged or fill material requires a permit under section 404 of the CWA.[122] Discharges of most other pollutants, including phosphorus, require a National Pollutant Discharge Elimination System (NPDES) permit under section 402 of the

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[111] Clean Water Act § 301(a), 33 U.S.C. § 1311(a).
[112] Clean Water Act § 502(6), 33 U.S.C. § 1362(6) (broadly defining pollutant); 40 C.F.R. § 132 Tables, tbl.5 (listing phosphorus in the Great Lakes System as a pollutant subject to federal, state, and tribal water quality requirements).
[113] Clean Water Act § 502(12), 33 U.S.C. § 1362(12).
[114] 33 U.S.C. § 1362(14).
[115] *See generally* Clean Water Act § 402, 33 U.S.C. § 1342. Discharges from home sewage treatment systems also can be included. 40 C.F.R. § 122.1(b)(2).
[116] *See generally* 40 C.F.R. § 122.26.
[117] *Id.*
[118] Clean Water Act § 502(14), 33 U.S.C. § 1362(14).
[119] *Id*.
[120] Clean Water Act § 502(7), 33 U.S.C. § 1362(7).
[121] *See* Rapanos v. United States, 547 U.S. 715 (2006); USEPA & ACOE Guidance, Clean Water Act Jurisdiction Following the U.S. Supreme Court's Decision in *Rapanos v. United States* (Dec. 2, 2008). Wetlands also can be waters of the United States if they have a continuous surface connection to relatively permanent bodies of water or have a significant nexus to navigable-in-fact waters.
[122] Clean Water Act § 404, 33 U.S.C. § 1344.

CWA.[123] NPDES permits set the terms under which discharges from point sources will be allowed.[124] The volume and concentration of a pollutant allowed to be discharged under a NPDES permit depends: primarily, on uniform, technology-based effluent limitations set by U.S. Environmental Protection Agency (USEPA) or state law; and secondarily, on the water quality standards of the receiving waterbody. In Ohio, OEPA establishes the water quality standards, subject to USEPA approval.[125]

The NPDES program is a delegable program, meaning that USEPA may delegate to a state agency the authority to administer and enforce the program subject to the requirements of federal law.[126] OEPA is the delegated agency in Ohio.[127] OEPA issues NPDES permits, while USEPA retains oversight and veto authority.[128] A requisite for delegation is that state law be at least as stringent as the CWA and federal regulations.[129] Ohio Revised Code (ORC) chapter 6111 is the primary Ohio statute governing discharges of pollutants from point sources into waters of the state.[130] In general, ORC chapter 6111 makes it unlawful to place or discharge any sewage, sludge, or other wastes into waters of the state without a NPDES permit.[131] Ohio's statute covers all "waters of the state," whereas the CWA only covers discharges to statutorily defined "navigable waters."[132] Similar to the CWA, ORC Chapter 6111 specifically exempts agricultural pollution, including stormwater runoff and animal waste.[133]

B. Nonpoint Source Regulation

> "*The importance of nonpoint sources to water pollution problems has been recognized for decades. Yet nonpoint sources have largely escaped federal regulation because of political, administrative, and technical difficulties."*[134]

"Nonpoint source" is not a defined term under the CWA or Ohio statutes.[135] In effect, nonpoint sources are diffuse sources that are not regulated as point sources.[136] As mentioned

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[123] Clean Water Act § 402, 33 U.S.C. § 1342.
[124] *See generally* Clean Water Act § 402, 33 U.S.C. § 1342.
[125] CWA § 303(a)-(c), 33 U.S.C. § 1313(a)-(c).
[126] *See* Clean Water Act § 101(b), 33 U.S.C. § 1251(b); 40 C.F.R. § 123 (2011).
[127] *See Division of Surface Water – About Us*, OHIO ENVTL. PROTECTION AGENCY, http://epa.ohio.gov/home.aspx (last visited Apr. (2015). As discussed more fully *infra*, Ohio Department of Agriculture plays a role in permitting CAFOs.
[128] *See* Clean Water Act § 402(d), 33 U.S.C. § 1342(d); 40 C.F.R. § 123.44.
[129] *See e.g.*, Clean Water Act § 402(b), 33 U.S.C. § 1342(b) (requiring states applying for delegation of the NPDES program to have 'adequate authority' to carry out a program). States may have programs that are broader or more stringent than the federal laws and regulations. *See* Clean Water Act § 510, 33 U.S.C. § 1370.
[130] OHIO REV. CODE ANN. § 6111.
[131] OHIO REV. CODE ANN. § 6111.04(A)(1).
[132] *Compare* OHIO REV. CODE ANN. § 6111.01(H) *with* 33 U.S.C. § 1362(7). OHIO REV. CODE ANN. § 6111.01(H) broadly defines "waters of the state" to include all accumulations of water, surface or underground, natural or artificial.
[133] OHIO REV. CODE ANN. § 6111.04(F)(3)-(4).
[134] ROBERT V. PERCIVAL ET AL., ENVIRONMENTAL REGULATION: LAW, SCIENCE, AND POLICY 763 (6th ed. 2009).
[135] *What is Nonpoint Source Pollution?*, U.S. ENVTL. PROT. AGENCY, http://water.epa.gov/polwaste/nps/whatis.cfm (last updated Aug. 27, 2012); *Cf.* 33 U.S.C. § 1362(14) (defining a "point source" as the following: "any discernible, confined and discrete conveyance, including but not limited to

above, most types of stormwater runoff are nonpoint sources. Agricultural activities are the most pervasive source of nonpoint source pollution in the United States[137] and have been identified as the most significant contributor of phosphorus to Lake Erie and its tributaries.[138] This subsection focuses on how the CWA and Ohio state law address nonpoint source pollution in general and how Ohio law addresses agricultural activities in particular.

1. Clean Water Act

The CWA prohibits unpermitted discharges from point sources, and violators are subject to sanctions.[139] By contrast, the CWA relies on planning and incentive programs to encourage voluntary reduction of nonpoint source pollution; mandatory regulation of nonpoint sources is largely left to the discretion of the states.

a. Clean Water Act Section 208

The CWA as originally enacted addressed nonpoint source pollution through section 208.[140] Section 208 required states to designate (a) areas with substantial water quality control problems, and (b) organizations capable of developing water treatment management plans for those areas.[141] Those designated organizations would then develop management plans for controlling nonpoint source pollution "to the extent feasible."[142] Both the designations and the plans were subject to USEPA approval, and the designated agencies were eligible for grants and technical assistance from the federal government.[143]

The Section 208 Program was widely viewed as ineffective. Although the statute purportedly mandated the states to develop and implement management plans to control nonpoint sources, USEPA could not force the states to do so. Further, once a plan was approved, USEPA could only withdraw approval for substantial failure to comply with the requirements.[144] USEPA had no power to implement the states' plans, and it could not develop its own plan. Instead, USEPA could only incentivize a state to participate with the promise of federal grants and assistance. Conversely, the only real consequence of non-compliance was USEPA's withholding of such funding and assistance. In reality, section 208 was voluntary for the states,

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any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged.").

[136] *See* USEPA Office of Water, Nonpoint Source Guidance 3 (1987); Cordiano v. Metacon Gun Club, Inc., 575 F.3d 199, 220 (2d Cir. 2009).

[137] *Id*. at 642.

[138] *Ohio Lake Erie Phosphorus Task Force Final Report*, OHIO ENVTL. PROTECTION AGENCY, 73 (Apr. 2010), http://epa.ohio.gov/portals/35/lakeerie/ptaskforce/Task_Force_Final_Report_April_2010.pdf; International Joint Commission, A Balanced Diet for Lake Erie: Reducing Phosphorus Loadings and Harmful Algal Blooms 4, 30 (Feb. 2014).

[139] *See* discussion *supra* Section II.A.

[140] 33 U.S.C. § 1288.

[141] 33 U.S.C. § 1288(a)(2).

[142] 33 U.S.C. § 1288(b). *See* 33 U.S.C. § 1288(b)(2)(F) (agricultural nonpoint sources).

[143] 33 U.S.C. § 1288(a)(7), (b)(3), (f)–(i). Further, the U.S. Department of Agriculture (USDA), through the Natural Resource Conservation Service (formerly the Soil Conservation Service), was authorized to enter into agreements with owners and operators of rural land whereby the USDA would share in the costs of installing and maintaining best management practices to control nonpoint source pollution. 33 U.S.C. § 1288(j).

[144] 33 U.S.C. § 1288(b)(4)(D)(ii).

and Congress ceased funding the grants programs in 1981. Section 208 remains on the books and its planning provisions continue to have relevance in Ohio.

b. Clean Water Act Section 319

In 1987, in response to the perceived failure of section 208 and the growing problem of nonpoint source pollution, Congress amended the CWA by adding section 319.[145] In short, section 319 requires states to submit assessment reports identifying waters that are impaired by nonpoint source pollution and to develop management plans, including best management practices (BMPs), to address the nonpoint sources significantly polluting those waters. States with USEPA-approved assessment reports and management plans receive federal grants to help implement section 319 programs. However, section 319 is not mandatory, and the incentives have often been insufficient to encourage states to comply voluntarily.

A state's assessment report submitted to USEPA must identify all "navigable waters within the state which, without additional action to control nonpoint sources of pollution, cannot reasonably be expected to attain or maintain applicable water quality standards or goals and requirements of [the CWA]."[146] The assessment report must also identify categories or individual nonpoint sources which contribute significant pollution to the impaired waters; describe the process for choosing BMPs to control such sources "to the maximum extent practicable;" and describe the state and local nonpoint source pollution control programs.[147] If the state fails to submit an adequate assessment report, USEPA must prepare an assessment report that lists the impaired waters and significant polluting nonpoint sources.[148]

Following the assessment report, the state must submit a management plan for controlling nonpoint sources of pollution.[149] The management plan must include BMPs to reduce pollution from each category or individual source identified in the assessment report.[150] The management plan must also describe how to achieve implementation of the BMPs and provide an implementation schedule, certification that state laws are adequate to implement the management program, and information regarding sources of funding.[151] States are urged to involve local agencies and organizations with experience in controlling nonpoint source pollution, and to develop and implement the program on a watershed-by-watershed basis.[152] While USEPA must disapprove a management plan if it is inadequate,[153] the agency has no authority to develop or implement its own plan.[154] The only sanction for a state's failure to

[145] 33 U.S.C. § 1329.
[146] 33 U.S.C. § 1329(a)(1)(A).
[147] 33 U.S.C. § 1329(a)(1)(B)-(D).
[148] 33 U.S.C. § 1329(d)(3).
[149] 33 U.S.C. § 1329(b).
[150] 33 U.S.C. § 1329(b)(2)(A).
[151] 33 U.S.C. § 1329(b)(2).
[152] 33 U.S.C. § 1329(b)(3-4).
[153] 33 U.S.C. § 1329(d).
[154] Kenneth Murchison, *Learning From More Than Five-and-a-Half Decades of Federal Water Pollution Control Legislation: Twenty Lessons for the Future*, 32 B.C. Envtl. Aff. L. Rev. 527, 569 (2005). A local public agency or organization may, with state approval, develop and implement a management plan for USEPA approval, if no state plan is approved. 33 U.S.C. § 1329(e).

develop or implement a management plan is the inability to receive federal grants to implement the program.

Once a state management program is approved, the state receives grants from USEPA for the program.[155] The federal grant cannot make up more than 60% of the program's total funds, and a state must show it has adequate funding for its share before federal funding is released.[156] Continued eligibility for the grant program is conditioned on the state making satisfactory progress in meeting its program's scheduled milestones and maintaining its level of expenditures.[157]

Because section 319 is mandatory, and the financial incentives to do so are insufficient, not all states have developed and implemented nonpoint source management programs. Even for states that have developed approved programs, there is no requirement that the states penalize nonpoint sources that fail to comply with BMPs.[158] Typically, the programs seek to encourage nonpoint sources to reduce pollution voluntarily via grants to help pay for implementation of the BMPs.

c. TMDLs

Total maximum daily loads (TMDLs) are a potentially important tool under the CWA that can be used by states to regulate nonpoint sources as well as point sources.[159] However, the CWA neither authorizes the federal government to regulate nonpoint sources, nor requires states to regulate nonpoint sources in order to comply with TMDLs.

A TMDL is the maximum amount of a pollutant that can be discharged daily into a waterbody from both point and nonpoint sources without violating water quality standards.[160] Pursuant to section 303(d), a TMDL must be calculated for all waterbodies/segments where effluent limitations on point sources are not stringent enough to attain/maintain water quality standards.[161] This includes waters that are impaired solely by nonpoint sources.[162] A TMDL is the sum of allocations to point sources (wasteload allocations) and nonpoint sources (load allocations), plus a margin of safety to account for natural variability and uncertainty in developing the pollution budget.[163] States must identify waters that need a TMDL, prepare the TMDL, and submit a list of impaired waters and TMDLs to USEPA for approval.[164] Once approved, a state must incorporate each TMDL into its continued planning process.[165] USEPA regulations require states to develop water quality management plans, for purposes of section 208 and section 303(e), that must describe how states will control nonpoint source pollution to

[155] 33 U.S.C. § 1329(h).
[156] 33 U.S.C. § 1329(h)(3).
[157] 33 U.S.C. § 1329(h)(8-9).
[158] *See* Natural Resources Defense Council v. EPA, 915 F.2d 1314 (9th Cir. 1990).
[159] *See* Oliver Houck, *TMDLs IV: The Final Frontier*, 29 Envtl. L. Rep. 10469 (1999).
[160] *See* Clean Water Act § 303(d)(1)(C), 33 U.S.C. § 1313(d)(1)(C); 40 C.F.R. § 130.2(i) (2011).
[161] Clean Water Act § 303(d)(1)(A), 33 U.S.C. § 1313(d)(1)(A).
[162] Pronsolino v. Nastri, 291 F.3d 1123 (9th Cir. 2002).
[163] 33 U.S.C. § 1251(a).
[164] 33 U.S.C. § 1313(d)(1)-(2).
[165] 33 U.S.C. § 1313(e).

impaired waters.[166] Thus, TMDLs are largely information and planning tools that could be used by the state to justify regulation of nonpoint sources as well as point sources.[167] If a state fails to identify waters or set TMDLs, USEPA must do so.[168] But USEPA itself cannot enforce TMDLs or plans, nor can states be required to enforce TMDLs or plans to regulate nonpoint sources.[169] Failure to enforce TMDLs or plans will deprive states of grant money.[170] However, states can choose to enforce the pollution limits for non-point sources contained in an approved TMDL.[171] TMDLs can also be used as part of a multi-state planning process to create a pollution budget enforceable under state programs, a subject addressed in detail in Section III(B) when we discuss the Chesapeake Bay TMDL.

d. Water Quality Standards

Water quality standards play a role in nonpoint source pollution control, specifically in connection with section 319 and TMDLs. Water quality standards also play a backup role in point source pollution control, mandating a stricter NPDES permit effluent limit if the primary, technology-based limit alone would exceed the water quality standard.[172] These standards set the maximum level of a pollutant that can lawfully exist in the ambient waterbody.[173] Water quality standards are based on the designated uses of the waterbody and water quality criteria necessary to protect those uses.[174] For example, the water quality standards for a waterbody designated for public drinking supply would include a 0.018 parts per million limit on arsenic. Water quality criteria must be adopted for all pollutants affecting a waterbody and may be numeric or narrative.[175] In Ohio, OEPA establishes the water quality standards, subject to USEPA approval.[176]

Ohio currently has no numeric water quality criteria for phosphorus; however, there is a generally applicable narrative water quality criteria that directly relates to algal blooms. All surface waters in Ohio must be "free from nutrients entering the waters as a result of human activity in concentrations that create nuisance growths of aquatic weeds and algae."[177]

e. Ohio: Nonpoint Sources and the Clean Water Act

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[166] 40 C.F.R. § 130.6.
[167] *See* 40 C.F.R. § 130.2(i); 40 C.F.R. § 130.7(b)(1)(iii).
[168] Clean Water Act § 303(d)(2), 33 U.S.C. § 1313(d)(2); Scott v. City of Hammond, 741 F.2d 992 (7th Cir. 1984); Alaska Center for the Environment v. Reilly, 762 F. Supp. 1422 (W.D. Wash. 1991).
[169] *See* American Wildlands v. Browner, 260 F.3d 1192, 1197 (10th Cir. 2001).
[170] *See generally* Clean Water Act § 303(d), 33 U.S.C. § 1313(d); 40 C.F.R. § 130. By contrast, states can be more easily coerced to force point sources to reduce the amount of pollutants being discharged. USEPA can refuse to approve a state-issued NPDES permit that would allow discharge of a pollutant in excess of the TMDL of the receiving water, and USEPA ultimately could withdraw state authorization to administer the NPDES program. Lara Guercio, *The Struggle Between Man and Nature – Agriculture, Nonpoint Source Pollution, and Clean Water: How To Implement the State of Vermont's Phosphorus TMDL Within the Lake Champlain Basin*, 12 Vt. J. Envtl. L. 455, 474-76 (2011).
[171] *See* Pronsolino v. Nastri, 291 F.3d 1123 (9th Cir. 2002).
[172] 33 U.S.C. § 1311(b)(1)(C).
[173] 33 U.S.C. § 1313(c)(2)(A).
[174] *Id.*
[175] 33 U.S.C. § 1313(c).
[176] 33 U.S.C. § 1313(a)-(c).
[177] OHIO REV. CODE ANN. § 3745-1-04(E).

Nationally section 208 of the CWA was not a success; however, in Ohio it retains some vibrancy. Ohio's USEPA-approved Water Quality Management Plan incorporates section 208 plans as well as planning requirements under section 303(e).[178] In Ohio, six area-wide councils of government develop the plans in their respective urban areas, encompassing 24 counties, while OEPA prepares the plan for the remaining 64 counties. The Toledo Metropolitan Area Council of Governments (TMACOG) develops the plan for the Toledo area, which includes Lucas County.[179]

The Water Quality Management Plan broadly addresses elements of water quality that the State supervises, including nonpoint sources. The Plan discusses the importance of identifying and supporting implementation of management practices to reduce nonpoint source pollution; however, the Plan imposes no requirements on nonpoint sources of pollution.[180]

Pursuant to its authority under section 303(d) of the CWA, OEPA biannually compiles a list of impaired waters where effluent limitations are not stringent enough to attain or maintain water quality standards. The most recent list was approved by USEPA in 2012.[181]

OEPA has established more than 1,700 TMDLs for waterbodies/segments, including hundreds for waters impaired by phosphorus.[182] Many of the tributary watersheds within the Lake Erie basin have phosphorus TMDLs, including the Lower Maumee River.[183] Where loadings exceed the TMDL, OEPA can impose more stringent NPDES permit limits on point sources, but the agency has no similar enforceable tool to reduce loadings for nonpoint sources. Instead the agency must rely on programs, such as the section 319 program, to encourage voluntary reductions.

Ohio's current section 319 nonpoint source management plan was approved by USEPA in 2014.[184] The plan broadly guides implementation of state and local nonpoint source management measures, and it includes strategies focused on nutrient pollution. However, there

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[178] *See List of Section 208 Plan Material for Certification-Final May 2014*, OHIO ENVTL. PROTECTION AGENCY, (May 2014) http://www.epa.ohio.gov/Portals/35/mgmtplans/ListofSection208PlanMaterialsforCert_2014.pdf; *See* 40 C.F.R. § 130.6.

[179] *See TMACOG Areawide Water Quality Management Plan*, TOLEDO METROPOLITAN AREA COUNCIL OF GOVERNMENTS (June 2014), http://www.tmacog.org/Environment/208currentplan/TMACOG_AWQMP.pdf.

[180] *See List of Section 208 Plan Material for Certification-Final May 2014*, OHIO ENVTL. PROTECTION AGENCY, (May 2014) http://www.epa.ohio.gov/Portals/35/mgmtplans/ListofSection208PlanMaterialsforCert_2014.pdf.

[181] *See* Ohio Envtl. Protection Agency, 2012 Integrated Water Quality Monitoring and Assessment Report § L4, *available at* http://epa.ohio.gov/dsw/tmdl/OhioIntegratedReport.aspx#123199061-report (last visited Apr. 10, 2015). The 2014 report has been submitted by OEPA but has not yet been approved by USEPA. *Id*.

[182] *Ohio Cumulative Number of TMDLs*, U.S. ENVTL. PROTECTION AGENCY, http://iaspub.epa.gov/waters10/attains_state.report_control?p_state=OH&p_cycle=2008&p_report_type=T#tmdl_by_pollutant (last updated Apr. 10, 2015). As of 2001 Ohio only had 3 TMDLs established, but a citizen suit and 2004 consent decree helped spur development by requiring the State to assess and establish TMDLs. *See also* Consent Decree, National Wildlife Federation v. USEPA, Case No. C2-01-1052 (S.D. Ohio Aug. 19, 2004).

[183] *See TMDL Final Report for Lower Maumee River Tributaries and Lake Erie Tributaries*, OHIO ENVTL. PROTECTION AGENCY (Sept. 2012), http://www.epa.state.oh.us/Portals/35/tmdl/MLLEtribs_Final_FactSheet.pdf.

[184] *Nonpoint Source Management Plan Update*, OHIO ENVTL. PROTECTION AGENCY, (2014), http://www.epa.ohio.gov/Portals/35/nps/NPS_Mgmt_Plan.pdf.

are no requirements on nonpoint sources of pollution. Participation in the section 319 grant program is entirely voluntary for nonpoint sources.[185]

Since 1990, OEPA has annually applied for, received, and distributed section 319 grant funds. The grant funds are distributed to local governments and other organizations for specific projects to implement locally developed watershed management plans, typically guided by the state nonpoint source management plan. During the 2014 fiscal year, OEPA distributed approximately $2 million in federal section 319 grant funds.[186]

2. Ohio Law

Part (a) of this section focuses on Ohio law applicable to nonpoint source pollution from agricultural activities. Part (b) focuses on home sewage treatment systems, which may be regulated as point sources or nonpoint sources.

a. Agricultural Activities

Runoff from agricultural activities—row crop farms and animal feeding operations—is the largest contributor of phosphorus to Lake Erie and its tributaries.[187] In the Lake Erie basin, there are three main agricultural sources of phosphorus: manure, biosolids, and commercial fertilizer. Commercial fertilizer accounts for about 66% of the fertilizer applied to row crop agriculture in the Lake Erie basin, with manure (27%), and biosolids (6%) comprising the remainder.[188]

i. Manure: Ohio Revised Code Chapter 1511

ORC chapter 1511, and its implementing regulations at Ohio Administrative Code 1501:15-5-01 *et seq.*, are the legal framework for ODNR's Agricultural Pollution Abatement Program.

ODNR, specifically the chief of the Division of Soil and Water Conservation, is required to adopt rules that establish management and conservation practices in farming operations that will abate the erosion of soil or the degradation of state waters by residual farm products,

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[185] *See id.*
[186] *OEPA Program Summary Nonpoint Source Program FY2014 Annual Report*, OHIO ENVTL. PROTECTION AGENCY, (2014), http://www.epa.ohio.gov/Portals/35/nps/319docs/FFY14_Annual_Report.pdf. *See* Ohio Rev. Code § 6111.037 (OEPA director sets priorities for nonpoint source management fund).
[187] *Ohio Lake Erie Phosphorus Task Force Final Report*, OHIO ENVTL. PROTECTION AGENCY, 73 (Apr. 2010), http://epa.ohio.gov/portals/35/lakeerie/ptaskforce/Task_Force_Final_Report_April_2010.pdf; International Joint Commission, *A Balanced Diet for Lake Erie: Reducing Phosphorus Loadings and Harmful Algal Blooms, Report of the Lake Erie Ecosystem Priority* 4, 30 (2014), *available at* http://www.ijc.org/files/publications/2014%20IJC%20LEEP%20REPORT.pdf.
[188] *Ohio Lake Erie Phosphorus Task Force Final Report* 37, 40-41 (April 2010), *available at* http://www.epa.oh.gov/portals/35/lakeerie/ptaskorce/Task_Force_Final_Report_April_2010.pdf

manure or soil sediment.[189] The standards adopted by the chief must be "technically feasible and economically reasonable."[190]

ORC section 1511.02(E)(1)[191] also requires the chief to issue orders to ensure compliance. When a discharger fails to comply with these adopted standards and causes agricultural pollution, the chief is authorized to require the discharger to implement an operation and management plan approved by the chief.[192] Agricultural pollution is defined as a failure to use management and conservation practices in farming, resulting in soil erosion or degradation of waters of the state by residual farm products, manure, or soil sediment.[193] An operation and management plan includes implementation schedules and operational procedures for pollution abatement practices.[194]

The standards issued by ODNR pursuant to ORC § 1511.02(E)(1) are set forth in Ohio Administrative Code 1501:15-5-01 *et seq*. The statutory mandate of "technically feasible and economically reasonable standards" has been interpreted as requiring owners and operators of agricultural, silvicultural, and animal feeding operations to implement BMPs.[195] Under the rules adopted by ODNR, if an owner or operator of an agricultural, silvicultural, or animal feeding operation fails to implement BMPs and agricultural pollution occurs, the owner or operator may be subject to enforcement, including civil and criminal liability.[196]

These rules prohibit specific types of agricultural pollution associated with either agricultural operations or animal feeding operations (AFOs). Agricultural operations must implement BMPs to prevent agricultural pollution caused by sheet and rill erosion, gully erosion, wind erosion, or placing soil directly into waters of the state or in such a position that it may readily erode or slough into waters of the state.[197] The regulations define BMPs as the most effective practicable means of preventing or reducing agricultural pollution to achieve compliance with water quality goals.[198] For purposes of standards required for compliance, the Field Office Technical Guide (FOTG), published by the federal Natural Resource Conservation Service,[199] attempts to clearly define BMPs.[200]

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[189] OHIO REV. CODE ANN. § 1511.02(E). Prior to the 2014 amendment by Senate Bill 150, chapter 1511 used the term "animal waste" instead of "residual farm products" and "manure." The definitions of "residual farm products," OHIO REV. CODE ANN. § 1511.01(G), and "manure," OHIO REV. CODE ANN. § 1511.01(I), are virtually identical to the former definition of "animal waste."

[190] OHIO REV. CODE ANN. § 1511.02(E)(1). The supervisors of the soil and conservation districts are also granted authority to make this designation, subject to state approval. OHIO REV. CODE ANN. § 1515.08(P)

[191] The statute also mandates orders to ensure compliance with animal composting. OHIO REV. CODE ANN. § 1511.02(G).

[192] *Id.*

[193] OHIO REV. CODE ANN. § 1511.01(D).

[194] OHIO REV. CODE ANN. § 1511.01(F).

[195] OHIO ADMIN. CODE 1501:15-5-01 thru -12.

[196] OHIO ADMIN. CODE 1501:15-5-01 *et seq*.

[197] OHIO ADMIN. CODE 1501:15-5-08 thru -12

[198] OHIO ADMIN. CODE 1501:15-5-01(B)(7). Practicable" implies "technological, economic, and institutional considerations." *Id*.

[199] *Field Office Technical Guild (FOTG)*, U.S. DEPT. OF AGRICULTURE, http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/fotg/ (last visited Apr. 10, 2015).

[200] The Field Office Technical Guide is defined at OHIO REV. CODE ANN. 1501:15-5-01(B)(19) and is referenced in several succeeding subsections.

These BMPs apply to AFOs. An AFO is defined as the production area of an agricultural operation where animals are kept in a confined area, excluding facilities that possess either a NPDES permit from the OEPA or a concentrated animal feeding facility permit from ODA.[201] Regulation of AFOs focuses primarily on manure. Owners and operators of AFOs are required to implement BMPs regarding animal manure collection, storage, or treatment facilities in order to prevent discharge into waters of the state.[202] AFOs are required to implement BMPs to prevent; seepage into waters of the state; discharge of manure-contaminated runoff into waters of the state; pollution from other wastewaters; and pollution from composting dead animals.[203] There are also limits on land application of manure, including a requirement that owners or operators applying manure to land follow the FOTG or other approved management methods.[204]

On December 23, 2010, new administrative rules and amendments went into effect,[205] including revisions that deal with distressed watersheds. The chief may designate a watershed in distress, subject to a majority vote from the Ohio Soil and Water Conservation Commission.[206] Designation of a watershed in distress invokes two important rules: (1) Ohio Administrative Code 1501:15-5-05 which significantly restricts land application of manure in a distressed watershed between December 15 and March 1, and when ground is frozen or snow-covered outside those dates,[207] and (2) Ohio Administrative Code 1501:15-5-19 which

[201] OHIO ADMIN. CODE 1511.01(J). The definition of an AFO explicitly excludes "a facility that possesses a permit issued under Chapter 903, or division (J) of section 6111.03." *Id.* Under Ohio Rev. Code ch. 903, the ODA is responsible for issuing permits to operate to CAFFs, which are essentially facilities with the same capacities as large CAFOs. OHIO REV. CODE ANN. § 903.03(A)(2). As the delegated agency for NPDES permitting, the OEPA is responsible for issuing NPDES permits to small, medium, and large CAFOs that discharge into waters of the United States. OHIO REV. CODE ANN. § 6111.03(J)(1). This leaves facilities too small to be deemed CAFOs or CAFFs and small and medium CAFOs that do not discharge into waters of the United States to be regulated as AFOs under OHIO REV. CODE ANN. § 1511.

[202] OHIO REV. CODE ANN. § 1501:15-5-02. It is important to note that overflow due to some infrequent storm event will not cause an operator to be in violation. AFOs must be constructed to withstand 25-year frequency flood. Ohio Admin. Code 1501:15-5-07. Discharge resulting from more severe weather events will not result in a violation.

[203] OHIO ADMIN. CODE 1501:15-5-03, 1501:15-5-04, 1501:15-5-06, 1501:15-5-18.

[204] OHIO ADMIN. CODE 1501:15-5-05.

[205] OHIO ADMIN. CODE 1501:15-5-01 et seq.

[206] OHIO ADMIN. CODE 1501:15-5-20.

[207] Beginning two years after the land is designated as being in distress, an owner or operator cannot apply manure between December 15th and March 1st without prior approval, cannot surface apply manure (manure either has to be injected or incorporated into the ground) when the ground is frozen or has at least one inch of snow cover, can only apply snowpack manure if it is in the nutrient management plan or approved by the chief, cannot apply manure if there is a weather forecast of a greater than 50% chance of at least one inch of rainfall within a 24 hour period after the land application, and must have capacity to store manure for a 120 days OHIO ADMIN. CODE 1501:15-5-05(B). This rule also makes failure to comply with the standards a violation whether or not pollution has actually occurred. OHIO ADMIN. CODE 1501:15-5-05(C). This is in contrast to other rules where actual pollution must occur before the chief can issue an order. OHIO ADMIN. CODE 1501:15-5-02 thru -04, 1501:15-5-06 thru -12.

requires farms generating or utilizing all but a small amount of manure to conform to an approved nutrient management plan.[208]

Key factors for designation of a watershed in distress include whether the watershed is listed as impaired by nutrients or sediments and whether streams or lakes within the watershed exhibit evidence of HABs.[209] The chief has designated neither the Lake Erie watershed nor any watershed within the Lake Erie basin as in distress. However, the Grand Lake St. Marys watershed was designated as in distress in January 2011 due to severe HABs experienced in Grand Lake St. Marys in summer 2010.[210]

An owner or operator may be held liable for failure to observe BMPs that result in pollution of waters of the state.[211] Before the owner or operator can be held liable for violating chapter 1511 or the regulations thereunder, the chief typically first must issue an order, and the owner or operator then must fail to comply with the order.[212]

The enforcement process for violating Ohio Administrative Code 1501:15-5-01 *et seq.* is somewhat complex. In general, there are two enforcement pathways. First, an owner or operator may be held liable as a result of an investigation. After receiving a written complaint from any person about a nuisance caused by agricultural pollution, the division of soil and water conservation must conduct an investigation.[213] If the division determines that the rules have been violated, the division must work with the owner or operator in developing a voluntary solution.[214] If the owner or operator fails to cooperate voluntarily, the division must submit an investigative report to the chief.[215] Then, the chief must decide whether a violation exists and whether corrective action is needed.[216] Next, the chief will develop a compliance schedule and inform the owner or operator that he has a period of time to voluntarily correct the action.[217] If the owner or operator fails to take the action in the time specified, the chief may then issue an order.[218] An owner or operator can only be held liable for failing to comply with an order, not for failing to comply with the rules before an order was issued.[219] Second, an owner or operator may be held liable for failure to comply with a voluntary solution proposed by a district representative. Every county in Ohio has a soil and water conservation

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[208] OHIO ADMIN. CODE 1501:15-5-19. The threshold amount is "producing, applying, or receiving in excess of three hundred fifty tons and/or one hundred thousand gallons of manure on an annual basis." OHIO ADMIN. CODE 1501:15-5-19(A).
[209] OHIO ADMIN. CODE 1501:15-5-20(A)(1) & (3).
[210] *Ohio Watersheds and Drainage Basins Maps*, OHIO DEP'T OF NAT. RESOURCES, http://soilandwater.ohiodnr.gov/maps/watershed-drainage-basin-maps (last visited Apr. 10, 2015); s*ee also*, OHIO'S COUNTRY J., JAN. 20, 2011, *ODNR Designates Grand Lake St. Marys Watershed Distressed*, http://ocj.com/2011/01/odnr-designates-grand-lake-st-marys-watershed-distressed%E2%80%A8/.
[211] OHIO ADMIN. CODE 1501:15-5-02 thru -12
[212] OHIO REV. CODE ANN. §§ 1511.02(G), 1511.07. Note that the chief ensures compliance with Ohio Rev. Code § 1511.02(E)(2) by reviewing and approving plans for development OHIO ADMIN. CODE 1501:15-1-06(B)(6).
[213] OHIO REV. CODE ANN. §1511.021(B).
[214] OHIO ADMIN. CODE 1501:15-5-15(C)(5).
[215] OHIO ADMIN. CODE 1501:15-5-15(C)(6)(a).
[216] OHIO ADMIN. CODE 1501:15-5-15(C)(6)(a).
[217] *Id*.
[218] OHIO ADMIN. CODE 1501:15-5-15(C)(6)(b).
[219] OHIO REV. CODE ANN. §§ 1511.02(G), 1511.07.

district that acts as a political subdivision of the State.[220] The district representative informs both the division and the district board of supervisors of the facts established by an investigative report, the solution proposed, and the action or inaction taken by the owner or operator.[221] If the district board determines a violation exists and corrective action is needed, the district board informs the owner or operator by certified mail of a period during which he can comply voluntarily.[222] If the owner or operator *still* fails to take corrective action in the time specified, the district board may request the chief to issue an order.[223]

Under either pathway, after an order is issued, the recipient has a right to an adjudicative administrative hearing,[224] and a final agency order can be appealed to the Franklin County Court of Common Pleas.[225] If that owner or operator fails to comply with the order, at the chief's request the Ohio attorney general must bring an action in Franklin County.[226] The court will uphold the order so long as it was "lawful and reasonable."[227] Violation of an order is a first degree misdemeanor punishable by up to a $1,000 fine and 180 days in jail.[228] Additionally, an owner or operator may be civilly liable for repairing any damage caused by violation of the chief's order.[229] Where there is a danger to public health, the chief may issue an emergency order to cease the violation.[230]

An owner or operator of agricultural land or an AFO may voluntarily develop an operation and maintenance plan approved by either the chief of soil and water resources or by the supervisors of the applicable soil and water conservation district.[231] An approved operation and management plan is an affirmative defense in private civil actions for nuisance,[232] which incentivizes voluntarily implementation of these plans. Additionally, ORC § 929.04 provides a defense to civil actions for nuisance involving agricultural activities, provided the activities were not in conflict with federal, state, and local laws or were conducted in accordance with generally accepted agricultural practices.[233]

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[220] OHIO REV. CODE ANN. § 1515.03.
[221] OHIO ADMIN. CODE 1501:15-5-15(D)(5)(a).
[222] OHIO ADMIN. CODE 1501:15-5-15(D)(5)(b).
[223] *Id.*
[224] OHIO ADMIN. CODE 1501:15-5-16(A)(1). The hearing must be conducted in accordance with Ohio Rev. Code ch. 119, which is Ohio's general statute for administrative procedures, including hearings and appeals. OHIO ADMIN. CODE 1501:15-5-16(A)(1)
[225] OHIO ADMIN. CODE 1501:15-5-16(A)(3). The one exception is where the order adopts a rule. *Id*.
[226] *Id.*
[227] OHIO REV. CODE ANN. § 1511.08.
[228] OHIO ADMIN. CODE 1501:15-5-16(A)(2); s*ee also*, OHIO REV. CODE ANN. § 1511.99. Each day will be considered a separate offense. *Id.*
[229] OHIO ADMIN. CODE 1501:15-5-16(A)(2); s*ee also*, OHIO REV. CODE ANN. § 1511.99.
[230] OHIO ADMIN. CODE 1501:15-5-16(B)(1). Situations where the public health is in danger include threats to drinking water supplies; threats to a primary contact recreational resource water; flooding of residential housing, commercial, or industrial property; and other situations as determined by the chief after consulting with health agencies. *Id*. This emergency order will only be effective up to 60 days, and if the operator wants to appeal the emergency order, there must be a hearing within 20 days of his application for a hearing. *Id.* at 1501:15-5-16(B)(2).
[231] OHIO REV. CODE ANN. § 1511.021(A).
[232] OHIO REV. CODE ANN. § 1511.021(C).
[233] Other conditions for a complete defense under OHIO REV. CODE ANN. § 929.04 are that the agricultural activities were conducted within an agricultural district, were established prior to plaintiff's activities or interest on which the action is based, and plaintiff was not involved in agricultural production.

Cost-share monies are available from the state through ODNR's Division of Soil and Water Conservation to assist landowners in installing BMPs.[234] In order to be eligible to receive cost-share monies, the expenditures must likely be greater than economic returns to the owner or operator.[235] If an owner or operator is eligible, as much as 75% of the cost of establishing the BMP or $30,000 per person per year will be reimbursed, whichever is less.[236] An owner or operator may implement an improved plan that is more expensive than the BMP, but cost-share grants are awarded based on the estimated cost of the least expensive acceptable practice.[237] The obligation to care for, manage, and maintain the BMP is attached to the land; so if the land is sold, the new owner is responsible for maintaining the BMP. Also, if the land is converted, the State may recover a prorated amount.[238]

The Ohio General Assembly unanimously passed Senate Bill 1 in late March 2015, which the Governor signed on April 2, 2015.[239] This new legislation takes positive steps toward addressing the nutrient pollution problem in Lake Erie.[240] Among its provisions, Senate Bill 1 adds two new sections to ORC chapter 1511 that impose specific prohibitions on the application of manure in Lake Erie's western basin.

The first new section, 1511.10, prohibits any person from surface applying manure in the western basin (i) on snow-covered or frozen soil; (ii) when the top two inches of soil are saturated from precipitation; or (iii) where the local weather forecast predicts a greater than 50% chance of precipitation exceeding ½ inch in a 24-hour period.[241] The term "western basin" is defined by tributary watersheds.[242] Exceptions to this general prohibition include: if the manure is injected into the ground, is incorporated within 24 hours of surface application, or is applied onto a growing crop.[243] Additionally, this section authorizes the chief of ODNR's division of soil and water resources to provide a written emergency exemption so long as the manure is applied in accordance with certain procedures established by the U.S. Department of

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[234] OHIO ADMIN. CODE 1501:15-5-13. The fund was established by the state treasury and depends primarily on the state for funding. OHIO REV. CODE ANN. § 1511.071.
[235] OHIO ADMIN. CODE 1501:15-5-13.
[236] OHIO ADMIN. CODE 1501:15-5-13(A). However, the $30,000 maximum may be waived by majority vote from the commission. *Id.*
[237] OHIO ADMIN. CODE 1501:15-5-13(C).
[238] OHIO ADMIN. CODE 1501:15-5-13(D)(3)(b) & (c).
[239] Sub. S.B. 1, 131st General Assembly (Ohio 2015); s*ee* Lauren Lindstrom, *Gov. Kasich Signs Algae Bill Into Law*, TOLEDO BLADE, April 3, 2015, http://www.toledoblade.com/Politics/2015/04/03/Governor-signs-algae-bill-into-law.html (noting that Senate Bill 1 takes effect 90 days after its signing, i.e., July 1, 2015).
[240] Senate Bill 1*, inter alia,* places restrictions on the application of manure and fertilizer in the western basin of Lake Erie, and provides for civil penalties for violations of those restrictions; requires major POTWs statewide to monitor their effluent for total and dissolved phosphorus and, if not subject to a phosphorus limit in their NPDES permits, to study their capability for meeting a 1 mg/L discharge limit for phosphorus; restricts open lake disposal of dredged materials in Lake Erie after July 1, 2020; designates the director of OEPA as the coordinator of HABs response and management; and revises the charge of the Healthy Lake Erie Fund. Sub. S.B. 1, 131st General Assembly (Ohio 2015).
[241] S.B. 1, 131st General Assembly (Ohio 2015) to be codified at OHIO REV. CODE ANN. § 1511.10(A).
[242] OHIO REV. CODE ANN. § 1511.10(E) (referencing the definition at ORC § 905.326). The watersheds are St. Marys, Auglaize, Blanchard, Sandusky, Cedar-Portage, Lower Maumee, Upper Maumee, Tiffin, St. Joseph and River Raisin.
[243] OHIO REV. CODE ANN. § 1511.10(B).

Agriculture.[244] Section 1511.10, like the rest of ORC chapter 1511, does not apply to large AFOs which are regulated as concentrated animal feeding facilities by ODA.[245]

The second new section, 1511.11, provides for the imposition of civil penalties for violations of section 1511.10.[246] The civil penalty is assessed through an ODNR order, in an amount to be established by ODNR rules, up to a maximum of $10,000 per violation.[247] Section 1511.11 also allows small and medium agricultural operations to apply for an exemption from the manure application prohibition of section 1511.10. The duration of this exemption is limited to one year for small operations and two years for medium operations from the effective date of this section.[248] The application for an exemption must specify the reasons the exemption is needed.[249] ODNR must approve or deny the application within 30 days, and the applicant is exempt from penalties while its application is pending.[250]

Senate Bill 1 requires the General Assembly to assess the results of implementation of sections 1511.10 and 1511.11, and issue a report to the Governor containing findings and recommendations within three years of the effective date of the act.[251]

ii. Manure: Concentrated Animal Feeding Facilities

As mentioned above, a Concentrated Animal Feeding Operation (CAFO) can be a point source under the Clean Water Act and must have a NPDES permit if discharging a pollutant to waters of the United States. Under Ohio law, a concentrated animal feeding facility (CAFF) must have permits to install and operate, issued by the Ohio Department of Agriculture, regardless of whether the CAFF needs a NPDES permit.[252] The definition of a CAFF is similar to that of a large CAFO under federal law, based on the number of animals confined.[253] Therefore, a CAFF that discharges to waters of the United States must have a NPDES permit as well as permits from ODA. A CAFF that does not discharge to waters of the United States needs only the ODA permits. Medium or small CAFOs that do not discharge to waters of the United States require neither a NPDES permit nor permits from ODA. Regulation of such medium

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[244] *Id.*
[245] OHIO REV. CODE ANN. § 1511.10(D).
[246] OHIO REV. CODE ANN. § 1511.11(A).
[247] OHIO REV. CODE ANN. § 1511.11(B), (C), (E). As with other ORC chapter 1511 orders, the recipient has a right to an administrative hearing under ORC chapter 119 and the right to appeal for judicial review. OHIO REV. CODE ANN. § 1511.11(B).
[248] OHIO REV. CODE ANN. § 1511.11(D). Small and medium agricultural operations are defined by reference to the numbers of animals listed for the definition of a medium CAFO at OHIO REV. CODE ANN. § 903.01(Q)(1). Agricultural operations with fewer animals than the threshold for a medium CAFO are classified as small, and those with numbers of animals that would qualify as a medium CAFO are classified as medium. *Id.* § 1511.11(F).
[249] OHIO REV. CODE ANN. § 1511.11(E). ODNR must promulgate rules to govern the exemption application form. *Id*.
[250] OHIO REV. CODE ANN. § 1511.11(D).
[251] Sub. S.B. 1, § 5. The bill also states that it is the intent of the General Assembly that legislation transferring the administration and enforcement of the Agricultural Pollution Abatement Program from ODNR to ODA shall be enacted by July 1, 2015. Sub. S.B. 1, § 6.
[252] *See* OHIO REV. CODE ANN. § 903.03(A)(2).
[253] *Compare* Ohio Rev. Code § 903.01(E) *with* 40 C.F.R. § 122.23(b)(4). For example, a facility with 700 mature dairy cattle would qualify as a CAFF or large CAFO.

and small CAFOs thus falls to ODNR, which has authority over AFOs that are not required to obtain a NPDES permit.[254]

ODA derives its authority over CAFFs from ORC chapter 903, and the agency's regulations for CAFFs are at Ohio Administrative Code 901:10. The statute prohibits anyone from creating a new CAFF or modifying an existing CAFF without first obtaining a permit to install (PTI) from ODA.[255] The statute also prohibits anyone from operating a CAFF without a permit to operate (PTO) from ODA.[256] In order to obtain a PTI, the facility must satisfy siting and construction requirements aimed at preventing discharges of manure and other pollutants to groundwater or surface waters.[257] An important aspect of a PTO is an approved manure management plan, which must include BMPs for reusing and recycling nutrients and preventing direct contact of confined animals with waters of the state.[258] The BMPs are specified in the regulations, and all aspects of the manure management plan must conform to the BMPs.[259] The manure management plan must include a nutrient budget specifying the quantity of nutrients to be applied in manure land application areas.[260] There are limits on application of manure over frozen or snow covered ground.[261] An operator must report any discharge to waters of the state within 24 hours of becoming aware of the discharge.[262]

Operating in accordance with BMPs established under a PTI or PTO is an affirmative defense for a CAFF in a private nuisance action.[263] Failure to comply with the terms of the permit, statute, or regulations may result in penalties and injunctive relief. ODA can impose a civil penalty only after the owner receives written notice of deficiencies and time to correct them.[264] ODA may request the attorney general to seek an injunction.[265] Installing or operating a CAFF without a permit is a criminal offense,[266] and knowing violation of the terms of a PTI or PTO is punishable by a fine up to $25,000 and three years in prison.[267]

Senate Bill 1[268] adds a new section to ORC chapter 903 that restricts who can apply manure obtained from a CAFF. No person shall apply manure obtained from a CAFF unless the person (1) has been issued a livestock manager certification under ORC section 903.07, or (2)

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[254] *See* OHIO REV. CODE ANN. § 1511.01(J).
[255] OHIO REV. CODE ANN. § 903.02(A)(2).
[256] *Id*.
[257] Requirements include that CAFFs must be sited to protect wells and aquifers, and manure storage and treatment facilities must be constructed to prevent discharges to waters of the state. *See* OHIO ADMIN. CODE 901:10-2-01 thru -06.
[258] OHIO ADMIN. CODE 901:10-2-08. Inspections, maintenance and monitoring also are required.
[259] OHIO ADMIN. CODE 901:10-2-02 thru -16.
[260] OHIO ADMIN. CODE 901:10-2-09(A).
[261] OHIO ADMIN. CODE 901:10-2-14(G).
[262] OHIO ADMIN. CODE 901:10-2-17(A)(4)(a).
[263] Ohio Rev. Code. § 903.13.
[264] OHIO REV. CODE ANN. § 903.16(A).
[265] OHIO REV. CODE ANN. § 903.16(C).
[266] OHIO REV. CODE ANN. § 903.99.
[267] OHIO REV. CODE ANN. § 903.99(C).
[268] Sub. S.B. 1, 131st General Assembly (Ohio 2015).

has been certified to apply manure by the ODA in accordance with the procedures for certifying applicators of commercial fertilizer under ORC sections 905.321 and 905.322.[269]

iii. Biosolids

Biosolids are the nutrient-rich solid or semisolid organic matter that result from the treatment of raw sewage.[270] Biosolids are frequently applied to land as fertilizer. Because biosolids are often high in phosphorus content, stormwater runoff from agricultural fields where biosolids have been applied may contribute to phosphorus pollution of waterbodies.

Clean Water Act section 405, and regulations promulgated thereunder, govern the use and disposal of biosolids that come from "treatment works," including POTWs and industrial wastewater treatment plants.[271] The federal regulations apply to both the producers and those who dispose of biosolids.[272] Any use or disposal of biosolids that would result in a pollutant entering navigable waters must be permitted under the NPDES program.[273] Local government agencies decide if biosolids may be used as fertilizer, or disposed of either in landfills or through incineration.[274]

Federal regulations governing land application of biosolids are set forth at 40 C.F.R. section 503. "Class A" biosolids must meet more stringent pathogen standards,[275] and may be more broadly used as fertilizer than "Class B" biosolids.[276] Biosolids can be applied as fertilizer only if pollutant loading and application rates for selected pollutants are not exceeded;[277] however, phosphorus is not regulated by these federal loading and application rates.[278] Unless otherwise permitted, biosolids may not be applied within 10 meters of waters of the United States.[279] Land where biosolids have been applied must be monitored for at least two years, and the frequency of monitoring activities depends on volume applied.[280] Extensive recordkeeping is required for all parties involved, from the producer of the biosolids down to the applicator.[281]

Ohio's regulations governing the use and disposal of biosolids are codified at Ohio

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[269] Sub. S.B. 1, 131st General Assembly (Ohio 2015)to be codified at Ohio Rev. Code § 903.40. The fertilizer applicator certification program is discussed *infra.*

[270] Introduction, U.S. ENVTL. PROT. AGENCY, http://water.epa.gov/polwaste/wastewater/treatment/biosolids/ (last updated July 22, 2014).

[271] Clean Water Act §§ 212(2)(A) & 405(f)(1), 33 U.S.C. §§ 1292(2)(A) & 1345(f)(1). Individual septic tanks do not qualify as "treatment works."

[272] 40 C.F.R. parts 501, 503.

[273] 33 U.S.C. § 1345(a); OHIO REV. CODE ANN. § 6111.03(J).

[274] 33 U.S.C. § 1345(e).

[275] *See* 40 C.F.R. § 503.32.

[276] There are restrictions on what type of land Class B biosolids may be applied to if used as a fertilizer (e.g., cannot be applied to lawns or home gardens), as well as what activities can be done on that land after the application of a Class B biosolid. 40 C.F.R. §§ 503.15(a) & 503.32(b)(5).

[277] 40 C.F.R. § 503.12(b), (c), (e)(2)..

[278] *See* 40 C.F.R. § 503.13 Table 1-4. Total nitrogen is regulated only to the extent that the entity supplying biosolids for use as a fertilizer must notify the applicator of the concentration. 40 C.F.R. § 503.12(d).

[279] 40 C.F.R. § 503.14(c).

[280] 40 C.F.R. § 503.16(a).

[281] 40 C.F.R. § 503.17.

Administrative Code 3745:40-01 *et. seq*.[282] Although largely consistent with federal regulations,[283] OEPA's regulations go further than the federal regulations in certain respects, such as the regulation of phosphorus. Ohio regulations classify biosolids as either "exceptional quality" or "Class B."[284] Ohio has more stringent standards for storing biosolids near water; biosolids may not be stored within one hundred feet of Ohio surface waters, within three hundred feet of a well, in low lying areas, or on slopes greater than fifteen percent.[285] Ohio regulations also tighten the requirements placed on the use of biosolids as fertilizer.[286] The application of biosolids as fertilizer must comply with the terms of a NPDES permit or an approved management plan.[287] For the explicit purpose of protecting the state's waters, biosolids may only be used as fertilizer at an agronomic rate calculated with the location-specific soil phosphorus and nitrogen concentrations.[288] Biosolids may not be applied as fertilizer during precipitation events or, for most soil types, when there is a 50% chance that a half-inch or more of rain will fall within 24 hours.[289] Further, biosolids may not be used as fertilizer within 33 feet of Ohio's surface waters.[290] Absent specific authorization, biosolids cannot be applied during winter, on frozen ground, snow-covered ground, or soon to be frozen or snow-covered ground.[291] Biosolids may not be used as fertilizer on frequently flooded sites or on certain types of sloped land unless special precautions are taken.[292] General monitoring requirements include monitoring of total phosphorus and nitrogen.[293] Ohio requires that any permittee transferring biosolids notify the recipient of pertinent nutrient content information, including total phosphorus.[294] Likewise, any entities using biosolids in agricultural production must create crop-year reports that include the concentration of total phosphorus in the biosolids used and the application rate of phosphate.[295]

iv. Commercial Fertilizer

Prior to 2014, Ohio law did not focus on nutrient pollution from commercial fertilizer. However, in both 2014 and 2015, the Ohio General Assembly enacted legislation taking steps toward addressing the contribution of commercial fertilizer to the nutrient pollution problem.

In 2014, prior to the Toledo water crisis in August, the Ohio General Assembly took the first step. Signed by Governor Kasich in June 2014, Senate Bill 150 establishes a certification regime for applicators of commercial fertilizer for agricultural purposes.[296] Effective

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[282] These regulations were significantly amended, effective July 2011.
[283] OHIO ADMIN. CODE 3745:40-02(A)(2) (2012).
[284] OHIO ADMIN. CODE 3745:40-04. The Ohio regulations also differ somewhat from the federal rules in how to achieve those classifications.
[285] OHIO ADMIN. CODE 3745:40-07(C)(1), (2)(a)-(c).
[286] OHIO ADMIN. CODE 3745:40-08.
[287] OHIO ADMIN. CODE 3745:40-03.
[288] OHIO ADMIN. CODE 3745:40-08(A)(2).
[289] OHIO ADMIN. CODE 3745:40-08(B).
[290] OHIO ADMIN. CODE 3745:40-08(C)(1).
[291] OHIO ADMIN. CODE 3745:40-08(D)(2).
[292] OHIO ADMIN. CODE 3745:40-08(D)(3)-(4).
[293] OHIO ADMIN. CODE 3745:40-09(B)(5).
[294] OHIO ADMIN. CODE 3745:40-05(A).
[295] OHIO ADMIN. CODE 3745:40-05(B).
[296] Am. Sub. S.B. 150, 130th General Assembly (Ohio 2014).

September 30, 2017, commercial fertilizer may be applied for agricultural purposes on farms of more than 50 acres either by an applicator who has been certified by the ODA or who is acting under the instructions and control of a certified applicator.[297]

The director of the ODA must adopt rules regulating the fertilizer applicator certification program. The certification rules must: educate an applicant on the time, place, form, amount, handling, and application of fertilizer; serve as a component of a comprehensive state nutrient reduction strategy; and support generally practical and economically feasible BMPs.[298] The rules must also establish: the application fee amount; what must be included in the application for certification; procedures for the issuance, renewal and denial of certification; grounds for denial of certification; the training that must be successfully completed; and recordkeeping requirements.[299] A certified applicator must comply with the requirements and procedures established in the rules.[300]

Senate Bill 150 also encourages development of voluntary nutrient management plans by providing an affirmative defense against private civil actions resulting from the application of fertilizer. The three elements of the defense are: (1) that the fertilizer was applied by a certified applicator or a person acting under the instruction and control of a certified applicator; (2) records were maintained in accordance with the rules adopted by the director; and (3) the fertilizer was applied in substantial compliance with an approved voluntary nutrient management plan.[301]

Senate Bill 1 adds two new sections to ORC chapter 905 that impose restrictions on the application of fertilizer in the western basin of Lake Erie. Effective July 2015, section 905.326 prohibits any person from surface applying fertilizer in the western basin (1) on snow-covered or frozen soil, or (2) when the top two inches of soil are saturated from precipitation.[302] Additionally, no person in the western basin can surface apply fertilizer in granular form where the local weather forecast predicts a greater than 50% chance of precipitation exceeding one inch within a 12-hour period.[303] Exceptions to this general prohibition include: if the fertilizer is injected into the ground, is incorporated within 24 hours of surface application, or is applied onto a growing crop.[304] "Fertilizer" is defined as nitrogen or phosphorus, notwithstanding a broader definition of fertilizer in ORC section 905.[305]

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[297] OHIO REV. CODE ANN. § 905.321.
[298] OHIO REV. CODE ANN. § 905.322(A)(1).
[299] OHIO REV. CODE ANN. § 905.322(A)(2).
[300] OHIO REV. CODE ANN. § 905.321.
[301] OHIO REV. CODE ANN. § 905.325. A voluntary nutrient management plan can be a plan that is in the form of the Ohio Nutrient Management Workbook made available by Ohio State University; a plan that has been developed by the USDA Natural Resources Conservation Service or its authorized delegate; or an equivalent plan approved by the Ohio Department of Agriculture including soil test results, documentation of the method and time of nutrient application, identification of the type of nutrients applied; and information about the land subject to the plan. OHIO REV. CODE ANN. § 905.31(DD).
[302] Sub. S.B. 1, 131st General Assembly (Ohio 2015) to be codified at OHIO REV. CODE ANN. § 905.326(A)(1).
[303] OHIO REV. CODE ANN. § 905.326(A)(2).
[304] OHIO REV. CODE ANN. § 905.326(B).
[305] OHIO REV. CODE ANN. § 905.326(F); s*ee* OHIO REV. CODE ANN. § 905.31 (defining "fertilizer").

Section 905.327 allows ODA to assess civil penalties for violation of section 905.326 through an administrative order, in an amount established by ODA rules, up to a maximum of $10,000 per violation.[306]

Senate Bill 1 requires the General Assembly to assess the results of implementation of sections 905.326 and 905.327, and issue a report to the Governor containing findings and recommendations, within three years of the effective date of the act.[307]

b. Home Sewage Treatment Systems

Home sewage treatment systems (HSTS) have been identified as a significant source of phosphorus to Lake Erie.[308] HSTS can be a point source and must have a NPDES permit if discharging to surface waters.[309] Most HSTS, however, do not discharge directly into surface waters and must be treated as nonpoint sources. [310]

A "household sewage treatment system" is defined as any sewage disposal or treatment system for a single-family, two-family or three-family dwelling.[311] A septic tank system is a common example of an HSTS.[312] In general, households may use HSTS only where no public or community sanitary sewage system is accessible.[313] With some exceptions, if a sanitary sewage system is or becomes accessible, the household must connect to the sanitary sewage system and abandon use of the HSTS.[314] HSTS are subject to regulation by the Ohio Department of Health and local boards of health such as the Toledo-Lucas County Health

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[306] OHIO REV. CODE ANN. § 905.327. The order recipient must be given an opportunity for an administrative hearing under ORC chapter 119 and has the right to appeal for judicial review. OHIO REV. CODE ANN. § 905.327(B).

[307] Sub. S.B. 1, § 5.

[308] OHIO EPA, OHIO LAKE ERIE TASK FORCE PHOSPHORUS TASK FORCE FINAL REPORT 35 (2010), *available at* http://epa.ohio.gov/portals/35/lakeerie/ptaskforce/Task_Force_Final_Report_April_2010.pdf.

[309] *See* CWA 33 U.S.C. § 1362(14) (defining "point source" as a discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container . . . from which pollutants may be discharged"). The Fifth Circuit has held that an individual septic tank can be a point source under the CWA. United States v. Lucas, 516 F.3d 316, 332 (5th Cir. 2008). Approximately 28% of HSTS in Ohio are designed to discharge into surface waters. OHIO DEPT. OF HEALTH, HOUSEHOLD SEWAGE TREATMENT SYSTEM FAILURES IN OHIO 7 (2012), *available at* http://www.odh.ohio.gov/~/media/ODH/ASSETS/Files/eh/STS/2012HSTSSystemsandFailures.ashx.

[310] *See Id*. at 8. *See also* OHIO EPA, NUTRIENT REDUCTION STRATEGY FRAMEWORK FOR OHIO WATERS-Draft 28 (Nov. 15, 2011), *available at* http://epa.ohio.gov/portals/35/documents/nutrient_reduction_strategy_framework.pdf (less than 3% of discharging HSTS in the Lake Erie watershed have NPDES permits).

[311] OHIO REV. CODE ANN. § 3718.01(F).

[312] OHIO REV. CODE ANN. § 3718.02 gives the Ohio Department of Health authority to approve septic tanks and their components for use in Ohio.

[313] OHIO ADMIN. CODE ANN. 3701-29-06(I) generally prohibits the installation of an HSTS if a sanitary sewer system is accessible.

[314] *Id. See also* Meeker v. Akron Health Dep't, 2009 Ohio App. LEXIS 3063, 2009 Ohio 3560 (Ohio App. 2009) (city public health department was not estopped from requiring a property owner to abandon his septic system once a city sewer system became available). *See* OHIO REV. CODE ANN. § 6117.51 for limited exceptions to mandatory connection.

Department.[315] ORC chapter 3718, and regulations issued thereunder, govern sewage treatment systems generally and HSTS specifically.[316]

Effective January 1, 2015, newly amended Ohio Administrative Code chapter 3701-29, sets forth statewide standards for HSTS.[317] According to these standards, an HSTS is prohibited from creating a public nuisance or exceeding water quality standards.[318] No HSTS shall discharge into any ditch, stream, pond, lake, natural or artificial waterway, drain tile, other surface water conveyance, or to the surface of the ground, unless authorized by a NPDES permit.[319] An HSTS shall not discharge into a well or groundwater.[320] An HSTS shall not be installed, altered, or operated without an appropriate permit from the board of health.[321] The board of health must conduct a site review for every permit application.[322] The regulatory standards also specify HSTS siting characteristics, soil absorption, drainage, system and equipment design, and effluent quality.[323] A local board of health may set more stringent standards necessary for the public health, subject to the approval of the Director of the Ohio Department of Health.[324]

Importantly, an HSTS in operation prior to September 17, 2010 (the effective date of the statute), is deemed approved and need not be replaced with a new system, provided the HSTS either does not cause a public health nuisance or the system is repaired to eliminate a public health nuisance as determined by the board of health.[325]

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[315] The state of Ohio is divided into health districts. *See* OHIO REV. CODE ANN. § 3709.01. There are 123 local health departments in Ohio. *See Local Health Departments*, OHIO DEPT. OF HEALTH (last updated Feb. 13, 2015), http://www.odh.ohio.gov/localhealthdistricts/lhdmain.aspx. Some of these are city health districts, some are general health districts (county), and some are combined health districts (city and county) as allowed under § 3709.01. *Id.* Each of these districts has board of health. OHIO REV. CODE ANN. § 3709.02.

[316] Ohio Revised Code chapter 3718 was substantially amended in 2010. The regulations at Ohio Admin. Code chapter 3701-29 were substantially revised effective January 1, 2015.

[317] *See generally* Ohio Admin. Code chapter 3701-29. *See also* Rebecca Fugit, Development of Ohio's Proposed Sewage Treatment System Rules (May 2014) (video presentation), *available at http://accordent.powerstream.net/008/00153/SewageRules05052014/main.htm*.

[318] OHIO ADMIN. CODE ANN. 3709-21-06(E)(3) (shall not cause an exceedance of water quality standards); OHIO REV. CODE ANN. § 3718.011(defining the circumstances in which HSTS cause public nuisances).

[319] OHIO ADMIN. CODE ANN. 3709-21-06(E)(4).

[320] OHIO ADMIN. CODE ANN. 3709-21-06(E)(5).

[321] *See* OHIO REV. CODE ANN. § 3718.023(A); OHIO ADMIN. CODE ANN. 3701-29-06(B).

[322] OHIO ADMIN. CODE ANN. 3709-21-09. The local board of health shall disapprove applications where application information, soil evaluation, STS design, or site review is incomplete, inaccurate, or otherwise not in compliance with chapter 3709. *Id.* at 3709-21-09(A)(3)(a)-(d). A permit that is granted shall include the application, fees, an approved site review, and proof of registration with the OEPA Class V injection well program, if applicable. *Id.* at 3709-21-09(B)(1)(a)-(c).

[323] *See generally* OHIO ADMIN. CODE ANN. 3709-21-06-16. *See e.g. Id*. at 3709-21-09(site review); *Id.* at 3709-21-10(A) (designs and designers); *Id.* at 3709-21-14 (water quality standards for soil absorption and distribution); *Id.* at 3709-21-15 (soil absorption standards); *Id.* at 3709-21-16 (site drainage).

[324] OHIO ADMIN. CODE ANN. 3701-29-22(C). The board must notify the Ohio Department of Health and submit a copy of the proposed rules. OHIO REV. CODE ANN § 3718.02(B)(2). The board must also consider the economic impact of the rules on owners in the district and submit documentation of to the Department of Health with the proposed rules. *Id.* The proposed rule shall not conflict with the Department of Health rules or be less stringent. *Id.* § 3718.02(B)(3).

[325] OHIO REV. CODE ANN. § 3718.012. *See id*. § 3718.011(describing situations where HSTS is causing public nuisance); *see generally* 53 Ohio Jur.3d, Health and Sanitation § 79 (2012).

An HSTS is deemed a public nuisance if the owner is given notice of and fails to timely remedy one of the following situations: the sewage treatment system is not operating properly due to mechanical or electrical failures; backup in the system is affecting the treatment process or proper drainage; there is pooling of liquid or bleeding onto the surface of the ground; or where a NPDES permit is in place, the system routinely exceeds effluent discharge limitations specified by the permit.[326]

The board of health is authorized to issue an order to abate a nuisance or a violation of ORC chapter 3718.[327] Relief can include penalties as well as injunctive relief.[328] The board of health may work with a system owner to develop a plan for phased repair or replacement to eliminate a public nuisance.[329]

A recent survey indicated that more than 30% of HSTS in Ohio, and nearly 40% in Northwest Ohio, were "failing."[330] "Failing" was defined as a situation that should result in alteration or replacement. Failing HSTS included surfacing of effluent, sewage backup into a home, positive dye test, structural failure, and discharge that constituted a public nuisance.[331] The most commonly cited reason for failing HSTS was the contamination of surface water.[332]

Following a complaint in writing from the board of health, OEPA may order a county to construct and operate sewage facilities where HSTS are causing unsanitary conditions.[333] The costs of the new facilities or maintenance may be assessed upon the benefitted properties.[334]

Effective January 1, 2015, the Ohio Department of Health adopted new rules under Ohio Administrative Code 3701-29. The new rules do not require repair or replacement of HSTS until they cause a public nuisance.[335] However, they do require local boards of health to develop a system for operation and maintenance (O&M) management for HSTS and system owner education.[336] O&M management programs are required to include important

[326] OHIO REV. CODE ANN. § 3718.011(A). A property owner may request a test to prove the system is causing a public nuisance, but the owner must pay for the test. *Id.* § 3718.011(B). Private citizens could seek to enjoin the operation of an HSTS if there is a nuisance. *Id.* § 3767.03.
[327] OHIO REV. CODE ANN. § 3718.09. If the order is neglected or disregarded, the board may elect to cause the arrest and prosecution of the offender, or to perform the ordered task through its officers and employees. OHIO REV. CODE § 3707.02. If the board seeks an injunction, it must be brought in the court of common pleas in the county where the offense is occurring. OHIO REV. CODE. ANN. § 3707.021.
[328] OHIO REV. CODE ANN. §§ 3718.10, 3718.99.
[329] OHIO ADMIN. CODE ANN. 3701-29-9(C). The incremental repair and replacement plan must require minimization or correction of the public nuisance or system failure in a timely manner.
[330] OHIO DEPT. OF HEALTH, HOUSEHOLD SEWAGE TREATMENT SYSTEM FAILURES IN OHIO 6 (2012). Discharging systems accounted for 36% of failing systems in Ohio. *Id.* at 10.
[331] *Id.* at 10–11.
[332] *Id.* at 3.
[333] *See* OHIO REV. CODE ANN. § 6117.34; State of Ohio v. Board of Commissioners for Trumbull County, No. 2002 CV 825 (C.P Trumbull, consent order Jan. 12, 2007).
[334] *See* OHIO REV. CODE ANN. § 6117.34
[335] *See generally* Ohio Dept. of Health, Development of Ohio's Proposed Sewage Treatment System Rules (May 2014) (slide presentation), *available at* http://www.odh.ohio.gov/~/media/ODH/ASSETS/Files/eh/STS/Sewagepre522014.ashx.
[336] OHIO ADMIN. CODE ANN. 3701-29-19(A).

information which tracks permit dates and general compliance for HSTS in the system.[337] Initially, only HSTS installed after the effective date of the new rules, and HSTS that have been issued general NPDES permits after January 1, 2007, are required to have O&M management programs.[338] Boards of health will phase in O&M management for previously installed HSTS.[339] A board of health may establish a household sewage treatment district.[340]

ORC chapter 6111 generally prohibits the unpermitted discharge of pollution into waters of the state,[341] but provides an exemption for HSTS installed in compliance with ORC chapter 3718.[342] An HSTS discharging into surface waters must have a NPDES permit under ORC chapter 3718.[343] The board of health is required to ensure that an HSTS "shall not discharge into a ditch, stream, pond, lake, natural or artificial waterway, drain tile, or other surface water or onto the surface of the ground" unless the discharge is covered by a NPDES permit.[344] Although the board of health is also required to ensure that an HSTS does not discharge into groundwater,[345] no NPDES permit is necessary unless there is a discharge to surface water.[346]

OEPA has issued two general NPDES permits for new and replacement HSTS. One general permit (OHK000002) allows the local board of health to determine a system's eligibility for coverage, provided the local board of health has signed a memorandum of understanding (MOU) with OEPA.[347] Toledo-Lucas County Health Department has an MOU with OEPA.[348] Under the second general permit (OHL000001), OEPA determines coverage eligibility.[349] HSTS installed prior to January 1, 2007 are not eligible for coverage under either permit,

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[337] *Id.* at 3701-29-19(C). O&M programs must include at least permit records describing: HSTS history; monitoring; demonstration of compliance with the board of health; tracking of activities associated with permit conditions; dates and results of inspections; times lines and expiration dates for permits, related enforcement activities; and water quality samples, as applicable.

[338] *See id.* at 3701-29-19(A)(1),(3).

[339] *See id.* at 3701-29-19(A)(2). Boards of health are required to work with interested stakeholder to develop a process and timeline for phasing in O&M management for systems installed prior to the new rules. Boards of health that already had systems in place prior to the new rules may continue the program, so long as the person can demonstrate the required maintenance of the HSTS in place of a board inspection. *Id.* at 3701-29-19(B).

[340] *See id.* at 3701-29-19(F)(1). A household sewage treatment district may be established to provide a responsive approach to HSTS problems in the district.

[341] OHIO REV. CODE ANN. § 6111.04(A). No person shall cause pollution or cause to be placed any sewage, sludge, sludge materials, industrial waste, or other wastes in a location where they cause pollution of any waters of the state. Such an action is a public nuisance, unless the actor has a permit. *Id.*

[342] OHIO REV. CODE ANN. § 6111.04(F)(7).

[343] *See id.* This section does not authorize, without a permit, any discharge that is prohibited by, or for which a permit is required by, USEPA regulations.

[344] OHIO REV. CODE ANN. § 3718.023(B).

[345] *Id.*

[346] Although "waters of the state" as defined by Ohio Revise Code § 6111.01(H) includes groundwater, the language of Ohio Revised Code § 3718.023(B) discussed in the text, the terms of the general NPDES permits not including groundwater, and OEPA practice indicate that only HSTS that discharge to surface waters must have a NPDES permit.

[347] NPDES Permit No. OHK000002 (effective Feb. 1, 2012, expiring Dec. 31, 2016), *available at* http://epa.ohio.gov/portals/35/permits/HSTS_OHK2_final_jan12.pdf.

[348] *See Discharging Household Sewage Treatment Systems – General Permits*, OHIO ENVTL. PROT. AGENCY (last updated May 30, 2012), http://epa.ohio.gov/Portals/35/permits/2012LocalHealthDistrictsandMOUslist.pdf.

[349] NPDES Permit No. OHL000002 (effective Aug. 1, 2013, expiring Dec. 31, 2016), *available at* http://epa.ohio.gov/Portals/35/permits/HSTS_L2_jul13.pdf.

unless the HSTS can be updated in accordance with the permit provisions.[350] To obtain coverage under either permit, an applicant must submit a notice of intent.[351] Both general permits do not contain a phosphorus effluent limit, but prohibit effluent in amounts that are conducive to the growth of algae.[352]

[350] *Id*
[351] *Id.*
[352] *Id*.

III. POTENTIAL LEGAL STRUCTURES FOR A MULTI-STATE ENTITY TO ADDRESS NUTRIENT POLLUTION IN LAKE ERIE

Nutrient pollution in Lake Erie is a multi-state problem.[353] The Lake Erie basin includes parts of five states (Ohio, New York, Pennsylvania, Michigan, and Indiana), and the western Lake Erie basin includes southeast Michigan and northeast Indiana as well as northwest Ohio.[354] The Maumee River, viewed as the prime driver of HABs in western Lake Erie,[355] stretches from Ft. Wayne, Indiana to Toledo, Ohio, and its watershed encompasses counties in Indiana and Michigan as well as Ohio.[356] Solving the nutrient pollution problem in Lake Erie will necessitate efforts to control phosphorus discharges in multiple states.

We have been asked to evaluate potential legal structures for a multi-state entity to address nutrient pollution in Lake Erie. There is no shortage of informal multi-state coalitions of state and federal officials with portfolios that include or could include the nutrient pollution problem in Lake Erie. Examples include the Council of Great Lakes Governors, an informal partnership of the eight Great Lakes governors formed in 1983 to advance environmentally responsible economic growth of the region,[357] and the Western Lake Erie Basin Partnership, formed in 2005 to encourage cooperation among the many federal and state agencies that are involved with the western Lake Erie basin.[358] While these informal partnerships certainly have value, they may lack the legal structure and authority to effectively address nutrient pollution in Lake Erie.

This section explores three options for a legal entity that could be vested with the authority to address nutrient pollution across state lines: (1) an existing federal agency, (2) a new federal agency, and (3) a commission formed pursuant to an interstate compact.

A. Existing Federal Agency, United States Environmental Protection Agency

A state generally cannot apply and enforce its laws beyond its boundaries in other states.[359] By contrast, the federal government has jurisdiction to apply and enforce laws in all states.[360] An existing federal agency already has authority to address nutrient pollution across multiple states in the Lake Erie region: United States Environmental Protection Agency. USEPA, created in 1970, is an independent federal agency charged with administering many of our

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[353] *See* INTERNATIONAL JOINT COMMISSION, A BALANCED DIET FOR LAKE ERIE: REDUCING PHOSPHORUS LOADINGS AND HARMFUL ALGAL BLOOMS 7 (Feb. 2014) (participation of all Lake Erie basin states is essential); OHIO LAKE ERIE PHOSPHORUS TASK FORCE II FINAL REPORT 71 (Nov. 2013) (recommendations in report should be considered in Indiana and Michigan as well as Ohio). Indeed, nutrient pollution in Lake Erie is an international problem, as Ontario sources contribute to phosphorus loading in Lake Erie. *See* IJC REPORT.

[354] INTERNATIONAL JOINT COMMISSION, A BALANCED DIET FOR LAKE ERIE: REDUCING PHOSPHORUS LOADINGS AND HARMFUL ALGAL BLOOMS 7–8 (Feb. 2014).

[355] OHIO LAKE ERIE PHOSPHORUS TASK FORCE II FINAL REPORT 31-32 (Nov. 2013).

[356] *Maumee River Watershed,* LAKE ERIE WATERKEEPER, http://www.lakeeriewaterkeeper.org/save-maumee/ (last visited Feb. 23, 2015).

[357] *About Us,* LAKE ERIE WATERKEEPER, http://www.lakeeriewaterkeeper.org/about-us/ (last visited Feb. 23, 2015).

[358] *About Us*, WESTERN LAKE ERIE BASIN PARTNERSHIP, http://wleb.org/about/ (last visited Feb. 23, 2015).

[359] *See* McCulloch v. Maryland, 17 U.S. 316, 428-31 (1819).

[360] *See* U.S. Const. art. I, § 8 (Congressional powers).

nation's environmental laws.[361] When Congress enacted the Clean Water Act (CWA) in 1972, USEPA was tasked with administering the statute.[362]

Congress could amend the CWA to provide for more tools to combat nutrient pollution in the Lake Erie basin, thus arming USEPA with those new tools. Congress alternatively could choose to enact a new statute authorizing new tools to combat nutrient pollution, and in the enabling legislation task USEPA with carrying out the mandates of the new statute. What those new tools should be is beyond the scope of this paper. Potential examples could include stronger authority to regulate nonpoint source pollution in general, and agricultural runoff in particular (such as authorizing regulations setting best management practices for reducing agricultural runoff, classifying agricultural runoff as a point source requiring a general National Pollutant Discharge Elimination System permit).

Using the CWA and USEPA for federal pollution control focused specifically on the Great Lakes region is not unprecedented. In 1987, Congress amended the CWA to add section 118,[363] which has as its purpose to achieve the goals embodied in the Great Lakes Water Quality Agreement of 1978, as amended.[364] USEPA was charged by Congress to take the lead in meeting those goals.[365] Section 118 established the Great Lakes National Policy Office (GLNPO) within USEPA.[366] Headquartered in Chicago, GLNPO's management functions include coordinating all USEPA actions aimed at improving Great Lakes water quality as well as the activities of other federal, state, and local authorities.[367] GLNPO responsibilities include developing a plan and program for reducing the amount of nutrients entering the Great Lakes.[368] All other federal agencies charged with the protection of environmental qualities and natural resources of the Great Lakes must coordinate with GLNPO, including submitting annual reports.[369]

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[361] *See* R. Percival, C. Schroeder, A. Miller & J. Leape, Environmental Regulation 95 (7th ed. 2013).
[362] 33 U.S.C. § 1251(d). State environmental agencies can play important roles in carrying out the mandates of the Clean Water Act, but USEPA remains the ultimate authority. For example, USEPA may delegate authority to administer the NPDES program to a state agency, such as OEPA, but USEPA has the power to revoke the delegation. Similarly, OEPA may issue water quality standards, but the standards are subject to USEPA approval, and the federal agency must issue water quality standards if the state fails to do so. USEPA promulgates regulations pursuant to the CWA and retains authority to enforce the act.
[363] Pub. L. No. 100-4, § 104 (1987). Section 118 is codified at 33 U.S.C. § 1258.
[364] 33 U.S.C. § 1258(a)(2). The Great Lakes Water Quality Act of 1978 is an executive agreement between Canada and the United States. The GLWQA is considered binding on the parties but not self-implementing. That is, the agreement does not have the force of law and its provisions cannot be enforced, but it serves to guide federal policy. The GLWQA also has been the impetus for certain state measures to improve water quality in the Great Lakes. See, e.g., Ohio Rev. Code § 6111.10 (banning high-phosphorus laundry detergent); Ohio Admin. Code 3745-1-07 (establishing total phosphorus effluent limit for major POTWs). The GLWQA was amended in 1987 and most recently in 2012. Annex 4, entitled "Nutrients," focuses on managing phosphorus concentrations and loadings in the Great Lakes.
[365] 33 U.S.C. §1258(a)(1)(c).
[366] *Id.* § 1258(b).
[367] *Id.* § 1258(c)(1).
[368] *Id.* § 1259(c)(6).
[369] *Id.* § 1258(f). Other region-specific sections of the Clean Water Act include § 1267 (Chesapeake Bay), § 1269 (Long Island Sound), and § 1270 (Lake Champlain).

As discussed in detail in Part IV (B), USEPA has been tasked as the lead agency for the federal government's efforts to restore the Chesapeake Bay.

B. Creating a New Federal Agency

USEPA, however, is not the only federal agency option. Congress could create a new federal agency via legislation.

Agencies are creatures of statute. They have no inherent powers; rather, their powers are derived from the statutes Congress enacts.[370] Typically, Congress creates the agency itself via enabling legislation. Some agencies, though, are formed by the executive branch as a means of carrying out statutory functions authorized by Congress.[371] The executive branch, however, cannot infuse the new agency with new powers beyond those authorized by Congress via statute. It is ultimately in Congress's power to create, organize, and disband federal agencies.[372]

One option would be to create a new agency to carry out new nutrient pollution control tools authorized in a new federal statute, aimed at curbing nonpoint source pollution in general and agricultural runoff in particular in the Lake Erie basin. Potential name: Lake Erie Water Protection Agency (LEWPA).

Another variation would be for Congress via legislation to transfer all of USEPA's CWA authority in the Lake Erie basin to the new agency. That is, in addition to its authority under the new statute, LEWPA instead of USEPA would be responsible for administering the CWA within the Lake Erie basin (for example, issue National Pollutant Discharge Elimination System permits, promulgate water quality standards, approve Total Maximum Daily Loads). Relevant duties and powers pertaining to Lake Erie of other federal agencies, such as the U.S. Army Corps of Engineers and the National Oceanic and Atmospheric Administration, also could be transferred to this new agency.

It has been suggested that the federal Tennessee Valley Authority (TVA) might be a suitable model for a multi-state entity to address nutrient pollution in Lake Erie. The TVA is a government corporation, established by Congress via the Tennessee Valley Act of 1933.[373]

A government corporation is best viewed as a particular type of government agency.[374] A government corporation is often described as a government agency established by Congress to

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[370] L. Bressman, E. Rubin & K. Stack, The Regulatory State 1-2 (2010).
[371] *Id.* For example, USEPA was created in 1970 by means of a reorganization plan by President Nixon. Duties relating to protection of the environment that had previously been handled by various existing agencies were transferred or consolidated in the new USEPA. The Bureau of Reclamation was formed within the Department of Interior to administer the Reclamation Act of 1903.
[372] *See* Howell & Lewis, Agencies by Presidential Design, 64 Journal of Politics 1095 (Nov. 2002).
[373] Tennessee Valley Act of 1933, 16 U.S.C. § 831 (2012).
[374] *See* U.S. Gov't Accountability Office, *The Problem of Definition*, 15 GAO-RB pt. B, s. 2, *The Problem of Defintion* (2008). There is no generally accepted definition for government corporation. *Id.* at 2. *But see* 40 U.S.C. § 102(4) (wholly-owned government corporations, like the Tennessee Valley Authority, are included in the definition of "executive agency"), *and* Clinton T. Brass et al., Cong. Research Serv., RL30795, *General*

provide a market-oriented public service and to produce revenue that approximates its expenditures.[375] There are 17 wholly owned government corporations, including the TVA. These wholly owned government corporations are subject to the Government Corporation Control Act.[376]

States have statutes by which corporations can be incorporated.[377] By contrast, there is no general incorporation statute for the federal government. Each government corporation is chartered through an act of Congress.[378] Like a government agency, a government corporation is a creature of statute, which lays out the purpose, structure and powers of the corporation.[379] Congress's power to create a government corporation, like its power to create an agency, is derived from the necessary and proper clause of the U.S. Constitution.[380]

A key characteristic of a government corporation is that, unlike a traditional agency, it has a legal identity separate from the United States.[381] The U.S. government in general is not liable for the debts of a government corporation.[382] The government corporation can be sued; it is not

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Management Laws: A Compendium 203 (citing *Cherry Cotton Mills v. United States*, 327 U.S. 536 (1946) for the proposition that government corporations are agencies and are therefore subject to laws governing agencies unless otherwise exempted by statute). *See also Matheny v. TVA*, 557 F.3d 311, 320 (6th Cir. 2009) (TVA is wholly-owned corporate agency of the United States).

[375] *See* Kevin R. Kosar, Cong. Research Serv., RL30365, *Federal Government Corporations: An Overview* 2 (defining government corporation as "an agency of the federal government . . . which provides a market-oriented service and is intended to produce revenue that meets or approximates its expenditures;" *and id.* at 13 (choosing the government corporation form of agency is useful when creating or reorganizing an agency that has revenue potential). *See also* U.S. Gov't Accountability Office, *The Problem of Definition*, 15 GAO-RB pt. B, s. 3, *The Problem of Defintion* (2008) (government corporations generally serve a public function that is predominantly business in nature).

[376] Government Corporation Control Act, 31 U.S.C. §§ 9101-9110 (2012). The GCCA applies to both "wholly owned" and "mixed-ownership" government corporations, and is the only regulatory statute with general application to government corporations. U.S. Gov't Accountability Office, *The Problem of Definition*, 15 GAO-RB pt. B, s. 2, *The Problem of Defintion* (2008). The purpose of the GCCA was to treat government corporations more consistently and assure the necessary financial flexibility they needed. Clinton T. Brass et al., Cong. Research Serv., RL30795, *General Management Laws: A Compendium* 196. The GCCA has accomplished this by laying out how a government corporation is to be established or acquired. GCCA §9102. The GCCA has also standardized "the budgets, auditing, debt management, and depository practices" for government corporations. Kevin R. Kosar, Cong. Research Serv., RL30365, *Federal Government Corporations: An Overview* 4. Wholly-owned government corporations are required to submit a "business-type" budget to the president each year. GCCA §9103.

[377] *See, e.g.,* OHIO REV. CODE ANN. § 17.04.

[378] *See* Kevin R. Kosar, Cong. Research Serv., RL30365, *Federal Government Corporations: An Overview* 4 (each government corporation is chartered through a separate act of Congress).

[379] *See* A. Michael Froomkin, *Reinventing the Government Corporation*, 1995 U. Ill. L. Rev. 543, 553 (1995). *See also* U.S. Gov't Accountability Office, *supra*, at 6 (as a creature of statute, government sponsored enterprises may only perform the functions assigned to it in its enabling legislation).

[380] U.S. Const. art. I, § 8. Congress has the power "to make all Laws which shall be necessary and proper for carrying into Execution the foregoing powers, and all other powers vested by this Constitution in the Government of the United States, or any Department or Officer thereof." *See also McCulloch v. Maryland*, 17 U.S. 316 (1819) (upholding the federal government's incorporation of the Second Bank of the United States).

[381] *See* Kevin R. Kosar, Cong. Research Serv., RL30365, *Federal Government Corporations: An Overview* 6.

[382] *See* A. Michael Froomkin, *Reinventing the Government Corporation*, 1995 U. Ill. L. Rev. 543, 552–53 (1995).

typically clothed with sovereign immunity.[383] The government corporation can make contracts and sue in its own name.[384] A government corporation also typically has more budgeting freedom and is less subject to congressional or executive oversight than are other government agencies.[385]

In the midst of the Great Depression, President Franklin Delano Roosevelt asked Congress to create "a corporation clothed with the power of government but possessed of the flexibility and initiative of a private enterprise."[386] Congress fulfilled FDR's request by creating the TVA through passage of the Tennessee Valley Authority Act of 1933. This act was meant to improve the navigability and to provide for flood control of the Tennessee River; to provide for agricultural and industrial development of the Tennessee Valley; and to provide for reforestation and proper use of marginal lands in the Tennessee Valley.[387] In the ensuing decades, the TVA built numerous dams that, in addition to promoting navigation and controlling flooding, generated hydroelectric power and brought electricity to the region.[388] The electrification of the Tennessee Valley in turn brought industrial development and jobs to

[383] *See* William Meade Fletcher et al., *Fletcher Cyclopedia of the Law of Corporations* § 4234 (perm. ed., rev. vol. 2014). Sovereign immunity does not prevent an action from being brought against a corporation in which a state or the United States is a shareholder. *See also Queen v. Tennessee Valley Authority*, 682 F.2d 80, 85 (6th Cir. 1982) ("It is clear that under TVA's 'sue and be sued' clause . . . the TVA enjoys no sovereign immunity, and that Congress has provided expressly that TVA 'may sue and be sued in its corporate name"). *But see Edwards v. TVA*, 255 F.3d 318, 322 (6th Cir. 2001). Under the discretionary function doctrine, a government corporation may be exempt from suits involving "certain wholly governmental functions."

[384] *See e.g.* 16 U.S.C. § 831c. TVA may "sue and be sued in its corporate name." *Id.* § 831(c)(2). TVA "may make contracts as authorized herein." *Id.* § 831(c)(4). The rationale behind allowing a government corporation to be sued is to facilitate business. Kevin R. Kosar, Cong. Research Serv., RL30365, *Federal Government Corporations: An Overview* 7. A private entity will be more likely to contract with a government corporation if they can go to court and settle the matter, as opposed to the drawn out process involved in bringing a claim against a traditional agency. *Id.*

[385] *See* Clinton T. Brass et al., Cong. Research Serv., RL30795, *General Management Laws: A Compendium* 198. Government corporations are exempt from most government management laws. Wholly-owned government corporations are required to submit an annual "business-type budget." *See* GCCA, 31 U.S.C. §§ 9103. *See also* 20 U.S. Congress, House, Document No. 19, 80th Congress, 2nd session (Washington: GPO, 1948), pp. M57-M62 (President Truman stating that the business-nature of government corporations meant that they needed greater budgetary flexibility).

[386] *From the New Deal to a New Century*, TENN. VALLEY AUTHORITY, www.tva.com/abouttva/history.htm (last visited Feb. 10, 2015), *and* H.R. 110-544, 110th Congress, at 2 (2008), WL 639259 (quoting President Roosevelt).

[387] *See* Tennessee Valley Act of 1933, 16 U.S.C. § 831 (2012). The Act also promoted national defense because the TVA would operate government properties at and near Muscle Shoals in Alabama. *See also Grant v. Tennessee Valley Authority*, 49 F. Supp. 564, 565 (E.D. Tenn. 1942) (the primary purposes behind creation of the TVA were to promote navigation and control flooding).

[388] *See* George E. Webb, *Journal of The Tennessee Academy of Science and the Scopes Trial*, 87 J. of the Tenn. Acad. of Science 97, 143-5 (2012). Frequent flooding had caused the Tennessee Valley to be one of the nation's most economically depressed regions. *See also* Congressional Digest, *The Dixon-Yates Controversy: The Tennessee Valley Authority*, Cong. Dig., Jan. 1955, at 11, 12. By 1955, there were 30 dams in the TVA system controlling flooding in the Tennessee Valley. Twenty-eight of these dams were providing hydroelectric power, along with 12 coal-fired plants. *Id.*

what had been a particularly economically depressed region.[389] In addition, the damming of rivers created numerous man-made lakes that created a booming tourist industry.[390]

Today TVA's mission is primarily providing affordable electricity.[391] TVA is the nation's third largest electricity provider, operating coal-fired and nuclear power plants as well as hydroelectric dams.[392] The TVA also continues to manage the Tennessee River system for purposes of navigation, flood control, and recreation.[393]

The TVA has no authority to regulate water pollution; it does not issue regulations and is not an environmental regulatory body.[394] Rather, USEPA and state regulatory agencies administer the CWA and state water pollution control laws in the Tennessee Valley.[395] The TVA is subject to and must comply with environmental laws. One of the most famous environmental law cases is *TVA v. Hill*, in which the TVA was enjoined from building a dam because it would adversely affect the critical habitat of an endangered fish species in violation of the Endangered Species Act.[396]

The TVA has a board of directors, the members of which are appointed by the President with the advice and consent of the Senate.[397] The TVA may sue and be sued in its own name, can

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[389] *See* Comment, *The Tennessee Valley Authority Act* 43 Yale L.J. 815, 818 (1934); *From the New Deal to a New Century*, TENN. VALLEY AUTHORITY, www.tva.com/abouttva/history.htm (last visited Feb. 10, 2015).
[390] *See* Bill Wolf, *These Southerners Just Love Yankees*, SATURDAY EVENING POST, Sept. 5, 1953, at 22. By 1953, the dams had created 600,000 acres of surface water, as well as 10,000 miles of lake shorelines. With the new lakes came thousands of private homes and $38,000,000 worth of recreational development. *Id.*
[391] *See TVA's Mission and Vision*, TENN. VALLEY AUTHORITY, http://www.tva.com/abouttva/vision.htm (last visited Feb. 12, 2015). *See also* 16 U.S.C. § 831(l) (authorizing TVA to "produce, distribute, and sell electric power").
[392] *See* Mark Chediak & Julie Johnsson, *Obama Budget Ponders Sale of Tennessee Valley Authority*, BLOOMBERG BUSINESS (Apr. 11, 2013, 6:28 PM), http://www.bloomberg.com/news/articles/2013-04-11/obama-mulls-sale-of-tennessee-valley-authority-in-budget-plan. With a production capacity of 38,040 megawatts, TVA is the third-largest power producer in the United States. *See also State Profiles*, Tennessee Department of Economic and Community Development, http://www.tn.gov/ecd/ER_state_profile.html (last visited Feb. 12, 2015). TVA provides electricity for 97% of Tennessee alone. *See also Energy,* TENN. VALLEY AUTHORITY, http://www.tva.com/power/index.htm (last visited Feb. 12, 2015) (TVA operates 29 hydroelectric dams, 11 coal-fired plants, and 3 nuclear power plants).
[393] *See* TENN. VALLEY AUTHORITY, TENNESSEE RIVER WATERWAY MANAGEMENT PLAN 2014, *available at* http://www.tva.gov/river/navigation/pdf/waterway_plan.pdf. TVA manages the Tennessee River system through a system of dams and locks, including 9 mainstream dams and 40 tributary dams. *Id.* at 4. The TVA is required to keep a nine-foot navigation channel available in the river. *Id.* It is TVA's practice to fill its reservoirs in the Spring, releasing minimal water for power production and thermal cooling. In the fall, more water is released from the reservoirs to prepare for winter rains. *Id.*
[394] *See* 16 U.S.C. §§ 831a(g)(A)-(C). The TVA board shall establish broad goals, objectives, and policies and ensure that they are met. *See also Water Quality*, TENN. VALLEY AUTHORITY, http://www.tva.com/environment/water/ (last visited Feb. 13, 2015) ("TVA does not have the authority to regulate water pollution. The [USEPA] and each of the states that share the river set their own pollution regulations and grant discharge permits").
[395] CWA, 33 U.S.C. §§ 1251-1387 (2012). *See e.g.* TENN. CODE. ANN. § 69-3-114 (West 2014); VA. CODE ANN. §62.1-44.5 (West 2014); KY. REV. STAT. ANN. § 224.70-110; N.C. GEN. STAT. §143-215.1(a); G.A. CODE ANN. § 12-5-30(b) (2014); ALA. CODE § 22-22-(9)(I)(3) (2014); MISS. CODE ANN. 49-27-29(2)(a)(I) (West 2014).
[396] Tennessee Valley Authority v. Hill, 437 U.S. 153, 172 (1978).
[397] *See* 16 U.S.C. § 831a(a)(1). The Board shall consist of 9 members, 7 of which must live in the TVA service area.

enter into contracts on its own, and can hold property.[398] While in many respects the TVA functions as a business, it was granted the power of eminent domain by Congress.[399] That is, like federal, state and local governments, the TVA may take private property for public use, so long as it pays just compensation to the owner of the property.[400] Hence, if TVA is unable to purchase real estate necessary to carry out its public purposes (for example, building dams, constructing transmission lines), TVA can acquire the land via condemnation. Persons whose land is acquired by eminent domain are entitled to just compensation from the TVA.[401]

Using the TVA as a model, perhaps Congress could create a government corporation for the purpose of providing clean water to residents of the Lake Erie basin. Potential name: Lake Erie Authority (LEA). The LEA could construct engineered solutions to the problem of phosphorus runoff, and then charge users of water from Lake Erie and its tributaries a fee to recoup some of the construction costs. Similarly, the LEA could build or upgrade water treatment plants that draw from Lake Erie and charge the users a fee to recoup some of those construction costs. The LEA also could be granted eminent domain power to acquire land necessary for such construction or farmland that otherwise would be discharging phosphorus to Lake Erie and its tributaries.

C. Multi-state Commission, Per Interstate Compact

The U.S. Constitution authorizes two or more states to enter into a binding agreement, subject to the approval of Congress. The so-called Compact Clause provides: "No State shall, without the Consent of Congress … enter into any Agreement or Compact with another State."[402] There are numerous examples of interstate compacts, and many compacts address interstate water issues.[403] The Lake Erie basin states could enter into an interstate compact that creates a multi-state commission charged with administering and enforcing laws addressing nutrient pollution within the basin.

The process of creating an interstate compact begins with negotiation of the terms of the multi-state agreement. This agreement must be ratified by the legislatures of each of the signatory states. Then, the agreement must be presented to Congress for its consent. Once Congress consents, and the President signs or does not veto, the agreement among the states has the

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[398] *See* 16 U.S.C. § 831c(b) (TVA may sue and be sued); *id.* § 831c(d)(TVA is authorized to make contracts). TVA is also authorized to sell, purchase, lease, or hold real and personal property as is necessary or convenient for the transaction of its business. *Id.* § 831c(f).

[399] *See id.* §831c(h)-(i) (TVA shall have the power to exercise the right of eminent domain in the name of the United States).

[400] *See* U.S. Const. amend. V ("private property shall not be taken for public use without just compensation"). Since 1897, the Fifth Amendment Takings Clause has also applied to the states via incorporation under the Due Process Clause of the 14th Amendment. *See Chicago, Burlington & Quincy Railroad Co. v. City of Chicago*, 166 U.S. 226 (1897).

[401] *See* 16 U.S.C. §831c(i). In the event an owner of property denies TVA's request to purchase at a price deemed "fair and reasonable" by the TVA board, TVA make exercise its right of eminent domain and condemn the property.

[402] U.S. Const. art. I, § 10, cl. 3.

[403] Noah D. Hall, *Interstate Water Compacts and Climate Change* Adaptation, 5 Envt'l & Energy L. & Policy 237, 240 (2010).

force of federal law. Part contract, part statute, the compact can be enforced by and against the signatory states.[404]

1. Existing Great Lakes Compacts

Eight states border the Great Lakes: Minnesota, Wisconsin, Illinois, Indiana, Michigan, Ohio, Pennsylvania and New York. The eight Great Lakes states have previously entered into, and Congress has approved, two major interstate compacts focused on water resources. While both compacts have many positive attributes, neither authorizes regulation of nutrient pollution.

The original Great Lakes Basin Compact was signed by the eight Great Lakes states in 1955 and received congressional consent in 1968.[405] The prime purpose of the Great Lakes Basin Compact was to promote the orderly, integrated and comprehensive development, use, and conservation of the water resources of the Great Lakes basin.[406] The compact created an intergovernmental entity, the Great Lakes Commission, composed of commissioners from each of the eight states.[407] Pursuant to the terms of the compact, the Commission's powers consist primarily of collecting data, studying issues, publishing reports, and making recommendations.[408] Although the states agree to consider the actions of the Commission on a variety of subjects, including measures for combating pollution, no action by the Commission has the force of law or is binding on any state.[409] The primary functions of the Great Lakes Commission are the following: communication among its member states and the people of the Great Lakes region; policy research, development and coordination on a regional basis; and advocacy of those positions on which member states agree.[410]

The second compact is the Great Lakes–St. Lawrence River Basin Water Resources Compact.[411] This compact was signed by the governors of the eight Great Lakes states in 2005, was subsequently ratified by the signatory state legislatures, and was approved by Congress and signed by President Bush in 2008. The Great Lakes–St. Lawrence River Basin Water Resources Compact took effect December 8, 2008.[412]

The Great Lakes–St. Lawrence River Basin Water Resources Compact is designed to: (1) prevent new or increased diversions of Great Lakes waters to outside of the Great Lakes basin, and (2) more wisely manage the waters within the Great Lakes basin.[413] To carry out various powers and duties, the compact created the Great Lakes–St. Lawrence River Basin Water Resources Council, which consists of a representative from each of the eight states.[414]

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[404] *See* J. Rasband, J. Salzman & M. Squillace, Natural Resources Law and Policy 884-86 (2d ed. 2009).
[405] Great Lakes Basin Compact, Pub. L. No. 90-419 (1968).
[406] *Id.* art. I.
[407] *Id.* art. IV.
[408] *Id.* art. VI.
[409] *Id.* arts VI, VII.
[410] *About Us*, GREAT LAKES COMM'N, http://glc.org/about/ (last visited Feb. 18, 2015).
[411] Great Lakes – St. Lawrence River Basin Water Resources Compact, Pub. L. No. 110-342 (2008).
[412] *Id.* See generally *State Legislation Passing and Federal Legislation Consenting to the Compact,* GREAT LAKES–ST. LAWRENCE RIVER BASIN WATER RES. COUNCIL, www.glslcompactcouncil.org (background and implementation of Compact) (last visited Apr. 10, 2015).
[413] Pub. L. No. 110-342, § 1.3.
[414] *Id.* art. 2.

With a few specific limited exceptions, the compact placed an outright ban on new or increased diversions of waters of the Great Lakes, defined as including all surface water and groundwater within the Great Lakes basin.[415] This protection against diversions outside the basin was prompted by concerns that drier regions of the nation and the world wanted to take Great Lakes waters, to the detriment of this region which relies on these waters.[416] The key exceptions are for "straddling communities" and "straddling counties;" that is, diversions to outside the basin but nevertheless within a community or county whose borders straddle the Great Lakes watershed may be permitted if certain uniform conditions are met. Diversions within straddling counties are subject to Council approval.[417]

The Great Lakes–St. Lawrence River Basin Water Resources Compact also requires each of the eight states to take steps toward conserving and managing use of waters within the basin. Required steps include each state compiling an inventory of all withdrawals of more than 100,000 gallons per day, and implementing a water conservation and efficiency program.[418] Additionally, each state must begin regulating new or increased withdrawals, over a threshold amount, pursuant to a standard at least as stringent as the decision-making standard set forth in the compact.[419] In most states, including Ohio, this has resulted in significantly more rigorous regulation of water withdrawals than in the past.[420]

Unlike the Great Lakes Basin Compact, the Great Lakes–St. Lawrence River Basin Compact contains terms that are enforceable.[421] The Council's powers include adjudication of disputes and promulgation and enforcement of rules and regulations.[422] The focus of the Great Lakes–St. Lawrence River Basin Water Resources Compact, though, is on water quantity, not water quality. The compact does not address nutrient pollution, and the Council has no authority to make or enforce laws pertaining to nutrient pollution.

2. Another Compact Model: Delaware River Basin

Elsewhere in the United States there are dozens of other interstate compacts that address interstate waters.[423] A prime example is the Colorado River Compact of 1922, by which an apportionment of specific quantities of water from that river system was agreed to by and for each of seven western states.[424] Other compacts create a commission, typically comprised of representatives from each state, with power to apportion water quantity and/or otherwise

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[415] *Id.* §§ 4.8, 4.9.
[416] *Background, Organization and Road To Development*, COUNCIL OF GREAT LAKES GOVERNORS http://cglg.org/media/1311/project_background_organization_and_road_to_development.pdf (last visited Apr. 10, 2015).
[417] Pub. L. No. 110-342, § 4.9.
[418] *Id.* §§ 4.1, 4.2.
[419] *Id.* §§ 4.10, 4.11, 4.12.
[420] *See, e.g.*, OHIO REVISED CODE §§1522.10-21 (codifying provisions of HB 473 enacted in 2012).
[421] Pub. L. No. 110-342, art. 7.
[422] *Id.* art. 3.
[423] Noah D. Hall, *Interstate Water Compacts and Climate Change* Adaptation, 5 ENVTL. & ENERGY L. & POLICY 237, 240 (2010).
[424] *The Law of the River*, BUREAU OF RECLAMATION, LOWER COLO. REGION (last updated Mar. 2008), http://www.usbr.gov/lc/region/g1000/lawofrvr.html.

administer, enforce the compact terms, and resolve future disputes.[425] Typically, however, these compacts focus on allocation of water resources among the states, not on water pollution.

The Delaware River Basin Compact, though, may be instructive for purposes of a multi-state entity to address nutrient pollution in Lake Erie. Although its principal focus is water quantity allocation, the Delaware River Basin Compact also addresses water pollution and created a commission with significant pollution control powers.

The Delaware River Basin Compact was approved by Congress in 1961, and its signatory states are Delaware, New Jersey, New York, and Pennsylvania.[426] The compact created the five-person Delaware River Basin Commission, consisting of one representative from each of the four states plus a U.S. commissioner appointed by the President. All five are voting members.[427] The powers and duties of the Commission include formulating a comprehensive plan to guide short- and long-term development of the water resources of the basin.[428] The Commission's powers also include water pollution control.[429] Importantly, no water project having a substantial effect on water resources of the basin may be undertaken unless approved by the Commission.[430] As a result, the Commission plays a critical role in a wide variety of projects in the Delaware River basin, including approval of National Pollutant Discharge Elimination System (NPDES) permits issued by state agencies.[431]

Proponents of water projects must submit applications to the Commission. Not only must the water project be in conformity with the comprehensive plan,[432] the project also must comply with water quality standards set by the Commission.[433] For example, the Commission has set a standard for Polychlorinated Biphenyl concentrations, commonly known as PCB, in Delaware Bay.[434]

Using the Delaware River Basin Commission as a model of sorts, the Lake Erie basin states could enter into an interstate compact that would set forth nutrient pollution control measures and authorize a commission to enforce and carry out those measures, including perhaps the powers to issue rules and orders. A commission created by interstate compact offers a number of advantages as a multi-state entity. A compact has the force of federal law, so a commission wielding power under a compact can have authority across state lines and overcome the impotence of voluntary interstate partnerships. Further, a compact-created commission can keep decision-making at the state and regional level, whereas empowering USEPA or another

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[425] Noah D. Hall, *Interstate Water Compacts and Climate Change* Adaptation, 5 ENVTL. & ENERGY L. & POLICY 237, 277–79 (2010).
[426] Delaware River Basin Compact, Pub. L. No. 87-328 (1961).
[427] *Id.* art. 3.
[428] *Id.* § 3.2.
[429] *Id.* §§ 5.1, 5.2.
[430] *Id.* § 3.8.
[431] *Id.* §§ 1.5, 7.1, 7.4; 40 C.F.R. part 410.
[432] DELAWARE RIVER BASIN COMM'N, COMPREHENSIVE PLAN (2001), *available at* http://www.state.nj.us/drbc/library/documents/comprehensive_plan.pdf. Article 3 of the Delaware River Basin Compact requires the commission to adopt a comprehensive plan for the immediate and long-range development and uses of the water resources of the basin.
[433] 18 C.F.R. part 410.
[434] Resolution No. 2013-8 (Dec. 4, 2013).

federal agency puts the United States government in charge. A significant potential disadvantage, however, is that the process for negotiation, ratification, and approval of an interstate compact is likely to be slower and more cumbersome than enacting a federal statute alone.

If empowering an interstate commission with nutrient pollution control authorities were the preferred choice of entity, the question then would become: Is it better to amend one of the existing Great Lakes compacts and empower the existing Commission or Council, or to develop a new compact with a new commission? Both options have pros and cons.

Amendment of a compact essentially follows the same requirements as creating a new compact: ratification by each of the signatory states, and consent by Congress.[435] Still, an amendment may be a simpler and speedier undertaking than starting a new compact from scratch. However, when amending an existing compact there is the risk that Congress may take the opportunity, when deciding whether to approve, to revisit the wisdom of all or part of the existing compact.[436]

Creating a new compact would allow the states to tailor the agreement terms, and the commission's powers and duties, specifically to the nutrient pollution problem. The new commission would not be obligated to fulfill the other duties imposed upon the Commission and Council by the existing two Great Lakes compacts. Perhaps most importantly, a compact with a focus on the Lake Erie basin would not need to include all eight states that are parties to the existing Great Lakes Basin Compact and Great Lakes– St. Lawrence River Basin Water Resources Compact. A compact addressing nutrient pollution in Lake Erie would only need five signatory states; a western Lake Erie basin compact would need only three states.

[435] *See* U.S. Const. art. I, § 10, cl. 3; 72 Am. Jur. 2d *States, Territories and Dependencies* § 10 (2003). See also Great Lakes–St. Lawrence River Basin Water Resources Compact § 8.5.
[436] *See* Jessica A. Bielecki, *Managing Resources With Interstate Compacts: A Perspective from the Great Lakes,* 14 BUFF. ENVTL. L.J. 173, 202 (2007).

IV. OTHER APPROACHES TO NONPOINT SOURCE NUTRIENT REDUCTION

A. An Overview of Nonpoint Source Reduction and Water Quality Trading

Water Quality Trading is one method of reducing nonpoint source pollution. Water Quality Trading is a market mechanism that occurs when one party agrees to reduce its pollution to allow for another party to meet permit limits or other regulatory requirements without decreasing pollution loading. This trading system for nutrients and pollutants ensures that total discharge into waterbodies does not increase, or can be reduced over time. Water Quality Trading can occur between point sources (municipal waste treatment facilities, for example) or between point and nonpoint sources (agricultural lands, for example). Trading programs rely on financial incentives and adaptive management to reduce pollution.[437]

Market-based pollution programs have been used in other contexts of environmental law. For example, the 1990 amendments to the Clean Air Act (CAA) established the Acid Rain Program (ARP). Since its inception, power plants covered by the ARP have reduced overall SO_2 emissions by 10 million tons, or more than 60%.[438] Under this market-based trading program, United States Environmental Protection Agency (USEPA or the Agency) sets an overall cap on SO_2 emissions. Polluters are then given "credits" or "allowances" for pollution reduction measures. The polluters can then trade the credits amongst themselves. This trading method ensures that net pollution does not exceed the set cap, but provides each polluter the flexibility to meet overall pollution limits in a more cost-effective manner. While some polluters will choose to purchase credits rather than install costly, marginally effective new controls, others will develop or install new technology to reduce emissions.

It is crucial to note that there are two major differences between the mechanisms utilized for emissions trading under the ARP or similar CAA programs and Water Quality Trading. First, monitoring SO_2 trading in the ARP is easier then Water Quality Trading programs because point sources are inherently simpler to monitor. Permit conditions in the ARP specify pollutant amounts that are easily located, measured, and verified. On the other hand, Water Quality Trading programs that include nonpoint sources are more difficult to monitor because pollutant reductions, if they occur, are diffuse. The lack of a quantifiable, easily monitored system for pollution reduction in Water Quality Trading programs makes monitoring difficult to enforce. Second, USEPA set a cap on air pollution emissions that it then reduced or "ratcheted down" over time, thereby ensuring the effectiveness of the scheme. A Water Quality Trading program could include such a "ratcheting down" mechanism, but this type of reduction is not inherent in such a system. Thus, the successes that market-based pollution trading schemes enjoyed under the CAA may not be easily transferred to market-based Water Quality Trading programs. These trading programs are mechanically and logistically different.

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[437] Stephenson, K., P. Norris, and L. Shabman, *Watershed-Based Effluent Trading: The Nonpoint Source Challenge*, 16 CONTEMPORARY ECONOMIC POLICY 412-421 (1998).

[438] *SO_2 Emission Reductions from Acid Rain Program Sources and Improvements in Air Quality*, U.S. ENVTL. PROT. AGENCY (last updated Nov. 4, 2010), http://www.epa.gov/captrade/maps/so2.html.

Because the CWA does not directly regulate diffuse agricultural runoff, the CWA does not provide any legal mechanisms to force farmers to reduce discharges.[439] However, Water Quality Trading programs may incentivize farmers to reduce discharge. Trading allows one source to meet its regulatory obligations by using pollutant reductions created by another source that has lower pollution control costs. In theory a farmer may implement practices that reduce nonpoint source pollution, and sell the credits generated to a point source discharger that cannot meet its NPDES permit limits. Trading takes advantage of the scale and control costs of pollutants across different sources.[440] USEPA has promoted such a policy for water pollution control for over a decade.

1. United States Environmental Protection Agency Policy

The 1987 amendments to the CWA created the Nonpoint Source Management Program.[441] This program authorized USEPA to provide grants to states to help reduce nonpoint source pollution.[442] Then, in 2003 USEPA published a Water Quality Trading Policy that encouraged states to include trading as a flexible compliance pathway to meet water quality standards under the CWA.[443] The Policy states: "Water quality trading is an approach that offers greater efficiency in achieving water quality goals on a watershed basis."[444] The policy also added that "[t]he [USEPA] believes that market-based approaches such as water quality trading provide greater flexibility and have potential to achieve water quality and environmental benefits greater than would otherwise be achieved under more traditional regulatory approaches."[445]

According to USEPA, market-based programs can achieve water quality goals without significant cost, recognizing that nonpoint sources are large contributors to pollution: "[P]ollution sources not traditionally regulated, most notably nonpoint pollutants from agriculture, are the primary source of water quality impairment in many watersheds."[446] The purpose of the Water Quality Trading Policy is to encourage states, interstate agencies, and tribes to develop trading programs for nutrients, sediments, and other pollutants to reduce pollution without spending a lot of money. USEPA outlines its policy with a list of trading objectives, and summarizes how to accomplish those objectives.

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[439] 33 U.S.C. § 1251 (2012).
[440] *Final Policy On Nutrient Trading,* U.S. ENVTL. PROT. AGENCY (Jan. 13, 2013), http://water.epa.gov/type/watersheds/trading/finalpolicy2003.cfm.
[441] 33 U.S.C. § 1329(h)-(i) (2006).
[442] 33 U.S.C. § 1329(h)-(i) (2006).
[443] *Final Policy On Nutrient Trading,* U.S. ENVTL. PROT. AGENCY (Jan. 13, 2013), http://water.epa.gov/type/watersheds/trading/finalpolicy2003.cfm.
[444] 33 U.S.C. § 1329(h)-(i) (2006).
[445] 33 U.S.C. § 1329(h)-(i) (2006).
[446] *EPA Water Quality Trading Evaluation*, U.S. ENVTL. PROT. AGENCY 1-2 (2008), *available at* http://www.epa.gov/evaluate/pdf/water/epa-water-quality-trading-evaluation.pdf; *Final Policy On Nutrient Trading,* U.S. ENVTL. PROT. AGENCY (Jan. 13, 2013), http://water.epa.gov/type/watersheds/trading/finalpolicy2003.cfm; A RETROSPECTIVE ASSESSMENT OF THE COSTS OF THE CLEAN WATER ACT: 1972-1997 (Oct. 2000)
(noting that the 1997 annual private point source control costs were about $14 billion and public point source costs were about $34 billion).

USEPA's Water Quality Trading objectives include: (1) establishing economic incentives for voluntary pollutant reductions from point and nonpoint sources within a watershed, (2) reducing the cost of compliance with water-quality based requirements, (3) offsetting new or increased discharges resulting from socio-economic growth in order to maintain levels of water quality that support all designated uses, (4) achieving greater environmental benefits than existing regulatory programs, and (5) securing long-term improvements in water quality through the purchase and retirement of credits by any entity.[447] USEPA's guidance is important because even though USEPA does regulate state trading programs, the agency can incentivize them through section 319 grants and technical expertise.[448] We review USEPA's guidance below.

a. Trading Areas

USEPA recommends that all Water Quality Trading occur within a watershed or a well-defined area. This recommendation will result in trades that improve the same waterbody or stream segment, and help maintain water quality standards throughout the trading area.[449] However, USEPA does not offer a preferred size of trade areas. USEPA recommends that trading occur within a Total Maximum Daily Load (TMDL) boundary; however, the policy lacks guidance if there is no TMDL. There is no geographic constraint for trades other than a "watershed"—however, watersheds can be large (the Mississippi River Basin), or small (like a tributary or creek). USEPA does not address differences in the sizes of the trading watershed in its policy.

b. Pollutants and Parameters Traded

USEPA supports trading that focuses on nutrients (like phosphorus and nitrogen) or sediment.[450] In addition, USEPA supports cross-pollutant trading for oxygen-related pollutants where "adequate information exists to establish and correlate impacts on water quality."[451] In other words, USEPA will support trades between pollutants that have the same impact on water such as depleted oxygen levels.

While USEPA recognizes that trading pollutants other than nutrients and sediment have the same potential to improve water quality, the Agency believes that "such trades may pose a higher level of risk and should receive a higher level of scrutiny to ensure that they are consistent with water quality standards."[452] This "other" type of trading will be examined on a case-by-case basis. For example, USEPA does not support trades of persistent bioaccumulative toxins, or PBTs.[453] PBTs are highly toxic, long-lasting substances that are

[447] *Final Policy On Nutrient Trading,* U.S. ENVTL. PROT. AGENCY (Jan. 13, 2013), http://water.epa.gov/type/watersheds/trading/finalpolicy2003.cfm.
[448] *See* discussion *supra* Part II.C.
[449] *Final Policy On Nutrient Trading,* U.S. ENVTL. PROT. AGENCY (Jan. 13, 2013), http://water.epa.gov/type/watersheds/trading/finalpolicy2003.cfm.
[450] *Id.*
[451] *Id.*
[452] *Id.*
[453] *Id.*

extremely harmful to humans and the environment. Some examples of PBTs are mercury, dioxin, and DDT.[454]

USEPA also considers mixing zones, the area where a discharge first enters a waterbody and becomes diluted or "mixed" in the water.[455] Where states and tribal water quality standards allow for mixing zones, USEPA does not support trades that would exceed the waterbody's ability to support aquatic life, or trades that would exceed the waterbody's human health criteria.[456]

c. Baselines

USEPA encourages the practice of requiring collection of baseline data. Baseline data provides a starting point for measuring pollution discharges: before any trades can take place, each polluter must know the quantity of pollutants it discharges. Baseline data allows for accurate calculations and trades.

Baselines differ for point sources and nonpoint sources. For point sources, the baseline is determined only after the discharger is in compliance with its permitted discharge amount.[457] For a nonpoint source discharger, the baseline is determined after the discharger is in compliance with all state, local, or tribal land use regulations. For example, a farmer would have to know how much pollution leaves her land as a discharge before she can reduce that pollution and sell the difference. This quantity can only be measured and calculated after she is in compliance with all local rules; for example, after all fences around streams are installed if required by local ordinance. The quantity of pollution that leaves her land before any trades occur is the baseline.

d. Trading Locations

USEPA has several recommendations for where Water Quality Trading should occur. USEPA supports trading in waterbodies that are currently meeting water quality standards, are impaired and do not have a TMDL, or are impaired and have a TMDL.

Waterbodies that currently meet water quality standards can support trades to accommodate new or increased discharges of pollutants, ensuring that water quality is maintained.

Waterbodies that are impaired and do not have a TMDL should conduct trades to preemptively reduce pollution. USEPA supports two types of trades in impaired waters: (1) individual trades, and (2) watershed scale trading programs with an established baseline and cap. USEPA supports trading in these impaired waters, especially if the trades will help achieve water quality standards for the designated use of the waterbody. Reducing point source pollutant

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[454] *Fact Sheet: Multimedia Strategy For Priority Persistent, Bioaccumulative, and Toxic (PBT) Chemicals,* U.S. ENVTL. PROT. AGENCY (last updated Apr. 18, 2011), http://www.epa.gov/pbt/pubs/fact.htm.
[455] *Basic Information: What is a "Mixing Zone"?,* U.S. ENVTL. PROT. AGENCY, http://water.epa.gov/scitech/swguidance/standards/mixingzones/about.cfm.
[456] *Final Policy On Nutrient Trading,* U.S. ENVTL. PROT. AGENCY (Jan. 13, 2013), http://water.epa.gov/type/watersheds/trading/finalpolicy2003.cfm.
[457] *Id.*

loads alone in these impaired waterbodies will not meet water quality standards. If the pre-TMDL trades do not result in meeting water quality standards, USEPA expects a TMDL to be developed.

USEPA also encourages trading in waterbodies that have TMDLs. Trading can reduce pollution from diffuse sources that are not regulated by the CWA, but still contribute to the overall amount of pollution in a waterbody.

e. Alignment with the Clean Water Act

USEPA's policy asserts that, "provisions for water quality trading should be incorporated into core water quality programs."[458] When states and tribes develop and implement Water Quality Trading programs, at a minimum they should incorporate the following provisions of the CWA: the requirement to obtain permits (section 403 or section 404); incorporating trading requirements into permits; public notice and comment (40 C.F.R. 124); sampling procedures and monitoring methods that are consistent with federal regulations on NPDES permits; protecting designated uses of waterbodies; anti-backsliding under section 303(d)(4) of the CWA; and trading in line with state and tribal anti-degradation policies.[459] USEPA wants to ensure that Water Quality Trading leads to attainment of water quality standards and protection of designated uses.

f. Common Elements of Credible Trading Programs

USEPA outlines seven key elements for successful and credible Water Quality Trading programs. These key provisions are: legal authority and mechanisms, units of trade, creation and duration of credits, quantifying credits and addressing uncertainty, compliance and enforcement provisions, public participation and access to information, and program evaluations.[460]

Legal authority and mechanisms provide states and tribes with a way to enforce and ensure that accurate and honest trading occurs. These mechanisms will also facilitate trading. USEPA does not recommend specific mechanisms.

Units of trade are necessary to ensure that trading is consistent. USEPA recommends that units or "credits" be expressed in rates, or mass per unit of time (for example, pounds of nitrogen per day).[461] Creation and duration of credits also depend on time periods. Since discharges fluctuate depending on the season, credits should be generated at a consistent time. In addition, such credits can only be generated as long as required pollution control mechanisms or practices are functioning as expected.

[458] *Id.*
[459] *Id.*
[460] *Id.*
[461] *Id.*

USEPA believes that standardized protocols are necessary to calculate and quantify pollutant loads.[462] However, the Agency does not suggest a uniform standard to apply. USEPA does address uniformity by standardizing nonpoint source pollution and identifying a number of methods to compensate for nonpoint source uncertainty. The Agency's approach includes: monitoring to verify load reductions, the use of greater than 1:1 trading ratios between point and nonpoint sources, using conservative estimates, and retiring a certain number of nonpoint source credits to ensure compliance with water quality standards.[463] These methods underscore the inherent difficulty in quantifying reductions in nutrient pollution from agricultural lands, a hallmark of market-based pollution trading.

USEPA also recommends that compliance with the reduction goals be monitored regularly. States and tribes take into account compliance history when determining who is eligible to participate in trading. Public participation will also play a role in determining the success of a program, and identify portions of the program that need to be more effective or credible. In addition, USEPA recommends that program evaluations be completed and made available to the public for further adjustments.[464]

g. EPA Oversight

Although USEPA has oversight authority for TMDLs, discharge permitting, and approval of revisions to water quality standards, it does not have complete authority over Water Quality Trading programs. The agency, however, does maintain that "where questions or concerns arise, EPA will use its oversight authorities to ensure that trades and trading programs are fully consistent with the CWA and its implementing regulations."[465]

USEPA encourages Water Quality Trading for a variety of pollutants. Recent nonpoint source pollution issues have illuminated the need to include nutrients like nitrogen and phosphorous in trading schemes. In 2011, USEPA reaffirmed its commitment to partner with states and collaborate with stakeholders to reduce nitrogen and phosphorus loading. Acting Assistant Administrator Nancy Stoner sent direction to the USEPA's ten regional offices in the form of a memorandum.[466] This memorandum, called *Working in Partnership with States to Address Phosphorus and Nitrogen Pollution thought Use of a Framework for State Nutrient Reductions*, laid out a framework for guiding USEPA's work with states and stakeholder to achieve nutrient reductions.[467]

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[462] *Id.*
[463] *Id.*
[464] *Id.*
[465] *Id.*
[466] Memorandum from Nancy K. Stoner, Acting Assistant Administrator of USEPA, to Regional Administrators, Regions 1-10 (Mar. 16, 2011) *available at* http://www2.epa.gov/sites/production/files/documents/memo_nitrogen_framework.pdf*; Hearing Before S. Comm. On Water and Wildlife and Comm. on Environment and Public Works*, (2013)(testimony of Michael H. Shapiro, Principal Deputy Assistant Administrator for Water at the US EPA) *available at* http://www.epa.gov/ocir/hearings/pdf/nutrient_trading_and_water_quality.pdf.
[467] Memorandum from Nancy K. Stoner, Acting Assistant Administrator of USEPA, to Regional Administrators, Regions 1-10 (Mar. 16, 2011) *available at* http://www2.epa.gov/sites/production/files/documents/memo_nitrogen_framework.pdf.

The memorandum noted:

> Nitrogen and phosphorus pollution has the potential to become one of the costliest and the most challenging environmental problems we face. A few examples of this trend include the following:
>
> 1) 50 percent of U.S. streams have medium to high levels of nitrogen and phosphorus.
> 2) 78 percent of assessed coastal waters exhibit eutrophication.[468]
> 3) Nitrate drinking water violations have doubled in eight years.
> 4) A 2010 USGS report on nutrient in ground and surface water reported that nitrates exceeded background concentrations in 64% of shallow monitoring wells in agriculture and urban areas, and exceeded EPA's Maximum Contaminant Levels for nitrates in 7% or 2,388 of sampled domestic wells.
> 5) Algal blooms are steadily on the rise; related toxins have potentially serious health and ecological effects.[469]

While USEPA emphasized the dangers and prevalence of phosphorus and nitrogen pollution, the memorandum highlighted that "States need room to innovate and respond to local water quality needs, so a one-size-fits-all solution to nitrogen and phosphorus pollution is neither desirable nor necessary."[470] In addition, the memorandum referred to "Recommended Elements of a State Framework for Managing Nitrogen and Phosphorus Pollution."[471] Among these recommendations included: prioritize watersheds on a statewide basis for nitrogen and phosphorus loading reductions, set watershed load reduction goals based upon best available information, and ensure effectiveness of point source permits in priority sub-watersheds.

h. EPA Involvement with Nutrient Trading

USEPA does not have a codified procedure for implementing nonpoint source nutrient trading. Generally, these programs are left to the states with some financial assistance from USEPA.[472]

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[468] Eutrophication occurs when there are disproportional amounts of nutrients in a waterbody, and as those nutrient decompose, they deplete the oxygen in the water. When the amount of oxygen goes down, it causes the death of other aquatic organisms. *See Eutrophication,* U.S. GEOLOGIC SURVEY (last updated June 2, 2014), http://toxics.usgs.gov/definitions/eutrophication.html.

[469] Memorandum from Nancy K. Stoner, Acting Assistant Administrator of USEPA, to Regional Administrators, Regions 1-10 (Mar. 16, 2011) *available at* http://www2.epa.gov/sites/production/files/documents/memo_nitrogen_framework.pdf.

[470] *Id.*

[471] *Id.*

[472] *Frequent Questions: Nutrient Criteria Implementation,* U.S. ENVTL. PROT. AGENCY (last updated Aug. 7, 2014), http://www2.epa.gov/nutrient-policy-data/frequent-questions-nutrient-criteria-implementation.

One way USEPA provides financial assistance to nutrient trading programs is through geographically targeted programs. The Great Lakes Restoration Initiative, (GRLI) is "the largest investment in the Great Lakes in two decades."[473] Launched in 2010, GRLI aims to "accelerate efforts to protect and restore the largest system of fresh surface water in the world."[474] GRLI began awarding grants in 2011 and has continued to do so annually.[475] In 2011, USEPA awarded various programs in Ohio over $4 million to improve the Great Lakes' health.[476] One of the main purposes of these grants is to reduce nutrient runoff that contributes to HABs.[477]

i. Summary of Nutrient Trading Programs Nationwide

USEPA has funded several nutrient trading programs throughout the United States. Since the 1980s USEPA has recognized almost 40 water quality trading programs.[478] The first water quality trade occurred at Lake Dillon, Colorado, in 1986.[479] In 1996, USEPA established a "draft framework for watershed-based training" paving the way for many water quality trading programs in the 1990s. Moreover, USEPA promulgated an official water quality trading program policy in January 2003.

Despite these efforts, few actual trades have taken place.[480] First, some projects only involve offsets, and do not use trades as part of the program model. Offsets are measures to reduce pollution by compensating for discharges elsewhere. Second, trading has only been incorporated into 24 programs.[481] As of spring 2014, 100 facilities have made trades, and over 80% of these trades were within Long Island Sound.[482] Overall, trades are increasing; however, these trades have rarely involved nonpoint sources.[483] As of spring 2013, only 10 programs have experienced any trading between nonpoint and point source pollution.[484] Within these 10 programs, most of them only experienced one trade.[485]

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[473] *Great Lakes Restoration Initiative,* U.S. ENVTL. PROT. AGENCY (last updated Oct. 20, 2014), http://www.epa.gov/greatlakes/glri/.
[474] *Great Lakes Restoration Action Plan*, GREAT LAKES RESTORATION, http://glri.us/actionplan/index.html (last visited Apr. 10, 2015.
[475] *Great Lakes Restoration Initiative,* U.S. ENVTL. PROT. AGENCY (last updated Oct. 20, 2014), http://www.epa.gov/greatlakes/glri/.
[476] *Great Lakes Restoration Initiative Grants: 2011,* U.S. ENVTL. PROT. AGENCY, (last updated June 11, 2012), http://www.epa.gov/greatlakes/glri/2011grants.html.
[477] *Great Lakes Restoration Initiative,* U.S. ENVTL. PROT. AGENCY (last updated Oct. 20, 2014), http://www.epa.gov/greatlakes/glri/.
[478] *See generally* Karen Fisher Vanden & Sheila Olmstead, *Moving Pollution Trading from Air to Water: Potential, Problems, and Prognosis,* 27 J. ECON. PERSP., 147 (2013) *available* at *http://pubs.aeaweb.org/doi/pdfplus/10.1257/jep.27.1.147.*
[479] Melissa K. Scanlan, *Adaptive Trading: Experimenting with Unlikely Partners*, 62 U. KAN. L. REV. 971 (2014).
[480] *Id.*; *see generally* HANNA L. BREETZ ET AL., WATER QUALITY TRADING AND OFFSET INITIATIVES IN THE U.S.: A COMPREHENSIVE SURVEY (2004), *available at* http://www.cbd.int/financial/pes/usa-peswatersurvey.pdf.
[481] Melissa K. Scanlan, *Adaptive Trading: Experimenting with Unlikely Partners*, 62 U. KAN. L. REV. 971 (2014).
[482] *Id.*
[483] *Id.*
[484] *Id.*
[485] *Id.*; U.S. ENVTL. PROT. AGENCY, WATER QUALITY TRADING EVALUATION 1-2 (2008), *available at* http://www.epa.gov/evaluate/pdf/water/epa-water-quality-trading-evaluation.pdf. (The ten programs that involve point to nonpoint source trading are: Red Cedar River, Wisconsin; Great Miami River, Ohio; NYC Phosphorus

These 10 programs experienced varying degrees of success and duration, with many studies reporting a lack of trading activity and limited participation by potential traders.[486] However, studies of these programs conclude that water quality trading is possible and cost-effective if designed and implemented correctly.[487] As authors studying nutrient trading in Minnesota concluded, "point-nonpoint source trading, when implemented with properly selected nonpoint source load reduction techniques, can indeed generate significant cost savings in pollution control."[488]

This section explores the positive and negative attributes of two successful but incomplete nonpoint trading programs: the California Grassland Area Farmers Tradable Loads Program and the Southern Minnesota Beet Sugar Cooperative. This section also examines in depth one of the most successful programs, located in Ohio and organized under the Ohio Administrative Code: the Great Miami River Watershed Trading Program. This Report later describes in detail the Chesapeake Bay TMDL and Nutrient Trading Program, the largest, yet controversial, nutrient trading program in the country.

These programs employ two different types of schemes to complete trades. The first is known as the bilateral method, which refers to the traditional one-on-one trade, typically arrived at by negotiation between the two parties, rather than observing a market price.[489] The other method is the clearinghouse, where a single intermediary connects buyers and sellers of credits. In the nutrient trading context, the regulated facilities (i.e., the POTWs) pay into a clearinghouse fund.[490] The fund then purchases credits of nutrient reduction created by nonpoint sources, for example, by farmers implementing agricultural BMPs.[491] The regulated community often prefers the clearinghouse method, as it allows facilities to avoid the trouble of finding nonpoint sources from which they can buy credits. This lowers the transaction cost for these facilities and generally simplifies the process.[492] However, smaller programs often choose to avoid the trouble of creating and managing a clearinghouse and instead opt for bilateral trades from point source to nonpoint source.[493]

i. Grassland Area Farmers Tradable Loads Program, California

Offset Program; Southern Minnesota Beet Sugar Cooperative; Rahr Malting Company, Minnesota; Pinnacle (Vlasic Foods), Delaware; Lake Dillon Reservoir, Colorado; Cherry Creek, Colorado; Chatfield Reservoir, Colorado; and Bear Creek, Colorado.).

[486] James Shortle, *Economics and Environmental Markets: Lessons from Water Quality Trading*, 42 AGRIC. AND RES. ECON. REV. 57, 58 (2013) available at http://ageconsearch.umn.edu/bitstream/148400/2/ARER%202013%2042x1%20Shortle.

[487] *Id.* at 61.

[488] Feng Fang et al., *Point-Nonpoint Source Water Quality Trading: A Case Study in the Minnesota River Basin*, 41 J. OF THE AM. WATER RES. ASS'N 645, 657 (2006) *available at* http://facultypages.morris.umn.edu/~kildegac/Courses/Enviro/papers/fang%20et%20al.pdf; U.S. Dep't of Agric.

[489] MINDY SELMAN ET AL., WORLD RES. INST., WATER QUALITY TRADING PROGRAMS: AN INTERNATIONAL OVERVIEW 11 (2009), available at http://pdf.wri.org/water_trading_quality_programs_international_overview.pdf.

[490] *Id.*

[491] *Id.* at 12.

[492] *Id.* at 11.

[493] *Id.*

The Grassland Area Farmers Tradable Loads Program (GAFTLP) is a good example of a successful small agricultural trading program. The Grassland Drainage Area is an agricultural region on the west side of California's San Joaquin Valley. The productive agricultural land contains a high level of selenium, which accumulates in the agricultural drainage water that collects in the tiles installed to drain excess water from the fields, eventually causing surface pollution.[494]

In order to improve the quality of water being delivered to wetland areas, a collection of drainage and irrigation systems formed the "Grassland Area Farmers" organization.[495] The systems were designed for point to point, point to nonpoint trades, or nonpoint to nonpoint trades. The program functioned by allocating the total allowable regional selenium load among member irrigation and drainage districts. If districts did not meet their load allocations, they could buy or trade allocations from other districts.[496]

The GAFTLP was deemed successful, and even met the organization's water quality goals before being suspended.[497] It reduced the regional selenium load by 54% and salt load by 29%.[498] There are two particularly interesting features of this program: first, unlike most American agricultural trading programs, it put a cap on agricultural discharges. It was able to do this thanks to the second feature—the fact that the trading parties were grouped into drainage districts. This made monitoring easier and more consistent, and even allowed for the measure of actual discharges.[499] Additionally, the trades were made bilaterally between districts without the need for a clearinghouse.

This program brought water bodies into compliance with water quality standards with only 29 trades in its few years of operation. This means that this model may not be applicable to water systems with a larger watershed or a more pervasive pollution problem. The program was also able to avoid the clearinghouse system, due in part to its small size, which allowed it to significantly reduce administrative costs. Again, programs that wish to involve more dischargers may find that bilateral trades are not the most efficient or practical, and may need to employ the clearinghouse method.

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[494] *California: Grassland Bypass Project: Economic Incentives Program Helps to Improve Water Quality*, U.S. ENVTL. PROT. AGENCY (last updated Aug. 31, 2012), http://water.epa.gov/polwaste/nps/success319/Section319III_CA.cfm.

[495] *Id.*

[496] *Id.*

[497] The CGAFTLP was suspended after a new drainage recycling system was developed, eliminating the need for trading. James Shortle, *Economics and Environmental Markets: Lessons from Water Quality Trading*, 42 AGRIC. AND RES. ECON. REV. 57, 61 (2013) available at http://ageconsearch.umn.edu/bitstream/148400/2/ARER%202013%2042x1%20Shortle.http://ageconsearch.umn.edu/bitstream/148400/2/ARER%202013%2042x1%20Shortle.pdf.

[498] *California: Grassland Bypass Project: Economic Incentives Program Helps to Improve Water Quality*, U.S. ENVTL. PROT. AGENCY (last updated Aug. 31, 2012), http://water.epa.gov/polwaste/nps/success319/Section319III_CA.cfm.

[499] James Shortle, *Economics and Environmental Markets: Lessons from Water Quality Trading*, 42 AGRIC. AND RES. ECON. REV. 57, 61 (2013) available at http://ageconsearch.umn.edu/bitstream/148400/2/ARER%202013%2042x1%20Shortle.pdf.

ii. Southern Minnesota Beet Sugar Cooperative

In 1999, a phosphorous TMDL prohibited a new discharger on the lower Minnesota River. Instead, the Minnesota Pollution Control Agency (MPCA) negotiated with the Southern Minnesota Beet Cooperative (SMBC) to implement point to nonpoint water quality trading as part of its NPDES permit.[500] The permit allowed the SMBC to build a wastewater treatment facility, and that wastewater treatment facility was allowed to discharge an additional 2,500 pounds of phosphorous per year if it acquired sufficient phosphorous reduction credits.[501]

Credits come in two forms: agricultural best management practices (BMPs) and in-stream erosion controls.[502] Nearly all of the BMPs come from contracts with the SMBC's own farmers, usually to put cover crops on their fields. An important feature of the SMBC program is that it implements a trade ratio of 2.6:1.[503] This means that for every unit of pollution load increase, at least 2.6 units of pollution load decrease need to be purchased.[504] In 2011, the United States Department of Agriculture (USDA) reported that the SMBC actually collects nearly 6,500 pounds worth of phosphorus credits annually, approximately 2.6 times the discharge limit.[505]

Although credit trades occur between the SMBC and individual farmers, the MPCA retains authority by reviewing and approving or denying every single trade.[506] This provides an additional level of accountability that is missing from bilateral programs without clearinghouses. Additionally, the MPCA requires "detailed technical and management reports" before and after each trade.[507]

Most of these trades occur once, as single transactions that create credit streams of up to 10 years or more.[508] This practice is preferable to ongoing trades back and forth, as it gives

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[500] Feng Fang et al., *Point-Nonpoint Source Water Quality Trading: A Case Study in the Minnesota River Basin*, 41 J. OF THE AM. WATER RES. ASS'N 645, 648 (2006) *available at* http://facultypages.morris.umn.edu/~kildegac/Courses/Enviro/papers/fang%20et%20al.pdf.
[501] U.S. DEP'T OF AGRIC., THE WATSON PARTNERS FARM 1 (2011) *available at* http://www.usda.gov/oce/environmental_markets/files/Watson_Partners_Brief.pdf.
[502] Feng Fang et al., *Point-Nonpoint Source Water Quality Trading: A Case Study in the Minnesota River Basin*, 41 J. OF THE AM. WATER RES. ASS'N 645, 648 (2006) *available at* http://facultypages.morris.umn.edu/~kildegac/Courses/Enviro/papers/fang%20et%20al.pdf; U.S. Dep't of Agric., The Watson Partners Farm 1 (2011) *available at* http://www.usda.gov/oce/environmental_markets/files/Watson_Partners_Brief.pdf.
[503] Feng Fang et al., *Point-Nonpoint Source Water Quality Trading: A Case Study in the Minnesota River Basin*, 41 J. OF THE AM. WATER RES. ASS'N 645, 649 (2006) *available at* http://facultypages.morris.umn.edu/~kildegac/Courses/Enviro/papers/fang%20et%20al.pdf; U.S. Dep't of Agric.
[504] *Id.* at 648.
[505] U.S. DEP'T OF AGRIC., THE WATSON PARTNERS FARM 1 (2011) *available at* http://www.usda.gov/oce/environmental_markets/files/Watson_Partners_Brief.pdf.
[506] Feng Fang et al., *Point-Nonpoint Source Water Quality Trading: A Case Study in the Minnesota River Basin*, 41 J. OF THE AM. WATER RES. ASS'N 645, 648 (2006) *available at* http://facultypages.morris.umn.edu/~kildegac/Courses/Enviro/papers/fang%20et%20al.pdf.
[507] *Id.*
[508] MINDY SELMAN ET AL., WORLD RES. INST., WATER QUALITY TRADING PROGRAMS: AN INTERNATIONAL OVERVIEW 12 (2009), available at http://pdf.wri.org/water_trading_quality_programs_international_overview.pdf.

regulated entities the certainty of securing credits for future projects and compliance periods. Additionally, suppliers of the credits (in this case, farmers implementing BMPs) have continuous funding streams for their water quality improvement projects.[509]

Perhaps the biggest criticism of the SMBC is that the program is not cost-effective. In fact, the cost farmers pay to put cover crops on their fields is not completely covered by the compensation received through the POTW's purchase of credits. However, there are other benefits to such agricultural BMPs, such as reduced soil erosion and protection of crops from wind and weather. Generally, the farmers involved have decided that these agricultural and environmental benefits are worth the additional cost to them, which is the difference between the cost of implementing BMPs and the payout from the POTW's purchase of credits.[510]

There are also social benefits to trading credits and offsetting pollution including expanded production scale and creation of jobs.[511] Moreover, while not the most cost-effective means of reducing pollution, a nutrient trading program like SMBC's provides initial funds for nonpoint sources to reduce agricultural runoff pollution. Without such up-front funding, most of these projects would never have been attempted or completed.[512]

Another major problem with the SMBC program is its lack of monitoring, which the MPCA determined would be too expensive to conduct.[513] Water quality monitoring is essential to the continued success and improvement of a trading program. Although it is clear that credits are being traded at the appropriate ratio, there is no true way of knowing whether net pollution loading to the waterbody is decreasing. The only documented data related to water quality is the amount of avoided phosphorous which would have been added to the watershed before this program.

Interestingly, one study of this program indicated that there might even be negative environmental impacts from a water quality trading system that relies on agricultural BMPs.[514] For example, this study reported "herbicides used in the sugar beet spring cover cropping practice may enter nearby waterways and cause unexpected environmental consequences."[515]

iii. Great Miami River Watershed Trading Program, Ohio

Perhaps the most successful example of nutrient trading between nonpoint sources is in Ohio: the Great Miami River Watershed Trading Program (GMRWTP). The watershed covers nearly 4,000 square miles, 70% of which is dedicated to agricultural uses—generally row-crop

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[509] *Id.*
[510] Feng Fang et al., *Point-Nonpoint Source Water Quality Trading: A Case Study in the Minnesota River Basin*, 41 J. OF THE AM. WATER RES. ASS'N 645, 651 (2006) *available at* http://facultypages.morris.umn.edu/~kildegac/Courses/Enviro/papers/fang%20et%20al.pdf.
[511] *Id.* at 654.
[512] *Id.*
[513] *Id.* at 648.
[514] *Id.* at 655.
[515] *Id.*

production of corn, soybeans, and wheat.[516] In 2004, when the GMRWTP began, 40% of the waterbodies in the watershed did not meet Ohio water quality standards.[517]

To reduce nutrient pollution, the Miami Conservancy District (MCD), founded in 1915 to deal with floods, began investigating the possibility of a nutrient trading program for nitrogen and phosphorous.[518] The final push toward a nutrient trading program was an economic study by Keiser & Associates. This study estimated that reducing pollution using agricultural BMPs would, on average, be 30 times less expensive than the same amount of point source pollution reduction by POTWs.[519]

The pilot program began, funded initially by a $1 million USDA Natural Resource Conservation Service grant.[520] By its full implementation in 2006, the program had received a total of $3 million in grants from USEPA, the USDA, and the Ohio Department of Natural Resources (ODNR). The pilot program's stated purpose at the time was to reduce nutrient pollution by "funding agricultural BMPs and providing regulated dischargers with a cost-effective regulatory compliance option."[521] Originally, the program was designed to be a 10-year pilot. However, the combination of its success and a lack of anticipated nutrient regulations caused the parties involved to extend that time frame.[522] The success of this program thus hinged on significant public funding.

In the words of the MCD, "farmers implement BMPs to generate credits that [wastewater treatment plants] can use to meet regulatory requirements."[523] This means that the trades are bilateral, with wastewater treatment plants/POTWs purchasing credits from upstream farmers.[524] The MCD and local Soil and Water Conservation Districts (SWCDs) act as a

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[516] David Newburn & Richard Woodword, *An Ex Post Evaluation of Ohio's Great Miami Water Quality Trading Program*,48 J. OF THE AM. WATER RES. ASS'N 156, 158 (2012), *available at* http://newserver.miamiconservancy.org/water/documents/NewburnandWoodward.ExpostEvaluation.pdf.
[517] ENVTL. PROT. AGENCY, WATER QUALITY TRADING EVALUATION 2-9 (2008), *available at* http://water.epa.gov/type/watersheds/trading/upload/wqt.pdf.
[518] David Newburn & Richard Woodword, *An Ex Post Evaluation of Ohio's Great Miami Water Quality Trading Program*,48 J. OF THE AM. WATER RES. ASS'N 156, 159 (2012), *available at* http://newserver.miamiconservancy.org/water/documents/NewburnandWoodward.ExpostEvaluation.pdf.
[519] *Id.*
[520] *Id.*
[521] ENVTL. PROT. AGENCY, WATER QUALITY TRADING EVALUATION 2-9 (2008), *available at* http://water.epa.gov/type/watersheds/trading/upload/wqt.pdf.
[522] MIAMI CONSERVANCY DIST., WATER QUALITY CREDIT TRADING PROGRAM FACTSHEET 1 (2014), http://newserver.miamiconservancy.org/water/documents/WQCTPfactsheet2014FINAL_000.pdf. The Miami Conservancy District's website currently reports that the program will continue to provide various benefits "for the next 20 years." *Great Miami River Watershed Water Quality Credit Trading Program*, MIAMI CONSERVANCY DIST., https://www.miamiconservancy.org/water/quality_credit.asp (last visited Mar. 1, 2015).
[523] ENVTL. PROT. AGENCY, WATER QUALITY TRADING EVALUATION 2-9 (2008), *available at* http://water.epa.gov/type/watersheds/trading/upload/wqt.pdf.
[524] David Newburn & Richard Woodword, *An Ex Post Evaluation of Ohio's Great Miami Water Quality Trading Program*,48 J. OF THE AM. WATER RES. ASS'N 156, 159 (2012), *available at* http://newserver.miamiconservancy.org/water/documents/NewburnandWoodward.ExpostEvaluation.pdf.

clearinghouse for these trades. Public and private entities are welcome to participate in the GMRWTP, so long as they possess or obtain the proper NPDES permits.[525]

The GMRWTP was designed to be less expensive in reducing nutrient pollution than upgrades to the local POTWs. In 2004, it was estimated that POTW upgrades would require $422 million in in technological improvements for traditional treatment-based, regulatory approaches to remove the goal amount of nutrient pollution from the watershed.[526] Instead, the MCD opted for point to nonpoint source trading, estimated to save between $314-387 million over 20 years.[527]

As opposed to using the watershed model, the GMRWTP uses site-specific measurements to determine the number of credits necessary to reduce pollution in a given location. Factors in this analysis include: soil type, slope, fertilizer application amounts, and fertilizer application rates.[528] This program has not yet put a cap on nutrient pollution from the agricultural sector; instead the credits are actually generated by the BMPs put in place by farmers. [529] POTWs then purchase these credits to offset their load reduction requirements. The number of credits necessary depends on the trading ratio, which is determined by when the POTW participates in the program. As a way to generate private funding, the program originally offered low trading ratios for those who purchased credits early. This allowed the MCD to finance additional BMP projects from the get-go. Favorable status will continue to be given to any POTW that participates before nutrient regulations are promugated. [530]

The success of this program has been measured in a few ways. In 2011, five years after its full implementation, the MCD reported that the program had funded 275 agricultural nutrient-reducing projects, resulting in an estimated 460 tons of phosphorus and nutrient reductions.[531] Three years later, in May 2014, the MCD worked with several partners (including universities and private companies) to evaluate the continued success of the program. The MCD noted:

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[525] MIAMI CONSERVANCY DIST., GREAT MIAMI RIVER WATERSHED WATER QUALITY CREDIT TRADING PROGRAM OPERATIONS MANUAL 4 (2005), *available at* https://www.miamiconservancy.org/water/documents/TradingProgramOperationManualFeb8b2005secondversion.pdf.

[526] *Id.* at 7-8.

[527] MIAMI CONSERVANCY DIST., GREAT MIAMI RIVER WATERSHED WATER QUALITY CREDIT TRADING PROGRAM OPERATIONS MANUAL 8 (2005), *available at* https://www.miamiconservancy.org/water/documents/TradingProgramOperationManualFeb8b2005secondversion.pdf.

[528] Suzanne Teller, *Trade Wars: Will Nutrient Trading Save or Spoil Our Streams?*, OUTDOOR AMERICA, Spring 2011 at 22, available at http://www.iwla.org/index.php?ht=a/GetDocumentAction/i/17100.

[529] David Newburn & Richard Woodword, *An Ex Post Evaluation of Ohio's Great Miami Water Quality Trading Program*,48 J. OF THE AM. WATER RES. ASS'N 156, 159 (2012), *available at* http://newserver.miamiconservancy.org/water/documents/NewburnandWoodward.ExpostEvaluation.pdf.

[530] *Id.* A POTW that does not buy into the Program until after regulations are promulgated will be required to purchase two credits when discharging into attaining waters and three when discharging into impaired waters. *Id.*

[531] Suzanne Teller, *Trade Wars: Will Nutrient Trading Save or Spoil Our Streams?*, OUTDOOR AMERICA, Spring 2011 at 22, available at http://www.iwla.org/index.php?ht=a/GetDocumentAction/i/17100.

> 397 agricultural projects have been contracted generating more than 1.14 million credits over the life of the projects. More than 1.6 million dollars will be paid to agricultural producers for these credits. This translates to a 572 ton reduction in nutrient discharges to rivers and streams and other benefits including more sustainable farming operations and an array of ancillary environmental benefits.[532]

There have also been independent evaluations of the economic and environmental efficiency of the GMRWTP. This program is generally considered one of the most successful nutrient trading programs; its success has been credited to few specific features, including water quality monitoring and trading ratios. These features should be considered in designing a nutrient trading program that intends to incorporate agricultural BMPs.

Water quality monitoring is critically important to this program; it is one of the reasons for the program's success. A water quality trading plan without monitoring has no tool to measure success, provide feedback, or direct any potentially necessary land use changes.[533] Unfortunately, and perhaps surprisingly, many water quality trading programs do not lay out steps for monitoring and follow up.[534]

At its conception, detailed monitoring of the GMRWTP was planned and accounted for with more than $8.5 million budgeted to cover the administrative costs associated with the initial and regular monitoring for the next 20 years.[535] This number represents the ongoing costs of running the program, and is funded both by grant money and the purchase of credits. Monitoring is only conducted at some sites, and only after a BMP project has been implemented.[536] SWCDs are responsible for checking on and testing the projects implemented in their county.[537] In general, the coordination of inter-agency efforts has been very important in keeping administrative costs down. This project model uses already existing departments, and cultivates mutually beneficial relationships, so few additional employees are hired and the costs saved are reinvested in BMP projects.[538]

The GMRWTP's use of trading ratios has also been deemed positive. As discussed earlier, lower trading ratios are offered to POTWs that buy into the program early, as an incentive for

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[532] MIAMI CONSERVANCY DIST., WATER QUALITY CREDIT TRADING PROGRAM FACTSHEET 2 (2014), http://newserver.miamiconservancy.org/water/documents/WQCTPfactsheet2014FINAL_000.pdf

[533] Melissa Scanlan, *Adaptive Trading: Experimenting with Unlikely Partners*, 62 KAN. L REV. 971, 988 (2014).

[534] For example, the Bay TMDL does not require monitoring; the Ohio River Pilot Program (designed in 2011) is also devoid of a monitoring plan. Melissa Scanlan, *Adaptive Trading: Experimenting with Unlikely Partners*, 62 KAN. L REV. 971, 988–89 (2014).

[535] MIAMI CONSERVANCY DIST., GREAT MIAMI RIVER WATERSHED WATER QUALITY CREDIT TRADING PROGRAM OPERATIONS MANUAL 8 (2005), *available at* https://www.miamiconservancy.org/water/documents/TradingProgramOperationManualFeb8b2005secondversion.pdf.

[536] *Id.* at 14.

[537] *Id.*

[538] David Newburn & Richard Woodword, *An Ex Post Evaluation of Ohio's Great Miami Water Quality Trading Program*,48 J. OF THE AM. WATER RES. ASS'N 156, 166 (2012), *available at* http://newserver.miamiconservancy.org/water/documents/NewburnandWoodward.ExpostEvaluation.pdf.

investment. However, there is another important feature of the GMRWTP's trading ratios: the ratio is higher for POTWs discharging into impaired waters.[539] This requires POTWs "to provide greater nutrient reductions upstream from nonattaining water bodies where water quality improvements are needed most."[540]

There have also been some important criticisms of the GMRWTP. First, the MCD originally intended to fund a variety of projects, giving farmers the option to choose which techniques worked best for them. As explained in the program's Operations Manual, "[t]he Trading Program does not recommend specific activities that generate credits but instead relies on agricultural producers, local soil and water conservation professionals, and members of community-based watershed organizations to identify projects that accomplish a desired nutrient reduction."[541] However, many farmers reported feeling constrained by the options available to them, meaning that there has been little to no experimentation or exploration of new management techniques.[542]

The GMRWTP uses a so-called "reverse auction" method for accepting bids by farmers to fund their BMPs.[543] This means that farmers submit bids for projects, along with their estimated cost of implementation. At least one study has criticized this method as being less cost-effective than simply using a fixed price model.[544] Initially, the reverse auction method provided savings, but strategic bidding nullified all financial benefits:

> all of the 50 applications submitted in round 6 were accepted. This is further evidence that, in the latter rounds, the participating counties have learned how to bid strategically to get the most possible money from the program while still having their bids accepted. This indicates that the MCD is purchasing nonpoint offset credits at an increased cost over time. As the MCD serves as a clearinghouse for all transactions between farmers and [POTWs], the higher cost of credits has somewhat reduced program efficiency.[545]

Generally, this program has had a positive effect on water quality in the Great Miami River watershed. It has done its part by keeping a significant amount of nutrients from entering the river, and has had positive economic and social effects. However, most studies indicate that the program's overall effect on water quality has not been large enough, and that its role in nutrient management has been rather minor.[546] Additionally, no verified studies of water quality improvements in the river as a whole have been linked to the trading program. This is

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[539] *Id.*
[540] *Id.* at 167.
[541] OPERATIONS MANUAL, *supra* note ##, at 9.
[542] David Newburn & Richard Woodword, *An Ex Post Evaluation of Ohio's Great Miami Water Quality Trading Program*,48 J. OF THE AM. WATER RES. ASS'N 156, 162 (2012), *available at* http://newserver.miamiconservancy.org/water/documents/NewburnandWoodward.ExpostEvaluation.pdf.
[543] *Id.* at 162-63.
[544] *Id.* at 163.
[545] *Id.*
[546] *Id.*

probably because the amount of nutrient pollution reduced by the program is comparatively small to the area's water pollution problems.[547] Its greatest success is the hundreds of millions of dollars saved by reducing pollution through changes in land use and farming practices, as opposed to requiring municipal treatment plants to complete expensive upgrades. Ultimately, if this program were expanded to include more dischargers throughout other parts of this watershed, the water quality improvement could be significant. For now, the GMRWTP remains only one part of the solution to the unresolved nutrient pollution of this waterbody.

2. Implementation Challenges

As illustrated above, although USEPA heralds water quality trading as the saving grace for nonpoint source pollution regulation, there is very little evidence of widespread programmatic success. However, despite water quality trading concepts existing for many years, the first point source to nonpoint source transfer occurred in 1997.[548] As mentioned above, successful trading is scant. Academics pinpointed several areas that contribute to the lack of success of water quality trading programs.

a. Science and Logistics

A major roadblock to the success of water quality trading programs is the blend of scientific uncertainty and complicated logistics. Specifically, there are issues with: lack of regulation, determining appropriate BMPs, quantification verification, and concentrated trades.

i. Issues

A. Lack of Regulation

As previously mentioned, the CWA does not regulate nonpoint sources. This initial lack of regulation gave birth to the preferred market-based regulatory mechanism. However, when nonpoint source pollution management is dependent on market mechanisms with no base regulatory framework, there is no uniform way to ensure these markets operate efficiently and consistently. This lack of regulation contributes to the inability of various states and watersheds to work together to achieve efficient, consistent water quality trading.

B. Best Management Practices and Buffer Offsets

BMPs are prescribed methods to reduce pollution with minimal expense. BMPs are typically used to reduce agricultural pollution. Their efficacy is projected in models. However, BMPs are not uniform solutions. Variables in soil, topography, distance to receiving water, and

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[548] HANNA L. BREETZ ET AL., WATER QUALITY TRADING AND OFFSET INITIATIVES IN THE U.S.: A COMPREHENSIVE SURVEY (2004), *available at* http://www.cbd.int/financial/pes/usa-peswatersurvey.pdf.

weather are among the factors that impact how much pollution will be reduced by a BMP.[549] Therefore, simply verifying that a BMP is completed does not guarantee that the BMP will operate as projected.

BMP modeling is not always reliable for many reasons. Models can show drastically different results with just a slight alteration of variables. Since there are so many variables that impact the efficacy of a BMP on the ground, models are likely not accurate predictors of the actual benefits of trading. At the same time, the market mechanism requires that a BMP results in a quantified reduction in pollution so that a credit value can be assigned. A credit is assigned to a BMP when the project is completed, though the actual beneficial impact of the BMP may accrue over several years, or not at all.

It is important to note that even though BMPs are effective at reducing sediment and nutrient runoff into surface waters, their reductions "have rarely been found to act in concert to produce measurable, broad-scale improvements in water quality."[550] However, this may be because pollution control is not often applied consistently across a watershed to achieve meaningful improvement.

C. Quantification Verification

One noted issue with nutrient trading programs is the lack of "quantification verification."[551] This means that there are issues with measuring, monitoring, and enforcing standards.[552] In order for nutrient trading programs to be successful, they must be carefully measured and monitored on a universal scale. Without consistency for measurements, trades cannot be made accurately across watersheds. In addition, it is technically difficult to measure runoff from a farm, compared to measuring runoff from a point source such as a pipe. This creates difficulties in accurately establishing tradable credits.

USEPA Trading Policy recognizes the "greater uncertainty" that exists in nonpoint source market trades. However, instead of encouraging greater monitoring to reduce this uncertainty, USEPA policy strongly encourages and emphasizes estimating pollution discharge for agricultural operations.[553]

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[549] Melissa K. Scanlan, *Adaptive Trading: Experimenting with Unlikely Partners*, 62 U. KAN. L. REV. 971 (2014); Corey Longhurst, *Where is the Point? Water Quality Trading's Inability to Deal with Nonpoint Source Agricultural Pollution*, 17 DRAKE J. AGRIC. L. 175, 194 (2012).
[550] Matthew W. Diebel et. al., *Landscape Planning for Agricultural Nonpoint Source Pollution Reduction I: A Geographical Allocation Framework*, 42 ENVTL. MGMT. 789, 798-800 (2008).
[551] Victor B. Flatt, *C(r)ap and Trade: The Brave New World of Non-point source nutrient trading and using lessons from Greenhouse Gas Markets to Make it work*, 52 HOUS. L. REV. 301 (2014).
[552] *Id.*
[553] *Final Policy On Nutrient Trading,* U.S. ENVTL. PROT. AGENCY (Jan. 13, 2013), http://water.epa.gov/type/watersheds/trading/finalpolicy2003.cfm.

D. Concentrated Trades

A second overarching issue with nutrient trading is the ability to control the total amount of pollutants entering a single waterbody.[554] Controlling the total pollution entering a single waterbody does not guarantee that other waterbodies within a watershed will remain unimpaired. There is no consideration of environmental impacts resulting from nutrient trading on a large scale. Without regulating where trades can take place, nutrient trading may result in "hot spots." "Hot spots" are where pollutant discharges greatly exceed what that waterbody can absorb, because polluters can buy credits and continue to discharge into impaired waters.

ii. Solutions

A. Lack of Regulation

It is the presence of consistent regulation that ensures effective market-based solutions.[555] This consistency creates something dependable for the market to rely on. Without federal regulations, states need to create stringent nutrient standards for specific waterbodies so trading will not be "piecemeal in application."[556]

B. Best Management Practices and Buffer Offsets

There are several ways BMP calculations and implementation can be altered to be more effective. One way to address the uncertainty of BMP modeling is to anticipate a larger margin of error in the models—a buffer offset. A buffer offset is a built-in margin of error that results in more accurate calculations. This is vital when models serve as the basis for determining the amount of pollution that can be traded. Buffer offsets take into consideration seasonal precipitation and vegetation variance to determine a more accurate trading ratio. This will account for the variability in topography, weather, and other unique characteristics of each place a BMP is installed.

A second way to ensure the efficacy of BMPs is to tailor them to the location they are placed. For example, a field could be monitored for runoff before and after the BMP is installed. This would quantify that BMPs pollution reduction.

BMP-induced nutrient reduction is not instantaneous and often takes time to make a tangible impact. A lack of long-term data contributes to the lack of certainty when it comes to the effectiveness of BMPs.

C. Quantification Verification

In order for a nutrient trading program to be successful, there needs to be baseline measurements and performance safeguards. Regular, consistent monitoring would provide

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[554] Victor B. Flatt, *C(r)ap and Trade: The Brave New World of Non-point source nutrient trading and using lessons from Greenhouse Gas Markets to Make it work*, 52 HOUS. L. REV. 301 (2014).
[555] Melissa K. Scanlan, *Adaptive Trading: Experimenting with Unlikely Partners*, 62 U. KAN. L. REV. 971 (2014).
[556] *Id.*

data upon which to base standards and expectations. By assigning numerical standards, credits would be uniform and trades could ensure more consistent results across watersheds. In addition, consistent measurement would help both point sources and nonpoint sources establish how many trades can take place without impairing a waterbody.

D. Concentrated Trades

To prevent the degradation of adjacent waterbodies in a nutrient trade, there needs to be a "blunt but blanket rule": no nutrient pollution offset can be approved if there is significant harm to other environments or ecosystems. [557] In addition, numeric standards are necessary to ensure conditions are uniform across all potentially affected waterbodies.

b. Market Liquidity

Market liquidity is an economic concept that provides a key piece to the success of water quality trading programs. Market liquidity is how easily something is traded.[558] A market-based solution to nonpoint source pollution is both the system that USEPA supports, and the most common solution sought in states. However, a market-based trading scheme cannot function if trades are not easy to make. The common issues in water quality trading schemes are: minimizing potential trade areas, lack of insurance mechanisms, and inadequate funding to support the market.

i. Issues

A. Minimizing Potential Trade Areas

Water quality issues are often location-specific. Therefore, trades need to be relatively concentrated in order to have a positive impact on water quality.[559] This means that the parties involved in water quality trades need to be close enough to each other to have a positive impact on a specific portion of a waterbody. However, if trades are restricted to an insufficiently sized area, there will not be enough potential traders to sustain the market.[560] This means, if there are not enough dischargers (both point and nonpoint sources) in the watershed or defined trade area, then a trade market cannot exist. There simply would not be parties to trade with. There is no "most effective" size prescribed by science, which presents the root of this issue.

B. (Lack of) Insurance Mechanisms

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[557] Victor B. Flatt, *C(r)ap and Trade: The Brave New World of Non-point source nutrient trading and using lessons from Greenhouse Gas Markets to Make it work*, 52 HOUS. L. REV. 301 (2014).
[558] Markus K. Brunnermeier & Lasse Heje Pedersen, *Markey Liquidity and Funding Liquidity*, Oxford Univ. Press (2008) *available at* http://pages.stern.nyu.edu/~lpederse/papers/Mkt_Fun_Liquidity.pdf.
[559] Karen Fisher Vanden & Sheila Olmstead, *Moving Pollution Trading from Air to Water: Potential, Problems, and Prognosis,* 27 J. ECON. PERSP., 147 (2013) *available at* http://pubs.aeaweb.org/doi/pdfplus/10.1257/jep.27.1.147.
[560] *Id.*

Currently, there is no back-up plan for if nutrient trades do not work out. If discharging offsets fail, the point source discharger is left exceeding water quality standards without an offset. The point source discharger is also left financially burdened for purchasing the offset in the first place. There is too much risk to promote point source to nonpoint source trading without any kind of fall back or insurance mechanism.

C. Funding

As of now, new TMDLs that rely on point source to nonpoint source trading assume that USDA or USEPA will fund the programs. Farmers need this financing to enter into the market for specific trades with point sources. This creates two major issues: 1) perpetual guarantees for government funding cannot be assured, and 2) these pr inclination and the expertise to develop, install, measure, market, and monitor nutrient reduction offsets on their property.[561]

ii. Solutions

A. Minimizing Potential Trade Areas

There needs to be designated areas for where trades can occur. These areas need to be based on both watersheds and the number of point source dischargers and nonpoint source dischargers. By taking both of these parameters into consideration, nutrient trades can benefit the water quality of a waterbody, but also ensure that there are enough buyers and sellers of credits to keep the nutrient trading program running. Another way to increase trading volume is to make a TMDL span multiple watersheds, if possible. This increases the number of point sources and nonpoint sources that can trade with one another. The limit to this strategy is the particular pollutant of concern.[562] Trades need to be close enough to have an impact on the impaired water.

B. Insurance Mechanisms and Third Party Investors

An insurance mechanism would allow dischargers to purchase and retire equivalent credits in the market when the discharger's offsets failed. When an insurance mechanism is paired with a third party offset developer, it allows room for true market flexibility and rebounding. One type of possible insurance mechanism allows one offset developer to retire equivalent credits in the market when another developer's offsets fail. For this to work, those who create and are responsible for the offsets (the offset developers) would need to have enough financial backing to replace the failed offsets.

C. Market Liquidity and Third Party Investors

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[561] Victor B. Flatt, *C(r)ap and Trade: The Brave New World of Non-point source nutrient trading and using lessons from Greenhouse Gas Markets to Make it work*, 52 HOUS. L. REV. 301 (2014).
[562] Karen Fisher Vanden & Sheila Olmstead, *Moving Pollution Trading from Air to Water: Potential, Problems, and Prognosis,* 27 J. ECON. PERSP., 147 (2013) *available at http://pubs.aeaweb.org/doi/pdfplus/10.1257/jep.27.1.147*

Having categories of standards for offsets available to farmers, and allowing third party developers be the ones to finance and install these offsets, would provide a solution to the lack of market liquidity.[563] There are a variety of offset types that third parties could specialize in. These include land management practices (such as buffers, fencing, cover crops, modifying fertilizers), and technology-based agricultural practices (such as equipment upgrades). Third party verifiers would be able to develop expertise on a specific type of offset, which would in turn justify their investment in the system. This would create a need for the third party since participants in the program would hire them to design and implement the offsets needed to generate credits.

c. Adaptive Management

i. What is Adaptive Management?

Adaptive Management is the concept that plans and management strategies can be flexible, and change to fit demands. Adaptive management has the potential to improve water quality trading based on the idea of experimenting, and then incorporating new information into a management strategy.

> Adaptive Management is an approach by which natural resource agencies are encouraged to learn as they implement their programs; in order to create feedback loops that allow programs to evolve and move towards achieving their goals by routinely incorporating new information.[564]

ii. Issues

While many watershed cleanup efforts mention adaptive management in their plans, many of these plans do not detail an approach to accomplish adaptive management goals. USEPA committed itself to "take an adaptive management approach to the [Chesapeake] Bay TMDL. . . ."[565] However, the details on how to follow through with the adaptive management approach are missing and nothing suggests they would even be used. For example, references to adaptive management in state and USEPA guidelines rarely explain how to structure such an experimental approach. Without incorporating current scientific advancements, data, and a way to modify programs, adaptive management can become an ineffective buzzword.

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[563] Victor B. Flatt, *C(r)ap and Trade: The Brave New World of Non-point source nutrient trading and using lessons from Greenhouse Gas Markets to Make it work*, 52 HOUS. L. REV. 301 (2014).
[564] Melissa K. Scanlan, *Adaptive Trading: Experimenting with Unlikely Partners*, 62 U. KAN. L. REV. 971 (2014); Melissa K. Scanlan & Stephanie Tai, *Marginalized Monitoring: adaptively Managing Urban Stormwater*, 31 UCLA J. ENVTL L. POL'Y 1, 7-16 (2013).
[565] U.S. EPA, CHESAPEAKE BAY TOTAL MAXIMUM DAILY LOAD FOR NITROGEN, PHOSPHORUS AND SEDIMENT §§ 10, 10.1.2, 10.2, 10.5 (2010), *available at* http://www.epa.gov/reg3wapd/tmdl/ChesapeakBay/tmdlexec.html.

iii. Solutions

With USEPA and many states supporting the idea of a market-based water quality control mechanism, adaptive management may be the best way to implement it.[566] Markets are flexible, and adaptive management provides ways to correct the system easily.

In order to effectively implement an adaptive management program, constant water quality monitoring must insure uniform data collection. This consistent data allows an agency to assess the program and provide feedback that would inform possible management changes.

Overall, nutrient trading has not yet produced widespread reduction in nonpoint nutrient pollution, except in very limited circumstances. USEPA has articulated the components of a viable trading program that could lead to measurable improvements, especially if integrated with other pollution reduction efforts. There are a number of critical features that must be incorporated for nutrient trading to succeed. Thus far, taxpayers, rather than the market, have mostly financed the programs. The largest experiment in nutrient trading is underway as part of the multi-state effort to reduce nutrient pollution in the Chesapeake Bay, which we address in the following section.

B. Chesapeake Bay as a Model

1. Failed Past Cooperative Efforts

The Chesapeake Bay is the largest estuary in the United States and one of the most productive bodies of water in the world. Over 500 million pounds of seafood are harvested each year. Spanning 64,000 square miles, the Chesapeake Bay watershed includes parts of Maryland, Virginia, Delaware, Pennsylvania, West Virginia, New York, and the District of Columbia. It is home to over 3,600 species of fish, plants, and other animals, in addition to being a major stop for migratory bird species along the Atlantic Flyway.[567] Although Congress has recognized the Chesapeake as a "national treasure and resource of worldwide significance," efforts to improve the water quality of the Bay have been on going for much of the last 30 years. [568] The combination of agricultural and forestry practices, in addition to urban development over the last half century, has led to a rating of "poor" or "very poor" by USEPA for more than half of the streams in the Bay's watershed.[569] This continual and uninterrupted decline of water quality eventually led the Obama Administration to announce a bold and comprehensive approach to water quality regulation— a multistate TMDL.

Prior to this action, agreements to clean up the Bay continuously called for an "inclusive, open and comprehensive public participation process" in the collaborative development of methods

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[566] Melissa K. Scanlan, *Adaptive Trading: Experimenting with Unlikely Partners*, 62 U. KAN. L. REV. 971, 994 (2014).
[567] U.S. EPA, *Chesapeake Bay Total Maximum Daily Load for Nitrogen, Phosphorous and Sediment,* ES-1 (2010), http://www.epa.gov/reg3wapd/pdf/pdf_chesbay/FinalBayTMDL/CBayFinalTMDLExecSumSection1through3_final.pdf.
[568] *Am. Farm Bureau Fed'n v. U.S. Envtl. Prot. Agency,* 984 F.Supp.2d 289, 300 (M.D. Pa. 2013).
[569] *Id.*

to improve the Bay's water quality.[570] Despite a history of collaboration, agreements from 1983, 1987, and 2000 all failed to meet their pollution reduction goals.[571] The 1983 agreement, entitled the Chesapeake Bay Agreement, signified the first multi-state coordinated effort to restore water quality. [572] This agreement had signatures from Maryland, Virginia, Pennsylvania, the District of Columbia, and USEPA Administrator acknowledging the Bay's decline in water quality. [573] Theses parties agreed "to assess and oversee the implementation of coordinated plans to improve and protect the water quality and living resources of the Chesapeake Bay estuarine systems."[574] These signatories, along with the Chesapeake Bay Commission, would eventually become the Chesapeake Bay Executive Council (Executive Council). The Executive Council establishes policy direction, exerts leadership to foster public support, and signs directives, agreements, and amendments to further Bay restoration.

These same signatories entered into another agreement in 1987, which furthered their "comprehensive approach." Their goal was a 40% reduction of nitrogen and phosphorous by 2000. The signatories checked in on progress intermittently. They found that between 1985 and 1996 phosphorus loads had decreased annually by 6 million pounds, and nitrogen loads had decreased by 29 million pounds, but the current strategies were not working well enough because there was no clear improvement of dissolved oxygen levels. Since the goal of nutrient reduction is to increase dissolved oxygen levels in Bay waters, it was determined that reduction strategies were not stringent enough and must be ramped up to meet the 40% goal by the year 2000.[575] Ultimately, this agreement was unsuccessful.

This lack of success, however, does not mean a complete lack of effort amongst the states. "[S]tates and the federal government spent $3.7 billion between 1995 and 2004 on cleaning up the Bay, including a substantial investment in upgrading sewage treatment plants to remove nitrogen."[576] Among cleanup efforts were investments such as new stormwater controls by developers, upgrades to power plants, as well as new techniques in the poultry industry, which were designed to help reduce phosphorus in the Bay.[577] Each party state also adopted regulations to protect wetlands, with some states going as far as creating "critical areas" to curb development near tidal waters.[578] However, none of theses measures markedly reduced nutrients in the Bay. "Without these efforts, it is fair to assume the Bay would have grown

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[570] Annabelle Klopman, *An Undercurrent of Discontent: The Chesapeake Bay Total Maximum Daily Load and its Impact on Bay Industries* 24, VILL. ENVTL. L.J. 97 (2013).
[571] Gina M. Zawitoski, *Restoring Chesapeake Bay Water Quality Through TMDL,* 44 FEB. MD B.J. 24, 29 (2011).
[572] *Am. Farm Bureau Fed'n v. U.S. EPA,* 984 F.Supp.2d 289, 300 (M.D. Pa. 2013).
[573] *Id.*
[574] *Id.*
[575] Oliver A. Houck, *The Clean Water Act Returns (Again): Part 1, TMDLs and the Chesapeake Bay,* 41 ENVTL. L. REP. 10208, 10223 (2011), *available at* http://www.eli.org/sites/default/files/docs/41.10208.pdf?q=pdf/41.10208.pdf.
[576] Timothy D. Searchinger, *Cleaning Up the Chesapeake Bay: How to Make an Incentive Approach Work for Agriculture*, 16 SOUTHEASTERN ENVTL. L.J. 171, 178 (Fall 2007).
[577] *Id.*
[578] See Del. Code Ann. Tit. 7, §§ 6603-20(2007); Md. Code Ann. Nat. Res. §§ 8-1801 to -1817 (West 2007); 25 Pa. Code §§ 105.1-452 (2004); Va. Code Ann. §§ 10.1-2100 to -2115 (2007).

significantly worse because of population growth and development sprawl. To some extent, maintaining the status quo represents an achievement."[579]

Although they looked good on paper, these occasional efforts to clean up the Bay did little to stem the increasing nutrient problem. "Most state and federal incentive programs are not performance-based, are varied and piecemeal, and do not mutually support societal goals of sustainable working lands and water quality protection."[580] Stakeholders in one state may show less interest in certain nutrient-reducing approaches than other states. Although some state programs, such as cover crops and buffers, offered real potential for Bay clean up efforts, piecemeal regulations and incentive programs could not effectuate change for the whole Bay. Something more was needed, leading these states to reevaluate their restoration efforts with a new multi-state approach.

In 2000, the signatories from 1983 and 1987 agreement entered into a third agreement, The Chesapeake Bay Agreement, and for the first time emphasized the regulatory framework of the CWA. The new agreement focused on a "tributary approach" setting specific benchmarks in the coming years that would define, develop, and set new water quality standards. These standards would be reviewed by USEPA and used as the basis for removing the Bay and its tributaries from the CWA impaired waters list. Essentially, the 2000 agreement set an overall goal of delisting the Bay and its tributaries from the impaired waters list by 2010.[581] Also in 2000, New York and Delaware joined the party states and signed a memorandum of understanding saying that despite moderate progress, if the Bay could not meet applicable water standards by 2010, a comprehensive TMDL would be established in 2011.[582] Additionally, Congress amended Section 117 of the CWA and established the Chesapeake Bay Program (CBP). The amended section directed the CBP to "coordinate state and federal efforts to improve Bay water quality, to evaluate sediment impacts on the Bay, and to determine the impact of natural and human induced environmental changes on the living resources of the Bay."[583] This language seemingly changed USEPA's role from a supporter of the 2000 agreement's goals, to a role of an active participant with the responsibility of ensuring that actions set forth in the agreement would actually happen.[584]

In 2003 USEPA and party states worked to establish cap loads for nitrogen, phosphorus, and sediment entering the Bay. These allocations would be used for each state's "tributary strategy." Each strategy outlined river basin-specific implementation methods to reduce nitrogen, phosphorus, and sediment load from point and nonpoint sources. By 2007 it was

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[579] Timothy D. Searchinger, *Cleaning Up the Chesapeake Bay: How to Make an Incentive Approach Work for Agriculture*, 16 SOUTHEASTERN ENVTL. L.J. 171, 179 (Fall 2007).
[580] *Id.* at 203.
[581] U.S. EPA, *Chesapeake Bay Total Maximum Daily Load for Nitrogen, Phosphorous and Sediment,* ES-1 (2010), http://www.epa.gov/reg3wapd/pdf/pdf_chesbay/FinalBayTMDL/CBayFinalTMDLExecSumSection1through3_final.pdf.
[582] *Am. Farm Bureau Fed'n v. U.S. EPA,* 984 F.Supp.2d 289, 300 (M.D. Pa. 2013).
[583] Clean Water Act, 33 U.S.C. § 1267(g) (2012).
[584] Oliver A. Houck, *The Clean Water Act Returns (Again): Part 1, TMDLs and the Chesapeake Bay,* 41 ENVTL. L. REP. 10208, 10223 (2011), *available at* http://www.eli.org/sites/default/files/docs/41.10208.pdf?q=pdf/41.10208.pdf.

clear that insufficient progress had been made toward improving water quality enough to remove the Bay and its waters from the CWA impaired waters list.[585] Deregulations under the Bush Administration essentially shelved many federal environmental requirements—the CWA was no exception.[586] Although reports were generally optimistic from 2000-2008, little was actually accomplished to reduce nutrient loadings.[587]

In early 2009, the Chesapeake Bay Foundation sued USEPA, stating that USEPA did not meet its obligation to restore the Bay under the 2000 Agreement, and violated its nondiscretionary duties under Section 117(g) of the CWA. That case, *Fowler v. U.S.EPA*,[588] settled in May 2010, required:

> establishing the stringent Chesapeake Bay total maximum daily load (TMDL), putting in place an effective implementation framework, expanding its review of Chesapeake Bay watershed permits, and initiating rulemaking for new regulations for concentrated animal feeding operations and urban and suburban stormwater.[589]

As a result of this case, USEPA was supposed to establish a nutrient and sediment TMDL for the Bay by December 31, 2010. Before this case settled, however, the Obama Administration issued Executive Order 13508 (EO 13508) in May of 2009—discussed in part (2)(b) below. Characterizing the Chesapeake Bay as a "national treasure," the Administration emphasized enforcement, deadlines, and accountability. EO 13508 identified four goals: "restoring clean water, recovering habitat, sustaining fish and wildlife and conserving land and increasing public access." EO 13508 called for a new found commitment from the federal government in restoring the Bay.[590]

On June 16, 2014, the Chesapeake Bay states—Delaware, Maryland, New York, Pennsylvania, Virginia, and West Virginia—and the District of Columbia (the District) signed the Chesapeake Watershed Agreement. Despite committing to specific goals in previous agreements, this is the first time that any of the headwater jurisdictions (New York, West Virginia, and Delaware) have fully committed to an agreement. Their partnership in the Agreement makes them full partners to the Chesapeake Bay Program and Chesapeake Executive Council.

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[585] U.S. EPA, *Chesapeake Bay Total Maximum Daily Load for Nitrogen, Phosphorous and Sediment,* ES-1 (2010), http://www.epa.gov/reg3wapd/pdf/pdf_chesbay/FinalBayTMDL/CBayFinalTMDLExecSumSection1through3_final.pdf.

[586] Patrick Parenteau, *Anything Industry Wants: Environmental Policy Under Bush II,* 4 DUKE ENVTL. L. & POL'Y J. 363 (2004).

[587] Oliver A. Houck, *The Clean Water Act Returns (Again): Part 1, TMDLs and the Chesapeake Bay,* 41 ENVTL. L. REP. 10208, 10223 (2011), *available at* http://www.eli.org/sites/default/files/docs/41.10208.pdf?q=pdf/41.10208.pdf.

[588] *Fowler v. EPA,* No. 09-005(CKK) 2009 WL 8634683 (D. DC. 2009).

[589] *Am. Farm Bureau Fed'n v. U.S. EPA,* 984 F.Supp.2d 289, 334 (M.D. Pa. 2013)

[590] Exec. Order No. 13508, 40 C.F.R. 130.7 (2009).

The Agreement sets out 10 goals and a series of measurable targets to meet each one. These include sustainable fisheries, vital habitats, water quality, toxic contaminants, healthy watersheds, climate resiliency, land conservation, stewardship, public access, and environmental literacy. The agreement seeks performance and pragmatism with goals that increase attainability. "[W]ithin one year of signing the Agreement the Chesapeake Bay Program's Goal Implementation Teams will develop Management Strategies for the Outcomes and support this Agreement's goals."[591] The Agreement focuses more on short-term ascertainable goals than long term hopes. The Water Quality Goal encompasses the jurisdictions' existing obligation to attain the Bay's water quality standards under the Bay TMDL. The other goals seek to combat other environmental and societal stresses that have slowly eroded the cultural, ecological, and economic health of the Bay. In tandem with the Bay TMDL program, this agreement is intended to lay out steps to improve and restore the Chesapeake Bay watershed. While this is a voluntary agreement, it conveys a strong message that the states are committed to the Bay's cleanup.[592] It implores collaboration between states, which must be present for an interstate voluntary agreement to succeed.

Five distinct sources of legal authority are credited with the creation of this TMDL: statutes, consent decrees, interstate compacts, settlement agreements, and the Executive Order.[593] Although legally there are multiple sources of authority for this TMDL, political and practical realities could have forced similar failed results if not for President Obama's Executive Order.[594] This time, coordination between the Bay states reached a consensus that USEPA would establish a Bay-wide TMDL with a target date of 2025 to set all pollution control measures in place. [595] This is compared to the unsuccessful, individual water-segment TMDLs.[596] Eleven federal agencies, led by USEPA committed to a comprehensive suite of actions on the same 2025 timeline as the TMDL, with two-year milestones designed to support each affected jurisdiction in meeting their reduction goals.[597]

2. Obama's Executive Order and Its Impact on the Chesapeake Bay TMDL

a. An Introduction to Executive Orders

[591] Chesapeake Watershed Agreement, (June 16, 2014) 15, http://www.chesapeakebay.net/documents/FINAL_Ches_Bay_Watershed_Agreement.withsignatures-HIres.pdf
[592] Darryl Fears, *Leaders of Chesapeake Bay States and the District Sign New Pact to Improve Bay's Health,* WASH POST (June 16, 2014), http://www.washingtonpost.com/national/health-science/leaders-of-chesapeake-bay-states-and-the-district-sign-new-pact-to-improve-bays-health/2014/06/16/a51d1572-f576-11e3-a3a5-42be35962a52_story.html (noting that this Agreement helps support the Government's position in the *American Farm Bureau* case because it "underscores the EPA's argument that the states are taking charge.").
[593] Response Brief of Defendant Interveners-Appellees at 27-29, *Am. Farm Bureau Fed'n v. U.S. EPA,* 984 F.Supp.2d 289, 300 (M.D. Pa. 2013) (No. 13-4079).
[594] Oliver A. Houck, *The Clean Water Act Returns (Again): Part 1, TMDLs and the Chesapeake Bay,* 41 ENVTL. L. REP. 10208, 10223 (2011), *available at* http://www.eli.org/sites/default/files/docs/41.10208.pdf?q=pdf/41.10208.pdf.
[595] U.S. EPA, *Chesapeake Bay Total Maximum Daily Load for Nitrogen, Phosphorous and Sediment,* ES-2 (2010), http://www.epa.gov/reg3wapd/pdf/pdf_chesbay/FinalBayTMDL/CBayFinalTMDLExecSumSection1through3_final.pdf.
[596] *Id.*
[597] *Id.*

One of the tools that the President possesses is the executive order. Although there is no formal definition of executive orders, they generally direct the actions and policies of executive agencies and officials. Executive orders are an inherently unilateral executive power that requires no judicial or legislative review. Executive orders can take various forms such as proclamations, presidential memoranda, directives, or presidential signing statements.

Executive orders have been critical in the development of our nation. For example, executive orders have established major agencies such as USEPA and the Department of Homeland Security (DHS). Furthermore, executive orders can mandate how programs apply to executive agencies. Interestingly, executive orders date back to George Washington. Beginning in 1789, Presidents have issued executive orders with varying frequency. In fact, "since the 1970s, on average, Presidents have issued about fourteen significant executive orders per year."[598]

Presidents have asserted that the legal basis for the authority to issue an executive order stems from the President's constitutional and/or statutory authority. Although the Constitution does not specifically give the President power to issue an executive order, "the president's power to do so is by now beyond dispute."[599] Unlike other legislation or regulations, "there are almost no legally enforceable procedural requirements that the president must satisfy before issuing (or repealing) an executive order or other presidential directive."[600] This makes them a powerful and appealing tool—Presidents can avoid the administrative burdens of rulemaking and the burden of obtaining majorities in both houses of Congress. One of the few requirements is that the President must publish any executive order that has "general applicability and legal effect" in the Federal Register.[601]

Executive orders are rarely overturned. The judiciary has only overturned two executive orders since 1789.[602] This is illustrative of the deference courts grant to the President in issuing executive orders, and the courts commitment to providing the President a great deal of latitude in overseeing the executive branch. Furthermore, "[b]etween 1945 and 1998, Congress legislatively overturned only four of the more than 3,500 executive orders issued."[603] Therefore, when issued, executive orders are unlikely to be repealed by either the judiciary or Congress.

Executive orders are a powerful tool that allows Presidents to dictate a wide range of law and policy. They allow a President to act unilaterally in determining agency action while remaining virtually unconstrained by procedural requirements.

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[598] Kevin M. Stack, *The Statutory President*, 90 IOWA L. REV. 539, 550 (2005).
[599] *Id.* at 551.
[600] *Id.* at 552.
[601] *Id.* at 554.
[602] John C. Duncan, *A Critical Consideration of Executive Orders: Glimmerings of Autopoiesis in the Executive Role*, 35 VT. L. REV. 333, 337 (2010).
[603] Kevin M. Stack, *The Statutory President*, 90 IOWA L. REV. 539, 542 (2005).

b. Executive Order 13508

EO 13508 centers on the protection and restoration of the Chesapeake Bay and its watershed. Specifically, EO 13508 recognizes that excess nitrogen, phosphorous, and sediment in the Chesapeake Bay prevent the Bay from attaining water quality standards under state and federal law.[604]

Recognizing the importance of the Nation's largest estuarine ecosystem, Section 201 of EO 13508 establishes the Federal Leadership Committee (the Committee) to oversee various agency activities dealing with the protection and restoration of the Chesapeake Bay.[605] The Administrator of USEPA, or the Administrator's designee, is responsible for overseeing the Committee. The Committee includes representatives from the USDA, the Department of Commerce (DOC), the Department of Defense (DOD), the DHS, the Department of the Interior (DOI), the Department of Transportation (DOT), and any other agencies the Committee determines are needed.[606]

In addition to establishing the Committee, EO 13508 requires that agencies submit reports recommending steps to protect and restore the Chesapeake Bay. Specifically, USEPA is responsible for defining essential actions in restoring the Chesapeake Bay, as well as addressing stormwater BMPs. This includes having the Administrator of USEPA examine the use of pollution control strategies within USEPA's CWA authority to restore the water quality of the Chesapeake Bay. This should include strengthening and extending existing permit programs, as well as establishing new minimum standards of performance.[607]

In addition, EO 13508 requires that the USDA concentrate on reducing nutrient and sediment loads in the Chesapeake Bay.[608] The DOD is responsible for strengthening "storm water management practices at Federal facilities and on Federal lands within the Chesapeake Bay watershed."[609] Furthermore, the DOI and the DOC are responsible for: 1) assessing and developing a strategy to adapt to the impacts of climate change on the Chesapeake Bay, 2) strengthening scientific support for decision-making to restore the Chesapeake Bay, and 3) protecting and restoring living resources and water quality within the Chesapeake Bay and its watershed.[610] In analyzing the impact of climate change on the Chesapeake Bay, the DOI and DOC should assess:

> (a) the impact of sea level rise on the aquatic ecosystem . . . the impacts of increasing temperature, acidity, and salinity levels of waters in the Chesapeake Bay; (c) the impacts of changing rainfall levels and changes in rainfall intensity on water quality and aquatic life; (d) potential impacts of climate change on fish, wildlife, and their habitats in the Chesapeake Bay and its

[604] Exec. Order No. 13508, 74 Fed. Reg. 23099 (May 15, 2009).
[605] *Id.*
[606] *Id.*
[607] *Id.*
[608] *Id.*
[609] *Id.*
[610] *Id.*

> watershed; and (e) potential impacts of more severe storms on Chesapeake Bay resources.[611]

In assessing gaps in scientific data, the DOI and DOC are required to assess: "(a) the health of fish and wildlife in the Chesapeake Bay watershed; (b) factors affecting changes in water quality and habitat conditions; and (c) using adaptive management to plan, monitor, evaluate, and adjust environmental management actions."[612] Furthermore, the Secretaries of the DOC and DOI are required to identify and prioritize critical living resources within the Chesapeake Bay and its watershed, and "conduct collaborative research and habitat protection activities that address expected outcomes for these species . . . ."[613] Finally, the DOI is responsible for expanding public access to the Chesapeake Bay, and conserving the landscapes and the ecosystems of the Chesapeake Bay watershed.

Further, Section 203 of EO 13508 requires that the Committee establish a strategy for protecting and restoring the Chesapeake Bay. This strategy must include: (a) environmental goals for restoring the Chesapeake Bay and objectives in achieving these goals; (b) indicators of environmental changes for effective leadership; (c) programs and strategies; (d) mechanisms for effective governmental activities; and (e) adaptive management principles.[614] Recognizing that the Federal Government cannot restore the Chesapeake Bay by itself, Section 204 of EO 13508 requires that federal, state, and local agencies collaborate when designing and implementing programs that benefit the Chesapeake Bay and its ecosystem.[615]

Additionally, Section 205 requires the publication of an annual Action Plan and Progress Report.[616] The Chesapeake Bay Action Plan must explain how federal funding will be used the following year to restore the Chesapeake Bay.[617] The Annual Progress Report must assess the implementation of the previous year's Action Plan, and recommend steps for furthering the restoration of the Chesapeake Bay. Both stakeholders and the public must be consulted when completing the Action Plan and the Progress Report.[618]

Pursuant to Section 203 of the Executive Order, in May 2010, the Committee published a strategy for protecting and restoring the Chesapeake Bay. Within this strategy, USEPA stated that the agency would implement the Chesapeake Bay TMDL as a key element in restoring the Bay.

3. The Multi-State Agreement and TMDL— Basic Structure and Operation

What makes the Chesapeake Bay TMDL unique is the extensive measures that both USEPA and jurisdictions have embraced to ensure accountability for meeting deadlines and making progress. Bear in mind that USEPA alone cannot command states to reduce nutrient pollution;

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[611] *Id.*
[612] *Id.*
[613] *Id.*
[614] *Id.*
[615] *Id.*
[616] *Id.*
[617] *Id.*
[618] *Id.*

a state-federal effort is required. The accountability structure from the Executive Order and the agreement among the states relies on Watershed Implementation Plans (WIPs), two-year milestones, and the role of USEPA as overseer to make sure that commitments are met by each jurisdiction. This is done through tracking and assessment of restoration progress, and certain contingency actions available to USEPA if commitments are not met. A common misconception of this "pollution diet" is that USEPA has developed tributary reduction strategies that jurisdictions must adopt, but this is not the case. Jurisdiction-based solutions were of the utmost importance to USEPA, which has always sought to provide jurisdictions the flexibility to determine how to reduce pollution in their given jurisdictions in the most efficient way.[619] Consistent with this approach, USEPA developed the total target pollution loads for each jurisdiction and then relied upon each jurisdiction to divide the total load among individual sources and sectors within its boundaries.[620] The TMDL's overall design attempts to ensure all pollution control measures needed to fully restore the Bay are in place by 2025, with at least 60% of controls in place by 2017. This newfound accountability framework exists in part to provide reasonable assurance obligations found in the CWA, Executive Order 13508, and various consent decrees and settlements regarding the Chesapeake Bay. Although the TMDL is being implemented according to this accountability framework, the framework is not itself actually part of the TMDL.[621] In addition, the 2014 Chesapeake Watershed Agreement provides the additional crucial foundation to implement the nutrient reduction plan set forth in the TMDL.

WIPs serve as roadmaps for when and how a specific jurisdiction expects to meet its pollutant allocations under the TMDL. They serve as the foundation for the Bay TMDL's accountability framework. Essentially, USEPA sets overall nitrogen, phosphorous, and sediment reduction goals and instructed each jurisdiction to draft a WIP showing how it could meet these goals by the year 2025.[622] USEPA allocated nitrogen and phosphorous loadings in an equitable manner, using three basic guides to divide loads amongst the seven jurisdictions. First, allocated loads should:

> protect living resources of the Bay and its tidal tributaries and should result in all segments of the Bay mainstem, tidal tributaries and embayments meeting water quality standards for dissolved oxygen, chlorophyll *a,* water clarity and underwater Bay grasses.[623]

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[619] Timothy D. Searchinger, *Cleaning Up the Chesapeake Bay: How to Make an Incentive Approach Work for Agriculture*, 16 SOUTHEASTERN ENVTL. L.J. 171, 195 (Fall 2007).
[620] U.S. EPA, *Chesapeake Bay Total Maximum Daily Load for Nitrogen, Phosphorous and Sediment,* ES-5 (2010), http://www.epa.gov/reg3wapd/pdf/pdf_chesbay/FinalBayTMDL/CBayFinalTMDLExecSumSection1through3_final.pdf.
[621] *Id.* at ES-8.
[622] *Am, Farm Bureau Fed'n v. U.S. EPA.,* 984 F.Supp.2d 289, 329 (M.D. Pa. 2013).
[623] U.S. EPA, *Chesapeake Bay Total Maximum Daily Load for Nitrogen, Phosphorous and Sediment,* ES-5 (2010), http://www.epa.gov/reg3wapd/pdf/pdf_chesbay/FinalBayTMDL/CBayFinalTMDLExecSumSection1through3_final.pdf.

Second, tributary basins contributing the most to the Bay's water quality issues must do the most to resolve the problem. Third, all tracked and reported reductions are credited towards achieving final assigned loads.[624] These allocations were provided to each jurisdiction, and form the basis for what is required in WIPs.

Two crucial criteria for each WIP are: 1) that it meets these basin-jurisdiction pollution allocations, and 2) provides reasonable assurance that reductions will be achieved and maintained, specifically for non-permitted, nonpoint sources like agricultural runoff and unregulated stormwater from suburban and urban environments. WIPs happen in three phases. Phase I, submitted in September 2010 prior to the final TMDL, tasked each jurisdiction with subdividing the Bay TMDL allocations for nitrogen, phosphorous, and sediment among various pollutant sources in each specific waterbody. This includes not just an overall wasteload allocation (WLA) and load allocation (LA), but one that subdivides along various sectors for agriculture, stormwater, wastewater, forest, non-tidal atmospheric deposition, onsite septic, and urban.[625] These Phase I WIPs were then evaluated by USEPA and either approved or federally adjusted through the use of backstops in order to create a draft TMDL.

After significantly improving WIPs, which removed and reduced many USEPA imposed backstops, the combined Phase I WIPs essentially formed the roadmap for the final TMDL reduction goals. Phase II WIPs were submitted to USEPA in 2012, with the main purpose of identifying key local, state, and federal partners. Of primary importance is at the local level, including local governments, planning commissions, utilities and watershed associations, and conservation districts. Jurisdictions were tasked with dividing their allocations into local area targets as appropriate with the intended goal of helping key partners understand the TMDL and their role in implementing WIP strategies.[626] Phase III WIPs are due in 2017, and are expected to provide any additional detail of restoration actions necessary to ensure 2025 goals are met.

Because logistics with certain jurisdictions and state agencies have made it hard to come into full compliance through the WIP, USEPA included in the final TMDL certain backstop allocations, actions, and adjustments.[627] This approach strengthens the relationship between the federal government and states. It endorses each jurisdiction's commitment to pollution reduction. The states and the District of Columbia get to do it their way first; with USEPA fully committed to use all of its authority to reduce pollution, it can step into its new role as overseer if inadequate plans to reduce pollution are proposed.

In addition to WIPs, beginning in 2012 all states are expected to follow two-year milestones to track their progress of reaching the TMDL's goals. These milestones essentially provide short-term evaluations of each jurisdiction's WIP. If progress proves to be stagnant, or insufficient, USEPA's overseer authority can be used to place additional backstop controls on federally

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[624] *Id.*
[625] *Am. Farm Bureau Fed'n v. U.S. EPA,* 984 F.Supp.2d 289, 303 (M.D. Pa. 2013).
[626] U.S. EPA, *Chesapeake Bay Total Maximum Daily Load for Nitrogen, Phosphorous and Sediment,* 1-15 (2010), http://www.epa.gov/reg3wapd/pdf/pdf_chesbay/FinalBayTMDL/CBayFinalTMDLExecSumSection1through3_final.pdf.
[627] *Id.*

permitted sources of pollution, and target compliance and enforcement activities.[628] Federally permitted sources of pollution include concentrated animal feeding operations (CAFOs), municipal stormwater systems, and wastewater treatment plants.[629] Federal action, although typically found during two-year milestones, can be taken at any time.[630] These backstop allocations, actions, and adjustments can include: expanding coverage of NPDES permits to sources that are currently unregulated, requiring additional pollution reductions from federally regulated sources, prohibiting new or expanded pollution discharges, conditioning and redirecting USEPA grants, revising water quality standards to better protect local and downstream waters, discounting nutrient and sediment reduction progress if jurisdiction cannot verify proper installation and management of controls, among others.[631]

One big question that will almost certainly continue to be litigated, is whether USEPA has overstepped its authority in issuing the Chesapeake Bay TMDL because it specifies both point source and nonpoint targets, as opposed to a single sum total. Nonpoint sources, also referred to as "load allocations," are not defined within the regulatory authority of the CWA, however USEPA has required each jurisdiction to provide reasonable assurances that it can reduce nonpoint source pollution. Industry objected to specific allocations for nonpoint source pollution reduction targets. However, *American Farm Bureau v. U.S. EPA*, discussed below, reasoned that USEPA, in creating a TMDL, can combine point and nonpoint pollution allocations.[632] Congress purposefully left the CWA open to interpretation when defining a TMDL. Since USEPA is not truly regulating nonpoint sources (a task left to the states for jurisdictional interpretation) it is simply using its overseer power to make sure certain quotas in reduction are met to achieve water quality standards.[633] This new approach ensures accountability.

> TMDLs are not an adjunct to watershed planning; rather, they are the *basis* of watershed planning, not because they are scientifically bulletproof, comprehensive, or efficient…but because they are objective, measurable, and the only approach so far that can be enforced by law.[634]

The combination of the TMDL, Executive Order, and the Chesapeake Watershed Agreement collectively bring enforcement to accountability for water quality and seek to improve and restore the Chesapeake Bay watershed, albeit in different ways. The Chesapeake Watershed Agreement is voluntary and nonbinding.[635] A state is not responsible for achieving every goal,

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[628] *Id.* at 7-11.
[629] *Id.*
[630] *Id.* at 1-16.
[631] *Id.* at ES-2.
[632] *Am. Farm Bureau Fed'n v. U.S. EPA,* 984 F.Supp.2d 289, 316-321(M.D. Pa. 2013).
[633] Oliver A. Houck, *The Clean Water Act Returns (Again): Part 1, TMDLs and the Chesapeake Bay,* 41 ENVTL. L. REP. 10208, 10223 (2011), *available at* http://www.eli.org/sites/default/files/docs/41.10208.pdf?q=pdf/41.10208.pdf.
[634] Annabelle Klopman, *An Undercurrent of Discontent: The Chesapeake Bay Total Maximum Daily Load and its Impact on Bay Industries* 24, VILL. ENVTL. L.J. 97, 99 (2013).
[635] Chesapeake Watershed Agreement, (June 16, 2014) 15, http://www.chesapeakebay.net/documents/FINAL_Ches_Bay_Watershed_Agreement.withsignatures-HIres.pdf

and can opt out of goals they do not have a vested interest in. An example of this could be New York and West Virginia, having no real connection to outcomes for blue crabs and oysters, opting out of parts of the sustainable fisheries goal. There is fear that a state could opt out of a more important goal, like toxic reduction. Political cohesiveness holds this partnership together and helps to fill otherwise obvious loopholes.

However, what must be adhered to in the Chesapeake Watershed Agreement are goals that relate to nutrient and sediment pollution, primarily the water quality goal. Under the TMDL, if a state is non-compliant, USEPA can take action at any time to: expand coverage of NPDES permits to sources that are currently unregulated, increase oversight of state-issued NPDES permits, require additional pollution reductions from federally regulated sources, increase federal enforcement, prohibit new or expanded pollution discharges, redirect USEPA grants, and revise water quality standards to better protect local and downstream waters.[636] Many of these are no different than how USEPA typically would enforce a TMDL. USEPA's true power is its ability to engage these actions at anytime it deems necessary. Where further enforcement comes into play is through EO 13508. Although USEPA can strip a state of its USEPA grant money, the Executive Order provides more general administrative enforcement abilities for the federal government.[637] The Order does not provide a right of action, however, administrative enforcement abilities could come in the form of withholding state federal funding. Essentially, the agreement and TMDL are non-binding. If a state wants to opt out they can, but they will suffer economic harm in doing so. This is why political cooperation and a willingness to spread reduction goals equitably is important.

4. American Farm Bureau Federation and Challenging the Chesapeake Bay TMDL

Not surprisingly, industry challenged Chesapeake Bay's TMDL as an inappropriate federal regulation of nonpoint pollution. The outcome of this challenge could affect the viability of Chesapeake Bay as a model for Lake Erie.

In *American Farm Bureau Federation v. U.S.EPA*, decided on September 13, 2013, the American Farm Bureau Federation (AFBF) and other industry groups challenged USEPA's authority to establish the Chesapeake Bay TMDL.[638] This argument became the central issue before the district court.

The AFBF raised three arguments. First, that USEPA lacked the authority to make separate TMDLs for both nonpoint and point source pollution.[639] The AFBF essentially argued that a TMDL should be one single value because of the CWA's clear language: "total" unambiguously, means sum.[640] Typically, where the language of a statute is silent or ambiguous, a court will defer to the implementing agency in interpreting the meaning of the

[636] U.S. EPA, *Chesapeake Bay Total Maximum Daily Load for Nitrogen, Phosphorous and Sediment,* ES-2 (2010), http://www.epa.gov/reg3wapd/pdf/pdf_chesbay/FinalBayTMDL/CBayFinalTMDLExecSumSection1through3_final.pdf.
[637] Kevin M. Stack, *The Statutory President*, 90 IOWA L. REV. 539, 552 (2005).
[638] *Am. Farm Bureau Fed'n v. U.S. EPA,* 984 F.Supp.2d 289, 294 (M.D. Pa. 2013).
[639] *Id.*
[640] *Id.*

statute. AFBF argues the court should not defer to USEPA because the term "total" clearly means one number—not one number for point source pollution, and another number for nonpoint source pollution. The district court held, in looking at the statute as a whole, the term TMDL was ambiguous and warranted great deference from USEPA. A TMDL is a highly technical calculation and one "that Congress does not decide for itself . . . ."[641] Rather, the agency would help devise the meaning of TMDL. The Act further suggests that USEPA should be involved when interpreting a statute.[642] USEPA is permitted to designate nonpoint and point sources within a TMDL.

Second, AFBF argued that the level of detail USEPA required in the TMDL, which allocated pollution according to specific source sectors, amounted to unlawful micro-managed implementation.[643] However, the district court stated,

> [a] core requirement of any TMDL is to divide sources of contamination along the water body by specifying load allocations, or LAs, to predict inflows of pollution from particular non-point sources; and to then set wasteload allocations, or WLAs, to allocate daily caps among each point source of pollution.[644]

Merely setting a number and leaving the responsibility for the states and interested groups to "duke it out" would be impractical and inconsistent with the CWA's foundational principle of sharing the burden to eliminate pollution between states, the federal government, and local authorities.[645] Acknowledging USEPA's authority to calculate source allocation, policy considerations, and prior court precedent, the district court dismissed the Plaintiffs' argument.

Within these source sectors, AFBF also argued that USEPA's "backstop allocations" are binding and an impermissible use of its authority.[646] The court, however, held that USEPA's measures were proper. The court first looked to the language of Section 117(g) of the CWA. Section 117(g) states that USEPA must ensure that implementation is consistent with the 2000 Chesapeake Bay Agreement.[647] The court explained that USEPA's disapproval of the allocations was consistent under Section 303(d) of the CWA, and USEPA's actions to shift allocations were appropriate under USEPA's "broad responsibilities" under Section 117(g). [648] Thus, the court held that the "backstop measures" were within the authority that Congress granted to USEPA under the CWA.

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[641] *Id.* (quoting *Zuni Publ. Sch. Dist. v. Dep't of Educ*., 550 U.S. 81, 90 (2007)).
[642] *Am. Farm Bureau Fed'n v. U.S. Envtl. Prot. Agency,* 984 F.Supp.2d 289, 318 (M.D. Pa. 2013).
[643] *Id.* at 321.
[644] *Id.* at 318 (quoting A*nacostia Riverkeeper, Inc., v. Jackson,* 798 F. Supp. 2d 210, 248-9 (D.D.C. 2011).
[645] *Am. Farm Bureau Fed'n v. U.S. Envtl. Prot. Agency,* 984 F.Supp.2d 289, 322 (M.D. Pa. 2013) (citing *Anacostia Riverkeeper, Inc., v. Jackson*, 798 F. Supp. 2d 210, 250 (D.D.C. 2011)); *see also* Friends of the Earth v. EPA, 346 F. Supp.2d. 182, 203 (D.D.C. 2004).
[646] *Am. Farm Bureau Fed'n v. U.S. Envtl. Prot. Agency,* 984 F.Supp.2d 289, 324 (M.D. Pa. 2013).
[647] *Id.*
[648] *Id.*

Third, AFBF argued that USEPA unjustly imposed a "reasonable assurance" requirement into the TMDL program process. The plaintiffs argue that the "reasonable assurance" requirement is an attempt for USEPA to "unlawfully insert itself into the TMDL implementation."[649] This argument also failed at the district court. The district court held that the reasonable assurances were a "practical measure" that had basis in both Section 303(d) and Section 117(g) of the CWA. USEPA was merely setting a standard to evaluate the TMDL. The court did not view USEPA's decision as part of implementation.[650] Here, the court first cited to Section 303(d)(1), requiring a TMDL to be "established at a level necessary to implement the applicable water quality standards . . . ."[651] That language, coupled with Section 117, which requires USEPA to ensure management and nutrient plans meet their goals, allowed the court to conclude that a "reasonable assurance" requirement was a lawful part of the TMDL program process.[652]

a. Appeal

The AFBF and other members of the agricultural industry appealed the district court's decision in January 2014. Twenty-one states and a group of eight counties filed amicus curiae briefs with the United States Court of Appeals for the Third Circuit supporting AFBF.[653] Out of the 21, West Virginia was the only Bay state to file a brief in support of AFBF. Many states supporting AFBF are located in the midwest, where agricultural industry around the Mississippi River is important to support many rural communities. These states contend that the TMDL will set dangerous precedent that threatens states' traditional authority over land-use management decisions. To be clear, West Virginia has joined as an amici in support of AFBF; but no Bay state, including West Virginia, has directly challenged USEPA's authority in establishing the Chesapeake Bay TMDL.

Conversely, Maryland and Virginia, joined by seven major cities, several municipalities, and various environmental organizations have filed briefs supporting USEPA, arguing that the TMDL is consistent with USEPA's authority and necessary for attaining meaningful reductions from all sources of nutrient pollution.

In November of 2014 the United States Court of Appeals for the Third Circuit heard oral arguments for AFBF's appeal of *American Farm Bureau Federation v. U.S. EPA*. As of April 9, 2015, the third circuit has not yet published its opinion. A decision is expected sometime within the next several months.

The third circuit's ruling will be of great precedential importance for USEPA's TMDL process moving forward. Of primary importance is the states' role in implementing water quality standards under the CWA, as well as determining to what extent USEPA can hold nonpoint

[649] *Id.*
[650] *Id.*
[651] *Id.* at 326 (citing 33 U.S.C. § 1313(d)(1)).
[652] *Am. Farm Bureau Fed'n v. U.S. Envtl. Prot. Agency,* 984 F.Supp.2d 289, 326 (M.D. Pa. 2013).
[653] Brief of the States of Kansas, Indiana, Missouri, Alabama, Alaska, Arkansas, Florida, Georgia, Kentucky, Louisiana, Michigan, Montana, Nebraska, North Dakota, Oklahoma, South Carolina, South Dakota, Texas, Utah, West Virginia, and Wyoming as *Amici Curiae* in Support of Reversal at 2-4, *Am. Farm Bureau Fed'n v. U.S. EPA,* 984 F.Supp.2d 289 (M.D. Pa. 2013) (No. 13-4079).

sources accountable for nutrient pollution. If the court finds the TMDL unlawful, thousands of TMDLs across the United States would be called be into question.[654] However, until that determination is made, each Bay jurisdiction operates its reduction strategies to reach the goals of the TMDL under the omnipresent eye of USEPA. With a goal of implementing all reduction control methods by 2025, jurisdictions have begun to experiment with new methods to achieve pollution reductions.

5. Current Status of Nutrient Trading within the Chesapeake Bay

All of the Bay states have implemented nutrient offset programs; however, depending on a states' nutrient loading, some jurisdictions have gone further to implement comprehensive nutrient trading programs. Out of the Bay states, five jurisdictions have some form of a nutrient trading program—only Delaware and New York do not. Of these five jurisdictions, Maryland, Virginia, the District of Columbia, and Pennsylvania have conducted trades between permit holders.

An offset program, compared to a comprehensive nutrient trading program, provides flexibility to permits holders but does not require any significant changes to existing regulations. For New York, implementing an offset program was a preferable option because the state contributes significantly less nutrients than the other jurisdictions, and does not have the demand for a comprehensive nutrient trading program.[655] Instead, New York State took the offset approach and developed a "bubble permit" for all the treatment plants within its watershed boundary. This offset system allows individual permittees to discharge above their effluent limitations, so long as the total amount of pollution is less than the total WLA. In other states, such as Maryland,[656] Virginia,[657] and Pennsylvania,[658] a comprehensive nutrient trading program can be a more effective tool. Virginia claims that implementing its nutrient trading program saved the Commonwealth more than one million dollars.[659] In other words, for a state that contributes a significant nutrient load, and has a diversity of source sectors, a nutrient trading scheme can be a cost-effective means of reducing nutrient pollution.

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[654] *See* Brief of Defendant-Appellee at 42, *A. Farm Bureau Fed'n v. U.S. EPA* (3rd Cir. argued Nov. 18, 2014) ("EPA has approved approximately 61,000 State-established TMDLs across the country, and has itself established approximately 7,000 more. About 30,000 of those TMDLs contain both wasteload allocations and load allocations.").

[655] *Chesapeake Bay TMDL*, U.S. ENVTL. PROTECTION AGENCY, 4-2, 4-3, 4-5, 4-6 (Dec. 29, 2010), http://www.epa.gov/reg3wapd/pdf/pdf_chesbay/FinalBayTMDL/CBayFinalTMDLSection4_final.pdf (According to the Bay TMDL model, New York's total load contribution in proportion to the other Bay jurisdictions is the following: nitrogen 4%; phosphorous 5%; sediment 4%. Of the Bay jurisdictions, New York's agricultural source sector contributes 4% of the total phosphorous, 5% of the total nitrogen, and 3% of the total sediment. Also, its point source sector contributes 3% of the total phosphorous, 5% of the total nitrogen, and 3% of the total sediment.)

[656] *Id.*

[657] *Id.*

[658] *Id.*

[659] Press Release, U.S. EPA, *Federal Agencies Support Virginia's Innovative Market-based Approach to Improving Water Quality in Chesapeake Bay* (Dec. 16, 2014) *available at* http://yosemite.epa.gov/opa/admpress.nsf/0/AB495CFDDE332C2B85257DB0004FD789.

The structure of each nutrient trading program varies from jurisdiction to jurisdiction. This overview distinguishes between offsets and a formal nutrient trading program. For instance, New York, West Virginia, and Delaware do not to have formal nutrient trading programs, but all of these states can authorize allocations to offset new or increased loads. Virginia, Pennsylvania, and the District of Columbia are the only three jurisdictions that published final nutrient trading regulations. Other jurisdictions, such as West Virginia and Maryland, may authorize trades on a case-by-case basis.

To meet the nutrient reduction goal by 2025, the Bay jurisdictions are employing a variety of tools—nutrient trading is just one of them. The Bay TMDL allocates nutrient reduction targets amongst six major source sectors: agriculture, forest, urban stormwater runoff, point source, onsite wastewater treatment systems, and non-tidal. From the 2009 baseline data, agricultural sources contributed 40% of the total nitrogen delivered and 52.7% of the total phosphorous in the Bay. Wastewater contributed 18.1% of the total nitrogen and 19.7% of the total phosphorous delivered. In 2009, together these source sectors contributed about 60%-70% of the total nutrient load delivered to the Bay.

States are tackling each source sector with specific regulatory tools. To reduce agricultural source pollution, they have developed new regulations that incentivize farmers to develop Resource Management Plans and implement agricultural BMPs. For point source nutrient reductions, major sources must install new technology. Maryland will complete Enhanced Nutrient Removal upgrades at 67 major POTWs by 2017. To tackle stormwater pollution, some jurisdictions implemented Municipal Separate Stormwater (MS4) permits under the NPDES program, requiring certain municipalities or counties to implement minimum control measures into their stormwater management programs. From the 2009 baseline data, the regulated stormwater source sector (including MS4s, industrial activities, and commercial activities) contributed 7.8% of the total nitrogen and 7.6% of the total phosphorous of the total WLA. In regards to onsite treatment systems, regulators are requiring advanced treatment in critical areas and developing maps to depict septic system location and condition. These are only some of the regulatory tools that Bay jurisdictions are implementing in order to reduce nutrient loading.

Ohio should look to Virginia's nutrient trading program as an example of a comprehensive and functioning scheme. Of the seven jurisdictions, Virginia developed the most effective nutrient trading program.[660] Virginia is one of the largest nutrient contributors as far as pounds of nutrient delivered. Absent a nutrient trading program, state treatment facilities would be pressured to install expensive technology.[661] Virginia's program permits point source wastewater treatment facilities and nonpoint agricultural sources to trade with each other. Also, similar to Virginia, Ohio is primarily an agriculture state with several metropolitan areas. This mix of land uses makes nutrient trading a viable option for Ohio because it provides the supply and the demand necessary for a market to function.

Virginia's program includes four important features. First, unlike Pennsylvania's program, USEPA has approved Virginia's baseline for farmers to generate credits from, because its

[660] *Id.*
[661] *Id.* (claiming that Virginia has saved $1 million dollars since implementing the program).

calculation is consistent with the Bay TMDL. Virginia's baseline requires each farmer to first implement five BMPs before a farmer can generate credits. Then, any additional BMPs installed generate credits. This approach encourages farmers to take minimal steps while reducing nutrient pollution. Second, the program uses a trading ratio of 1:2 for point to nonpoint source trades.[662] A trading ratio can be used for multiple reasons: two reasons are accounting for uncertainty in the nutrient credit calculation, and distance between credit generation and facility discharging. Third, Virginia developed an independent third-party broker for all trades between point and nonpoint sources.[663] An independent body to oversee trades relieves the risk from state agencies and reduces the use of resources. Fourth, the Virginia Department of Environmental Quality or a third-party is responsible for verifying nonpoint source credit generation.[664] A nutrient trading program must layout specific steps to verify that the farmer installs and maintains the BMPs. Although Virginia's regulations only generally mention verification, the program nevertheless incorporates it and lays the foundation for the state to fill in the details. If Ohio decides to develop a nutrient trading program, the elements noted above should be incorporated into the regulations.

6. Conclusion

The Chesapeake Bay TMDL is the starting block for perhaps the most ambitious water restoration overhaul the United States has ever seen. Analyzing from a watershed-based platform holds every jurisdiction and industry accountable for the pollutants knowingly and unknowingly discharged into our waters. New ideas, however, are rarely met without blowback from firmly established methodologies. Opposition from the Chesapeake TMDL is severe, and it will get worse before it subsides.

Farm and point source industry lobbies, and their representatives, have mischaracterized USEPA's intentions with drafting the Chesapeake Bay TMDL. Part of the problem is the success and benefits of a TMDL of this size will not be universally seen for over a decade, when its final deadlines are set to pass. This success, without question, is predicated on USEPA's willingness to stand its ground against this opposition. If they are not blocked by litigation, legislation, budget cuts, investigations, and defecting states success will most certainly follow. Progress cannot be traded for other administrative priorities. The TMDL program is the best chance we have to accomplish nitrogen and phosphorous reduction. What cannot be forgotten, however, is the interstate cooperation and equitable planning that went in to creating the Chesapeake Bay TMDL. Bay jurisdictions have worked together, on some level, since the 1980s with a common goal of facilitating change. Although past efforts failed, it was these friendly political relationships that ultimately allowed this TMDL to take place, even before the Executive Order. To be successful in other interstate watersheds, this same level of cooperation must be present. Jurisdictions must be willing to sit at the table and accept that interstate water quality problems can only be handled equitably, making each jurisdiction accountable for the pollution they create furthers the common goal of improving water quality across an entire watershed.

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[662] VA. ADMIN. CODE § 25-820-70.II.B.1.b. (2014).
[663] VA. CODE ANN. § 62.1-44.19:17 (2014).
[664] VA. ADMIN. CODE § 25-820-70.II.B.2.D. (2014).

C. Other Nonpoint Source Successes and Failures

Developing a nutrient trading program is not the only remedy to nonpoint source pollution. USEPA publishes success stories related to CWA § 319 Nonpoint Sources. USEPA' Success Stories website profiles nonpoint source impaired waterbodies that have documented water quality improvements as a result of restoration efforts. 119 USEPA Success Stories were reviewed, and the four most relevant were included in this report. Each story profiles a watershed that has been listed as impaired for nutrient pollution from nonpoint sources under § 303(d). These stories, taken in a prudential light, may provide a basis for mitigating water quality issues in Lake Erie. Profiled below are EPA success stories that have successfully diminished nutrient loading and stopped harmful algal blooms (HABs). Each reduction program is critically analyzed by examining funding sources, as well as the current success of the watershed. These stories may provide a basis, other than nutrient trading, for launching successful projects in the Lake Erie River Basin.

1. North Carolina: Neuse River Basin; Basin-wide Cleanup Effort Reduces In-stream Nitrogen[665]

The Neuse River basin encompasses 6,000 square miles in North Carolina and was listed on the State's 303(d) list in 1993 due to elevated nitrogen levels resulting from agricultural runoff. Nutrient loading caused algal blooms, fish kills, and hypoxic (low oxygen) conditions in the basin throughout the 1990s. Excessive nutrient loading also affected the Albemarle-Pamlico Sound system, which the Neuse River feeds into.

As a result of the section 303(d) listing, the North Carolina Environmental Management Commission (EMC) created the State's first mandatory point and nonpoint source pollution plan in 1995, requiring a 30% reduction in nitrogen in the Neuse River Basin by 2003.[666] The plan includes rules for the protection and maintenance of riparian areas,[667] wastewater discharges,[668] urban stormwater management,[669] agricultural nitrogen reduction,[670] nutrient management,[671] and nitrogen offset fees.[672] The program also restricts discharges from wastewater facilities[673] and creates nutrient offset payment schedules for load reductions in the same watershed.[674] Payments from the offset program are deposited in the Riparian Buffer Restoration Fund,[675] which is administered by the EMC. The Fund provides money "only for those purposes directly related to the restoration, acquisition, creation, enhancement, and

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[665] *North Carolina: Neuse River Basin Nonpoint Source Success Stories*, U. S. ENVTL PROT. AGENCY (Mar. 2012), http://water.epa.gov/polwaste/nps/success319/nc_neu.cfm.
[666] 15A N.C. Admin. Code 2B.0232 (2014).
[667] *Id.* at 2B.0233.
[668] *Id.* at 2B .0234.
[669] *Id.* at 2B .0235.
[670] *Id.* at 2B .0236, .0238.
[671] *Id.* at 2B .0239.
[672] *Id.* at 2B .0240.
[673] *Id.* at 2B.0234.
[674] *Id.* at 2B.0240.
[675] Riparian Buffer Restoration Fund administered by the Department, 15A N.C. ADMIN. CODE 2B.0240 (2014).

maintenance of riparian buffers or to construct approved alternative measures that reduce nutrient loading as well or better than a riparian buffer."[676]

This program required significant outside funding, mostly from taxpayers. USEPA's section 319 program provided $1 million; substantial funds were also contributed by: the NRCS Environmental Quality Incentives Program ($4.7 million), the North Carolina Agricultural Cost Share Program ($3.2 million), the Clean Water Management Trust Fund ($2.7 million) and the Pew Charitable Trust. From 1996 to 2003, half of the agricultural land had BMPs implemented, including no-till planting, creek fencing, buffers, contour planting, and removing croplands from production. By 2006, the basin had reduced in-stream nitrogen by 27% and nitrogen loading in the Neuse River estuary by 42%.

The success of the program appears to have involved a lot of stakeholder buy-in throughout the watershed. Though the program has been largely successful due to long-term monitoring and legislation, nitrogen continues to be a problem in the watershed, and annual reports on the basin are compiled to continue baseline monitoring.[677] The 2012 Basin report to the EMC states, "[a]lthough significant progress has been made in nitrogen loss reduction by the agricultural community, the 30% nitrogen reduction target established by the General Assembly from all sources has not yet been reached."[678] USEPA points to the implementation of BMPs as moving the Neuse River Basin closer to its goal of 30% nitrogen reduction. However, the target still has not been reached as of 2015. Still the project shows that a concerted, well-funded effort in a target watershed can reduce nonpoint nutrient pollution.

2. Maine: Cobbossee Lake- Lake Restored: 35 Years of Sustained Work Succeeds

Cobbossee Lake has had issues with HABs for over 50 years. A 5,238-acre lake in central Maine, Cabbossee Lake is used primarily for bass fishing, swimming, boating, and wildlife viewing. The lake also provides drinking water to Maine's state capital, Augusta. Cobbossee Lake had elevated phosphorous levels beginning in the 1960s as a result of soil erosion and agricultural, commercial, and residential runoff. HABs resulted from heavy nutrient loading, which further depleted oxygen levels. The Lake also had high levels of phosphorous as a result of sewage discharges from upstream Lake Annabessacook. Although sewage discharges ceased in 1977, phosphorus from Annabessacook sediments continued to flow downstream into Cobbossee Lake. In 1995, a TMDL assessment was conducted.[679] While developed lands accounted for 40% of the nutrient loading, agriculture was the primary cause of phosphorous loading. Maine set a target phosphorus level of 15 parts per billion (ppb) to attain Maine's water quality criteria for water clarity.[680]

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[676] N.C. GEN. STAT. ANN. § 143-214.21 (2014).
[677] *2012 Annual Progress Report on the Neuse Agricultural Rule (15 A NCAC 2B.0238) A Report to the NC Environmental Management Commission From the Neuse Basin Oversight Committee Crop Year 2011*, (2012), http://portal.ncdenr.org/c/document_library/get_file?uuid=46f396a3-6fb0-45e9-a4eb-9f629532a0e3&groupId=38364.
[678] *Id.*
[679] *Maine: Cobbossee Lake Nonpoint Source Success Stories*, U. S. ENVTL PROT. AGENCY (Mar. 2012), http://water.epa.gov/polwaste/nps/success319/me_cobb.cfm.
[680] *Id.*

In 1973, the Cobbossee Watershed District (CWD) was formed as a result of HABs. The CWD has worked with nine municipalities, USEPA and USDA to reduce nutrient loading. With a TMDL in place in 1995, Cabbossee Lake has not experienced HABs for 10 years and was removed from Maine's section 303(d) list in 2006. USEPA has provided over $1 million in section 319 grants to perform diagnostic studies and restoration activities, including BMP installations and alum treatments (a commonly practiced phosphorous remediation effort in smaller waterbodies, which has detrimental effects on fish populations and is ineffective for treatment of high external loading). Additionally, farmers in the area received assistance from DEP and the USDA Farm Bill Program to reduce agricultural runoff.[681]

The long-term success of reducing nutrient loading in Cabbossee Lake provides some guidance for future nutrient loading management programs. The success was built on BMP installations, sufficient funding, stakeholder buy-in, continued monitoring, and a TMDL.

3. New York—Upper West Branch, Delaware River—Restoration and Protection Activities in River Branch Protects City Drinking Water Supply[682]

The Upper West Branch of the Delaware River (UWBDR) in Delaware County, south-central New York provides much of New York City's (NYC) drinking water and spans 37.1 miles.[683] The River feeds into Cannonsville Reservoir that serves NYC. New York State placed the UWBDR on its 303(d) list in 1998 due to high phosphorus loading in Cannonsville Reservoir from dairy farming and septic systems. Delaware County developed a local watershed management plan[684] to control point and nonpoint sources of nutrient loading through a voluntary, incentive-based program. The program allowed farmers to implement BMPs such as Whole Farm Plans (WFPs)[685] on dairy farms which included creating riparian buffer zones, alternate water sources for animals, precision feeding, and stream relocation.

Monitoring activities continued, including watershed studies of BMP implementation, and nutrient loading in both the Cannonsville Reservoir and in the UWBDR. As a result of the establishment of BMPs through WFPs and continued monitoring, New York removed the UWBDR from its 303(d) list of impaired waters in 2004.

The success of this program's nutrient reduction was based on long-term monitoring and BMPs established by WFP, a long with community and stakeholder involvement within the UWBDR basin.

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[681] *Id.*

[682] U.S. EPA, *New York: Upper West Branch, Delaware River Nonpoint Source Success Stories,* (March 2012), http://water.epa.gov/polwaste/nps/success319/ny_wbde.cfm.

[683] *Id.*

[684] *Delaware County Action Plan DCAP II for Watershed Protection and Economic Vitality*, (May 2002), http://www.co.delaware.ny.us/departments/h2o/docs/dcap.pdf.

[685] *Whole Farm Planning*, (2013), http://www.nycwatershed.org/ag_planning.html.

4. North Dakota: Powers Lake—Implementing Best Management Practices and Targeting Technical Assistance Improve Powers Lake[686]

North Dakota's Powers Lake is a natural, freshwater 1,616-acre lake that experienced algal blooms as a result of agricultural runoff in the 1990s. In response, stakeholders formed the Powers Lake Advisory Committee (PLAC) and assessed the Lake's condition and generated pollution estimates using modeling data. The Lake was listed under section 303(d) as threatened but fully supporting its designated uses for recreation and aquatic life. A TMDL prepared in 2008 showed that nonpoint source pollutants primarily caused impairments from nutrients in agricultural runoff. PLAC used agricultural nonpoint source modeling to set goals for reducing nutrient loading to prevent algal blooms. Voluntary BMPs were implemented in designated high-priority watersheds which included grazing management, converting croplands to haylands, installing livestock fencing, creating riparian buffer zones, and no-till management. These BMPs have reduced phosphorus levels, however, Powers Lake is still listed as impaired due to high phosphorus levels.

USEPA provided section 319 funds in 2003 and 2011. Powers Lake phosphorous levels have decreased significantly because of these section 319 funds and community fundraising from agricultural producers. PLAC developed BMP contracts with agricultural producers, and provided assistance and educational activities for community members. Though this project has been marginally successful in mitigating nutrient loading, the Lake is still impaired for phosphorous and has yet to be removed from the State's 303(d) list.[687]

5. Conclusion

USEPA has provided funding to reduce nutrient loading, with varied levels of success. The most successful USEPA projects, profiled above, provide a framework for reducing high levels of phosphorous with substantial stakeholder involvement. The Neuse River basin was successful partially because of state legislation that required the basin to be in compliance with its program. Cobbossee Lake was valued by Maine as an important recreational resource, and continued monitoring and involvement over 30 years led to reduced nutrient loading. The Delaware River Basin and Powers Lake were both successful in implementing programs by establishing BMPs. These successful programs may help provide a framework for Lake Erie to reduce nutrient loading by establishing BMPs, involving stakeholders, applying for federal and state funding, legislating nutrient caps, and providing long-term monitoring.

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[686] U.S. EPA, *North Dakota: Powers Lake, Nonpoint Source Success Stories,* (March 2012), http://water.epa.gov/polwaste/nps/success319/nd_powers.cfm.

[687] *Powers Lake Watershed Project: Powers Lake Improvement Continues* (2012) http://www.powerslakend.com/lakeproject.htm.

V. GRANT FUNDING OPPORTUNITIES

Both the federal government and the State of Ohio have grant programs that can be used for projects to address nutrient pollution in the Lake Erie basin. Selected relevant governmental grant funding opportunities are identified in this part. Note: Some federally authorized grant programs are administered at the state level by state agencies.

A. Federal

1. U.S. Environmental Protection Agency

a. Nonpoint Source Implementation: Clean Water Act Section 319[688]

"EPA provides formula grants to the states, territories, and tribes to implement nonpoint source programs and projects in accordance with section 319 of the Clean Water Act (CWA). Nonpoint source pollution projects can be used for a wide range of activities including agriculture, forestry, construction, and urban challenges. When set as priorities within a state's nonpoint source management program, projects may also be used to protect source water areas and high quality waters."[689] Administered by OEPA in Ohio.

Eligible: Business, Community/Watershed Group, Conservation District, Educational Institution, Federal Agency, Local Government, Nonprofit Groups, Private Landowner, State/Territorial Agency, Tribal Agency.

b. Wetland Program Development Grants: Clean Water Act Section 104(b)(3)[690]

"Wetland Program Development Grants provide eligible applicants an opportunity to conduct and promote the coordination and acceleration of research, investigations, experiments, training, demonstrations, surveys, and studies relating to the causes, effects, extent, prevention, reduction, and elimination of water pollution."[691]

All proposals must be for projects that build or refine state/tribal/local government wetland programs.

c. Urban Waters Small Grants: Clean Water Act Section 104(b)(3)[692]

This program has an emphasis on engaging communities that have environmental justice concerns. In 2014, USEPA allocated $2.1 million to 37 organizations, receiving grants of

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[688] 33 U.S.C. § 1329 (2012).
[689] *Catalog of Federal Funding Sources for Watershed Protection: Nonpoint Source Implementation Grants (319 Program),* U.S. ENVTL. PROT. AGENCY (last updated Apr. 9, 2015), https://ofmpub.epa.gov/apex/watershedfunding/f?p=109:2:0::NO::P2_X_PROG_NUM,P2_X_YEAR:44,2014.
[690] 33 U.S.C. § 1254(b)(3) (2012).
[691] *Wetland Programs Development Grants*, U.S. ENVTL. PROT. AGENCY (last updated Apr. 9, 2014), http://water.epa.gov/grants_funding/wetlands/grantguidelines/.
[692] 33 U.S.C. § 1254(b)(3) (2012).

$40,000 to $60,000 each. USEPA's priority in distributing these funds is to achieve the goals and commitments established in the Agency's Urban Waters Strategic Framework.[693]

Eligible: Educational Institution, Indian Tribes, Local Government, Nonprofit Groups, Schools and Governments, State/Territorial Agency, Tribal Agency.

d. Clean Water State Revolving Fund (CWSRF): Clean Water Act, Title VI[694]

The CWSRF provides funding to states to establish a revolving fund from which low-interest loans are provided for construction of POTWs. Additionally states can use these funds for implementation of nonpoint source pollution programs under CWA section 319.[695] Administered by OEPA in Ohio (see Water Pollution Control Fund).

e. Drinking Water State Revolving Fund (DWSRF): Safe Drinking Water Act Section 1452[696]

The Safe Drinking Water Act (SDWA) makes grants to states to capitalize their DWSRF, which provides a long-term source of financing for the price of safe drinking water infrastructure. States use a portion of their capitalization grants to set up a revolving fund from which loans are provided to eligible public water utilities (publicly and privately owned). States rank projects and offer loans to utilities accordingly. Priority is given to eligible projects that: (1) address the most serious risk to human health; (2) are necessary to ensure compliance with the requirements of the SDWA; and, (3) assist systems most in need, on a per household basis, according to state-determined affordability criteria. States may also use up to 31% of their capitalization grants to fund set-aside activities that help to prevent contamination of drinking water supplies, as well as enhance water system management through source water protection, capacity development, and operator certification programs. Administered by OEPA in Ohio (see Water Supply Revolving Loan Account).

Eligible: Community/Watershed Group, Conservation District, Educational Institution, Nonprofit Groups, State/Territorial Agency, Tribal Agency, Water and Wastewater Utilities.

f. Public Water System Supervision Grant: Safe Drinking Water Act Section 1443(a)[697]

A public water system is: "a system for the provision to the public of water for human consumption through pipes or other constructed conveyances, if such system has at least

[693] *Urban Waters Small Grants*, U.S. ENVTL. PROT. AGENCY (last updated Apr. 6, 2015), http://www2.epa.gov/urbanwaters/urban-waters-small-grants.
[694] 33 U.S.C. §§ 1381-7 (2012).
[695] *The Clean Water State Revolving Fund Program: Tapping its Untapped Potential*, U.S. ENVTL. PROT. AGENCY, http://www2.epa.gov/sites/production/files/documents/SRF_TappingUntappedPotential.pdf (last visited Apr. 9, 2015).
[696] *Drinking Water State Revolving Fund (DWSRF)*, U.S. ENVTL. PROT. AGENCY (last updated Apr. 1, 2015), http://water.epa.gov/grants_funding/dwsrf/.
[697] 42 U.S.C. § 300j-2.

fifteen service connections or regularly serves at least twenty-five individuals."[698] This grant serves to ensure that even the smallest public water system maintains safe drinking water.

g. Water Pollution Control Grant: Clean Water Act Section 106[699]

Assistance to establish and maintain adequate measures for the prevention and control of surface and ground water pollution from point and nonpoint sources.[700]

Eligible: States, Tribes.

h. Great Lakes Restoration Initiative (GLRI)[701]

The Obama Administration initiated the GLRI through appropriation bills. USEPA is the lead agency, however, multiple federal agencies can receive funding and award grants pursuant to the GLRI. The GLRI Action Plan has four focus areas: cleaning up Areas of Concern; combatting invasive species; reducing nutrient runoff that contributes to harmful algal blooms; and restoring habitat to protect native species. Non-federal projects are awarded grants for work in these four focus areas.

Examples of grant programs currently funded by GLRI include:

- NOAA Great Lakes Habitat Restoration Grants[702]
- Great Lakes Commission Great Lakes Sediment and Nutrient Reduction Grants[703]
- NOAA Great Lakes Areas of Concern Land Acquisition Grants.[704]

2. U.S. Department of Agriculture

a. Environmental Quality Incentives Program (EQIP):[705] 2014 Farm Bill[706]

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[698] *State Public Water System Supervision*, CATALOG OF FED. DOM. ASSISTANCE, https://www.cfda.gov/index?s=program&mode=form&tab=core&id=f73a5afd30f6debbbcdad50935685b99 (last visited Apr. 8, 2015).
[699] 33 U.S.C. § 1256.
[700] *Water Pollution Control Program Grants (Section 106)*, U.S. ENVTL. PROT. AGENCY (last updated Oct. 31, 2013), http://water.epa.gov/grants_funding/cwf/pollutioncontrol.cfm.
[701] GREAT LAKES RESTORATION INITIATIVE, http://greatlakesrestoration.us/ (last visited Apr. 8, 2015).
[702] *NOAA Great Lakes Habitat Restoration Project Grants under the U.S. Great Lakes Restoration Initiative in Areas of Concern*, GRANTS.GOV, http://www.grants.gov/view-opportunity.html?oppId=270988 (last visited Apr. 8, 2015).
[703] *Great Lakes Sediment and Nutrient Reduction Program*, GREAT LAKES COMMN. http://keepingitontheland.net/ (last visited Apr. 8, 2015).
[704] GREAT LAKES AREAS OF CONCERN LAND ACQUISITION GRANTS, OHIO DEP'T OF NATURAL RES. (2015), *available at* http://coastal.ohiodnr.gov/portals/coastal/grantdocs/AOC/AOC_FY15_Factsheet.pdf.
[705] *2014 Farm Bill, Environmental Quality Incentives Program*, U.S. DEP'T OF AGRIC., http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/financial/eqip/?cid=stelprdb1242633 (last visited Apr. 9, 2015).
[706] Agricultural Act of 2014, Pub. L. No. 113-79, 128 Stat. 649.

EQIP is a voluntary conservation program that assists agricultural producers in addressing significant natural resource needs and objectives. Through a competitive process, EQIP offers financial assistance contracts to help implement eligible conservation practices. EQIP contracts have a maximum term of ten years and are administered by the Natural Resources Conservation Service.[707]

Eligible: Owners of land under agricultural production or who are engaged in livestock or agricultural production on eligible land, including private non-industrial forestland, or Indian Tribes.

b. 2014 Farm Bill: Conservation Innovation Grants (CIG)[708]

"CIG is a voluntary program intended to stimulate the development and adoption of innovative conservation approaches and technologies while leveraging federal investment in environmental enhancement and protection associated with agricultural production. Under CIG, EQIP funds are used to award competitive grants to non-Federal governmental or nongovernmental organizations, Tribes, or individuals."[709]

c. Conservation Reserve Program (CRP): Food Security Act of 1985[710]

CRP is a voluntary program for agricultural landowners. CRP consists of three financial mechanisms: cost-share, rental payment and monetary incentives. CRP's financial mechanisms assist eligible farmers in establishing long-term, resource-conserving covers on farmland. Administered by Farm Service Agency.[711]

d. Conservation and Reserve Enhancement Program (CREP): Food Security Act of 1985[712]

"CREP targets high-priority conservation issues identified by local, state, or tribal governments or non-governmental organizations."[713]

"In exchange for removing environmentally sensitive land from production and introducing conservation practices, farmers, ranchers, and agricultural landowners are paid an annual rental rate. Participation is voluntary, and the contract period is typically 10–15 years, along with other federal and state incentives as applicable per each CREP agreement."[714] Administered by Farm Service Agency.

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[707] *Id.*
[708] *Conservation Innovation Grants*, U.S. DEP'T OF AGRIC., NATURAL RES. CONSERVATION SERV., http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/cig/ (last visited Apr. 8, 2015).
[709] *Id.*
[710] Public Law No. 99–198, 99 Stat. 1504, Dec. 23, 1985.
[711] *Program Fact Sheets: Conservation Reserve Program,* U.S. DEP'T OF AGRIC. (June 2014), http://www.fsa.usda.gov/FSA/newsReleases?area=newsroom&subject=landing&topic=pfs&newstype=prfactsheet&type=detail&item=pf_20140604_consv_en_crp.html.
[712] 16 U.S.C. 3801-3862 (2012).
[713] *Conservation Reserve Enhancement Program*, U.S. DEP'T OF AGRIC., FARM SERV. BUREAU (last updated May 13, 2013), http://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=cep.
[714] 16 usc 3801-3862

e. Conservation Stewardship Program (CSP): 2014 Farm Bill[715]

The CSP provides two types of payments through five-year contracts: annual payments for installing new conservation activities and maintaining existing practices; and supplemental payments for adopting a resource-conserving crop rotation. A producer may be able to renew a contract if it has successfully fulfilled the initial contract and agrees to achieve additional conservation objectives. Payments are made soon as practical after October 1 of each fiscal year for contract activities installed and maintained in the previous year.[716] Administered by NRCS.

"Eligible lands include private and tribal agricultural lands, cropland, grassland, pastureland, rangeland, and nonindustrial private forest land. CSP is available to all producers, regardless of operation size or type of crops produced, in all 50 states, the District of Columbia and the Caribbean and Pacific Island areas. Applicants may include individuals, legal entities, joint operations, or Indian tribes. Each applicant must meet the stewardship threshold for at least two priority resource concerns when it applies. Applicants must also agree to meet or exceed the stewardship threshold for at least one additional priority resource concern by the end of the contract."[717]

f. National Integrated Water Quality Program (NIWQP): Safe Drinking Water Act Section 1442(a)(1);[718] Clean Water Act Sections 104, 105[719]

The NIWQP provides "funding for research, education, and extension projects aimed at improving water quality in agricultural and rural watersheds."[720] Administered by the National Institute of Food & Agriculture.

Only universities are eligible to participate in this program.

3. U.S. Department of Commerce, National Oceanic & Atmospheric Administration (NOAA)

a. Coastal and Estuarine Land Conservation Program (CELCP): Coastal Zone Management Act[721]

"The CELCP provides matching funds to state and local governments to purchase threatened coastal and estuarine lands, or obtain conservation easements. To be considered, the land must

[715] *Conservation Stewardship Program*, U.S. DEP'T OF AGRIC., NATURAL RES. CONSERVATION SERV., http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/csp/ (last visited Apr. 9, 2015).
[716] *Id.*
[717] *Id.*
[718] 42 U.S.C. § 300j-1.
[719] 42 U.S.C. §§ 1394, 1395.
[720] *Catalog of Federal Funding Sources for Watershed Protection: National Integrated Water Quality Program (NIWQP)*, U.S. ENVTL. PROT. AGENCY (last updated Apr. 9, 2015), https://ofmpub.epa.gov/apex/watershedfunding/f?p=109:2:0::NO::P2_X_PROG_NUM,P2_X_YEAR:61,2014.
[721] 16 U.S.C. §§ 1451-1466.

be ecologically important or possess other coastal conservation values, such as historic features, scenic views, or recreational opportunities."[722] Administered by ODNR in Ohio.

b. National Sea Grant College Program (NSGCP): National Sea Grant College Program Act of 1966 (As Amended)[723]

The NSGCP "serves as a bridge between government, academia, industry, scientists, and private citizens to promote the sustainable use of Great Lakes and ocean waters for long-term economic growth. Funding opportunities are available through national- and state-level competitions."[724]

Eligible: Business, Educational Institution, Local Government, Nonprofit Groups, State/Territorial Agency, Tribal Agency.

c. National Harmful Algal Bloom Programs: Harmful Algal Bloom and Hypoxia Research and Control Act of 1998[725]

NOAA' s Center for Sponsored Coastal Ocean Research (CSCOR) annually rotates three national competitive HAB grant programs: Monitoring and Event Response for Harmful Algal Blooms (MERHAB), Ecology and Oceanography for Harmful Algal Blooms (ECOHAB), and Prevention, Control and Mitigation of Harmful Algal Blooms (PCM HAB). CSCOR employs a regional approach, giving providing grants to the Great Lakes and five other regions in the United States. The grants are designed to *"advance scientific understanding of HAB and the ability to detect, assess, predict, control, and mitigate HAB events."*[726]

4. U.S. Department of the Interior

a. Cooperative Watershed Management Program (CWMP): Cooperative Watershed Management Act of 2009[727]

The purpose of the CWMP is to "enhance water conservation, including alternative uses; improve water quality; and improve ecological resiliency of a river or stream. The Program also attempts to reduce conflicts over water at the watershed level by supporting the formation

[722] *Coastal and Estuarine Land Conservation Program*, NAT'L OCEANIC & ATMOSPHERIC ADMIN., OFFICE FOR COASTAL MGMT., http://coast.noaa.gov/czm/landconservation/?redirect=301ocm (last visited Apr. 9, 2015).
[723] 33 U.S.C. §§ 1121-1131 (2008); *Funding and Fellowships*, NAT'L OCEANIC & ATMOSPHERIC ADMIN., http://seagrant.noaa.gov/FundingFellowships.aspx (last visited Apr. 9, 2015).
[724] Catalog *of Federal Funding Sources for Watershed Protection: National Sea Grant College Program*, U.S. ENVTL. PROT. AGENCY (last updated Apr. 9, 2015), https://ofmpub.epa.gov/apex/watershedfunding/f?p=109:2:0::NO::P2_X_PROG_NUM,P2_X_YEAR:43,2014.
[725] Public Law No. 105–383, 112 Stat. 3447 (Nov. 13, 1998).
[726] *HABHRCA*, NAT'L OCEANIC & ATMOSPHERIC ADMIN., CTR. FOR SPONSORED COASTAL OCEAN RESEARCH (last updated Feb. 16, 2011), http://www.cop.noaa.gov/stressors/extremeevents/Hab/habhrca/default.aspx.
[727] Pub. L. No. 111-11, §§ 6001-03, 123 Stat. 991 (Mar. 30, 2009).

of watershed groups to develop local solutions to address water management issues."[728] Administered by the Bureau of Reclamation.

5. U.S. Geological Survey

a. Water Resources Research Institute (WRRI) Program: Water Resources Act Section 104[729]

USGS, in coordination with National Institute for Water Resources, provides annual grants to the WRRI within each state and competitive grants to university scientists. The focus of these grants is resolving state or regional water problems.

B. Ohio

1. Ohio Environmental Protection Agency

a. Nonpoint Source Pollution Grants: Clean Water Act section 319;[730] Ohio Revised Code section 6111.037

OEPA administers the federal grant program for addressing nonpoint source pollution authorized by CWA section 319. Grants provide 60% of the project costs. Projects restoring or improving impaired waters are priorities.[731]

b. Water Pollution Control Loan Fund (WPCLF): Ohio Revised Code Section 611.036

OEPA administers the federal Clean Water State Revolving Fund authorized by CWA Title VI. "Ohio's WPCLF offers assistance opportunities (direct and indirect loans) for qualifying point source projects (including planning, design, and construction loans) owned by public entities."[732]

c. Water Supply Revolving Loan Account (WSRLA): Ohio Revised Code Section 6109.22

OEPA administers the federal Drinking Water State Revolving Fund authorized by SDWA section 1452. The Ohio WSRLA "provides financial assistance for the planning, design, and construction of improvements to community water systems and non-profit, non-community

[728] *Cooperative Watershed Management Program*, CATALOG OF FED. DOM. ASSISTANCE, https://www.cfda.gov/index?s=program&mode=form&tab=core&id=111ed1b1c2b44265777a8a9d4e847b79 (last visited Apr. 9, 2015).
[729] 42 U.S.C. § 10304.
[730] 33 U.S.C. § 1329.
[731] OHIO ENVTL. PROT. AGENCY, REQUEST FOR PROPOSALS: 2014 SURFACE WATER IMPROVEMENT FUND GRANTS (2014), *available at* http://www.epa.ohio.gov/Portals/35/nps/swif_docs/2014_Statewide_SWIF_RFP.pdf.
[732] OHIO ENVTL. PROT. AGENCY, OHIO WATER POLLUTION CONTROL FUND: FACT SHEET (2014), *available at* http://www.epa.ohio.gov/Portals/29/documents/WPCLF.pdf.

public water systems. Below-market interest rates are offered for public health or compliance related infrastructure improvements to public water systems."[733]

d. Drinking Water Assistance Fund (DWAF): Ohio Revised Code Section 6109.22

Several programs "offer below market rate loans to eligible public water systems to fund improvements to eliminate public health threats and ensure compliance with federal and state drinking water laws and regulations."[734]

e. State Water Improvement Fund Grants (SWIF): Ohio Revised Code Sections 6111.038, 6111.0382

The SWIF provides grant funding for projects that address nonpoint source pollution or storm water runoff and protect surface water quality.[735]

Eligible: Include local governments, park districts, environmental nonprofit organizations and universities.

2. Ohio Department of Natural Resources

a. Agricultural Pollution Abatement Program: Ohio Revised Code Chapter 1511

ODNR provides farmers with cost-share assistance to develop and implement BMPs to protect surface water quality. Local Soil & Water Conservation Districts help implement the program. Grants can cover up to 75% of costs and are capped at $30,000 per person annually.[736]

b. Coastal Management Assistance Grant: Coastal Zone Management Act Section 306, Ohio Revised Code Section 1506.02

ODNR administers federal funding provided by NOAA for grant projects that "preserve, protect . . and enhance the Lake Erie area coastal resources."[737] Grants can cover up to 50% of the project.[738]

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[733] *Money for Upgrading Public Water Systems*, OHIO ENVTL. PROT. AGENCY, http://ohioepa.custhelp.com/app/answers/detail/a_id/275/~/money-for-upgrading-public-water-systems (last visited Apr. 9, 2015).
[734] *Financial Assistance*, OHIO ENVTL. PROT. AGENCY, http://epa.ohio.gov/ddagw/financialassistance.aspx (last visited Apr. 9, 2015).
[735] OHIO ENVTL. PROT. AGENCY, REQUEST FOR PROPOSALS: 2014 SURFACE WATER IMPROVEMENT FUND GRANTS (2014), *available at* http://www.epa.ohio.gov/Portals/35/nps/swif_docs/2014_Statewide_SWIF_RFP.pdf.
[736] *Agricultural Pollution Abatement*, OHIO DEP'T OF NATURAL RES., SOIL & WATER RES., http://soilandwater.ohiodnr.gov/water-conservation/agricultural-pollution-abatement (last visited Apr. 9, 2015).
[737] OHIO DEP'T OF NATURAL RES., OFFICE OF COASTAL MGMT., COASTAL MANAGEMENT ASSISTANCE GRANT PROGRAM (2014), *available at* http://coastal.ohiodnr.gov/Portals/coastal/grantdocs/CMAG/CMAG_cycle19guidebook.pdf.
[738] *Coastal Management Assistance Grants*, OHIO DEP'T OF NATURAL RES., OFFICE OF COASTAL MGMT., http://coastal.ohiodnr.gov/cmagrants (last visited Apr. 9, 2015).

Eligible: Local governments and state agencies, as defined at 15 CFR 24.3, or entities eligible for assistance under section 306 of the CZMA, 16 U.S.C. § 1455.

3. Ohio Department of Agriculture

a. Clean Ohio Local Agricultural Easement Purchase Program (LAEPP): Ohio Revised Code Chapter 901

"LAEPP provides funding to assist landowners and communities in preserving Ohio's farmland, our most vital resource. The program purchases agricultural easements from landowners who volunteer to keep their land in agricultural production in perpetuity. In 2013 the program was changed to the LAEPP to reflect the increased role of ODA's local sponsors in farmland preservation: counties, cities, townships, soil & water conservation districts and land trusts."[739]

4. Ohio Lake Erie Commission

a. Lake Erie Protection Fund: Ohio Revised Code Section 1506.23

Commission provides grants for projects that directly benefit Lake Erie or its tributaries.[740]

5. Ohio Clean Lakes Initiative – OEPA, ODNR & ODA[741]

These three Ohio agencies are using funds (e.g., from the Healthy Lake Erie Fund) to implement the recommendations of the Directors' Agricultural Nutrients and Water Quality Working Group, including incentives for agricultural best management practices, soil testing and tributary monitoring. Highlights of the initiative include:

$150 million in no-interest loans for improvements to local drinking water and wastewater treatment facilities;

Support for agriculture of $1.25 million for farmers to plant cover crops or install controlled drainage devices that protect against nutrient runoff and help support water quality, and;

$2 million to Ohio universities for further research on algal blooms.[742]

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[739] *Clean Ohio Local Agricultural Easement Purchase Program (LAEPP)*, OHIO DEP'T OF AGRIC., FARMLAND PRESERVATION, http://www.agri.ohio.gov/divs/farmland/Farm_AEPP.aspx (last visited Apr. 9, 2015).
[740] *Lake Erie Protection Fund*, OHIO LAKE ERIE COMM'N, http://lakeerie.ohio.gov/LakeErieProtectionFund.aspx (last visited Apr. 9, 2015).
[741] OHIO ENVTL. PROT. AGENCY, OHIO STRENGTHENS EFFORTS TO FURTHER PROTECT LAKE ERIE WHILE ENSURING DREDGING OF NAVIGATIONAL CHANNEL IN CLEVELAND (2015) *available at* http://epa.ohio.gov/Portals/33/documents/DredgingNavigationChannel.pdf.
[742] Rob Nichols, *Kasich Signs Executive Order to Further Protect Lake Erie*, OHIO CLEAN LAKES INITIATIVE (Feb. 11, 2015) http://cleanlakes.ohiodnr.gov/home/post/kasich-signs-executive-order-to-further-protect-lake-erie.

Table 1.1 Federal Grant Opportunities

Funding Agency	Name of Grant	Website
USEPA	Non-Point Source Implementation	http://water.epa.gov/polwaste/nps/cwact.cfm
USEPA	Wetland Program Development Grants	http://water.epa.gov/grants_funding/wetlands/grantguidelines/
USEPA	Urban Waters Small Grants	http://www2.epa.gov/urbanwaters/urban-waters-small-grants
USEPA	Clean Water State Revolving Fund	http://water.epa.gov/grants_funding/cwsrf/cwsrf_index.cfm
USEPA	Drinking Water State Revolving Fund	http://water.epa.gov/grants_funding/dwsrf/
USEPA	Public Water System Supervision Grant	http://water.epa.gov/grants_funding/pws/
USEPA	Water Pollution Control Grant	http://water.epa.gov/grants_funding/cwf/pollutioncontrol.cfm
USEPA	Great Lakes Restoration Initiative	http://greatlakesrestoration.us/
USDA	Environmental Quality Incentives Program	http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/eqip/
USDA	Conservation Innovation Grants	http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/cig/
USDA	Conservation Reserve Program	http://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=crp
USDA	Conservation and Reserve Enhancement Program	http://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=cep
USDA	Conservation Stewardship Program	http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/csp/
USDA	National Integrated Water Quality Program	http://nifa.usda.gov/funding-opportunity/integrated-research-education-and-extension-competitive-grants-program-national

NOAA	Coastal and Estuarine Land Conservation Program	http://coast.noaa.gov/czm/landconservation/
NOAA	National Sea Grant College Program	http://seagrant.noaa.gov/FundingFellowships.aspx
NOAA	National Harmful Algal Bloom Programs	http://www.cop.noaa.gov/stressors/extremeevents/hab/current/fact-ecohab.aspx
U.S. Dept. of the Interior	Cooperative Watershed Management Program	http://www.usbr.gov/WaterSMART/cwmp/
U.S. Geological Service	Water Resources Research Institute Program	http://water.usgs.gov/wrri/index.php

Table 1.2 Ohio Grant Opportunities

Funding Agency	**Name of Grant**	**Website**
OEPA	Nonpoint Source Pollution Grants	http://www.epa.ohio.gov/dsw/nps/index.aspx
OEPA	Water Pollution Control Loan Fund	http://www.epa.ohio.gov/Portals/29/documents/WPCLF.pdf
OEPA	Water Supply Revolving Loan Account	http://www.epa.state.oh.us/portals/28/documents/dwaf/dwaf_wsrla_fact_sheet.pdf
OEPA	Drinking Water Assistance Fund	http://epa.ohio.gov/ddagw/financialassistance.aspx
OEPA	State Water Improvement Fund Grants	http://www.epa.state.oh.us/dsw/nps/swif.aspx
ODNR	Agricultural Pollution Abatement Program	http://soilandwater.ohiodnr.gov/water-conservation/agricultural-pollution-abatement
ODNR	Coastal Management Assistance Grant	http://coastal.ohiodnr.gov/cmagrants
Ohio Dept. of Agriculture	Clean Ohio Local Agricultural Easement Purchase Program	http://www.agri.ohio.gov/divs/farmland/

Ohio Lake Erie Commission	Lake Erie Protection Fund	http://lakeerie.ohio.gov/LakeErieProtectionFund
OEPA, ODNR & ODA	Ohio Clean Lakes Initiative	http://cleanlakes.ohiodnr.gov/

VI. CONCLUSIONS AND RECOMMENDATIONS

A. The Multi-State Lake Erie Basin

Harmful Algal Blooms are a serious threat to water quality in Lake Erie and are likely to worsen in the future.

Lake Erie's hydrology, geology and climate make it particularly susceptible to HABs caused by excessive nutrient pollution from man-made sources. The best available science indicates that HABs are likely to continue and possibly worsen in the 21st century as climate change exacerbates the lake's susceptibility to HABs.

Efforts to reduce nutrient pollution in Lake Erie must be legally mandated, for nonpoint sources as well as point sources, and must apply to all states in the Lake Erie watershed.

Nutrient pollution in Lake Erie is a multi-state problem and Ohio cannot solve it alone. Voluntary efforts to control nonpoint source nutrient pollution have failed. Accordingly, there needs to be mandatory regulation of all sources of nutrient pollution in states within the Lake Erie watershed.

One option is for Congress to empower a federal agency with the authority to regulate nonpoint source nutrient pollution. Alternatively, the Lake Erie basin states could create a multi-state commission with such authority via an interstate compact, approved by Congress.

Short of those options, **the Chesapeake Bay approach is a potential model for solving the nutrient pollution problem in Lake Erie.** We say "potential" because it is too early to assess its effectiveness. The Chesapeake Bay approach is a good example of a strong federal-state partnership aimed at addressing nutrient pollution in a multi-state watershed. The Chesapeake Bay TMDL, effectively a nutrient pollution budget set by EPA, and an Executive Order by the President, mandating the coordinated efforts of federal agencies, are necessary starting points. Equally important is for the states to commit themselves to implementing the TMDL through a legally binding multi-state agreement, while retaining flexibility to achieve reductions through individual watershed implementation plans that address both point and nonpoint sources of nutrients. Interim targets allow all stakeholders to assess effectiveness.

Efforts to reduce nutrient pollution must be based on sound data, effective monitoring, and proactively address climate change.

Lake Erie's pollution problems are well-studied, and any solution should draw upon conclusions offered by these studies. However, data gaps regarding all sources of nutrient pollution should be addressed. Any solution will require comprehensive monitoring to insure its effectiveness. Because climate change will exacerbate HABs in multiple ways (warmer, more frequent intense precipitation, changing wind and water circulation patterns) solutions must incorporate a large margin of safety.

Public participation and stakeholder involvement are essential.

Broad public participation and stakeholder buy-in are essential. Lake Erie is a priceless public resource, and it is vital for the affected public to have a voice in shaping pollution reduction strategies.

Water quality trading programs might be a part of the solution to the nutrient pollution problem in the Lake Erie basin, but to date have not proven effective to reduce large scale nonpoint pollution.

Nutrient trading to reduce nutrient pollution loads is part of the Chesapeake Bay program and has been developed in many parts of the country, though few programs are functional and none have achieved significant water quality improvements. Water quality trading is encouraged by EPA and may be attractive to some stakeholders. If nutrient trading is considered for Lake Erie, it must be properly implemented to achieve success. First and foremost a trading program must not simply shift pollution around a watershed, but be developed to ratchet down overall pollution loads to achieve water quality standards. The following recommendations arise from our study of nutrient trading nation-wide.

Nonpoint source pollution as part of water quality trading requires a conservative approach.

Nonpoint source pollution trading is inherently more complicated that trades between point sources, because the former are based largely on installing Best Management Practices for agriculture while the later are based on "end-of-pipe" improvements that are easily measured. However, variables in soil, topography, distance to receiving water, and weather impact how much pollution will be reduced by a BMP. Verifying that a BMP is installed does not guarantee that the BMP will operate as projected. For BMPs to reduce nutrient loading, programs should anticipate a greater margin of error in the models—a buffer offset.

A buffer offset is built-in "wiggle-room" so that BMP calculations maintain accuracy. A buffer offset is vital when models serve as the basis for determining the quantity of pollution that can be traded. Buffer offsets consider variances in seasonal precipitation and vegetation variance to determine more accurate trading ratios. These offsets will account for the viability in topography, weather, and other unique characteristics of locations where BMPs are installed.

Water quality trading must include comprehensive monitoring and "quantification verification."

Quantification verification measures, monitors, and enforces water quality standards. In order for nutrient trading programs to be successful, they must be carefully measured and monitored on a universal scale. Successful water quality trading programs need to have upfront baseline measurement standards and performance safeguards. Consistent monitoring provides data on which to base standards and expectations. By assigning numerical standards, trades could ensure more consistent results across watersheds. In addition, consistent measurements may

help point sources and nonpoint sources alike in establishing how many credits or trades are needed to attain water quality standards.

Water quality trading schemes should use "adaptive management."

Adaptive management is the concept that plans and management strategies can be flexible, and change to fit demands. Adaptive management has the potential to improve water quality by experimenting and incorporating new information into a management strategy. However, a program running without current scientific advancements, up-to-date data, and a way to modify programs cannot adaptively manage. In order to effectively implement an adaptive management program, constant water quality monitoring must insure uniform data collection. Consistent data allow an agency to assess the program and provide feedback that would inform possible management changes.

Trading ratios should be carefully selected to further limit pollution.

More credits should be required to discharge into an impaired waterway than into an attaining waterway. Lower credit ratios should be provided to regulated point sources that are willing to invest in the program early. These ratios would secure funding for the program early on, by creating a cost-saving incentive for point sources to become involved at the program's inception.

A nutrient trading program should be run, to the extent possible, with existing staff and agencies.

In order to lower administrative costs and allow for the most cost-saving pollution reduction, it is best to run a nutrient trading program with existing staff and agencies. Training existing personnel on conducting trades and monitoring water quality is more cost-effective than creating and staffing a new office. Moreover, state, county, and local-level government employees need to work together to share resources and data.

Successful pollution reduction should utilize multiple approaches and be adequately funded over the long term to insure success.

We found numerous successful small scale efforts to reduce nutrient pollution. Because nutrient pollution occurs from many sources, point and nonpoint, urban, suburban, and rural, a combination of strategies is essential. The best "success stories," and the massive on-going effort in Chesapeake Bay, all had broad based stake holder involvement, addressed the root causes of pollution for that waterbody, and had significant government-supported funding streams.

A TMDL provides the starting point to measure success in nutrient reduction. Analyzing from a watershed-based platform holds every jurisdiction and industry accountable for the pollutants both knowingly and unknowingly discharged into our waters. A comprehensive TMDL for the entire basin is an essential starting point, regardless of the pollution-reduction approaches that are taken.

B. Ohio

In Ohio, existing legal tools should be used more effectively and new tools should be instituted to help combat nutrient pollution and the formation of HABs in Lake Erie.

Below are recommendations—agency by agency—for what Ohio can do now with their current authority. Then we set forth recommendations for what the Ohio General Assembly could do to provide new and improved legal tools for controlling nutrient pollution.

1. Ohio Environmental Protection Agency

OEPA should establish by rule a more stringent phosphorus effluent limit for POTWs in the Lake Erie basin with a design flow of 1 million gallons per day (gpd) or more.

In the successful fight against HABs in Lake Erie decades ago, establishing a total phosphorus effluent limit for major POTWs was perhaps the single most effective legal tool adopted.[743] For many years Ohio has required POTWs in the Lake Erie basin with a design flow of at least 1 million gpd to meet a total phosphorus discharge limit of 1 mg/L.[744] Today we need to reduce phosphorus in Lake Erie again. Major POTWs as a category remain one of the largest contributors of phosphorus to Lake Erie.[745] OEPA has acknowledged the need for a stricter phosphorus effluent limit for major POTWs where the receiving waterbody in the Lake Erie basin is impaired by nutrients.[746] OEPA should amend Ohio Administrative Code 3745-33-06(C) to set a more stringent phosphorus effluent limit for major POTWs in the Lake Erie basin.

OEPA should apply a discharge limit for total phosphorus to a broader class of POTWs in the Lake Erie basin.

Most POTWs in the Lake Erie basin have design flows of less than 1 million gpd. Therefore, most of these smaller POTWs do not have any phosphorus effluent limits in their NPDES permits.[747] OEPA has acknowledged that a total phosphorus discharge limit of 1 mg/L would be appropriate for POTWs with a design flow of less than 1 million gpd where the receiving waterbody is impaired by phosphorus.[748]

OEPA should require more NPDES permit holders in the Lake Erie basin to monitor for phosphorus.

Phosphorus effluent limits are included in the NPDES permits of only a fraction of POTWs and industrial wastewater treatment plants in the Lake Erie basin. Less than one-third of these

[743] *See* Ohio Lake Erie Phosphorus Task Force Final Report 12 (2010).
[744] OHIO ADMIN. CODE 3745-33-06(C)(1) (based on 30-day average).
[745] Task Force Report, *supra*, at 34.
[746] OEPA, Ohio Nutrient Reduction Strategy 20 (June 2013).
[747] OEPA, Nutrient Reduction Strategy Framework for Ohio Waters (Draft) 22 (Nov. 2011).
[748] OEPA, Nutrient Reduction Strategy 21 (June 2013).

POTWs and treatment plants are even required to monitor their permitted discharges for phosphorus.[749] These additional monitoring data about phosphorus entering waters in the Lake Erie basin should facilitate TMDL load and waste load allocations for point and nonpoint sources. Phosphorous effluent limits in NPDES permits could then be tightened where appropriate, allowing for more informed decision-making regarding use of other legal tools to attain or maintain water quality standards and combat the formation of HABs.

OEPA should include more "green" infrastructure requirements in NPDES permits for POTWs and municipal separate stormwater systems within the Lake Erie basin.

"Green" infrastructure practices and technologies (e.g., grassed swales, green roofs, permeable pavement) sometimes helps to achieve reductions in phosphorus runoff with less cost and more environmental benefits than traditional stormwater runoff solutions (e.g., those heavy on concrete and piping).[750] Such green infrastructure could be required in NPDES permits as controls for combined sewer overflows and as BMPs for municipal separate stormwater systems.[751]

OEPA should more aggressively use its enforcement authority under ORC chapter 6111 against property owners whose home sewage treatment systems (HSTS) are contributing significant pollution to surface waters of the state without a NPDES permit.

Discharges from HSTS to surface waters of the state without a NPDES permit are prohibited and constitute a public nuisance.[752] Enforcement should be targeted to the most significant polluters and could include seeking injunctive relief to compel compliance, as well as civil penalties for past and ongoing violations.[753] To ease compliance, we recommend that OEPA develop a general NPDES permit for older systems that are not eligible for current general NPDES permits which govern new and replacement HSTS.

OEPA should develop numeric water quality criteria for total phosphorus applicable to rivers and streams in the Lake Erie basin and to nearshore waters of Lake Erie.

Water quality criteria set the maximum level of a pollutant that can lawfully exist in an ambient waterbody. OEPA is responsible under the CWA for establishing water quality

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[749] Draft Framework, *supra*, at 22, 27.

[750] *See* USEPA, Office of Water & Office of Enforcement and Compliance Assurance, Protecting Water Quality with Green Infrastructure in EPA Water Permitting and Enforcement Programs (April 20, 2011), *available at* http://water.epa.gov/infrastructure/greeninfrastructure/gi_support.cfm; American Rivers et al, Banking on Green: A Look at How Green Infrastructure Can Save Municipalities Money and Provide Economic Benefits Community-wide (April 2012), *available at* http://www.americanrivers.org/library/reports-publications/going-green-to-save-green.html. *See also* OEPA, Nonpoint Source Management Plan Update 7-11 (2014); OEPA, Ohio Nutrient Reduction Strategy 32-39 (June 2013).

[751] Combined sewer overflows at POTWs are subject to control requirements in NPDES permits. *See* USEPA Combined Sewer Overflow Policy, 59 Fed. Reg. 18688 (April 19, 1994). Discharges from municipal separate storm sewer systems (MS4s) serving populations of 100,000 or more must have NPDES permits, which can mandate best management practices to reduce discharge of pollutants to the maximum extent practicable. *See* 33 U.S.C. § 1342(p); Ohio Admin. Code 4745-39-04.

[752] *See* OHIO REV. CODE **§** 6111.04(A). See also OHIO REV. CODE **§** 3718.011(A).

[753] *See* OHIO REV. CODE §**§** 6111.07, .99.

criteria, subject to USEPA approval.[754] Ohio currently has no numeric water quality criteria for phosphorus, instead relying exclusively on narrative criteria.

For more than a decade, USEPA has been urging states to develop numeric water quality criteria for nutrients such as phosphorus.[755] Numeric water quality criteria offer several advantages over narrative criteria, which are more subjective, less precise, and more cumbersome to work with. Numeric criteria facilitate identifying impaired waters, developing TMDLs, improving section 319 management plans, setting protective NPDES permit effluent limits, and providing targets for water quality trading programs.[756] Several states recently adopted numeric phosphorus water quality criteria. For example, in 2010, Wisconsin finalized numeric water quality criteria for total phosphorus in lakes, rivers, streams, and nearshore waters of Lake Superior and Lake Michigan.[757]

1. Ohio Department of Natural Resources

Ohio Department of Natural Resources (ODNR) should designate the Maumee River watershed as in distress, pursuant to Ohio Administrative Code 1501:15-5-20.

The chief of the ODNR division of soil and water conservation may designate a watershed to be in distress, thus triggering restrictions on the land application of manure during winter and requirements for manure generators and users to conform to an approved nutrient management plan.[758] ODNR promulgated rules in 2010 to alleviate Harmful Algal Blooms (HABs) problems. Pursuant to this new rule, in January 2011 Grand Lake St. Marys was designated as a distressed watershed in order to reduce HABs.[759] The application of the distressed watershed rules to the Maumee River watershed, identified as the largest contributor of phosphorus to western Lake Erie, should reduce phosphorus pollution and thus inhibit the formation of HABs in Lake Erie.

Among the factors the chief may consider when designating are: whether the watershed is listed as impaired by nutrients or sediments from agricultural sources; waterbodies within the

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[754] USEPA arguably could establish, or could be forced to establish, numeric water quality criteria for phosphorus for Ohio waters if the state fails to do so. Clean Water Act § 303 provides that a state's water quality standards are subject to USEPA approval, and where the state fails to submit adequate standards, USEPA must promulgate water quality standards for that state. 33 U.S.C. §1313(c).

[755] *See* USEPA Office of Water, National Strategy for the Development of Regional Nutrient Criteria 9 (June 1998).

[756] *See* USEPA Office of Water, Memorandum from Benjamin Grumbles, Assistant Administrator, to Directors of State Water Programs re Nutrient Pollution and Numeric Water Quality Standards 2 (May 25, 2007), *available at* http://water.epa.gov/scitech/swguidance/standards/criteria/nutrients/memo2007.cfm.

[757] WIS. ADMIN. CODE NR §102.06..

[758] *See* OHIO ADMIN. CODE 1501:15-5-05(B),1501:15-5-05(C) and 1501:15-5-19. These requirements are stricter than those imposed by Senate Bill 1 of 2015. The application of manure is banned from December 15 to March 1 and is restricted when the ground is frozen, snow-covered, or a ½ inch of precipitation is likely within the next 24 hours. Manure applicators also must follow government-approved standards to minimize pollution. *Id.* 1501-15-5-05. The nutrient management plan contemplates soil testing, best management practices and recordkeeping requirements. *Id.* 1501-15-5-19.

[759] ODNR, *Distressed Watershed Designation Analysis Grand Lake St. Marys Watershed* 15 (Jan. 18, 2011), http://ohiodnr.com/portals/12/water/watershedprograms/GLSM/Distressed_Watershed_Designation_Analysis_Grand_Lake_St_Marys.pdf.

watershed exhibit periodic evidence of HABs; and other unacceptable nuisance conditions exist including the depletion of dissolved oxygen.[760] ODNR can designate a watershed as in distress without needing to issue any new rules, although the Ohio soil and water conservation commission must consent to the designation by majority vote.[761]

ODNR should issue new rules establishing a minimum set of mandatory best management practices (BMPs), applicable to all farming operations, designed to reduce phosphorus pollution to waters of the state.

The chief of the division of soil and water conservation is authorized by ORC § 1511.02(E)(1) to adopt rules establishing "technologically feasible and economically reasonable standards" for management and conservation practices in farming operations that will abate degradation of state waters by residual farm products, manure or soil sediment.[762] However, under current regulations, (except for distressed watersheds) specific pollution-prevention practices are not mandated for farming operations. Rather, specific BMPs must be implemented only after the chief determines that the farmer has caused pollution to waters of the state, the chief advises the farmer of specific BMPs to implement, and the farmer fails to implement the specific BMPs.[763] Requiring specific BMPs would reduce uncertainty in the regulated community, relieve ODNR's burden of establishing BMPs on a case-by-case basis, and reduce phosphorus pollution from agricultural activities.[764]

Contemporaneously, ODNR should also issue a new rule that would allow for streamlined enforcement of generally applicable minimum BMPs. The chief, subject to the approval of the ODNR director, has the statutory power to issue orders requiring compliance with any rule adopted under ORC § 1511.02(E)(1).[765] Section 1511.02(G) also provides that the chief must give each owner or operator an adjudicative hearing before issuing such an order.[766] Enforcement under the current regulations, however, is relatively cumbersome. Currently

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[760] OHIO ADMIN. CODE 1501:15-5-20(A)**.**
[761] *ID*. 1501:15-5-20(C).
[762] OHIO REV. CODE **§** 1511(E)(1).
[763] OHIO ADMIN. CODE 1501:15-5-01 thru -12.
[764] These minimum, mandatory BMPs would not apply to AFOs subject to the permitting requirements of ORC chapter 903 (CAFFs subject to ODA permits) or OEPA (CAFOs subject to NPDES permits). *See* Ohio Admin. Code 1501:15-5-01(B)(4).

Exactly what the mandatory BMPs should be is beyond the scope of this paper. However, generally applicable BMPs for reducing phosphorus pollution could include timing restrictions on the application of manure (e.g., not during the winter, not immediately before predicted precipitation events); limiting the rate of manure to be applied based on soil tests; restricting how close manure may be applied to waters of the state; mandating that manure be incorporated into the soil; prohibiting plowing near waters of the state; and requiring installation and maintenance of buffer strips between crop fields and watercourses. *See, e.g.***,** OHIO ADMIN. CODE 1501:15-5-05(B) (restricting application of manure on frozen or snow-covered ground and during precipitation event for watersheds designated as in distress); Ohio Admin. Code 3745:40-08 (restrictions on land application of biosolids).
[765] OHIO REV. CODE § 1511(G).
[766] *Id.* This is typical under Ohio administrative law. *See* OHIO REV. CODE § 119.06. The Ohio Administrative Procedure Act contemplates a notice setting forth the facts giving rise to the action, the law involved, and the relief sought. *Id.* § 119.07. Following an adjudication hearing, the agency may issue the order. *Id.* § 119.09. A party adversely affected by the order may appeal to a court of common pleas. *Id.* § 119.12.

(with a limited exception for emergency orders),[767] an order can only be issued if an investigation reveals an owner or operator is violating the rules and the owner or operator fails to comply with a voluntary solution.[768] Where the regulations already articulate the BMPs, there is no need to advise the farmers of the BMPs and provide opportunities for voluntary compliance. A rule allowing enforcement of the generally applicable BMPs without such unnecessary preliminary steps should enhance the efficiency and effectiveness of enforcement, which should in turn enhance compliance and reduce phosphorus pollution.

Of course, the General Assembly could enact agricultural BMPs aimed at reducing nutrient pollution. Recently enacted Senate Bill 1 prohibits (with some exceptions) the application of manure in the western basin of Lake Erie on snow-covered, frozen or saturated soil or when precipitation of one-half-inch or more is likely within the next 24 hours.[769] Senate Bill 1 should be viewed as one step toward robust regulation of manure application and the prevention of nutrient runoff from farming operations.

2. Ohio Department of Agriculture

Ohio Department of Agriculture (ODA) should craft strong regulations to carry out the mandate of Senate Bill 150 for a fertilizer applicator certification program.

Enacted in 2014, Senate Bill 150 prohibits anyone from applying fertilizer for the purposes of agricultural production on farms over 50 acres beginning September 2017, unless that person has been certified to do so by the director of agriculture or is acting under the instructions and control of a person who is so certified.[770] The legislation mandates that the director of agriculture adopt rules that create a fertilizer certification program in accordance with the general terms of the law.[771] A certified applicator must comply with these rules.[772] Accordingly, it is up to the ODA to "fill in the gaps" of the statute with rules detailing the certification program, including what the applicators are instructed regarding the time, place, form, and amount of fertilizer to be applied.[773] We note that others have made recommendations that would be a good starting point for these rules, including the "Avoid, Control and Trap" approach recommended by the Ohio Lake Erie Phosphorus Task Force[774] and the "4R Nutrient Stewardship" recommended by the Directors' Agricultural Nutrients and Water Quality Working Group.[775]

[767] OHIO ADMIN. CODE 1501:15-5-16(B)(1).
[768] OHIO ADMIN. CODE 1501:15-5-15(C)-(D).
[769] S.B. 1, 131st General Assembly (2015).
[770] Ohio Rev. Code § 905.321(A).
[771] *Id.* § 905.322(A)-(B).
[772] *Id.* § 905.321(B).
[773] *See id*. § 905.322(A)(1)(a).
[774] *See* Ohio Lake Erie Phosphorus Task Force Final Report II 51-58 (Nov. 2013).
[775] *See* Directors' Agricultural Nutrients and Water Quality Working Group Final Report and Recommendations 4 (March 2012). This working group was established by the directors of the ODA, OEPA and ODNR.

3. Boards of Health

Local boards of health in the Lake Erie basin should more aggressively use their enforcement authority against public nuisance Household Sewage Treatment System (HSTS) that are significantly contributing to phosphorus pollution.

While an HSTS that is discharging into surface waters should be referred to OEPA for enforcement under the NPDES permitting program, an HSTS that is significantly contributing to phosphorus pollution as a nonpoint source should be subject to enforcement by the local board of health. A local board of health is authorized to issue an order to abate a public nuisance being caused by an HSTS. Relief can include repairing the unit to abate the nuisance or replacing the unit with a new HSTS installed in accordance with the requirements of ORC chapter 3718 and the regulations thereunder.

Local boards of health in the Lake Erie basin should consider imposing more stringent standards when permitting the installation, alteration, or operation of HSTS in order to minimize phosphorus pollution.

Pursuant to ORC chapter 3718, the Ohio Department of Health has issued regulations setting statewide standards for the installation, alteration, and operation of an HSTS. But a local board of health may set more stringent standards, subject to the approval of the state department.[776] Boards of health in the Lake Erie basin should consider establishing additional, more stringent standards (for example, siting, effluent quality) that would reduce the potential for nutrient pollution into waters of the state from HSTS.

4. Ohio General Assembly

The Ohio General Assembly should enact legislation: (1) establishing a goal of a 40% reduction in phosphorus loading to Lake Erie from Ohio sources; (2) mandating that OEPA, ODNR and ODA regulate point sources and nonpoint sources in Ohio to achieve the 40% phosphorus loading reduction goal; and (3) providing the agencies with additional statutory authority to regulate key phosphorus sources if necessary.

Experts in Ohio and beyond have recommended that, in order to significantly reduce or eliminate HABs in Lake Erie, phosphorus loading in the western Lake Erie basin should be reduced by approximately 40%.[777] Ohio agencies currently have the authority to regulate key point sources, such as publicly owned treatment works (POTWs) and municipal stormwater, and nonpoint sources, such as agriculture, more rigorously to reduce phosphorus loading. The General Assembly should mandate that Ohio agencies use that authority to reduce phosphorus loading. To the extent Ohio agencies lack the authority, the General Assembly should enact legislation that regulates the key sources directly or authorizes the agencies to regulate them. Additional recommendations for specific legislation by the General Assembly follow.

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[776] *See* Ohio Admin. Code 3701-29-22(c).

[777] Task Force II Report, *supra*, at 31; International Joint Commission, A Balanced Diet for Lake Erie: Reducing Phosphorus Loading and Harmful Algal Blooms 8 (Feb. 2014)..

The Ohio General Assembly should enact legislation restricting the application of phosphorus-containing fertilizer on lawns.

Phosphorus is a significant ingredient in many lawn fertilizer products, and stormwater runoff can carry the phosphorus from lawns into Lake Erie and its tributaries.[778] Phosphorus-free lawn fertilizers are now available.[779] Several states, including Minnesota, Wisconsin, and most recently Michigan, have enacted statutes that largely prohibit the application of fertilizer containing phosphorus to residential and commercial lawns and other types of managed turf such as parks and golf courses.[780] The bans do not extend to agricultural purposes and typically feature a few exceptions. For example, Michigan's new statute allows phosphorus-containing fertilizer to be applied on new lawns in the first growing season; on soil shown by testing within the previous 36 months to be deficient in available phosphorus; and on golf courses whose staff has completed an approved training program regarding BMPs for use of fertilizer containing phosphorus.[781]

The Ohio General Assembly should enact legislation authorizing the regulation of farming operations to abate degradation of waters in the Lake Erie watershed by commercial fertilizer.

Senate Bill 150 of 2014 was a start, establishing a fertilizer applicator certification program. Senate Bill 1 of 2015 will be a good next step, prohibiting the application of fertilizer in the western basin of Lake Erie on snow-covered, frozen or saturated soil or when precipitation of one inch or more is likely within the next 12 hours. Ultimately, more needs to be done to regulate nutrient pollution of agricultural use of commercial fertilizer in the Lake Erie watershed. Ohio agencies have some authority to regulate nutrient pollution from manure under ORC chapters 1511 (Agricultural Pollution Abatement Program) and 903 (Concentrated Animal Feeding Facilities). Similarly, OEPA has some authority to regulate nutrient pollution from biosolids under federal and state law. It is time to authorize an Ohio agency to regulate nutrient pollution from commercial fertilizer by farming operations in the Lake Erie watershed.

The Ohio General Assembly should amend the definition of "concentrated animal feeding facility" (CAFF) under ORC § 903.01 to include medium CAFOs as well as large CAFOs.

CAFFs must, pursuant to ORC §§ 903.02 & .03, obtain and comply with permits to install and to operate. These permits, and accompanying regulations, impose many requirements aimed at preventing manure and other pollutants from entering waters of the state (for example, siting and construction requirements, approved manure management plan, specific BMPs). A CAFF, however, currently is defined by ORC § 903.01(E) as equivalent to a large CAFO (for

[778] *See* Task Force Report, *supra*, at 51-54.
[779] Scotts in 2013 eliminated phosphorus from its law fertilizers sold in Ohio. Task Force Report II, *supra*, at 10.
[780] **MINN. STAT.** §18C.60; **WIS. STAT.** § 94.643; **MICH. COMP. LAWS ANN.** § 324.8512b.
[781] **MICH. COMP. LAWS ANN.** § 324.8512b.

example, 700 or more cows).[782] Animal feeding operations with fewer animals, unless they require a NPDES permit, currently are governed by ORC chapter 1511 and its mostly voluntary provisions administered by ODNR.[783]

Only a small percentage of animal feeding operations in Ohio are permitted under the CWA or ORC chapter 903. These smaller, unpermitted AFOs, because they often lack the engineering and manure storage and handling required of larger permitted CAFOs/CAFFs, are more likely to contribute nutrients to nearby waterways.[784] Revising the definition of CAFF under ORC § 903.01(E) to include medium CAFOs (for example, 200-699 cows)[785] would extend the phosphorus pollution prevention requirements to more AFOs now only applicable to large CAFOs.[786]

[782] **OHIO REV. CODE** § 903.01(E)(defines CAFF as an AFO with a design capacity of at least as many animals as specified at **OHIO REV. CODE** § 903.01(M)(defining large CAFO).
[783] *See* Ohio Admin. Code 1501:15-5-01(B)(4) (2014).
[784] *See* Draft Framework, *supra*, at 32.
[785] *See* OHIO REV. CODE § 903.01(Q) (2014) (defining medium CAFO).
[786] *See* OHIO ADMIN. CODE 901:10-2 (2014).

Appendix A
Acronyms

AFBF American Farm Bureau Federation

AFOs Animal Feeding Operations

BMP Best Management Practice

BPJ Best Professional Judgment

CAFF Concentrated Animal Feeding Facility

CAFO Concentrated Animal Feeding Operation

CBP Chesapeake Bay Program

CELCP Coastal and Estuarine Land Conservation Program

CIG Conservation Innovation Grants

CREP Conservation and Reserve Enhancement Program

CRP Conservation Reserve Program

CSP Conservation Stewardship Program

CWA Clean Water Act or The Act

CWD Cobbossee Watershed District

CWSRF Clean Water State Revolving Fund

DDOE District of Columbia Department of the Environment

DEP Department of Environmental Protection

DHS Department of Homeland Security

DMR Discharge Monitoring Report

DWSRF Drinking Water State Revolving Fund

DNREC Delaware Department of Natural Resources and Environmental Control

DOC Department of Commerce

DOI Department of the Interior

DOD Department of Defense

DOT Department of Transportation

DRP Dissolved Reactive Phosphorus

DSWR Ohio Department of Natural Resources Division of Soil & Water Resources

DWAF Drinking Water Assistance Fund

ECOHAB Ecology and Oceanography for Harmful Algal Blooms

EMC North Carolina Environmental Management Commission

EO Executive Order

EQIP Environmental Quality Incentives Program

FOTG Field Office Technical Guide

FWPCA Federal Water Pollution Control Act

FY Fiscal Year

GAFTLP Grassland Area Farmers Tradable Loads Program

GLNPO Great Lakes National Policy Office

GMRWTP Great Miami River Watershed Trading Program

gpd Gallons Per Day

GRLI Great Lake Restoration Initiative

HABs Harmful Algal Blooms

HSTS Home Sewage Treatment Systems

IJC International Joint Commission

LA Load Allocation

LEA Lake Erie Authority

LAEPP Local Agricultural Easement Purchase Program

LEWPA Lake Erie Water Protection Agency

MPCA Minnesota Pollution Control Agency

MERHAB Monitoring and Event Response for Harmful Algal Blooms

MS4 Municipal Separate Storm Sewer System

NIWQP National Integrated Water Quality Program

NPDES National Pollutant Discharge Elimination System

NOAA National Oceanic & Atmospheric Administration

NYC New York City

ODA Ohio Department of Agriculture

ODNR Ohio Department of Natural Resources

OEPA Ohio Environmental Protection Agency

ORC Ohio Revised Code

PBT Persistent Bioaccumulative Toxins

PCB Polychlorinated Biphenyl

PENNVEST Pennsylvania Infrastructure Investment Authority

PLAC Powers Lake Advisory Committee

POTW Publicly Owned Treatment Works

PTI Permit to Install

PTO Permit to Operate

SMBC Southern Minnesota Beet Cooperative

SPDES State Pollutant Discharge Elimination System

SRC Stormwater Retention Credit

SRC Program Stormwater Retention Credit Trading Program

SWCD Soil and Water Conservation District

SWIF State Water Improvement Fund

SWRV Stormwater Retention Volume

TMACOG The Toledo Metropolitan Area Council of Governments

TMDL Total Maximum Daily Load

TP Total Phosphorus

TSP Technical Service Provider

TVA Tennessee Valley Authority

USDA United States Department of Agriculture

USEPA United States Environmental Protection Agency

USGS United States Geological Survey

UWBDR Upper West Branch of the Delaware River

WFP Whole Farm Plan

WIP Watershed Implementation Plan

WLA Waste Load Allocation

WPCLF Water Pollution Control Loan Fund

WQ Water Quality

WSRLA Water Supply Revolving Loan Account

WWTP Wastewater Treatment Plant

Appendix B
Chesapeake Bay State Specific Nutrient Trading Programs

a. Virginia

In 2005, Virginia enacted Article 4.02 of the Virginia Code, establishing the Virginia Nutrient Credit Exchange Program (Exchange Program).[787] In September 2006, the Virginia State Water Control Board approved final regulations of the Exchange Program.[788] Under Virginia's program, every point source seeking to discharge total nitrogen or total phosphorous must obtain a General Virginia Pollutant Discharge Elimination System Watershed Permit (General Permit). Under the terms of the General Permit, an owner or operator of a facility with a design flow of 40,000 gallons per day or greater must acquire a WLA sufficient to offset new or expanded discharges. A permitted facility may receive a transfer of its discharge allocation when either offsetting new or expanded discharges, or when consolidating two or more existing facilities.[789] Allocations to offset new and increased discharges can be acquired in one of three ways: first, the permit holder may acquire point source nitrogen or point source phosphorous credits from another facility; second, it may acquire nitrogen or phosphorous credits from a nonpoint source; finally, it may pay the Water Quality Improvement Fund for credits.[790]

In the first scenario, a discharger may acquire credits at a 1:1 ratio from another facility that is not making use of its credits.[791] In the second scenario, a facility acquires offsets from an eligible agricultural landowner.[792] In this case, the facility would be subject to a trading ratio of 1:2—this ratio is considered to be an "uncertainty factor" and does not bank credits. In the third scenario, the POTW would pay the Water Quality Improvement Fund $6.04 for each pound of nitrogen and $15.08 per pound of phosphorous needed to offset.[793]

i. Baseline

[787] VA. CODE ANN. § 62.1-44.19:12–23. (2005).
[788] VA. ADMIN. CODE § 25-820-70 (2012).
[789] DEPARTMENT OF ENVIRONMENTAL QUALITY, DIVISION OF WATER QUALITY PROGRAMS, ADDENDUM NO. 1 TO GUIDANCE MEMO NO. 07-2008, AMENDMENT NO. 2 PERMITTING CONSIDERATIONS FOR FACILITIES IN THE CHESAPEAKE BAY WATERSHED (2009) a*vailable at* http://www.deq.virginia.gov/Portals/0/DEQ/Water/PollutionDischargeElimination/GM07-2008.CB_Watershed_Facilities_Pmttg-Amd-2-Add-1.pdf; *see also* VA. ADMIN. CODE § 25-820-10 (excluding "confined animal feeding operations, discharges of stormwater, return flows from irrigated agriculture, or vessels" from the definition of "facility").
[790] VA DEQ, *Guidance Manual for Total Maximum Daily Load Implementation Plans*, (2003), http://www.deq.virginia.gov/Portals/0/DEQ/Water/TMDL/ImplementationPlans/ipguide.pdf.
[791] 9 VA. ADMIN. CODE § 25-820-70(J)(2)(b) (except in trades between the Rappahannock tributary by an Eastern Coastal Basin facility, which require a trading ratio of 1:1.3).
[792] 9 VA. ADMIN. CODE § 25-820-70.II.B.1.b.
[793] *Id.* at (J)(3).

The baseline to establish credits is different between point sources and nonpoint sources. For point sources, the baseline is its assigned WLA. For nonpoint agricultural sources, the baseline is equal to the implementation of five BMPs:

(1) Implementing a soil conservation plan
(2) Implementing a nutrient management plan
(3) Cover cropping (cropland)
(4) Livestock stream exclusion (pasture only)
(5) Installing a riparian buffer of 35 feet[794]

A source may generate credits by reducing nutrient loading beyond the baseline. A point source facility generates credits equal to the difference of its annual WLA and its annual pollution loading stated in the annual report or Discharge Monitoring Report (DMR).[795]

For nonpoint sources, the agricultural landowner can generate credits through either enhancement of BMPs or land conservation.[796] Some examples of enhanced BMPs include the following: (1) planting cover crops at an early planting date, (2) 15% nitrogen application reduction on corn, (3) continuous no-till, (4) land conversion, and (5) a combination of these practices.[797] Virginia has developed a BMP Enhancement and Land Conversion Offsets Calculation Worksheet, which helps to calculate credits for each BMP implemented in each river basin.[798] In order to generate credits through conservation means, a farmer can alter land-uses to reduce nutrients. To generate credits through enhanced BMPs, each enhanced BMP must have a calculated nutrient reduction value. For every acre a farmer employs each BMP, the farmer can generate credits.[799] The farmer would then need to implement the projects and authenticate offsets with the Virginia Department of Environmental Quality (DEQ). Also, Virginia's program prohibits a farmer from generating credits from state or federal cost-share payments.[800] A farmer may only generate credits from using private cost-share payments.

ii. Aggregators

[794] VA. DEP'T OF ENVTL. QUALITY, TRADING NUTRIENT REDUCTIONS FROM NONPOINT SOURCE BEST MANAGEMENT PRACTICES IN THE CHESAPEAKE BAY WATERSHED: GUIDANCE FOR AGRICULTURAL LANDOWNERS AND YOUR POTENTIAL TRADING PARTNERS, 3-5 (2008) *available at* http://www.deq.virginia.gov/Portals/0/DEQ/Water/PollutionDischargeElimination/VANPSTradingManual_2-5-08.pdf.
[795] 9 VA. ADMIN. CODE § 25-820-10.
[796] VA. DEP'T OF ENVTL. QUALITY, TRADING NUTRIENT REDUCTIONS FROM NONPOINT SOURCE BEST MANAGEMENT PRACTICES IN THE CHESAPEAKE BAY WATERSHED: GUIDANCE FOR AGRICULTURAL LANDOWNERS AND YOUR POTENTIAL TRADING PARTNERS, 3–5 (2008) *available at* https://www.google.com/search?q=http%3A%2F%2Fwww.deq.virginia.gov%2FPortals%2F0%2FDEQ%2FWater%2FPollutionDischargeElimination%2FVANPSTradingManual_2-5-08.pdf&ie=utf-8&oe=utf-8&aq=t&rls=org.mozilla:en-US:official&client=firefox-a.
[797] *Id*. at 6.
[798] *Id.* at APP. A.
[799] *See id.* (providing "Conversion Offsets Calculation Worksheets" for each BMP or conservation method).
[800] *Id.* at 5.

Virginia law does not require credit trades to be coordinated by a particular entity.[801] The 2005 law that established nutrient trading created the Exchange Program. The Exchange Program acts as a broker between the buyers and the sellers. "Bilateral trades of compliance credits between two [point source] dischargers are allowed."[802] But, Virginia law requires nonpoint source discharges to work through a third party for trades. This third party must propose sales to the DEQ, and the DEQ must certify all sales for nonpoint source credits.[803] "Once offsets are certified and released for sale, DEQ has no involvement in any agreements between buyers and sellers."[804]

iii. Verification

The DEQ certifies point sources by DMR reports before April 1 of each year. Nonpoint sources may be inspected for verification by the DEQ, the Virginia Department of Conservation and Recreation, or a third party.[805]

iv. Status

In 2013, 20 POTWs participated in Virginia's nutrient trading program. That year, all facilities were able to find sufficient credits to offset and fulfill their permit obligations.[806] The federal government estimates that since its implementation, the Virginia nutrient trading program has saved the state over $1 million. In December 2014, USEPA, the USDA, and the White House Center for Environmental Quality held a press conference to highlight the progress of Virginia's nutrient trading program. There, USEPA Administrator said, "Virginia's nutrient trading program is a strong example of how to create economic opportunity and new income for rural America while protecting and improving local waterways and the Chesapeake Bay."[807]

b. West Virginia

Currently, West Virginia does not have a formal nutrient trading program in place. However, in 2011, West Virginia enacted the Chesapeake Bay Restoration Initiative (the Initiative).[808] In the Initiative, the legislature authorized the establishment of a nutrient trading and offset program.[809] Since the legislature enacted the Initiative, West Virginia submitted its WIP Phase

[801] ENVTL. PROT. AGENCY, VIRGINIA'S TRADING AND OFFSET PROGRAMS REVIEW OBSERVATIONS, 8-9 (2012) *available at* http://www.epa.gov/reg3wapd/pdf/pdf_chesbay/Phase2WIPEvals/Trading_Offsets/VAFinalReport.pdf.
[802] *Id.*
[803] *Id.* at 9.
[804] *Id.* at 10.
[805] *Id.* at 8-9.
[806] VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY, 2013 NUTRIENT TRADES REPORT (2014) *available at* http://www.deq.virginia.gov/Portals/0/DEQ/Water/PollutionDischargeElimination/NutrientTradesReport2013.pdf.
[807] Press Release, EPA, Federal Agencies Support Virginia's Innovative Market-based Approach to Improving Water Quality in Chesapeake Bay (Dec. 16, 2014) *available at* http://yosemite.epa.gov/opa/admpress.nsf/0/AB495CFDDE332C2B85257DB0004FD789
[808] W. VA. CODE § 22-11-30 (2014).
[809] *Id.* at § 22-11-30(e).

II to USEPA.[810] In its WIP Phase II, West Virginia stated that new growth and current loadings do not demonstrate a need for a comprehensive trading program. Although a formal nutrient trading program is not in place, the West Virginia Department of the Environment grants POTW permit holders allocations to offset on a case-by-case basis. USEPA evaluated and approved West Virginia's strategy in 2014, accepting the state's decision to postpone the development of a formal nutrient trading program.[811] By the end of 2015, West Virginia will perform a comprehensive assessment of new growth nutrient loading from the urban stormwater sector.

c. Maryland

Maryland allows nutrient trading to offset new or increased loads. The development of policy and final regulations has been slow. "Maryland has been given $750,000 in federal funds since 2008 to set up its own marketplace for buying and selling nutrient pollution credits."[812] The State of Maryland has also invested a considerable amount of resources into develop a comprehensive nutrient trading program; however, the program is not fully operational and the details of the program are still under review. Currently, the program operates under a 2008 policy document and a draft policy document for point to nonpoint sources.

In 2008, through public participation, Maryland published *Maryland Policy for Nutrient Cap Management and Trading in Maryland's Chesapeake Bay Watershed* (the Policy).[813] Recently, this policy was temporarily removed off the internet for review and updates to ensure consistency with the Bay TMDL and EPA's technical memorandums (TMs). Currently, the Maryland Department of the Environment (MDE) reviews any trading requests on case-by-case basis. Since the Policy's publication, MDE has approved nutrient trading between point sources. But in the last 12-month period, no point source dischargers have requested trades. Only private or public wastewater treatment systems may generate credits.

Maryland will be working this year to further review and propose new strategies.[814] Moving forward, MDE is considering trading as a tool to offset nonpoint source loads associated with new growth. But, a policy involving point to nonpoint source trades has not been finalized. MDE anticipates that a new Cap Management policy will be updated once EPA completes and issues its TMs.

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[810] WEST VIRGINIA WIP DEVELOPMENT TEAM, WEST VIRGINIA'S CHESAPEAKE BAY TMDL FINAL PHASE II WATERSHED IMPLEMENTATION PLAN (2012) *available at* http://www.wvca.us/bay/files/bay_documents/253_WV_WIP_Final-Phase_II_03292012.pdf.

[811] ENVIRONMENTAL PROTECTION AGENCY, EVALUATION OF WEST VIRGINIA'S 2012-2013 AND 2014-2015 MILESTONES, 4 (2014) *available at* http://www.epa.gov/reg3wapd/tmdl/2014Evaluations/WVA.pdf.

[812] Timothy B. Wheeler, *Nutrient Pollution Trading in Limbo in Maryland as it Expands in Virginia*, BALTIMORE SUN, DEC. 16, 2014, http://www.baltimoresun.com/features/green/blog/bal-nutrient-pollution-trading-in-limbo-in-maryland-as-it-expands-in-virginia-20141216-story.html#page=1.

[813] State of Maryland, Maryland's Phase I Watershed Implementation Plan for the Chesapeake Bay total Maximum Daily Load, 3-12 (2010) *available at* http://www.mde.state.md.us/programs/Water/TMDL/TMDLHome/Pages/Final_Bay_WIP_2010.aspx.

[814] Timothy B. Wheeler, *Nutrient Pollution Trading in Limbo in Maryland as it Expands in Virginia*, BALTIMORE SUN, DEC. 16, 2014, http://www.baltimoresun.com/features/green/blog/bal-nutrient-pollution-trading-in-limbo-in-maryland-as-it-expands-in-virginia-20141216-story.html#page=1.

d. Delaware

Currently, the State of Delaware does not have a formal nutrient trading program in place. However, Delaware has been making strides to implement the regulatory foundation needed for some form of a nutrient credit-trading program. Delaware is considering a nutrient credit registry and a small-scale trading program. The State is not interested, at this time, in developing a program that would include the aggregation of BMPs into tradable credits.[815] Delaware only has four point source dischargers within the watershed boundary—three of which are well within their NPDES permit requirements.[816] Therefore, Delaware has decided that a complex trading program is not the most effective tool to reduce nutrient load.

Nevertheless, the State has moved forward by amending two of its environmental regulations and allowing permit holders to meet requirements through offsets, rather than tradable credits. First, in January 2014, Delaware amended its on-site wastewater treatment regulations.[817] Now, when a permit holder cannot meet performance standards, it may compensate for the loading through obtaining an offset subject to the Delaware Department of Natural Resources and Environmental Control (DNREC) approval.[818]

Also, in November 2014, Delaware amended its sediment and stormwater regulations to provide the option of offsets in order to comply with stormwater permit requirements.[819] An offset may be in the form of "trading, retrofitting previously unmanaged sites, mitigation, construction of off-site management measures, banking," or fees-in-lieu.[820] All offsets are subject to DNREC approval. Under Delaware procedures for fee-in-lieu offsets, the owner will pay a "fee-in-lieu in the amount of $18.00 per cubic foot of volume of runoff that is not able to be reduced or managed."[821] The permit holder may also install other water treatment practices in order to reduce offset fee-in-lieu.

According to USEPA, Delaware's sector tracking system, which monitors distinct categories of point and nonpoint sources, is the nutrient reduction program's most significant

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[815] *See* ENVTL. PROT. AGENCY, DELAWARE'S TRADING AND OFFSET PROGRAMS REVIEW OBSERVATIONS, 5 (2012) ("The program Delaware is contemplating includes a credit registry and the potential for exchanging credits but will not be a full-blown trading program that includes the aggregation of BMPs into tradable credits, like Pennsylvania's program.") *available at* http://www.epa.gov/reg3wapd/pdf/pdf_chesbay/Phase2WIPEvals/Trading_Offsets/DEFinalReport.pdf.

[816] DELAWARE'S CHESAPEAKE INTERAGENCY WORKGROUP, DELAWARE'S PHASE II CHESAPEAKE BAY WATERSHED IMPLEMENTATION PLAN, 140 (2012) *available at* http://www.dnrec.delaware.gov/swc/wa/Pages/DE-WIP-Phase-II-Info.aspx

[817] 7-1000-7101 DEL. ADMIN. CODE § 1.0 *et. seq. available at* http://www.dnrec.delaware.gov/wr/Information/GWDInfo/Documents/DelawareFinalOnSiteRegulations_01112014.pdf.

[818] *Id.* at § 3.16.

[819] 7-5000-5101 DEL. ADMIN. CODE § 1.0 *et. seq. available at* http://regulations.delaware.gov/AdminCode/title7/5000/5101.pdf.

[820] DELAWARE SEDIMENT AND STORMWATER PROGRAM, TECHNICAL DOCUMENT: ARTICLE 2 POLICIES AND PROCEDURE, 2.04 (2014) *available at* http://www.dnrec.delaware.gov/swc/Drainage/Documents/Sediment%20and%20Stormwater%20Program/Technical%20Document/Latest%20Version%20of%20all%20Articles/2.0%20Article%202%20Policies%20and%20Procedures.pdf.

[821] *Id.*

weakness.[822] As a result of USEPA's assessment of 2014, Delaware must develop a better system to determine whether sector loads within its boundary of the Bay are increasing. Delaware must either make improvements to its current system or develop a new system by December 31, 2015.

e. District of Columbia

Unlike the other jurisdictions that trade nutrient credits, the District of Columbia (the District) employs a trading scheme to reduce its load contribution for only the urban stormwater source sector. In July 2013, the District of Columbia Department of the Environment (DDOE) published its final rule regarding stormwater and established the Stormwater Retention Credit Trading Program (SRC Program).[823] Under the SRC Program, a regulated site may meet a portion of its required stormwater retention volume (SWRV) through off-site retention or offsets. The regulated site has two options for off-site retention: (1) use of Stormwater Retention Credits (SRCs) or (2) pay a fee-in-lieu to the District. In September 2014, the DDOE approved its first and only trade of 11,013 SRCs, valued at $25,000.[824]

The District takes a retention-based approach to achieve its source sector allocations. Under the District's system, stormwater regulations require properties undergoing major development or redevelopment to employ BMPs to meet a minimum SWRV. Two types of projects are required to obtain SWRVs: "Major Land Disturbing Activities" and "Major Substantial Improvement Activities." Major Land Disturbing Activities ("[s]ites that disturb 5,000 square feet or more of land area") must retain stormwater volumes attributable to 1.2 inches of rainfall.[825] Major Substantial Improvement Activities are defined as "[r]enovation projects in existing structures with a combined footprint of 5,000 square feet for which the project costs exceed 50 percent of the structure's assessed value."[826] These sites must retain stormwater volumes attributable to 0.8 inches of rainfall.

One SRC is equal to one gallon of retention for one year. One SRC may be used by a major regulated project to achieve one gallon of its off-site retention volume for one year. DDOE does not certify credits for a retention capacity greater than 1.7 inches in a rainfall event; this restriction is known the "SRC Ceiling."[827]

Regulated and unregulated activities may generate SRC credits. Regulated activities may generate credits when an activity achieves the retention volume in excess of regulatory

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[822] ENVIRONMENTAL PROTECTION AGENCY, EVALUATION OF DELAWARE'S 2012-2013 AND 2014-2015 MILESTONES, 5 (2014) available at http://www.epa.gov/reg3wapd/tmdl/2014Evaluations/DE.pdf.
[823] 21 D.C. CODE MUN. REGS. §§ 500–599 (LexisNexis) *available at* http://green.dc.gov/sites/default/files/dc/sites/ddoe/page_content/attachments/2013%20SW%20Rule.pdf
[824] Press Release, Dist. Dep't of the Env't, DDOE Approve First Stormwater Retention Credit Trade (Sept. 19, 2014) *available at* http://ddoe.dc.gov/release/ddoe-approves-first-stormwater-retention-credit-trade.
[825] 21 D.C. CODE MUN. REGS. § 500.3.
[826] *Id.* at § 599.
[827] DIST.DEP'T OF THE ENVT., WATERSHED PROT. DIV., STORMWATER MANAGEMENT GUIDEBOOK 300 (2013) *available at* http://ddoe.dc.gov/sites/default/files/dc/sites/ddoe/page_content/attachments/FinalGuidebook_changes%20accepted_Chapters%201-7_07_29_2013_compressed.pdf.

requirements, but less than the SRC Ceiling. Unregulated projects can generate credits when an activity achieves the retention volume in excess of pre-project retention but less than the SRC Ceiling. Once a project achieves the minimum retention value, the project can employ a series of BMPs to reduce the site's nutrient loading and generate credits.

To generate credits, an applicant installs BMPs that the District has pre-approved. Then, the DDOE conducts a post-construction inspection. Next, the permit holder signs a statement swearing to maintain the retention capacity for the credit's lifetime. Finally, the DDOE accepts the application for certification of SRCs. The DDOE publishes all approved SRCs in the *D.C. Register*.[828]

DDOE will certify up to three years' worth of SRCs. At the end of the three-year period the owner can apply for another three years' worth of SRCs. Buyers and sellers of SRCs can post their offers online at *https://octo.quickbase.com/db/biqiykw8u?a=showpage&pageid=83.* An application for sale must be submitted to DDOE. DDOE approves all transfers of sale.

f. New York

New York does not have a nutrient trading program in place; however, the State has the authority to develop a nutrient trading program for point source to point source trading.[829] Previous nutrient loading studies have not demonstrated the need for a comprehensive trading program.[830] New York relied on a conclusion by the CBP and the USDA that "the small additional loads expected in the urban stormwater will be more than compensated for by load reduction resulting from predicted decreases in the numbers of farm animals and acreage."[831] USEPA requests that New York report annually on whether loads are growing, and if evidence reveals that they are, New York will be required to develop a sector tracking and accountability program. Further, in order for New York to develop a nutrient credit trading program, the New York Department of Environmental Conservation (DEC) will need to amend the SPDES permit program and the State will need to contribute funding for the program's implementation.

This year, New York issued an aggregate permit with nitrogen effluent limits. New York regulations prohibit wasteload allocations for new or expanded discharges from sewage treatment facilities of any size.[832] The regulations prescribe that any new or expanded discharges must be offset. This aggregate permit, also known as a "bubble permit," limits nitrogen loading from "Bay-significant wastewater treatment plants" (including commercial

[828] 21 D.C. CODE MUN. REGS. § 522.4.
[829] ENVTL. PROT. AGENCY, NEW YORK'S TRADING AND OFFSET PROGRAMS REVIEW OBSERVATIONS 3 (2012), *available at* http://www.epa.gov/reg3wapd/pdf/pdf_chesbay/Phase2WIPEvals/Trading_Offsets/NYFinalReport.pdf.
[830] ENVTL. PROT. AGENCY, EVALUATION OF NEW YORK'S 2012–2013 AND 2014–2015 MILESTONES 4 (2014), *available at* http://www.epa.gov/reg3wapd/tmdl/2014Evaluations/NY.pdf.
[831] *Id.*
[832] N.Y. STATE DEP'T OF ENVTL. CONSERVATION, FINAL PHASE II WATERSHED IMPLEMENTATION PLAN 124 (2012), *available at* http://www.dec.ny.gov/docs/water_pdf/finalphaseiiwip.pdf; N.Y. COMP. CODES R. & REGS. tit. 6, § 750-1.18(b)(4) (2015).

and public wastewater treatment facilities, with one specific exemption).[833] Under this program, the DEC sets nitrogen loading limits for each permit holder of a commercial or public wastewater treatment facility. The DEC states "the idea behind the bubble permit concept is that discharges from facilities are aggregated so that excess load from one facility can potentially be offset by other facilities provided those facilities achieve better than required pollutant removal during that respective month, or running 12-month period."[834] Each month the DEC reviews the loading of all permit holders within the "bubble." When the "bubble bursts" because the total loading exceeds the aggregate limit, the facility responsible for bursting the bubble is fined or penalized. By 2017, all wastewater treatment plants will meet permitted nitrogen levels that are consistent with 2017 targets.[835]

g. Pennsylvania

In October 2010, the Commonwealth of Pennsylvania published its nutrient trading regulations and established the Pennsylvania Nutrient Credit Trading Program.[836] The regulations authorize point sources and nonpoint sources to generate credits for phosphorous and nitrogen. Under the Program, point sources may trade with other point source facilities or with eligible nonpoint source landowners. The scope of the trading program includes two basins: The Potomac River Basin and the Susquehanna River Basin. Credits and offsets may only be utilized in the basin in which they are generated.

i. Baseline

Generally, an owner or operator may generate credits once a minimum pollutant loading is achieved. The baselines for point sources and nonpoint sources are different. For point sources, the baseline equals the pollutant effluent load included in the facility's NPDES permit and additional regulations.[837] For nonpoint agricultural sources, the baseline includes: (1) compliance with the erosion and sedimentation requirements for agricultural operations, (2) the requirements for agricultural operations under § 91.36 (relating to pollution control and prevention at agricultural operations), (3) the requirements under § 92a.29 (relating to CAFO) and (4) the requirements for agricultural operations under Chapter 83, Subchapter D (relating to nutrient management), as applicable.[838]

ii. Credit Generation

In addition to baseline requirements, agricultural operations must meet a "threshold requirement," which consists of implementing one of three specified BMPs.[839] A permit holder may only generate credits once baseline and threshold requirements are met.[840]

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[833] N.Y. STATE DEP'T OF ENVTL. CONSERVATION, FINAL PHASE II WATERSHED IMPLEMENTATION PLAN 102, 104–105 n.48 (2012) *available at* http://www.dec.ny.gov/docs/water_pdf/finalphaseiiwip.pdf.
[834] *Id.*
[835] ENVL. PROT. AGENCY, EVALUATION OF NEW YORK'S 2012–2013 AND 2014–2015 MILESTONES 3–4 (2014) *available at* http://www.epa.gov/reg3wapd/tmdl/2014Evaluations/NY.pdf.
[836] 25 PA. CODE § 96.8.
[837] 25 PA. CODE § 96.8(d)(2)(i).
[838] 25 PA. CODE § 96.8(d)(2).
[839] 25 PA. CODE § 96.8(d)(3) (listing the three threshold BMPs: (A) "Manure is not mechanically applied within 100 feet" of a waterbody; (B) "A minimum 35 feet of permanent vegetation is established and maintained

Credits are generated according to a model that assumes that the landowner is in full compliance with both requirements. Credit calculation considers quantity of fertilizer applied, time of fertilizer application, amount and type of crop yield, and other factors. The Commonwealth provides a website to calculate credit generation.[841]

For point sources, the facility must "treat at a level that exceeds the requirement stated in the NPDES permit."[842] The credit calculation consists of the difference between the treatment level according to the DMR and the permit limit. The Pennsylvania Department of Environmental Protection (DEP) must certify all credit-generating activities. The term of certification is five years, unless expressly stated otherwise, and credits cannot be banked for future years.

iii. Aggregator

The Clearinghouse maintained by Pennsylvania Infrastructure Investment Authority (PENNVEST) is the prominent venue for nutrient credit trades. The Clearinghouse facilitates each trade "by acting as the buyer to each seller trading in the exchange and the seller to each buyer trading in the exchange."[843] Trades by PENNVEST and any other credit aggregator must comply with all requirements of the nutrient credit trading law.[844]

iv. Ratio

A trading ratio is the proportion of credits that must be traded from one sector source or tributary to another. Pennsylvania itself does not employ a specific trading ratio, but the ratio is generally 1:1 (meaning one credit of nitrogen from "point source A" for one credit of nitrogen from "point source B").[845] A reserve ratio also applies to all transactions: the credit

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between" the agricultural field and a waterbody; (C) "The applicant applies an adjustment of at least 20% to the overall amount of the pollutant reduction generated by the pollutant reduction activity the person is submitting for certification.").

[840] ENVTL. PROT. AGENCY, PENNSYLVANIA'S TRADING AND OFFSET PROGRAMS REVIEW OBSERVATIONS 14 (2012), *available at* http://www.epa.gov/reg3wapd/pdf/pdf_chesbay/Phase2WIPEvals/Trading_Offsets/PAFinalReport.pdf.

[841] Pa. Dep't of Envtl. Prot., *Credit Generation Process*, http://www.portal.state.pa.us/portal/server.pt/community/nutrient_trading/21451/credit_generation_process/1548036 (last visited Apr. 10, 2015).

[842] PA. DEP'T OF ENVTL. PROT., NUTRIENT TRADING CRITERIA SPECIFIC FOR THE CHESAPEAKE BAY WATERSHED 5 (2006), *available at* http://files.dep.state.pa.us/Water/Chesapeake%20Bay%20Program/lib/chesapeake/15nov2006/appendix_a__11-15_.pdf.

[843] PENNVEST, PENNVEST NUTRIENT CREDIT CLEARINGHOUSE RULEBOOK 4 (2015), *available at* http://www.portal.state.pa.us/portal/server.pt/document/1426849/pennvest_nutrient_credit_clearinghouse_rulebook_version_7_pdf.

[844] ENVTL. PROT. AGENCY, PENNSYLVANIA'S TRADING AND OFFSET PROGRAMS REVIEW OBSERVATIONS 13 (2012), *available at* http://www.epa.gov/reg3wapd/pdf/pdf_chesbay/Phase2WIPEvals/Trading_Offsets/PAFinalReport.pdf ("the generation and use of credits must fall under 25 Pa. Code § 96.8").

[845] *Id*.

calculation requires 10% of credits to be set aside in a credit reserve.[846] In addition, DEP reserves the authority to alter the ratio in order to account for factors such as location, reserve, uncertainty, or special needs.[847] One type of ratio is called a "delivery ratio": a diminution of the nutrient reductions allowed due to the distance between the two locations.

v. Verification

A facility's request for certification must include a verification plan, which must lay out how DEP will verify the pollution reduction activity.[848] Also, the plan must include a means for either self-verification or third-party verification. The guidelines state that the verification process may require a site visit.

vi. Status

In 2014, a total of 1,889,079 nitrogen and 109,791 phosphorus credits were verified, of which 803,685 nitrogen and 85,079 phosphorus credits were registered and sold.[849] Three scheduled auctions were held and one spot auction took place.[850] The price of nitrogen credits ranged from $1.15 to $2.50 per credit. The price of phosphorous credits ranged from $2.50 to $2.51 per credit.

In 2014, USEPA rejected Pennsylvania's agriculture trading baseline, stating that it was inconsistent with the Bay TMDL.[851] USEPA will offer alternative language to address its concerns, and expects EPA to develop a new agricultural baseline by 2015.[852]

[846] 25 PA. CODE § 96.8(e)(3)(v).
[847] 25 PA. CODE§ 96.8(e)(3)(vi).
[848] 25 PA. CODE§ 96.8(e)(5).
[849] PA. DEP'T OF ENVT. PROT., PA 2014-2015 PROGRAMMATIC MILESTONES 15 (2015), *available at* http://www.dep.state.pa.us/river/iwo/chesbay/docs/PA2014-2015ProgrammaticMilestonesSTATUSREPORT1-13-15.pdf.
[850] *Id.*
[851] ENVTL. PROT. AGENCY, EVALUATION OF PENNSYLVANIA'S 2012-2013 AND 2014-2015 MILESTONES 6 (2014), *available at* http://www.epa.gov/reg3wapd/tmdl/2014Evaluations/PA.pdf.
[852] *Id.*

Appendix C
Source List of Sources

- *2014 Farm Bill, Environmental Quality Incentives Program*, U.S. DEP'T OF AGRIC., http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/financial/eqip/?cid=stelprdb1242633 (last visited Apr. 9, 2015).

- 72 Am. Jur. 2d *States, Territories and Dependencies* § 10 (2003).

- A. Michael Froomkin, *Reinventing the Government Corporation*, 1995 U. Ill. L. Rev. 543 (1995).

- *About Us,* LAKE ERIE WATERKEEPER, http://www.lakeeriewaterkeeper.org/about-us/ (last visited Feb. 23, 2015).

- Anderson et al., *Harmful Algal Blooms and Eutrophication; Nutrient Sources, Composition, and Consequences*, 25 ESTUARIES 704 (2002).

- Anna M. Michalak et al., *Record-setting Algal Bloom in Lake Erie Caused by Agricultural and Meterological Trends Consistent with Expected Future Conditions*, 110 PROCEEDINGS OF THE NAT'L ACAD. OF SCI. 6448 (2013).

- Annabelle Klopman, *An Undercurrent of Discontent: The Chesapeake Bay Total Maximum Daily Load and its Impact on Bay Industries* 24, VILL. ENVTL. L.J. 97 (2013).

- Backer et al., *Recreational Exposure to Low Concentration of Microcystins During an Algal Bloom in a Small Lake*, 6 MARINE DRUGS SP. ED. MARINE TOXINS 389 (2008).

- *Background, Organization and Road To Development*, COUNCIL OF GREAT LAKES GOVERNORS http://cglg.org/media/1311/project_background_organization_and_road_to_development.pdf (last visited Apr. 10, 2015).

- *Basic Information: What is a "Mixing Zone"?,* U.S. ENVTL. PROT. AGENCY, http://water.epa.gov/scitech/swguidance/standards/mixingzones/about.cfm.

- Bill Wolf, *These Southerners Just Love Yankees*, SATURDAY EVENING POST, Sept. 5, 1953.

- Bryon Shaw et al., *Understanding Lake Data*, BOARD OF REGENTS OF THE UNIVERSITY OF WISCONSIN SYSTEM (2004), http://www3.uwsp.edu/cnr-ap/weal/Documents/G3582.pdf.

- *California: Grassland Bypass Project: Economic Incentives Program Helps to Improve Water Quality*, U.S. ENVTL. PROT. AGENCY (last updated Aug. 31, 2012), http://water.epa.gov/polwaste/nps/success319/Section319III_CA.cfm.

- *Catalog of Federal Funding Sources for Watershed Protection: Nonpoint Source Implementation Grants (319 Program),* U.S. ENVTL. PROT. AGENCY (last updated Apr. 9, 2015), https://ofmpub.epa.gov/apex/watershedfunding/f?p=109:2:0::NO::P2_X_PROG_NUM,P2_X_YEAR:44,2014.

- *Clean Ohio Local Agricultural Easement Purchase Program (LAEPP)*, OHIO DEP'T OF AGRIC., FARMLAND PRESERVATION, http://www.agri.ohio.gov/divs/farmland/Farm_AEPP.aspx (last visited Apr. 9, 2015).

- *Climate Change in the Great Lakes Region*, GREAT LAKES INTEGRATED SCIENCE ASSESSMENTS (2014), http://glisa.umich.edu/media/files/GLISA_climate_change_summary.pdf.

- Clinton T. Brass et al., Cong. Research Serv., RL30795, *General Management Laws: A Compendium* 198.

- *Coastal and Estuarine Land Conservation Program*, NAT'L OCEANIC & ATMOSPHERIC ADMIN., OFFICE FOR COASTAL MGMT., http://coast.noaa.gov/czm/landconservation/?redirect=301ocm (last visited Apr. 9, 2015).

- Comment, *The Tennessee Valley Authority Act* 43 Yale L.J. 815 (1934); *From the New Deal to a New Century*, TENN. VALLEY AUTHORITY, www.tva.com/abouttva/history.htm (last visited Feb. 10, 2015).

- Congressional Digest, *The Dixon-Yates Controversy: The Tennessee Valley Authority*, Cong. Dig., Jan. 1955.

- *Conservation Innovation Grants*, U.S. DEP'T OF AGRIC., NATURAL RES. CONSERVATION SERV., http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/cig/ (last visited Apr. 8, 2015).

- *Conservation Reserve Enhancement Program*, U.S. DEP'T OF AGRIC., FARM SERV. BUREAU (last updated May 13, 2013), http://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=cep.

- Corey Longhurst, *Where is the Point? Water Quality Trading's Inability to Deal with Nonpoint Source Agricultural Pollution*, 17 DRAKE J. AGRIC. L. 175 (2012).

- *Current State of Harmful Algal Bloom Impacts on Michigan Drinking Water Supplies*, MICH. DEP'T OF ENVTL. QUALITY (2014), *available at* http://www.michigan.gov/documents/deq/deq-odwma-water-cdw-HAB_Impacts_467739_7.pdf.

- *Cyanobacteria and Cyanotoxins: Information for Drinking Water Systems*, U.S. EPA OFFICE OF WATER (July 2009), http://water.epa.gov/scitech/swguidance/standards/criteria/nutrients/upload/cyanobacteria_factsheet.pdf.

- Darryl Fears, *Leaders of Chesapeake Bay States and the District Sign New Pact to Improve Bay's Health,* WASH POST (June 16, 2014), http://www.washingtonpost.com/national/health-science/leaders-of-chesapeake-bay-states-and-the-district-sign-new-pact-to-improve-bays-health/2014/06/16/a51d1572-f576-11e3-a3a5-42be35962a52_story.html.

- David Newburn & Richard Woodword, *An Ex Post Evaluation of Ohio's Great Miami Water Quality Trading Program*,48 J. OF THE AM. WATER RES. ASS'N 156 (2012), *available at* http://newserver.miamiconservancy.org/water/documents/NewburnandWoodward.ExpostEvaluation.pdf.

- DELAWARE RIVER BASIN COMM'N, COMPREHENSIVE PLAN (2001), *available at* http://www.state.nj.us/drbc/library/documents/comprehensive_plan.pdf.

- *Division of Surface Water – About Us*, OHIO ENVTL. PROTECTION AGENCY, http://epa.ohio.gov/home.aspx (last visited Apr. (2015).

- *Drinking Water State Revolving Fund (DWSRF)*, U.S. ENVTL. PROT. AGENCY (last updated Apr. 1, 2015), http://water.epa.gov/grants_funding/dwsrf/.

- *Energy,* TENN. VALLEY AUTHORITY, http://www.tva.com/power/index.htm (last visited Feb. 12, 2015) (TVA operates 29 hydroelectric dams, 11 coal-fired plants, and 3 nuclear power plants).

- *Eutrophication,* U.S. GEOLOGIC SURVEY (last updated June 2, 2014), http://toxics.usgs.gov/definitions/eutrophication.html.

- *Fact Sheet: Multimedia Strategy For Priority Persistent, Bioaccumulative, and Toxic (PBT) Chemicals,* U.S. ENVTL. PROT. AGENCY (last updated Apr. 18, 2011), http://www.epa.gov/pbt/pubs/fact.htm.

- Feng Fang et al., *Point-Nonpoint Source Water Quality Trading: A Case Study in the Minnesota River Basin*, 41 J. OF THE AM. WATER RES. ASS'N 645 (2006) *available at* http://facultypages.morris.umn.edu/~kildegac/Courses/Enviro/papers/fang%20et%20al.pdf; U.S. Dep't of Agric.

- *Final Policy On Nutrient Trading,* U.S. ENVTL. PROT. AGENCY (Jan. 13, 2013), http://water.epa.gov/type/watersheds/trading/finalpolicy2003.cfm.

- *Financial Assistance*, OHIO ENVTL. PROT. AGENCY, http://epa.ohio.gov/ddagw/financialassistance.aspx (last visited Apr. 9, 2015).

- *Frequent Questions: Nutrient Criteria Implementation,* U.S. ENVTL. PROT. AGENCY (last updated Aug. 7, 2014), http://www2.epa.gov/nutrient-policy-data/frequent-questions-nutrient-criteria-implementation.

- *From the New Deal to a New Century*, TENN. VALLEY AUTHORITY, www.tva.com/abouttva/history.htm (last visited Feb. 10, 2015).

- G.W. Kling et al., *Confronting Climate Change in the Great Lakes Region: Impacts on our Communities and Ecosystems*, UNION OF CONCERNED SCIENTISTS & THE ECOLOGICAL SOCIETY OF AMERICA (2003) *available at* http://www.ucsusa.org/sites/default/files/legacy/assets/documents/global_warming/greatlakes_final.pdf?_ga=1.90401946.128942933.1428695818.

- George E. Webb, *Journal of The Tennessee Academy of Science and the Scopes Trial*, 87 J. of the Tenn. Acad. of Science 97 (2012).

- Gertrud K. Nürnberg, *Quantified Hypoxia and Anoxia in Lakes and Reservoirs*, 4 SCI. WORLD J. 42 (2004).

- Gilbert et al., *The Global, Complex Phenomena of Harmful Algal Blooms*, 18 OCEANOGRAPHY 136 (2005).

- Gina M. Zawitoski, *Restoring Chesapeake Bay Water Quality Through TMDL,* 44 FEB. MD B.J. 24 (2011).

- *Global Climate Change Impacts in the United States*, U.S. GLOBAL CHANGE RESEARCH PROGRAM (2009), http://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf.

- *Great Lakes Area of Concern: Maumee River*, U.S. ENVTL. PROTECTION AGENCY, http://www.epa.gov/greatlakes/aoc/maumee/ (last updated June 18, 2013).

- GREAT LAKES AREAS OF CONCERN LAND ACQUISITION GRANTS, OHIO DEP'T OF NATURAL RES. (2015), *available at* http://coastal.ohiodnr.gov/portals/coastal/grantdocs/AOC/AOC_FY15_Factsheet.pdf.

- *Great Lakes Restoration Action Plan*, GREAT LAKES RESTORATION, http://glri.us/actionplan/index.html (last visited Apr. 10, 2015).

- *Great Lakes Restoration Initiative,* U.S. ENVTL. PROT. AGENCY (last updated Oct. 20, 2014), http://www.epa.gov/greatlakes/glri/.

- *Great Lakes Sediment and Nutrient Reduction Program*, GREAT LAKES COMMN. http://keepingitontheland.net/ (last visited Apr. 8, 2015).

- Great Lakes–St. Lawrence River Basin Water Resources Compact § 8.5.

- Guntram Weithoff et al., *Effects on Water-column Mixing on Bacteria, Phytoplankton and Rotifers Under Different Levels of Herbivory in a Shallow Eutrophic Lake,* 125 OECOLOGIA 91 (2000).

- *HABHRCA*, NAT'L OCEANIC & ATMOSPHERIC ADMIN., CTR. FOR SPONSORED COASTAL OCEAN RESEARCH (last updated Feb. 16, 2011), http://www.cop.noaa.gov/stressors/extremeevents/Hab/habhrca/default.aspx.

- HANNA L. BREETZ ET AL., WATER QUALITY TRADING AND OFFSET INITIATIVES IN THE U.S.: A COMPREHENSIVE SURVEY (2004), *available at* http://www.cbd.int/financial/pes/usa-peswatersurvey.pdf.

- *Healthy Niagara: Niagara River Watershed Management Plan*, BUFFALO NIAGARA RIVERKEEPER (2009), http://bnriverkeeper.org/wp-content/uploads/2009/11/Chapter-4-Water-Quality-FINAL.pdf.

- *Hearing Before S. Comm. On Water and Wildlife and Comm. on Environment and Public Works*, (2013)(testimony of Michael H. Shapiro, Principal Deputy Assistant Administrator for Water at the US EPA) *available at* http://www.epa.gov/ocir/hearings/pdf/nutrient_trading_and_water_quality.pdf.

- Howell & Lewis, *Agencies by Presidential Design*, 64 J. OF POLITICS 1095 (2002).
- *Impacts on Climate Change on the Occurrence of Harmful Algal Blooms*, U.S. Envtl. Protection Agency, (May 2013), http://www2.epa.gov/sites/production/files/documents/climatehabs.pdf
- International Joint Commission, *A Balanced Diet for Lake Erie: Reducing Phosphorus Loadings and Harmful Algal Blooms, Report of the Lake Erie Ecosystem Priority* (2014), *available at* http://www.ijc.org/files/publications/2014%20IJC%20LEEP%20REPORT.pdf.
- INTERNATIONAL JOINT COMMISSION, A BALANCED DIET FOR LAKE ERIE: REDUCING PHOSPHORUS LOADINGS AND HARMFUL ALGAL BLOOMS (Feb. 2014).
- *Introduction*, U.S. ENVTL. PROTECTION AGENCY, http://water.epa.gov/polwaste/wastewater/treatment/biosolids/ (last updated July 22, 2014).
- J. RASBAND, J. SALZMAN & M. SQUILLACE, NATURAL RESOURCES LAW AND POLICY (2d ed. 2009).
- James Shortle, *Economics and Environmental Markets: Lessons from Water Quality Trading*, 42 AGRIC. AND RES. ECON. REV. 57 (2013) available at http://ageconsearch.umn.edu/bitstream/148400/2/ARER%202013%2042x1%20Shortle
- Jeffrey A. Andresen, *Historical Climate Trends*, *in* CLIMATE CHANGE IN THE GREAT LAKES REGION: NAVIGATING AN UNCERTAIN FUTURE, 19 (Thomas Dietz & David Bidwell eds. 2012).
- JEFFREY G. MILLER, ANN POWERS AND NANCY LONG ELDER, INTRODUCTION TO ENVIRONMENTAL LAW CASES AND MATERIALS ON WATER POLLUTION CONTROL (2008).
- Jessica A. Bielecki, *Managing Resources With Interstate Compacts: A Perspective from the Great Lakes,* 14 BUFF. ENVTL. L.J. 173 (2007).
- John C. Duncan, *A Critical Consideration of Executive Orders: Glimmerings of Autopoiesis in the Executive Role*, 35 VT. L. REV. 333 (2010).
- John Heisler et al., *Eutrophication and Harmful Algal Blooms: A Scientific Consensus* 8 HARMFUL ALGAE 3 (2008).

- Juli D. Bressie, *Drinking Water as Route of Exposure to Microystins in Great Lakes Communitities*, NAT'L OCEANIC AND ATMOSPHERIC ADMIN., http://www.glerl.noaa.gov/pubs/annual/2009/2009-03.pdf (last visited Apr. 10, 2015), http://www.glerl.noaa.gov/res/Task_rpts/2009/epdyble06-1.html.

- Karen Fisher Vanden & Sheila Olmstead, *Moving Pollution Trading from Air to Water: Potential, Problems, and Prognosis,* 27 J. ECON. PERSP., 147 (2013) *available at* http://pubs.aeaweb.org/doi/pdfplus/10.1257/jep.27.1.147.

- Kelly E. Arbuckle and John A. Downing, *The Influence of Watershed Land Use of Lake N: P in a Predominantly Agricultural Landscape,* 46 LIMNOLOGY & OCEANOGRAPHY 970 (2001).

- Kenneth Murchison, *Learning From More Than Five-and-a-Half Decades of Federal Water Pollution Control Legislation: Twenty Lessons for the Future*, 32 B.C. Envtl. Aff. L. Rev. 527 (2005).

- Kevin M. Stack, *The Statutory President*, 90 IOWA L. REV. 539, 550 (2005).

- Kevin R. Kosar, Cong. Research Serv., RL30365, *Federal Government Corporations: An Overview* 2.

- L. BRESSMAN, E. RUBIN & K. STACK, THE REGULATORY STATE (2010).

- *Lake Erie Binational Site: A Primer on Phosphorus in Lake Erie*, ENVIRONMENTAL PROTECTION AGENCY, http://www.epa.gov/greatlakes/lakeerie/primer.html (last updated July 2, 2012).

- *Lake Erie Protection Fund*, OHIO LAKE ERIE COMM'N, http://lakeerie.ohio.gov/LakeErieProtectionFund.aspx (last visited Apr. 9, 2015).

- *Lake Erie*, U.S. ENVTL. PROTECTION AGENCY, http://www.epa.gov/greatlakes/lakeerie/ (last updated Mar. 27, 2015).

- *Lake Stratification and Mixing*, U.S. ENVTL. PROTECTION AGENCY, http://www.epa.state.il.us/water/conservation/lake-notes/lake-stratification-and-mixing/lake-stratification.pdf.

- Lara Guercio, *The Struggle Between Man and Nature – Agriculture, Nonpoint Source Pollution, and Clean Water: How To Implement the State of Vermont's Phosphorus TMDL Within the Lake Champlain Basin*, 12 Vt. J. Envtl. L. 455 (2011).

- Lauren Lindstrom, *Gov. Kasich Signs Algae Bill Into Law*, TOLEDO BLADE, April 3, 2015, http://www.toledoblade.com/Politics/2015/04/03/Governor-signs-algae-bill-into-law.html (noting that Senate Bill 1 takes effect 90 days after its signing, i.e., July 1, 2015).

- *List of Section 208 Plan Material for Certification-Final May 2014*, OHIO ENVTL. PROTECTION AGENCY, (May 2014) http://www.epa.ohio.gov/Portals/35/mgmtplans/ListofSection208PlanMaterialsforCert_2014.pdf.

- *Local Health Departments*, OHIO DEPT. OF HEALTH (last updated Feb. 13, 2015), http://www.odh.ohio.gov/localhealthdistricts/lhdmain.aspx.

- *Maine: Cobbossee Lake Nonpoint Source Success Stories*, U. S. ENVTL PROT. AGENCY (Mar. 2012), http://water.epa.gov/polwaste/nps/success319/me_cobb.cfm.

- Marc O. Ribaudo & Jessica Gottlieb, *Point & Nonpoint Trading–Can It Work?*, 47 J. AM. WATER RES. ASS'N. 5 (2011).

- Mark Chediak & Julie Johnsson, *Obama Budget Ponders Sale of Tennessee Valley Authority*, BLOOMBERG BUSINESS (Apr. 11, 2013, 6:28 PM), http://www.bloomberg.com/news/articles/2013-04-11/obama-mulls-sale-of-tennessee-valley-authority-in-budget-plan.

- Markus K. Brunnermeier & Lasse Heje Pedersen, *Markey Liquidity and Funding Liquidity*, Oxford Univ. Press (2008) *available at* http://pages.stern.nyu.edu/~lpederse/papers/Mkt_Fun_Liquidity.pdf.

- Matthew W. Diebel et. al., *Landscape Planning for Agricultural Nonpoint Source Pollution Reduction I: A Geographical Allocation Framework*, 42 ENVTL. MGMT. 789 (2008).

- *Maumee River Watershed,* LAKE ERIE WATERKEEPER, http://www.lakeeriewaterkeeper.org/save-maumee/ (last visited Feb. 23, 2015).

- Megha Satyanarayana, *Officials Monitor Lake Erie Water Closely for Hazardous Algae*, TRIBLIVE.COM (Aug. 4, 2014, 10:33PM), http://triblive.com/state/pennsylvania/6556693-74/lake-erie-algae#axzz3VjY2sZq8.

- Melissa K. Scanlan, *Adaptive Trading: Experimenting with Unlikely Partners*, 62 U. KAN. L. REV. 971 (2014).

- Memorandum from Nancy K. Stoner, Acting Assistant Administrator of USEPA, to Regional Administrators, Regions 1-10 (Mar. 16, 2011) *available at* http://www2.epa.gov/sites/production/files/documents/memo_nitrogen_framework.pdf

- MIAMI CONSERVANCY DIST., WATER QUALITY CREDIT TRADING PROGRAM FACTSHEET 1 (2014), http://newserver.miamiconservancy.org/water/documents/WQCTPfactsheet2014FINAL_000.pdf.

- Michael Mallin et al., *Factors Contributing to Hypoxia in Rivers, Lakes, and Streams*, 51 LIMNOLOGY & OCEANOGRAPHY 690 (2006).

- MINDY SELMAN ET AL., WORLD RES. INST., WATER QUALITY TRADING PROGRAMS: AN INTERNATIONAL OVERVIEW 11 (2009), *available at* http://pdf.wri.org/water_trading_quality_programs_international_overview.pdf.

- *Money for Upgrading Public Water Systems*, OHIO ENVTL. PROT. AGENCY, http://ohioepa.custhelp.com/app/answers/detail/a_id/275/~/money-for-upgrading-public-water-systems (last visited Apr. 9, 2015).

- Myers, D.N., Thomas, M.A., Frey, J.W., Rheaume, S.J., and Button, D.T., *Water Quality in the Lake Erie-Lake Saint Clair Drainages Michigan, Ohio, Indiana, New York, and Pennsylvania, 1996–98*, 1203 U.S. GEOLOGICAL SURVEY CIRCULAR 35 (2000), *available at* http://pubs.usgs.gov/circ/circ1203/pdf/circ1203.pdf.

- *Niagara River/Lake Erie Watershed*, N.Y.S. DEP'T OF ENVTL. CONSERVATION http://www.dec.ny.gov/lands/48024.html (last visited Apr. 6, 2015).

- *NOAA Great Lakes Habitat Restoration Project Grants under the U.S. Great Lakes Restoration Initiative in Areas of Concern*, GRANTS.GOV, http://www.grants.gov/view-opportunity.html?oppId=270988 (last visited Apr. 8, 2015).

- Noah D. Hall, *Interstate Water Compacts and Climate Change* Adaptation, 5 Envt'l & Energy L. & Policy 237 (2010).

- *Nonpoint Source Management Plan Update*, OHIO ENVTL. PROTECTION AGENCY (2014), http://www.epa.ohio.gov/Portals/35/nps/NPS_Mgmt_Plan.pdf.

- *North Carolina: Neuse River Basin Nonpoint Source Success Stories*, U. S. ENVTL PROT. AGENCY (Mar. 2012), http://water.epa.gov/polwaste/nps/success319/nc_neu.cfm.

- OCEAN STUDIES BOARD AND WATER SCIENCE AND TECHNOLOGY BOARD ET AL., CLEAN COASTAL WATERS: UNDERSTANDING & REDUCING THE EFFECTS OF NUTRIENT POLLUTION 31-36 (2000).

- *ODNR Designates Grand Lake St. Marys Watershed Distressed*, OHIO'S COUNTRY J., JAN. 20, 2011, http://ocj.com/2011/01/odnr-designates-grand-lake-st-marys-watershed-distressed%E2%80%A8/.

- *OEPA Program Summary Nonpoint Source Program FY2014 Annual Report*, OHIO ENVTL. PROTECTION AGENCY, (2014), http://www.epa.ohio.gov/Portals/35/nps/319docs/FFY14_Annual_Report.pdf.

- *Ohio Cumulative Number of TMDLs*, U.S. ENVTL. PROTECTION AGENCY, http://iaspub.epa.gov/waters10/attains_state.report_control?p_state=OH&p_cycle=2008&p_report_type=T#tmdl_by_pollutant (last updated Apr. 10, 2015).

- Ohio Dept. of Health, Development of Ohio's Proposed Sewage Treatment System Rules (May 2014) (slide presentation), *available at* http://www.odh.ohio.gov/~/media/ODH/ASSETS/Files/eh/STS/Sewagepre522014.ashx.

- Ohio Dept. of Health, Household Sewage Treatment System Failures In Ohio (2012), *available at* http://www.odh.ohio.gov/~/media/ODH/ASSETS/Files/eh/STS/2012HSTSSystemsandFailures.ashx.

- OHIO ENVTL. PROT. AGENCY, OHIO STRENGTHENS EFFORTS TO FURTHER PROTECT LAKE ERIE WHILE ENSURING DREDGING OF NAVIGATIONAL CHANNEL IN CLEVELAND (2015) *available at* http://epa.ohio.gov/Portals/33/documents/DredgingNavigationChannel.pdf.

- OHIO ENVTL. PROT. AGENCY, OHIO WATER POLLUTION CONTROL FUND: FACT SHEET (2014), *available at* http://www.epa.ohio.gov/Portals/29/documents/WPCLF.pdf.

- OHIO ENVTL. PROT. AGENCY, REQUEST FOR PROPOSALS: 2014 SURFACE WATER IMPROVEMENT FUND GRANTS (2014), *available at* http://www.epa.ohio.gov/Portals/35/nps/swif_docs/2014_Statewide_SWIF_RFP.pdf.

- OHIO EPA, NUTRIENT REDUCTION STRATEGY FRAMEWORK FOR OHIO WATERS-Draft 28 (Nov. 15, 2011), *available at* http://epa.ohio.gov/portals/35/documents/nutrient_reduction_strategy_framework.pdf.

- *Ohio Lake Erie Phosphorus Task Force Final Report*, OHIO ENVTL. PROTECTION AGENCY, (Apr. 2010), http://epa.ohio.gov/portals/35/lakeerie/ptaskforce/Task_Force_Final_Report_April_2010.pdf.

- OHIO LAKE ERIE PHOSPHORUS TASK FORCE II FINAL REPORT 31-32 (Nov. 2013).

- Oliver A. Houck, *The Clean Water Act Returns (Again): Part 1, TMDLs and the Chesapeake Bay,* 41 ENVTL. L. REP. 10208, 10223 (2011), *available at* http://www.eli.org/sites/default/files/docs/41.10208.pdf?q=pdf/41.10208.pdf.

- Oliver Houck, *TMDLs IV: The Final Frontier*, 29 Envtl. L. Rep. 10469 (1999).

- Patrick Parenteau, *Anything Industry Wants: Environmental Policy Under Bush II,* 4 DUKE ENVTL. L. & POL'Y J. 363 (2004).

- *Predictive Modeling of Bacteria Concentrations at Presque Isle State Park, Erie, Pennsylvania*, U.S. GEOLOGIC SURVEY, http://pa.water.usgs.gov/projects/waterquality/presque_isle/ (last updated Dec. 8, 2014).

- Press Release, Dist. Dep't of the Env't, DDOE Approve First Stormwater Retention Credit Trade (Sept. 19, 2014) *available at* http://ddoe.dc.gov/release/ddoe-approves-first-stormwater-retention-credit-trade.

- Press Release, U.S. EPA, *Federal Agencies Support Virginia's Innovative Market-based Approach to Improving Water Quality in Chesapeake Bay* (Dec. 16, 2014) *available at* http://yosemite.epa.gov/opa/admpress.nsf/0/AB495CFDDE332C2B85257DB0004FD78.

- *Program Fact Sheets: Conservation Reserve Program,* U.S. DEP'T OF AGRIC. (June 2014), http://www.fsa.usda.gov/FSA/newsReleases?area=newsroom&subject=landing&topic=pfs&newstype=prfactsheet&type=detail&item=pf_20140604_consv_en_crp.html.

- R. PERCIVAL, C. SCHROEDER, A. MILLER & J. LEAPE, ENVIRONMENTAL REGULATION (7th ed. 2013).

- Rebecca Fugit, Development of Ohio's Proposed Sewage Treatment System Rules (May 2014) (video presentation), *available at http://accordent.powerstream.net/008/00153/SewageRules05052014/main.htm*.

- Rob Nichols, *Kasich Signs Executive Order to Further Protect Lake Erie*, OHIO CLEAN LAKES INITIATIVE (Feb. 11, 2015) http://cleanlakes.ohiodnr.gov/home/post/kasich-signs-executive-order-to-further-protect-lake-erie.

- Sarah C. Pryor et al., *Ch. 9: Did precipitation regimes change during the twentieth century?*, *in* UNDERSTANDING CLIMATE CHANGE: CLIMATE VARIABILITY, PREDICTABILITY, & CHANGE IN THE MIDWESTERN UNITED STATES, (Sara C. Pryor ed., 2009).

- Schoof, J. T., S. C. Pryor, & J. Suprenant, 115 *Development of Daily Precipitation Projections for the United States Based on Probabilistic Downscaling*, J. GEOPHYSICAL RES., (2010).

- Scudder D. Mackey, *Climate Change Impacts and Adaptation Strategies for Great Lakes Nearshore and Coastal Systems*, *in* CLIMATE CHANGE IN THE GREAT LAKES REGION: NAVIGATING AN UNCERTAIN FUTURE (Thomas Dietz & David Bidwell eds. 2012).

- *SO_2 Emission Reductions from Acid Rain Program Sources and Improvements in Air Quality*, U.S. ENVTL. PROT. AGENCY (last updated Nov. 4, 2010), http://www.epa.gov/captrade/maps/so2.html.

- *State Legislation Passing and Federal Legislation Consenting to the Compact,* GREAT LAKES–ST. LAWRENCE RIVER BASIN WATER RES. COUNCIL, www.glslcompactcouncil.org (background and implementation of Compact) (last visited Apr. 10, 2015).

- *State Profiles*, Tennessee Department of Economic and Community Development, http://www.tn.gov/ecd/ER_state_profile.html (last visited Feb. 12, 2015).

- *State Public Water System Supervision*, CATALOG OF FED. DOM. ASSISTANCE, https://www.cfda.gov/index?s=program&mode=form&tab=core&id=f73a5afd30f6debbbcdad50935685b99 (last visited Apr. 8, 2015).

- Stephenson, K., P. Norris, and L. Shabman, *Watershed-Based Effluent Trading: The Nonpoint Source Challenge*, 16 CONTEMPORARY ECONOMIC POLICY (1998).

- Suzanne Teller, *Trade Wars: Will Nutrient Trading Save or Spoil Our Streams?*, OUTDOOR AMERICA (2011), *available at* http://www.iwla.org/index.php?ht=a/GetDocumentAction/i/17100.

- T. B. Bridgeman, J.D. Chaffin & J.E. Filbrun *A Novel Method for Tracking Western Lake Erie Microcystis Blooms, 2002-2011,* 39 J. GREAT LAKE RES. 83 (2013).

- *The Clean Water State Revolving Fund Program: Tapping its Untapped Potential*, U.S. ENVTL. PROT. AGENCY, http://www2.epa.gov/sites/production/files/documents/SRF_TappingUntappedPotential.pdf (last visited Apr. 9, 2015).

- *The Law of the River*, BUREAU OF RECLAMATION, LOWER COLO. REGION (last updated Mar. 2008), http://www.usbr.gov/lc/region/g1000/lawofrvr.html.

- Timothy B. Wheeler, *Nutrient Pollution Trading in Limbo in Maryland as it Expands in Virginia*, BALTIMORE SUN, DEC. 16, 2014, http://www.baltimoresun.com/features/green/blog/bal-nutrient-pollution-trading-in-limbo-in-maryland-as-it-expands-in-virginia-20141216-story.html#page=1.

- Timothy D. Searchinger, *Cleaning Up the Chesapeake Bay: How to Make an Incentive Approach Work for Agriculture*, 16 SOUTHEASTERN ENVTL. L.J. 171 (2007).

- *TMACOG Areawide Water Quality Management Plan*, TOLEDO METROPOLITAN AREA COUNCIL OF GOVERNMENTS (June 2014), http://www.tmacog.org/Environment/208currentplan/TMACOG_AWQMP.pdf.

- *TMDL Final Report for Lower Maumee River Tributaries and Lake Erie Tributaries*, OHIO ENVTL. PROTECTION AGENCY (Sept. 2012), http://www.epa.state.oh.us/Portals/35/tmdl/MLLEtribs_Final_FactSheet.pdf.

- Tom Henry, *Carroll Township's Scare with Toxin a "Wake Up Call"*, TOLEDO BLADE, Sept. 15, 2013, http://www.toledoblade.com/local/2013/09/15/Carroll-Township-s-scare-with-toxin-a-wake-up-call.html.

- *TVA's Mission and Vision*, TENN. VALLEY AUTHORITY, http://www.tva.com/abouttva/vision.htm (last visited Feb. 12, 2015).

- U.S. DEP'T OF AGRIC., THE WATSON PARTNERS FARM (2011) *available at* http://www.usda.gov/oce/environmental_markets/files/Watson_Partners_Brief.pdf.

- U.S. ENVTL. PROT. AGENCY, WATER QUALITY TRADING EVALUATION (2008), *available at* http://www.epa.gov/evaluate/pdf/water/epa-water-quality-trading-evaluation.pdf.

- U.S. EPA, *Chesapeake Bay Total Maximum Daily Load for Nitrogen, Phosphorous and Sediment,* (2010),

http://www.epa.gov/reg3wapd/pdf/pdf_chesbay/FinalBayTMDL/CBayFinalTMDLExecSumSection1through3_final.pdf.

- U.S. Gov't Accountability Office, *The Problem of Definition*, 15 GAO-RB pt. B, s. 2, *The Problem of Defintion* (2008).

- *Urban Waters Small Grants*, U.S. ENVTL. PROT. AGENCY (last updated Apr. 6, 2015), http://www2.epa.gov/urbanwaters/urban-waters-small-grants.

- Victor B. Flatt, *C(r)ap and Trade: The Brave New World of Non-point source nutrient trading and using lessons from Greenhouse Gas Markets to Make it work*, 52 HOUS. L. REV. 301 (2014).

- *Wetland Programs Development Grants*, U.S. ENVTL. PROT. AGENCY (last updated Apr. 9, 2014), http://water.epa.gov/grants_funding/wetlands/grantguidelines/.

- *What is Nonpoint Source Pollution?*, U.S. ENVTL. PROT. AGENCY, http://water.epa.gov/polwaste/nps/whatis.cfm (last updated Aug. 27, 2012); 33 U.S.C. § 1362(14).

- William Meade Fletcher et al., *Fletcher Cyclopedia of the Law of Corporations* § 4234 (perm. ed., rev. vol. 2014).

- Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, *Climate Change 2007: The Physical Science Basis* (Susan Solomon et al. eds., (2007), *available at* http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4_wg1_full_report.pdf.

- Yuntao Zhou et al., *Spatial and Temporal Trends in Lake Erie Hypoxia, 1987–2007*, 47 ENVTL. SCI. & TECH. 899 (2012).