

POLICY ANALYSIS

Conveners' Report on the Illinois Nutrient Trading Initiative Stakeholder Process

By

Gerald Keenan
Palmer Bellevue LLC
Former Chairman, Illinois Pollution Control Board

Mark Templeton, Robert Weinstock, and Jaymal Patel
Abrams Environmental Law Clinic
University of Chicago Law School

Alaina Harkness and Svetlana Taylor
Current

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Executive Summary

“There’s a giant dead zone in the Gulf of Mexico — thanks in large part to pollution from Chicago”

– Chicago Tribune, June 14, 2019¹

“GAO to probe federal response to algal blooms”

– E&E News, August 11, 2020²

For more than three decades, scientists have warned about the damage to aquatic life in both the Gulf of Mexico and local Illinois waterways caused by excess nutrients from our farms, storm drains, and sewage treatment plants. When these nutrients reach the Gulf, they can fuel algal growth, creating a large bloom that depletes oxygen when it decomposes. In local waterways, excess nutrients can fuel algal blooms that produce toxins that can cause serious health effects in humans and animals. In severe cases, public drinking water supplies have been threatened—and even interrupted. Climate change will exacerbate the problems, increasing both the size and duration of deadly algal blooms, as well as decreasing the likelihood that affected water bodies will ever recover.

Illinois is a significant contributor to the Gulf Hypoxia problem, accounting for an estimated 20 percent of the overall nitrogen and 11 percent of the phosphorus nutrient load created by a total of 13 states and deposited into the Gulf.³ In Illinois, algae can also be a concern in local lakes and streams, which can also suffer depleted oxygen supplies and algal blooms directly related to excess nutrients. Illinois’ list of waterways that are impaired due to excess nutrients includes 4,430 miles of rivers and streams and 131,114 acres of lakes and reservoirs.⁴

In recognition of the severity of this issue, during the last 20 years, the federal government has issued two federal Gulf Hypoxia Actions Plans, and Illinois and other states have developed a number of Nutrient Loss Reduction strategies. Here in Illinois, the Nutrient Loss Reduction Strategy (NLRs) released in July 2015 aims to achieve 45% loss reductions in both nitrate-nitrogen and total phosphorus with the interim loss reduction goals of 15% nitrate-

1. Tony Briscoe, *There’s a Giant Dead Zone in the Gulf of Mexico — Thanks in Large Part to Pollution from Chicago*, Chicago Tribune (June 14, 2019), <https://www.chicagotribune.com/news/breaking/ct-met-dead-zone-gulf-of-mexico-midwest-20190612-story.html> (last visited July 23, 2020).

2. Hannah Northey, *Water Pollution: GAO to Probe Federal Response to Algal Blooms*, Greenwire (Aug. 11, 2020), <https://www.eenews.net/eenewspm/2020/08/11/stories/1063711425> (last visited Aug. 18, 2020).

3. Illinois Environmental Protection Agency (IEPA), et al., *Illinois Nutrient Loss Reduction Strategy*, at 3-10 (2015), <https://www2.illinois.gov/epa/Documents/iepa/water-quality/watershed-management/nlrs/nlrs-final-revised-083115.pdf>.

4. See U.S. Environmental Protection Agency (USEPA), *Waters Assessed as Impaired due to Nutrient-Related Causes*, <https://www.epa.gov/nutrient-policy-data/waters-assessed-impaired-due-nutrient-related-causes> (last visited July 23, 2020).

nitrogen and 25% total phosphorus by 2025. In the past five years, the collaborative effort among more than 60 partners has led to \$340 million in investments towards implementing the strategy, and annual statewide total phosphorus loads from point sources have been reduced by 24% from the 2011 baseline.

Yet nearly two decades of work and billions of dollars later, nutrient-driven algal problems in the Gulf have gotten worse, not better, with the Hypoxic Zone size exceeding the long-term average in four of the past five years. Overall, no reductions in the nitrate loading from the Mississippi River to the Gulf of Mexico have occurred in the last few decades.

While some state regulators have used their authority under the Clean Water Act to reduce the amount of nutrients that point sources can discharge into waterways, reductions from point sources alone cannot solve this problem. About half of the phosphorus and nearly 80% of nitrogen in our waterways result from farms and urban run-off from lawns and golf courses. The Clean Water Act does not regulate such nonpoint sources directly. Today, these sources have limited financial incentives to reduce nutrient run-off, even though their per-unit cost of reductions has been found to be significantly less than further incremental reductions from point sources.

We find ourselves facing a conundrum—lower-cost nutrient reductions are achievable, but agricultural sources that could provide those reductions have few incentives and insufficient capital to do so. At the same time, there is opportunity, as farmers are urgently searching for means to diversify their revenue streams and weather financial challenges.

Fortunately, harnessing incentives to improve environmental performance has a nearly 40-year track record of success, both nationally and in Illinois. Market-based policies push society to address environmental problems at the lowest cost by providing regulated entities with flexibility to meet environmental quality goals. The use of incentives in other environmental policy areas has decreased the overall costs, increased innovation, and driven environmental performance.

Answering the call of the NLRS to explore a “watershed-scale total phosphorus trading program” and acknowledging the reality that little progress had been made in meeting the goals of the 2008 Gulf Hypoxia Action Plan, the authors launched the Illinois Nutrient Trading Initiative (INTI) in 2018. This stakeholder-based collaborative process explored the development of a statewide framework for using market-based mechanisms to address Illinois’ significant nutrient management problem.

This Conveners’ Report finds that further development and implementation of market-based solutions hold significant potential to improve environmental performance at lower costs.

Using markets, funds from point sources could be invested either in making more affordable reductions at other point sources or in changing agricultural practices—achieving better, cheaper, and faster results. While policy design and implementation questions remain, there appears to be broad consensus on the potential benefits of such approaches among stakeholders representing public utilities, agriculture, and environmental organizations.

Market-based solutions encourage innovation in technology and its applications to solve complex problems. We cannot create a 21st-century solution to the nutrient problem by relying on 20th-century technologies. A regulatory framework that encourages and incentivizes technological, financial and market structure innovation while requiring monitoring and verifying pollution reduction performance and environmental quality improvements is an essential catalyst for progress. If we get the regulatory framework, incentives and technologies right, Illinois could become a leader in nutrient reduction in the Mississippi River Basin.

Introduction

For more than three decades, scientists have warned about the damage caused to aquatic life in the Gulf of Mexico by excess nutrients, primarily nitrogen and phosphorus carried from farms, municipal sewage treatment facilities, concentrated animal feeding operations, and urban run-off from lawns and golf courses. When the nutrients reach the Gulf, they create hypoxic or “dead zones” – areas with low levels of dissolved oxygen that can kill fish and marine life. The largest Hypoxic Zone in the world is in the northern Gulf, just off the Louisiana and Texas coasts, but low oxygen levels caused by excess nutrients plague waterbodies in Illinois and around the country.

Excess nutrients also cause problems in local waterways, affecting public health and drinking water supplies. Illinois’ list of waterways that are impaired due to excess nutrients includes 4,430 miles of rivers and streams and 131,114 acres of lakes and reservoirs.⁵

Nationally, the annual cost of hypoxic zones to the fishery and tourism industries has been estimated to be between \$370 million and over \$1.1 billion.⁶ Excess nutrient pollution causes odor and taste issues for public water supplies, resulting in an estimated over \$800 million every year in costs to replace drinking water.⁷

Illinois and the 12 other Mississippi River Basin states are the primary contributors to the Gulf Hypoxia problem.⁸ Illinois contributes an estimated 20 percent of the overall nitrogen and 11 percent of the phosphorus nutrient load created by the 13 states and deposited into the Gulf.⁹ Iowa is the largest contributor of nitrogen,¹⁰ but Chicago’s sewage treatment facilities are the largest source of the phosphorus that enters the Gulf.¹¹

A primary reason that excess nutrient pollution has such dire environmental and economic consequences is that high nutrient loads drive overgrowth of algae. While algae are the base of the food chain for some fish, when these green plumes proliferate beyond what fish are

5. *Id.*

6. Mississippi River/Gulf of Mexico Watershed Nutrient Task Force, 2017 Report to Congress, at 7 (2017), https://www.epa.gov/sites/production/files/2017-11/documents/hypoxia_task_force_report_to_congress_2017_final.pdf.

7. *Id.*

8. IEPA, et al., Illinois Nutrient Loss Reduction Strategy, at 1-1 (2015), <https://www2.illinois.gov/epa/Documents/iepa/water-quality/watershed-management/nlrs/nlrs-final-revised-083115.pdf>.

9. *Id.* at 3-10.

10. Christopher S. Jones, et al., *Iowa Stream Nitrate and the Gulf of Mexico*, PLOS One, at 2 (2018), <https://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0195930&type=printable>. (“This intense production of carbohydrates and protein has resulted in the state being a leading contributor to MARB NfO3-N loads and Gulf hypoxia.”).

11. Briscoe, *supra* note 1. The Metropolitan Water Reclamation District has made significant investments in nutrient removal equipment in recent years that should result in lower phosphorus loads in the future.

capable of eating, their decomposition consumes much of the oxygen in the water. The plant and algal over-growth consume the dissolved oxygen (DO) in the water, dropping it below the levels needed by fish, mussels and other aquatic life for survival.¹²

Certain types of blue-green algae (cyano-bacteria) can also pose a direct health risk to people and animals when they are exposed to them in large quantities. These Harmful Algal Blooms (HABs) produce toxins that can cause severe health effects in humans, such as skin irritation, nausea, vomiting, allergic reactions and difficulty breathing. Ingestion of water in sufficient quantities can affect the liver and nervous system.¹³

Nutrient pollution can also degrade drinking water quality and require cities to install costly treatment equipment. Increasing concern is being raised about similar issues in Lake Decatur and the Sangamon River, the source of water for many central Illinois cities and towns.¹⁴ In fact, two sampling locations on the Sangamon River had high flow-weighted mean concentrations of total organic nitrogen, ammonia nitrogen, and phosphorus.¹⁵ Numerous cities and towns draw drinking water from the River, including the City of Decatur. The Illinois EPA (IEPA) has identified both the Sangamon River and Lake Decatur as impaired waterways.¹⁶

While not in the Mississippi River basin, Toledo, Ohio, experienced a significant problem from harmful algal blooms. In 2014, Toledo closed its public water system for several days when toxic bacteria infiltrated the water intake system. A 2015 study found that Toledo's 2014 algal bloom produced an estimated \$65 million in economic losses.¹⁷ To meet National Primary Drinking Water Regulations (NPDWR) for nitrates, an increasing number of public water systems have been forced to add ion-exchange or other technologies to remove nitrates from drinking water supplies. For example, the water system serving Des Moines, Iowa, had to double its nitrate removal capacity in 2018 at a cost of \$15 million.¹⁸

12. See USEPA, Nutrient Pollution – The Effects, <https://www.epa.gov/nutrientpollution/effects> (last visited July 23, 2020).

13. *Id.*

14. See U.S. Geological Survey (USGS), Water Quality in the Lower Illinois River Basin, Illinois, 1995-98, Circular 1209 (2000), <https://pubs.usgs.gov/circ/circ1209/pdf/circ1209.pdf>.

15. *Id.*

16. See IEPA, Sangamon River/Lake Decatur Watershed TMDL Report (2007), <http://www.epa.state.il.us/water/tmdl/report/sangamon-decatur/final-sangamon-decatur-nostage2.pdf>.

17. Environmental Consulting & Technology, Inc., Economic Benefits of Reducing Harmful Algal Blooms in Lake Erie, at 3 (2015), <https://legacyfiles.ijc.org/tinymce/uploaded/Publications/Economic-Benefits-Due-to-Reduction-in-HABs-October-2015.pdf>.

18. See *Water Works Plans \$15 million for Expanded Nitrate Facility*, Des Moines Register (May 24, 2017), <https://www.desmoinesregister.com/story/news/2017/05/25/water-works-plans-15-million-expanded-nitrate-facility/336648001/> (last visited Oct. 27, 2020).

States have spent significant financial and other resources in efforts to prevent these massive environmental, public health, and infrastructure costs. Illinois¹⁹ and Iowa²⁰ report spending hundreds of millions of dollars on nutrient reduction programs and projects from 2016 to 2018.

Despite significant expenditure of private and public funds by these states and others, the Gulf's Hypoxia problem shows no sign of abating. In fact, most recent years' Dead Zones in the Gulf have been larger than the 30-year average, with 2017's being the largest in the 33 years of recordkeeping—8,776 square miles, slightly smaller than the State of New Hampshire.

This problem persists more locally, too. In 1994, the Illinois Department of Energy and Natural Resources found that despite general improvement in Illinois' streams and lakes, nutrients (phosphorus and nitrite/nitrate nitrogen) significantly affected the State's waters.²¹ Twenty-six years later, nutrient pollution from nonpoint sources, point sources and urban storm sewer run-off still significantly negatively affect Illinois' streams and lakes.²²

The Illinois Nutrient Loss Reduction Strategy (NLRS), released in July 2015, was developed as a response to the Gulf Hypoxia Action Plan of 2008.²³ The strategy's primary goals are to: 1) reduce nutrient loads leaving the State via the Mississippi River; and 2) improve local water quality. The ultimate goal is to achieve 45% loss reductions in both nitrate-nitrogen and total phosphorus with the interim loss reduction goals of 15% nitrate-nitrogen and 25% total phosphorus by 2025. While the point source permitting strategies and voluntary actions of nonpoint sources called for in the NLRS have resulted in some modest progress toward these goals, new approaches are needed to achieve the speed and scale necessary to meet the NLRS goals.

The time may be ripe to implement a market-based approach to reducing nutrient run-off into Illinois waterways because each of the stakeholder groups brought together by the INTI process—municipal wastewater treatment entities, agricultural, and environmental advocacy communities—believe there is an urgent need for new approaches and have shared interests in speeding innovative solutions.²⁴ As described above, the environmental need has never

19. IEPA, et al., Illinois Nutrient Loss Reduction Strategy, Biennial Report 2019 (2019), <https://www2.illinois.gov/epa/topics/water-quality/watershed-management/excess-nutrients/Documents/NLRS-Biennial-Report-2019-Final.pdf>.

20. See Chuan Tang, et al., The Costs and Benefits of Nutrient Reduction Programs, Center for Agricultural and Rural Development, Iowa State University (2018), https://www.card.iastate.edu/ag_policy_review/article/?a=88.

21. Illinois Dept. Of Energy & Natural Res. (IDNR), The Changing Illinois Environment: Critical Trends, Volume Two 1 (summary) (1994), <https://archive.org/details/changingillinois02illi>.

22. IEPA, et al., Illinois Nutrient Loss Reduction Strategy Presentation (2020), https://www2.illinois.gov/epa/topics/water-quality/watershed-management/excess-nutrients/Documents/NLRS-percent20Presentation-March_2020.pdf.

23. The 2008 Gulf Hypoxia Action Plan was created by the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force, and guided by the U.S. Environmental Protection Agency (EPA) memorandum: Recommended Elements of a State Nutrients Framework.

24. Many of the INTI stakeholder organizations have express policies supportive of market-based approaches to address water quality challenges. See, e.g., Illinois Farm Bureau, Stronger Together 2021 Policy Resolutions at 20, 30 (2021), <https://www.ilfb.org/media/7865/2021-resolutions-book.pdf> ("We support . . . market-based solutions that

been more acute. Excessive nutrients continue to pollute our waters and imperil our water-based economies. Traditional approaches to protecting water quality have failed; new strategies are long overdue.

The NLRS proposed adding point-source permit provisions that require municipal wastewater agencies to conduct nutrient-related studies; these studies are setting the stage for permit requirements that are likely to require significant investments in new controls. These compliance costs will be massive for the agencies—including all Illinoisans as their ratepayers—as numeric nutrient limits begin to come into force in their Clean Water Act permits. Finally, there is new momentum and interest from the agricultural sector, which has demonstrated a willingness to be proactive in seeking solutions to the problem of nutrient run-off. Producers are now actively investigating and supporting new solutions that would help them both optimize their yields and diversify their revenue streams.

In short, all stakeholder groups seek mutual solutions to the collective challenge we face; this sets the stage for a new approach. A thoughtfully designed nutrient trading market could deliver novel economic opportunities and verifiable environmental benefits at lower costs than what is viable through the current regulatory strategies that have not solved our national and local water quality issues.

establish economic incentives for farmers to voluntarily adopt conservation practices that . . . improve water quality”); Letter from Chris Hornback, Deputy CEO, National Association of Clean Water Agencies to Amelia Letnes, Environmental Protection Agency Office of Wastewater Management Water Permits Division at 1 (December 18, 2019), https://www.nacwa.org/docs/default-source/resources---public/nacwa-comments-epa-hq-ow-20190415.pdf?sfvrsn=cfc8fd61_2 (comments supporting use of trading to address Clean Water Compliance at point sources and engage nonpoint sources in reducing pollutant loadings); Newtrient, How Dairy Benefits from Market-Driven Solutions (2020), <https://www.youtube.com/watch?v=grOQf5Y0jW0&t=210s> (last visited March 29, 2021); Openlands, Friends of the Chicago River, Our Liquid Asset: The Economic Benefits Of A Clean Chicago River at 1-2 (2013), http://s3.amazonaws.com/chicagoriver/rich/rich_files/rich_files/272/original/summary-20review-20doc-20final.pdf (advocating for market-based approaches to address water quality in the Chicago River); Sierra Club Illinois Chapter, Illinois has a nutrient problem at 2, <https://www.sierraclub.org/sites/www.sierraclub.org/files/sce/sierra-club-illinois-chapter/documents/INLRS%20Public%20Handout%20%282%29.pdf> (supporting incentives for adopting best management processes, such as a monthly stormwater fee for property owners in Downers Grove, Illinois); The Nature Conservancy, How We Secure Food & Water (2021), <https://www.nature.org/en-us/what-we-do/our-priorities/provide-food-and-water-sustainably/> (supporting approaches to “improve water quality . . . all while increasing profits for farmers”).

I. Federal and State Regulatory Framework

One might think that the Clean Water Act (CWA) would be the solution to excess nutrients in waterways and the resulting negative public health and economic outcomes. Enacted into law in 1972, the CWA aims to restore and maintain the chemical, physical, and biological integrity of the Nation's waters.²⁵ Broadly, the CWA allows the U.S. Environmental Protection Agency (USEPA) to delegate implementation to the states, which includes both the responsibility to assess water quality and to regulate discharges of pollutants.²⁶ The CWA specifically defines water pollution from a point source to mean any discernible, confined and discrete conveyance, excluding agricultural storm water discharges and return flows from irrigated agriculture.²⁷ By implication, the CWA further defines a nonpoint source to mean any source of water pollution that does not meet the definition of a point source.²⁸

The CWA set up the National Pollutant Discharge Elimination System (NPDES), which requires every point source to hold a permit limiting its pollutant discharges.²⁹ The Act also requires states to set forth water quality standards for various bodies of water, from which states derive individual permit limits, in part, as well as calculating any total maximum daily load (TMDL) for each pollutant that is impairing a water body.³⁰ The TMDL, sometimes called a "pollution diet," is a maximum amount of a given pollutant that all sources may discharge to ensure that the water body meets water quality standards.³¹ Under these traditional permit-based schemes for point sources, owners of point sources can be held liable individually for exceeding the permit limits.³²

In contrast, the CWA does not regulate nonpoint sources directly. Instead, USEPA awards grants to states through the Section 319³³ program to fund projects that address nonpoint source pollution. Under the Section 319 program, states are required to develop nonpoint source management programs to be eligible for federal funding.³⁴ State agencies then use

25. 33 U.S.C. § 1251(a).

26. *Id.* § 1313.

27. *Id.* § 1362(14).

28. The CWA does not contain an explicit definition of "nonpoint source." See *id.* § 1362.

29. *Id.* § 1342(a).

30. *Id.* § 1313(d).

31. *Id.* § 1313(d).

32. *Id.* § 1319(a).

33. *Id.* § 1329.

34. *Id.* § 1329(b)(2).

federal funds to establish programs to encourage implementation of nonpoint pollution reduction practices for categories of nonpoint sources, collaboration with other stakeholders, monitoring efforts, and the development of TMDLs in watersheds.

USEPA delegated authority to Illinois to implement the CWA, and the State has made significant strides in cleaning the State's waterways since Congress passed the CWA in 1972. Illinois implements the CWA through provisions in the Illinois Environmental Protection Act and related state regulations.³⁵ Under these regulations, IEPA issues NPDES permits that control point source pollution discharges.³⁶ IEPA does not directly limit nonpoint source pollution, but instead addresses it through best management requirements (i.e., operational guidance for nonpoint sources that are expected to reduce pollution loadings), watershed-based plans, TMDL designations, and load reduction strategy implementation plans.³⁷

Over the past several years, IEPA has developed a set of special conditions for NPDES permits to deal with nutrient pollution, such as phosphorous, from a significant category of point sources: publicly owned treatment works (POTWs), i.e., sewage treatment systems.³⁸ In permit renewals for POTWs issued over the past three to four years, IEPA has required all major municipal POTWs to optimize existing treatment facilities for phosphorus removal by requiring Phosphorus Discharge Optimization Plans.³⁹ IEPA has also included special conditions requiring POTWs to conduct feasibility studies examining what upgrades would be necessary to meet 0.5 mg/L and 0.1 mg/L limits for phosphorous.⁴⁰ Permits for point sources now generally include an effluent limit of 1.0 mg/L as well as a projected limit of 0.5 mg/L (Total Phosphorus 12 month rolling geometric mean), which will become effective January 1, 2030 unless the permittee demonstrates that it is not technologically feasible or economically reasonable, or meets another special circumstance that may result in the modification of the permit.⁴¹

If a POTW is located upstream of a waterbody or stream segment that does not meet water quality standards (i.e., is "impaired") or that is deemed at risk of adverse effects from nutrient pollution (i.e., eutrophication), IEPA imposes additional special conditions in renewed permits.⁴² The special conditions in these NPDES permits call for the development of a Nutrient Assessment and Reduction Plan (NARP), which includes specific requirements for major municipal facilities that discharge over 1 million gallons per day or greater into such waterways. The permit may require the permittee to participate in a watershed group (e.g.,

35. 415 Ill. Comp. Stat 5/11 et seq. (2015); 35 Ill. Admin. Code subtit. C (2015).

36. 35 Ill. Admin. Code § 309.141 (2015).

37. IEPA, Illinois' Nonpoint Source Management Program, at 49 (2013), <http://www.epa.state.il.us/water/watershed/publications/nps-management-program/index.pdf>.

38. IEPA et al., *supra* note 19, at 100.

39. *Id.* at 104.

40. *Id.* at 100.

41. *Id.* at 101.

42. *Id.*

the Fox River Study Group) through the next five-year permit cycle to determine cost-effective solutions, as well as to prepare and share feasibility and optimization studies with IEPA and the watershed group.

Watershed groups include representatives from local communities and public agencies, public and private drinking water suppliers, environmental organizations and engineering companies. The groups develop analyses and implement targeted projects and programs to move towards CWA goals in a cost-effective way. In addition, IEPA reserves the right to modify permits to include alternative discharge limitations pursuant to an approved TMDL or the implementation of such watershed group findings, including through a trading program for discharges in the watershed.⁴³

IEPA gives deference to watershed groups to generate locally applicable limits as needed. If a local watershed plan determines that a lower phosphorous limit is necessary and achievable, then the permittee shall meet that limit (e.g., Fox River Implementation Plan).⁴⁴

The nutrient-related studies being pursued by municipal wastewater agencies are setting the stage for significant and required investments in new controls; these compliance costs will be massive for the agencies—and all Illinoisans as their ratepayers—as numeric nutrient limits begin to come into force in their Clean Water Act permits. These NARPs are based on local conditions and are very site-specific, and do not take into consideration the broader focus of reducing nutrients across the Mississippi River watershed. Local reductions will probably provide some overall benefit. The question is whether the several hundred million dollars required could achieve more reductions if planning focused holistically on both local needs and wider scale benefits of nutrient reductions. Many of these NARPs are currently due to be completed by December 2023, so there is little time to adjust IEPA's approach to nutrient reductions.

43. See, e.g., IEPA, Reissued NPDES Permit No. IL0033553 for the City of Joliet – Westside STP, at 9, 12 (2015), <https://www2.illinois.gov/epa/Documents/iepa/public-notice/2015/city-of-joliet-westside-stp/public-notice.pdf>.

44. This report describes the progress of the two earliest watershed groups further below.

II. Federal Response to Nutrient Issues

Federal regulators have undertaken two major initiatives to address nutrient issues through assessment and coordination. First, in 1997, federal regulators established the Gulf Hypoxia Task Force to understand and address ongoing Hypoxic Zone issues in the Gulf of Mexico. Second, USEPA has endeavored to align the states with federal priorities in reduction of nutrient pollution.

With regard to the first effort, the Gulf Hypoxia Task Force supports nutrient management reduction activities from all sources in the Mississippi River and Gulf of Mexico Watersheds. Representatives from federal agencies, state agencies and tribal entities throughout the Mississippi River Basin serve on the Task Force. The Task Force released the 2001 Action Plan,⁴⁵ a national strategy to reduce the Gulf's Hypoxia Zone to about 1,900 square miles (on a five-year running average), to restore and protect the waters of the states and tribal lands in the Basin, and to improve the communities and economic conditions in the Basin. The Task Force assessed and updated its strategy in its 2008 Action Plan.⁴⁶

Seven years later, the primary goal of the 2008 Plan was still to reduce the Gulf Hypoxia Zone to 1,900 square miles, compared to an annual average of more than 5,000 square miles.⁴⁷ The Action Plan included a call for all states in the Mississippi River Basin to complete nutrient loss reduction plans and strategies by 2013.⁴⁸ Most states completed their Implementation Strategies in response to the Action Plan by 2015. States provide biennial updates, noting progress towards their goals as well as challenges related to implementation.

45. See Mississippi River/Gulf of Mexico Watershed Nutrient Task Force, Action Plan for Reducing, Mitigating, and Controlling Hypoxia in the Northern Gulf of Mexico (2001), https://www.epa.gov/sites/production/files/2015-03/documents/2001_04_04_msbasin_actionplan2001.pdf.

46. See Mississippi River/Gulf of Mexico Watershed Nutrient Task Force, Gulf Hypoxia Action Plan 2008 for Reducing, Mitigating, and Controlling Hypoxia in the Northern Gulf of Mexico and Improving Water Quality in the Mississippi River Basin (2008), https://www.epa.gov/sites/production/files/2015-03/documents/2008_8_28_msbasin_ghap2008_update082608.pdf.

47. *Id.* at 14.

48. *Id.* at 32–33.

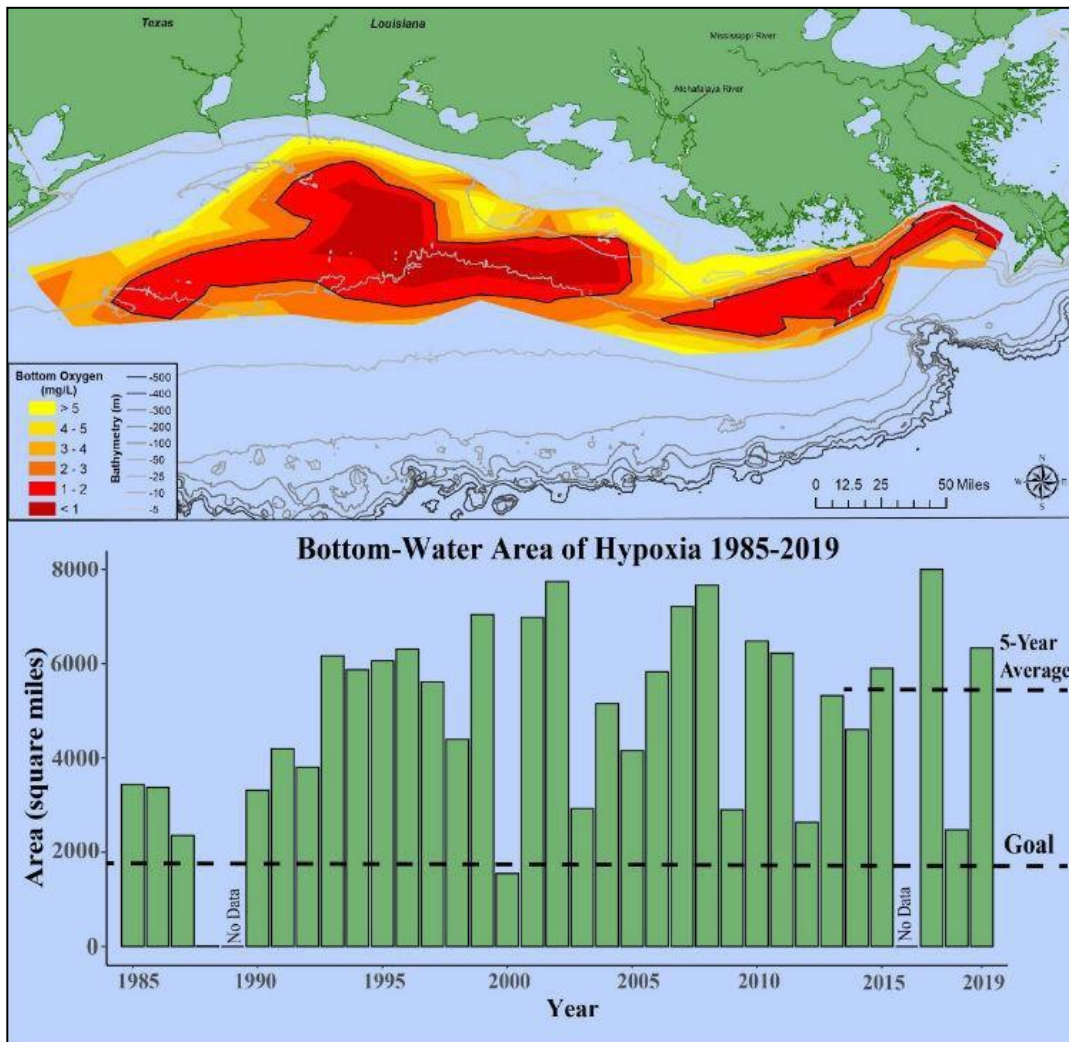


Figure 1. (Top) Hypoxia in the Gulf of Mexico in 2019. (Bottom) Long-term size of the hypoxia zone, including the target goal established by the Gulf Hypoxia Task Force.⁴⁹

With regard to the second effort, in 2011, USEPA issued a memorandum that laid the foundation for a partnership among states, USEPA and stakeholders to make greater progress.⁵⁰ The framework provides for: prioritizing watersheds on a statewide basis for nitrogen and phosphorus loading reductions; ensuring the effectiveness of point source permits; integrating innovative approaches into agricultural practices; identifying and using government tools to assure reductions in stormwater and septic systems; verifying load reductions and ensuring that measures implemented are effective; and developing a plan for the adoption of numeric nutrient criteria.

49. NOAA, Large 'Dead Zone' Measured in Gulf of Mexico (Aug. 1, 2019) <https://www.noaa.gov/media-release/large-dead-zone-measured-in-gulf-of-mexico> (last visited Oct. 27, 2020).

50. See Memorandum from Nancy K. Stoner, Acting Assistant Administrator, USEPA, to the Regional Administrators, Regions 1-10 (Mar. 16, 2011), https://www.epa.gov/sites/production/files/documents/memo_nitrogen_framework.pdf (titled "Working in Partnership with States to Address Phosphorus and Nitrogen Pollution through Use of a Framework for State Nutrient Reductions").

From these initial federal efforts, specific efforts in Illinois have emerged to address the water quality crisis caused by excessive nutrient loadings.

III. Illinois Nutrient Loss Reduction Strategy

In response to the 2008 Gulf Hypoxia Action Plan and the health and safety issues resulting from nutrient pollution (e.g., algal blooms in drinking water reservoirs), the NLRS was developed in 2015 by Illinois EPA, the Illinois Department of Agriculture, the University of Illinois, and a multi-stakeholder Policy Working Group of over 60 partners such as federal and state agencies, agricultural organizations, wastewater treatment agencies, non-governmental organizations, and industries.⁵¹ The NLRS built upon ongoing regulatory and voluntary efforts to reduce loads from point sources, agricultural nonpoint sources, and urban nonpoint sources.

The goals of the strategy were twofold: reduce the load of nutrient pollution leaving the State by way of the Mississippi River and improve localized water quality for the benefit of Illinois residents. The NLRS documented the existing nutrient loss reduction efforts occurring across Illinois and laid out a roadmap for improving these efforts through increased watershed targeting, improved collaboration, and new initiatives. Among the key goals of the NLRS was a 45 percent reduction of Nitrogen and Phosphorus with an interim goal of a 25 percent reduction in Phosphorus loads and a 15 percent reduction in Nitrogen loads by 2025.⁵² Since 2015, the State has issued two biennial updates, reporting on actions taken and results achieved.⁵³

The strategy provided recommendations for the implementation of nutrient-related requirements in NPDES permits and technology-based approaches for POTWs, and additional outreach, education, and incentives for the implementation of BMPs for nonpoint sources, including urban stormwater (responsible for 2% of nitrogen) and agriculture (responsible for 80% of nitrogen). Notably, while the Implementation Strategy demonstrates that nonpoint sources contribute about half of Illinois' phosphorous loading to the Mississippi River and 80 percent of the nitrogen,⁵⁴ it acknowledges that the CWA specifically authorizes regulatory limits on point sources only, leaving IEPA unable to require reductions from nonpoint sources—despite their contribution to the nutrient problem.

51. IEPA, et al., *supra* note 8, at 1-4.

52. *Id.* at 2-1.

53. IEPA, et al., Illinois Nutrient Loss Reduction Strategy, Biennial Report 2015-2017 (2017), [https://www2.illinois.gov/epa/Documents/iepa/water-quality/watershed-management/excess-nutrients/NLRS-Biennial-Report/NLRS percent20Biennial percent20Report.pdf](https://www2.illinois.gov/epa/Documents/iepa/water-quality/watershed-management/excess-nutrients/NLRS-Biennial-Report/NLRS%20Biennial%20Report.pdf); IEPA, et al., *supra* note 19.

54. IEPA, et al., *supra* note 8, at 3-54.

NLRS progress to date includes watershed activities in 18 priority watersheds; \$340 million dedicated toward implementation of the strategy; and the engagement of 97% of Illinois Municipal Separate Storm Water Sewer Systems (MS4s) in community outreach, including stormwater best management practices (BMPs). Most importantly, annual statewide total phosphorus loads from point sources have been reduced by 24% from the 2011 baseline.

But while progress has been made in the first five years of the NLRS and there is significant stakeholder interest in continuing to act jointly to leverage existing programs and resources, the NLRS is not on pace to meet its goals. The second NLRS Biennial Update, released in December 2019,⁵⁵ reports that average statewide loads for both nitrates and phosphorus during the 2013-17 period have increased by 7 percent and 26 percent respectively from the baseline calculated using data from 1980 to 1996.

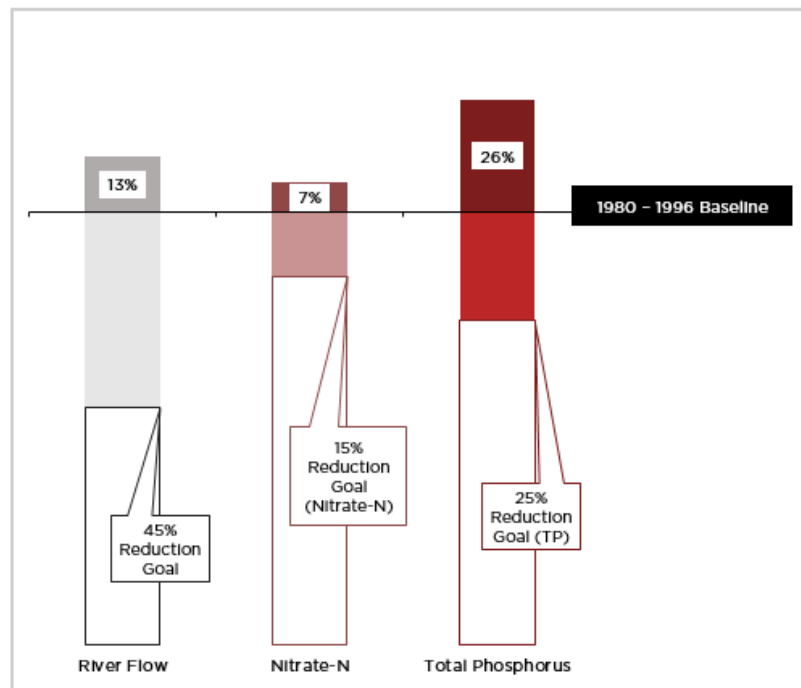


Figure 2. Percent increase from baseline to average 2013-2017.⁵⁶

The update also reports that point sources achieved a 24 percent decrease in total phosphorus output in 2018. As point sources were responsible for about half of the total phosphorus load during the baseline period, the 2018 data would likely mitigate the overall increase in phosphorus load. In 2018, nitrate loads from point sources declined by 8 percent from a 2011 baseline. Since about 80 percent of nitrate loads come from nonpoint sources, this would not have been enough to offset the overall 7 percent increase.

55. IEPA, et al., *supra* note 19.

56. *Id.* at 06.

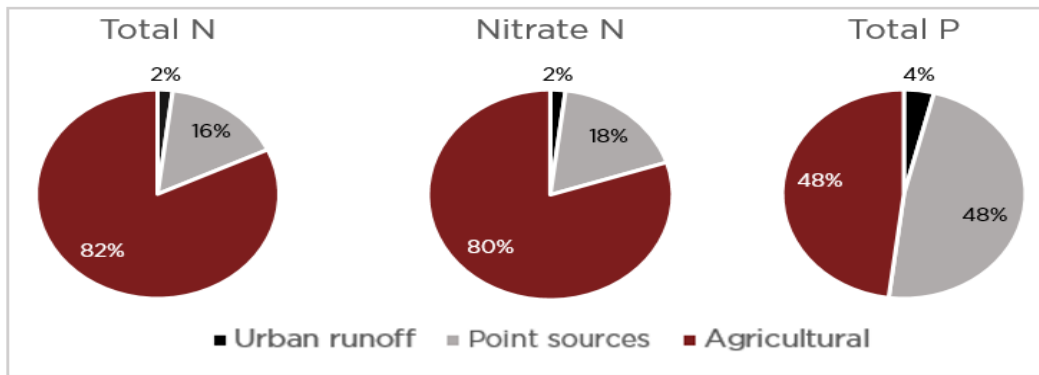


Figure 3. The proportion of nitrate and total phosphorous lost to the Mississippi River by source.⁵⁷

These point source reductions have come at a significant cost. In 2017 and 2018 combined, point sources report spending \$224 million on nutrient reduction activities. Of this total, \$212 million was for capital expenditures. The agricultural sector spent a further \$59 million on nutrient mitigation measures, including expanded education regarding the use of fertilizers and remediation projects, such as constructed wetlands, woodchip bioreactors and the increased use of cover crops.

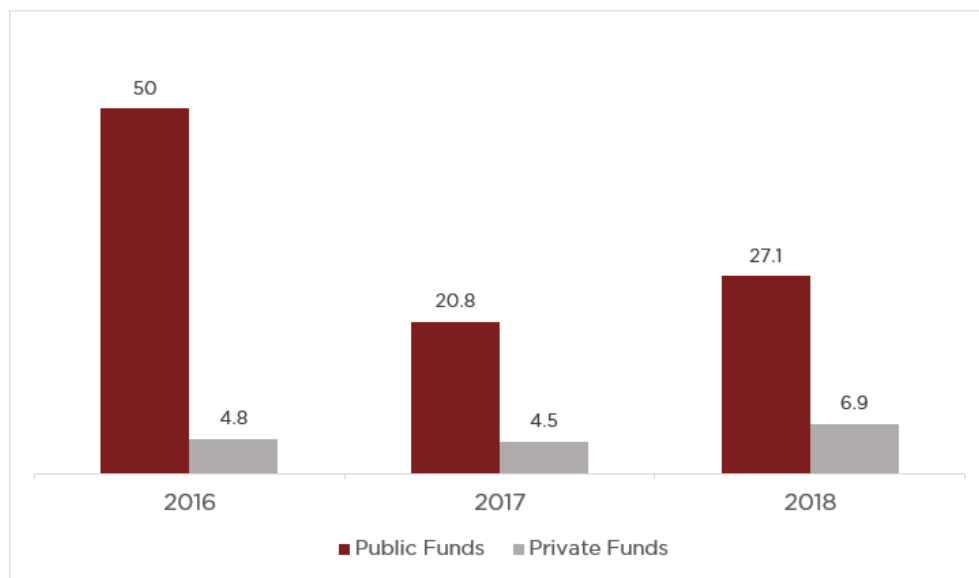


Figure 4. Funds supporting the agricultural sector implementation of NLRS.⁵⁸

57. IEPA, et al., *supra* note 8, at 2-1.

58. IEPA, et al., *supra* note 19, at 28.

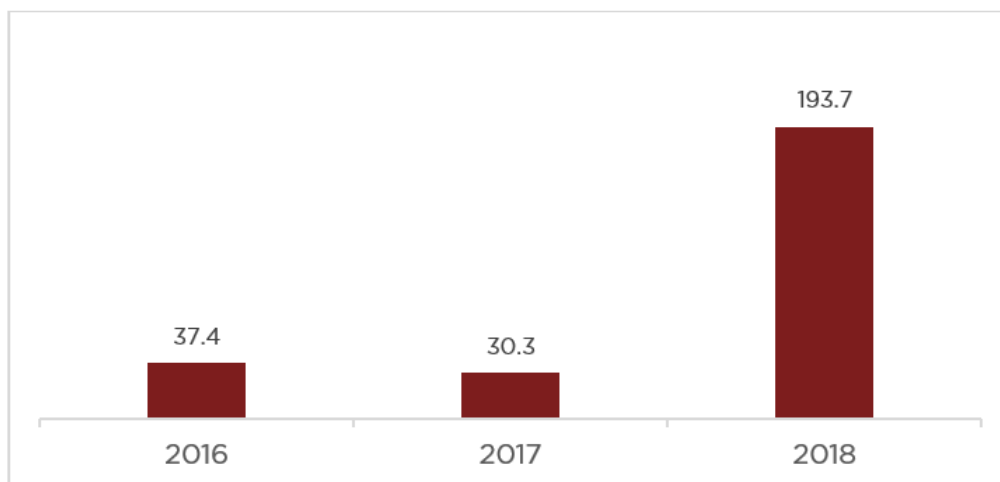


Figure 5. Point source spending comparison reported by IAWA member wastewater treatment agencies.⁵⁹

Given continued stakeholder interest and commitment to the NLRS, this raises the question of what additional technology, innovation, financial incentives, and market-based mechanisms are needed to help accelerate the pace of progress and put NLRS goal attainment within reach.

59. *Id.* at 93

IV. Watershed-Level Nutrient Reduction Efforts

In addition to these point source reductions and nonpoint source education and best practices dissemination efforts, other initiatives are also underway to improve both local water quality and reduce total nutrient contribution to the Mississippi River Basin. IEPA is using a watershed management approach to meet objectives in the NLRs, with an increased focus on local watershed groups. IEPA is not only requiring watershed group participation for point sources through NPDES permit conditions; it is also encouraging point sources to coordinate with nonpoint sources within local watersheds.⁶⁰ As such, IEPA has developed watershed priority lists for total phosphorous and nitrate-nitrogen loss, agricultural watersheds for total phosphorus loss, and agricultural watersheds for nitrate-nitrogen loss, which are being targeted for funding, outreach, implementation programs and monitoring.⁶¹

IEPA has prioritized the watersheds by total loads, local water quality concerns, and the presence of active watershed plans already organizing loss reduction activities. The progress of two active watershed groups, as well as various statewide agricultural activities, is provided below.

60. *Id.* at 105.

61. IEPA, et al., *supra* note 8, at 4-1.

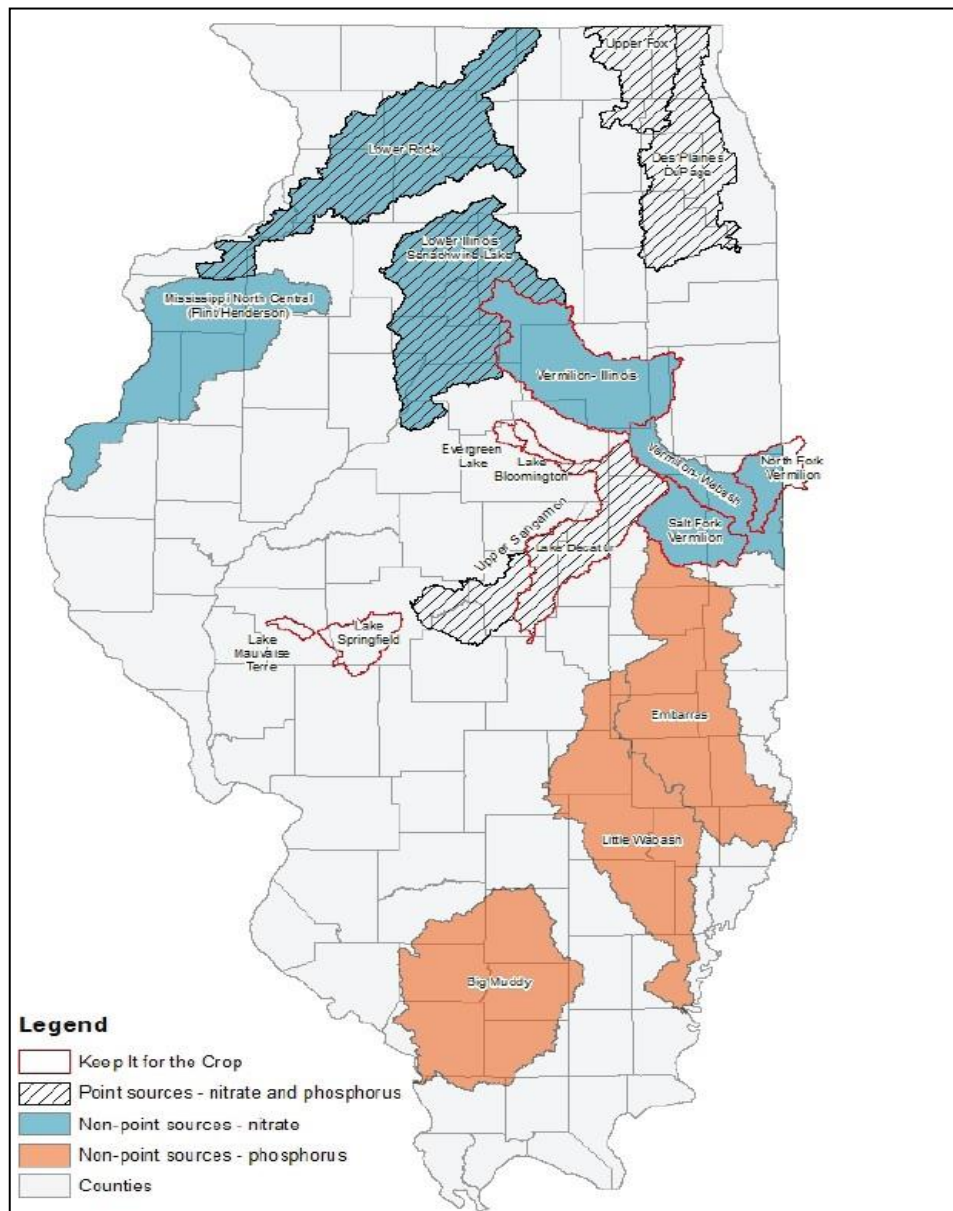


Figure 6. Priority watersheds for nutrient loss reduction in Illinois.⁶²

A. Watershed Groups

i. DuPage Salt Creek

Established in 2005, the DuPage River Salt Creek Watershed group (DRSCW) developed an alternative approach in response to IEPA's 2014 implementation of limits for phosphorous for wastewater treatment plants in Illinois. The DRSCW Permit Special Condition, approved by IEPA, implements a targeted alternative to increase the efficiency and outcomes of

⁶² *Id.* at 4-6.

investments in nutrient management. Rigorous analysis of years of monitoring data from the DRSCW area showed that habitat variables were much stronger explanations of impairments to aquatic life than phosphorous.⁶³ That analysis allowed the DRSCW to convince government scientists and representatives of advocacy groups to allow a new kind of permit, one that tackled a wide spectrum of water quality problems, notably the severe physical modification of our rivers. Postponing phosphorous removal saved operational costs for the additional treatment at wastewater treatment plants (WWTPs) and allowed funding to be redirected toward the Special Condition. A significant portion of those savings was then used to fund the implementation of projects to maximize benefits to aquatic life, such as the Oak Meadows Golf Course Stream Restoration Project.⁶⁴ Post-project analyses have demonstrated that such targeted interventions can substantially support the CWA goal of supporting aquatic life in a more cost-effective manner than technological upgrades to reduce nutrient pollution.

While the projects undoubtedly provide benefits to the local waterway, the funding source is deferral of phosphorous discharge reductions from the local POTWs. So, in this case, the local waterway improvement comes at the cost of not reducing the phosphorus load and impacts downstream, including in the Gulf of Mexico.

In addition, in 2017, DRSCW retained advisors to study the development of a nutrient trading framework for the DuPage River and Salt Creek watersheds. In February 2018, Tetra Tech, a DRSCW advisor, presented a nutrient trading program framework.⁶⁵ The presentation focused on the 20-year net present value of costs to POTWs for achieving three target levels of phosphorous discharges—1.0 mg/L, 0.5 mg/L, and 0.1mg/L—as well as the cost curves for implementing each treatment level. The costs for each municipal POTW in the watershed are estimated to increase non-linearly as more phosphorous is removed (i.e., the costs will increase significantly for most POTWs in the watershed as the 0.1 mg/L limit is approached). The analysis also highlighted low-cost optimization opportunities for POTWs to meet permit limits at the higher end of the range studied, such as retrofits, volatile fatty acids additions, and oxidation-reduction potential control.

The Tetra-tech study highlights the significant increases in costs, both capital and operating, that point sources will face in order to reach CWA requirements and the goals of the NLRS as translated into permits through low phosphorus limits. The increased costs of meeting those low phosphorus limits will be funded by POTW's ratepayers. Thus, if alternative approaches

63. See DuPage River Salt Creek Watershed group (DRSCW), Reports and Data Sets, <http://www.drscw.org/wp/portfolio/reports-and-data-sets/> (last visited Aug. 4, 2020).

64. A second project is underway at the Spring Brook Stream Restoration with a third project proposed at Fullersburg Woods.

65. See Presentation from Tetra Tech to DRSCW (Feb. 1, 2018), https://www.drscw.org/wp-content/uploads/2018/02/5_TetraTech.pdf (title: Developing a Basin-wide Nutrient Trading Program Framework for the DuPage River & Salt Creek Watersheds).

are not developed, it is likely that sewer bills for customers of POTWs will increase significantly.

ii. Fox River Study Group

The Fox River Study Group, a multi-stakeholder group focused on water quality improvement on the Illinois portion of the Fox River, began its work in 1998. In 2015, IEPA adopted the final Fox River Implementation Plan (FRIP) as an alternative to developing a traditional TMDL.⁶⁶ The primary goal of the FRIP is the reduction of water quality impairments for dissolved oxygen and excessive algal growth in the Fox River and the ultimate achievement of water quality standards. In particular, the FRIP targets six segments of the Fox River within the FRIP planning area with low levels of dissolved oxygen and nine segments with high levels of aquatic algae and total phosphorus.

The FRIP includes the following elements:

1. Effluent limits on major municipal WWTPS for total phosphorus of 1.0 mg/L (annual average);
2. Creation of an upstream TMDL for the Chain O'Lakes region in order to meet the State water quality standard for phosphorus in lakes (0.05 mg/L);
3. Potential removal of two dams; and
4. Implementation of nonpoint source controls necessary and appropriate to meet the goals of the FRIP.

These actions are expected to reduce total phosphorus loading to the Fox River by approximately 35 percent.⁶⁷

B. Other Watershed Planning and Implementation

As a result of IEPA prioritizing several watersheds across the State for purposes of the NLRS, collaboration is already occurring between point source and nonpoint sources. A variety of collaborators across agriculture, municipalities and academia have been working together to apply for Section 319 grant funding or USDA grant funding to update or establish watershed plans and offset costs for implementation. Examples include the Embarras River Watershed in the southeastern part of the State, as well as more recent efforts in the Mississippi North-Central Watershed, where efforts are guided by available data, stakeholder concerns and obtaining the buy-in and support of landowners in the watershed. Several downstate

66. See Fox River Study Group, Fox River Implementation Plan: A Plan to Improve Dissolved Oxygen and Reduce Nuisance Algae in the Fox River (2015), https://804b851f-552e-46e5-aa1c-ba2a54f10878.filesusr.com/ugd/61ae1d_cc20fb984eda4b68805f48de246ecc3a.pdf.

67. *Id.* at xiv-xv.

municipalities are leading collaborative efforts with neighboring agricultural groups to advance implementation of conservation BMPs, including the cities of Springfield, Bloomington, Danville, and Decatur. A long-standing collaboration also exists between the State's largest farm organization, Illinois Farm Bureau, and the State's largest operator of wastewater treatment plants, the Metropolitan Water Reclamation District of Greater Chicago, in downstate Fulton County, where research on agricultural BMPs is being conducted and displayed, and relationships are being built between rural and urban parts of our state.⁶⁸

C. Agriculture Initiatives

A variety of governmental and non-governmental programs aim at helping nonpoint sources such as agriculture reduce their contributions to nutrient pollution. The NLRS identified 39 agricultural-related programs, initiatives, and projects from federal and state agencies and NGOs, including, but not limited to: Section 319 grants, Conservation Reserve Enhancement Program, Partners for Conservation Cost-Share Program, State Revolving Fund, Mississippi River Basin Initiative, Advanced Conservation Drainage Training, Illinois Cover Crop Programs, and Edge-of-Field Partnerships for Saturated Buffers and Woodchip Bioreactors.⁶⁹ There are also other urban nonpoint source programs and projects (i.e., Streambank Stabilization and Restoration Program). While these programs are important and provide financial assistance and technical support, other funding sources and cost-effective solutions are needed.

Catalyzed by governmental funding, some farmers are investing in reducing nutrient run-off. According to the Illinois Farm Bureau, farmers' demand in Illinois for voluntary federal conservation cost-share programs has always exceeded the financial resources available, and that continues to be the case. State-level programs add additional cost-share and technical resources, and some farmers invest their own funding on the farm level to implement nutrient loss reduction practices. According to the Illinois Farm Bureau, agricultural interests helped form the Agriculture Water Quality Partnership to reach out to farmers and the agricultural industry to educate them about conservation practices and programs to address nutrient loss.

A variety of initiatives related to the NLRS continue in Illinois' agricultural community, with over \$59 million expended in 2017-18.⁷⁰ Many of these are funded through grants and other incentives provided by the US Department of Agriculture (USDA) and the Illinois Nutrient Research and Education Council (funded by a per-ton tax on agricultural fertilizer).

68. See Illinois Farm Bureau, Rural-Urban Collaboration in Fulton County (2021), <https://www.ilfb.org/take-actionstar/current-priorities/protecting-our-environment/rural-urban-partnerships/>.

69. IEPA, et al., *supra* note 8, at 1-14.

70. IEPA, et al., Illinois Nutrient Loss Reduction Strategy, Biennial Report 2019 (2019), <https://www2.illinois.gov/epa/topics/water-quality/watershed-management/excess-nutrients/Documents/NLRS-Biennial-Report-2019-Final.pdf> at 28.

While many of these initiatives under the NLRS are focused on row crop farmers, livestock operations in the State also present distinct nutrient reduction opportunities. Such opportunities need to be pursued in the face of different market pressures in a distinct regulatory context.

Outreach to farmers has focused on the following recommended BMPs:

1. **Timing and placement of nitrogen and phosphorus fertilizers;**
2. **Cover crops** that store nutrients until they can be used for crops in the following year, thereby reducing nutrient run-off and leaching and reducing/mitigating soil compaction;
3. **Edge-of-field practices** like saturated buffers, woodchip bioreactors, and drainage water management; measure the amount and quality of agricultural run-off and can aid the development of targeted strategies for run-off reduction.
4. **Constructed wetlands** that are engineered treatment systems that significantly reduce pollutants and improve water quality.
5. **In-field structural practices** like water and sediment control basins, terraces and grassed waterways; and
6. **Riparian buffers** that slow the flow of farm field run-off into surface water and allow for greater infiltration into soils.

V. New Approaches are Necessary

Although these efforts are important steps forward, the data from Illinois and other states suggest that new, innovative approaches are needed to accelerate progress towards the NLRS goals. The progress that has been made in the nearly 20 years since the first Gulf Hypoxia Action Plan in 2001 has not come close to meeting the need. The NOAA forecast for the 2020 Gulf Hypoxia Zone is 6,700 square miles, more than three times the goal of the 2008 Action Plan and nearly 20 percent larger than the long-term average.⁷¹ In fact, over the past five years, the Gulf Hypoxia Zone is consistently larger than the long-term average—indicating that the situation is getting worse, not better. As Figure 7 on the next page shows, Illinois’ contributions to these problems have increased, with a 7 percent increase in nitrate loading reported for the five-year period of 2013-17 (above the 1980 to 1996 baseline period).⁷²

The nutrient pollution problem persists despite the expenditure of hundreds of millions of dollars per year on nutrient reduction strategies. As noted above, \$311 million was spent in Illinois in 2017 and 2018. Other states have also spent significant sums, with Iowa, the largest contributor of nitrates, reporting expenditures for 2016 and 2017 of \$388 million and \$420 million, respectively.⁷³

71. See NOAA, NOAA Forecasts Larger than Average ‘Dead Zone’ for Gulf of Mexico, (June 3, 2020), <https://coastalscience.noaa.gov/news/noaa-forecasts-larger-than-average-dead-zone-for-gulf-of-mexico/> (last visited Aug. 10, 2020). The NOAA forecast is based on nutrient loading data, among other inputs; intense Gulf storm activity can reduce the size of the Dead Zone, which, in 2020, resulted in measurements of a smaller Dead Zone than projected. See also NOAA, Smaller-than-expected Gulf of Mexico ‘Dead Zone’ Measures (Aug. 4, 2020) <https://www.noaa.gov/media-release/smaller-than-expected-gulf-of-mexico-dead-zone-measured> (last visited Aug. 4, 2020) (“NOAA-supported scientists have determined this year’s Gulf of Mexico ‘dead zone’...is approximately 2,116 square miles,” as a result of “Hurricane Hana pass[ing] through the central and western Gulf days prior to the research cruise and mix[ing] the water column, disrupting the hypoxic zone....[w]hile the size of the hypoxic zone fluctuates naturally throughout the summer, it usually forms again within days or weeks after the passage of storms. Due to the close proximity of the storm to the survey cruise, the hypoxia area was only able to partially reform before the end of the monitoring cruise.”).

72. IEPA, et al., *supra* note 19, at 6.

73. See Tang, et al., *supra* note 20.

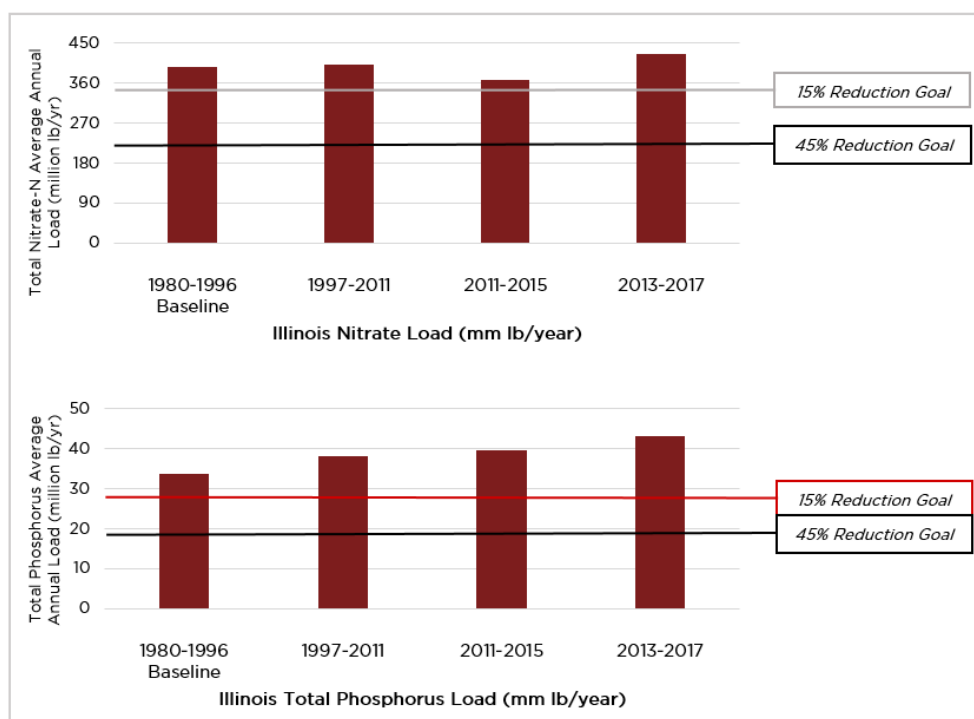


Figure 7. Long-term nutrient loads in Illinois.⁷⁴

While there are significant opportunities for nutrient loss reductions in Illinois' agricultural community, it is also clear that most farmers lack the capital to make the required investments.⁷⁵ Corn and soybean prices have declined by nearly 50 percent from their 2012 peak, leaving Illinois farmers cash-strapped, with no ability to invest in nutrient reduction projects, no matter how promising.⁷⁶ While farmers do have access to some federal and State programs that provide funding for specific nutrient run-off reduction practices, these are usually limited to two or three years. Without ongoing appropriations for maintenance and repairs, environmental performance will deteriorate. Further, more than 50 percent of farmland used for commodity crops is leased, leaving farmers with few incentives to invest in nutrient reduction activities on land they do not own.⁷⁷ Of the landowners, 80 percent are not actively engaged in farming, renting their land to tenant farmers. Thus, without the opportunity to earn cash returns, they have little incentive to invest in nutrient reduction measures.⁷⁸ Farmers are also interested in practices that increase yields, but an effective nutrient market could create new revenue streams for environmental services that offer more value than merely increasing yields.

74. IEPA, et al., *supra* note 19, at 148.

75. *Id.* at 68–69

76. See U.S. Dept. of Agriculture (USDA), Inflation-adjusted price indices for corn, wheat, and soybeans show long-term declines (2019), <https://www.ers.usda.gov/data-products/chart-gallery/gallery/chart-detail/?chartId=76964> (last visited Aug. 4, 2020).

77. See USDA, Farmland Ownership and Tenure (2019), <https://www.ers.usda.gov/topics/farm-economy/land-use-land-value-tenure/farmland-ownership-and-tenure/> (last visited Aug. 4, 2020).

78. *Id.*

The NLRS and experts nationwide agree that innovative mechanisms, methodologies and approaches need to be deployed to address meaningfully contributions to nutrient loading. The lack of progress in mitigating the Gulf Hypoxia problems and the increases in both Illinois statewide nitrogen and phosphorus loading reported in the NLRS 2019 Biennial Update are clear demonstrations of this unfortunate reality. If a system to incentivize nutrient reductions could augment or replace high-cost interventions at regulated point sources, then significant potential exists for a marked improvement in water quality. Further, a market to compensate farmers for implementing verifiable nutrient loss reductions could help the State's farms diversify their revenue streams.

A nutrient management approach that has the potential to incentivize innovation and broad participation among stakeholders is needed to develop cost-effective solutions that provide environmental benefits. Indeed, the NLRS contemplates the development of a "watershed-scale total phosphorus trading program,"⁷⁹ and further states that "Illinois EPA will promote trading, urban/rural partnerships...as part of watershed planning and implementation efforts and may use such trading when considering NPDES permits after an appropriate, enforceable, and transparent program has been developed."⁸⁰

79. IEPA, et al., *supra* note 8, at 5-4.

80. *Id.* at 5-11.

VI. Market-Based Approaches

A. Market-Based Approaches to Environmental Challenges

In environmental law and policy, market-based approaches are policy instruments that use markets, price, and other economic tools to provide financial incentives for regulated entities to reduce or eliminate their pollution. Such policies seek to incorporate into market decision-making the costs of production or consumption activities that are not borne directly by the producer (i.e., externalities) by creating property rights and facilitating the establishment of a proxy market for the use of environmental services.⁸¹

Examples include emissions trading and other tradeable permit systems, deposit-refund systems, licenses, and economic property rights. The European Union Emissions Trading Scheme is an example of a market-based instrument to reduce greenhouse gas emissions. In the US, significant environmental advancements have been enabled, at least in part, through the use of market-based approaches. These include: the phaseout of lead in gasoline (Lead Credit Trading); significant reductions in sulphur dioxide emissions from utility power plants (Acid Rain or SO₂ allowance trading); and markets for CO₂ reductions (e.g., the Regional Greenhouse Gas Initiative).

Market-based approaches differ from traditional regulation (sometimes called “command-and-control”), such as the CWA framework described above. Command-and-control regulation focuses on how and how much pollutants are discharged at a specific source; these sorts of traditional regulatory approaches “command” that polluters meet certain limits and, to some extent, “control” the means by which they meet such limits. Market-based systems recognize that the impacted environment is broader and limit the overall burden by either creating specific prices for pollution or allocating the rights to discharge specific amounts that can be bought and sold. However, implementation of market-based approaches still requires regulation, such as: setting a reduction requirement for polluters which they may meet through a market mechanism, defining the form of a pollution credit that can be traded; establishing how transactions will be monitored; and creating appropriate enforcement mechanisms. Such an approach provides regulated entities and other market participants with more flexibility to achieve compliance.

For example, in 1990, Congress enacted a national cap on the emissions of SO₂ from utility power plants. Regulators determined for each powerplant an allotment of pollution credits

81. See Nathaniel O. Keohane & Sheila M. Olmstead, *Markets and the Environment* (2nd ed. 2016).

based upon a specific level of annual SO₂ emissions, with each plant required to meet the same emissions rate. Significant flexibility in achieving the specified level was permitted, including switching to lower sulphur fuels, implementing technological improvements, or purchasing credits from powerplants that over-complied and had excess credits. Failure to match credits to the annual emissions resulted in significant financial penalties.⁸² The program was an overwhelming success, with many powerplants achieving significant reductions well ahead of the required timeframes, substantially improving air quality at a far lower cost than initially forecast.⁸³

B. USEPA Encouragement for Market-Based Approaches to Nutrients

USEPA has been developing and implementing market-based approaches to pollution reduction since the 1980s. As the problems related to nutrient pollution became more evident and concerns mounted that traditional regulation would be insufficient to manage the issues, USEPA again turned to market-based approaches as an alternative tool.

USEPA first provided guidance related to market-based approaches to water quality issues like nutrient pollution in 2003⁸⁴, followed by a Water Quality tool kit in 2009.⁸⁵ USEPA has actively supported several of the larger Water Quality Trading programs, like projects in the Chesapeake Bay and Ohio River, including by providing funding to state and local entities.

In December 2018, USEPA and USDA sent a joint letter to state agricultural and environmental directors inviting engagement on market-based and other collaborative approaches to reducing excess nutrients.⁸⁶ The letter emphasized USEPA's and USDA's commitment to working with local stakeholders to identify watersheds and basins where market-based approaches could supplement traditional regulatory programs. The agencies expressed that they could provide technical and financial support to facilitate progress in this space, but they did not indicate that they would lead or organize these efforts.

In February 2019, USEPA announced a new policy memorandum clearly articulating its renewed emphasis: "the Agency's expectation is that states and tribes will develop robust

82. Clean Air Act Amendments of 1990, subchapter IV-A, 42 U.S.C. § 7651 et seq..

83. See Gabriel Chan, et al., *The SO₂ Allowance-Trading System and the Clean Air Act Amendments of 1990: Reflections on 20 Years of Policy Innovation*, National Tax Journal 65 (2012), https://scholar.harvard.edu/files/stavins/files/chan_et_al_so2_article_national_tax_journal_2012.pdf.

84. 2003 USEPA Water Quality Trading Policy, 68 Fed. Reg. 1610 (Jan. 13, 2003).

85. USEPA, Water Quality Trading Toolkit for Permit Writers (June 2009), <https://www.epa.gov/sites/production/files/2016-04/documents/wqtradingtoolkit.pdf>.

86. See Joint USEPA-USDA Letter (example) to State Environmental and Agricultural Departments (Dec. 4, 2018), <https://www.epa.gov/sites/production/files/2018-12/documents/andersen-kansas-joint-letter.pdf>.

and defensible water quality trading programs that comply with the Clean Water Act and result in water quality improvements.”⁸⁷ Designed to help states, tribes and stakeholders use market-, incentive- and community-based programs to reduce excess nutrients and improve water quality in their communities, the memorandum identified six Market-Based Principles designed to encourage creativity and innovation in the development and implementation of programs that reduce pollutants in US waters:

1. States, tribes and stakeholders should consider implementing water quality trading and other market-based programs on a watershed scale;
2. EPA encourages the use of adaptive strategies for implementing market-based programs;
3. EPA recommends that water quality credits and offsets be permitted to be banked for future use;
4. EPA encourages simplicity and flexibility in implementing baseline concepts;
5. EPA recommends policies that allow a single project to generate credits for multiple markets⁸⁸; and
6. Financing opportunities exist to assist with deployment of nonpoint land-use practices.

Subsequent to the release of the memorandum and a related webinar, in September 2019, USEPA formally asked for comments on its February memorandum.⁸⁹ Comments were filed by a number of parties, but no further action has been taken by USEPA.

Highlighting its encouragement of market-based approaches, in February 2020, USEPA awarded more than \$1.8 million in Great Lakes Restoration Initiative (GLRI) grants to five organizations that will use market-based approaches, including water-quality trading, to enhance nonpoint source excess nutrient reduction efforts in the Great Lakes basin. Funding included \$437,000 for the Dairy Research Institute to identify and design the functional elements of a market-based, water-quality trading clearinghouse in the Fox River watershed, with the goal of establishing, promoting and operating a transparent water quality trading marketplace. In addition, the Great Lakes Commission will provide incentives for drinking water utilities to participate as buyers of water quality credits, further encouraging the development of water quality trading programs in this area.⁹⁰ And most recently, a

87. See Memorandum from David P. Ross, Assistant Administrator, USEPA, to the Regional Administrators, Regions 1-10 (Feb. 6, 2019), <https://www.epa.gov/sites/production/files/2019-02/documents/trading-policy-memo-2019.pdf>.

88. Nitrogen reduction strategies can also sequester greenhouse gasses or reduce such emissions from agricultural practices, meaning they could be used to create credits in climate change markets. The 2019 Refinement to the 2006 IPCC Guidelines for National GHG Inventories provides new guidance on these calculations. See Intergovernmental Panel on Climate Change, 2019 Refinement to the 2006 IPCC Guidelines for National GHG Inventories, UN Climate Change Conference (Dec. 5, 2019) https://www.ipcc.ch/site/assets/uploads/2019/12/03COP25_2019-Refinement.pdf.

89. Water Quality Trading Under The National Pollutant Discharge Elimination System Program, 84 Fed. Reg. 49293 (Sept. 19, 2019)

90. See USEPA, EPA Awards Over \$1.8 Million for Innovative, Market-Based Nutrient Reduction Projects in Great

September 2020 USEPA memo issued additional guidance on federal funding sources to help finance nonpoint pollution reduction efforts, “including Clean Water Act (CWA) Section 319 grants, State Revolving Fund (SRF) loans, and Water Infrastructure Finance and Innovation Act (WIFIA) credit assistance.”⁹¹ In short, USEPA has expressed consistent and continued support for state-led efforts to develop water quality trading programs.

C. Development of Market-Based Approaches for Nutrient Trading

Market-based approaches seek to achieve the water quality goals using incentives and providing opportunities for entities other than point sources to participate in creating the required reductions in pollution. For example, a system can be created where point sources, nonpoint sources, and other parties can generate, sell, buy, trade, and retire credits that represent units of a particular pollutant allowed to be discharged into a common water body.⁹² Depending on the structure of the program, these transactions can be arranged directly between participants (bilateral) or through an exchange (as in a commodities market or futures exchange).

While market-based approaches can be a dynamic alternative to traditional regulatory approaches, they still must comply and integrate with the underlying law, the CWA. Under the 2003 Water Quality Trading Policy,⁹³ EPA recommended that States “should establish clear, enforceable mechanisms consistent with NPDES regulations that ensure legal accountability for the generation of credits that are traded.” Because the 2003 Policy emphasizes that the credit “buyer” must remain legally liable for the pollution-reducing actions it uses to demonstrate compliance, this 2003 Policy was more focused on bilateral trades than on market models utilizing a clearinghouse structure.

As in traditional regulatory frameworks, permit holders who participate in trading are still responsible for meeting overall discharge limits. However, dischargers with lower costs of reduction can over-control beyond their requirements, while others with higher compliance costs purchase excess reductions created by lower-cost compliers.⁹⁴ Entities without direct compliance requirements (e.g., nonpoint agricultural sources) can also create tradable credits by reducing nutrient run-off, using a variety of verifiable means. Thus, reductions can

Lakes Basin, News Release (Feb. 24, 2020), <https://www.epa.gov/newsreleases/epa-awards-over-18-million-innovative-market-based-nutrient-reduction-projects-great> (last visited Aug. 10, 2020).

91. Memorandum from David P. Ross, Assistant Administrator USEPA, to State and Tribal Environmental Agency Directors (Sept. 30, 2020) https://www.epa.gov/sites/production/files/2020-10/documents/memo_to_state_and_tribal_environmental_directors_-_09.2020.pdf.

92. James S. Shortle and Richard D. Horan, *The Economics of Water Quality Trading*, 2 Int'l Rev. of Env'tl & Resource Econ. 101, 102 (2008).

93. USEPA Water Quality Trading Policy, *supra* note 85, at 10.

94. James Shortle, *Economics and Environmental Markets: Lessons from Water-Quality Trading*, 42 Agric. & Res. Econ. Rev. 57, 66 (2013).

take place more cheaply in total than they would if each entity had to meet limits only through actions at its own site.

Regulators play an important role: they ensure the integrity of the creation and retirement of credits and verify actual reductions, as necessary. One way this is done is through the development and implementation of monitoring and verification protocols used to prevent fraudulent behavior. This ensures regulatory goals are met while protecting market participants, who rely on the value of the credits as the basis of their investments and transactions.

Trading works particularly well when pollution reduction strategies vary widely among dischargers (i.e., both the means and costs of reducing particular pollutants). In the water domain, point sources typically install end-of-pipe technology or change production or waste-treatment processes, while nonpoint sources (often agriculture) apply BMPs to their

land.⁹⁵ A market among these parties could functionally reduce the overall per-unit price of reductions to the level at which marginal POTW reduction costs are lower than marginal nonpoint reduction costs, factoring in any transaction costs. Opportunities may also arise between point sources. Large wastewater treatment agencies may be able to exploit economics of scale and scope that are unavailable to smaller agencies. They may have financing and operational advantages as well. Creating incentives for them to over-comply may provide significant benefits for both types of agencies by functionally equalizing the price of reductions between those with high costs and those with lower costs.

Key elements of a market-based approach, which include both point and nonpoint sources, are described below. While delivering more limited benefits, a viable market incorporating only point sources could also be developed instead, considering these same design questions.

1. **Geographic scope of the market** – Unlike markets for atmospheric pollutants (e.g., SO_x, CO₂), markets focused on improving water quality will depend on the program's goal, the existing environmental conditions and the physical configuration of the waterways. For example, if the goal is to reduce nitrates and phosphorus that lead to the creation of the Gulf Hypoxia Zone, the geographic scope of the market would likely be more expansive than if the goal were aimed at reducing localized pollution issues in a specific waterway.
2. **Credits generation** – Agricultural producers, dairy and animal feeding operations, and landowners can generate credits for sale in a water quality market by adopting

95. Karen Fisher-Vanden & Sheila Olmstead, *Moving Pollution Trading from Air to Water: Potential, Problems, and Prognosis*, 27 J. Econ. Perspectives 147, 161 (2013).

BMPs. A credit is a unit of pollutant reduction usually measured in pounds equivalent. Credits can be generated by a point source over-controlling its discharge or by a nonpoint source installing BMPs beyond its baseline. In the case of nutrients, these practices could include livestock fencing, cover cropping, conservation tillage, wetland restoration, and filter strips. These water quality benefits could then be translated into tradable credits.⁹⁶ Any source of pollution—point or nonpoint—could be eligible to engage in these transactions.

3. **Credit duration** – There may also be a temporal dimension to water quality credits, in that they may be monthly, seasonal, annual, or permanent. But a credit may only be effective during its designated life span. Certain types of pollution reduction projects may continue to generate credits for many years.⁹⁷ Some practices can generate credits immediately, such as conservation tillage. Others take longer to mature, such as filter strips and reforestation. Credits for point sources may also need to reflect monthly or other temporal limits.
4. **Credit quantification for nonpoint sources** – With many different ways of generating credits across diverse land use and agriculture operations, it may be challenging and costly to measure the specific reductions that result from a specific action at a specific location. One way to address this challenge is by establishing a uniform methodology accounting for various types of load reductions. In order to quantify credits, nonpoint sources may use standard practices and calculations, confirmed by periodic sampling, to establish credits that are quantifiable and creditable. Approaches to quantifying credits include modeling, use of pre-determined pollution reduction rates, and direct monitoring.⁹⁸ Reducing the time and cost of establishing credits would likely induce more nonpoint sources to participate in the market.
5. **Credit Transactions** – A market could be established based on bilateral trades, through a centralized broker, or a clearinghouse or other decentralized market. Each possible market structure will provide different levels of environmental and market oversight and will implicate different levels of transaction costs.

96. *Id.* at 159.

97. Willamette Partnership, Building a Water Quality Trading Program: Options and Considerations, at 95, 115 (July 2012), <http://willamettepartnership.org/wp-content/uploads/2015/06/BuildingaWQTPProgram- NNWQT.pdf>.

98. *Id.* at 66; Shortle, *supra* note 94, at 61.

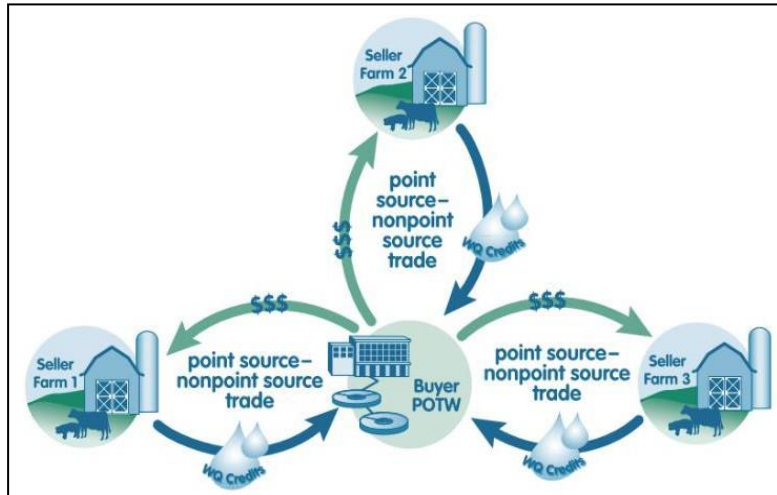


Figure 8. Point source-nonpoint source trade.⁹⁹

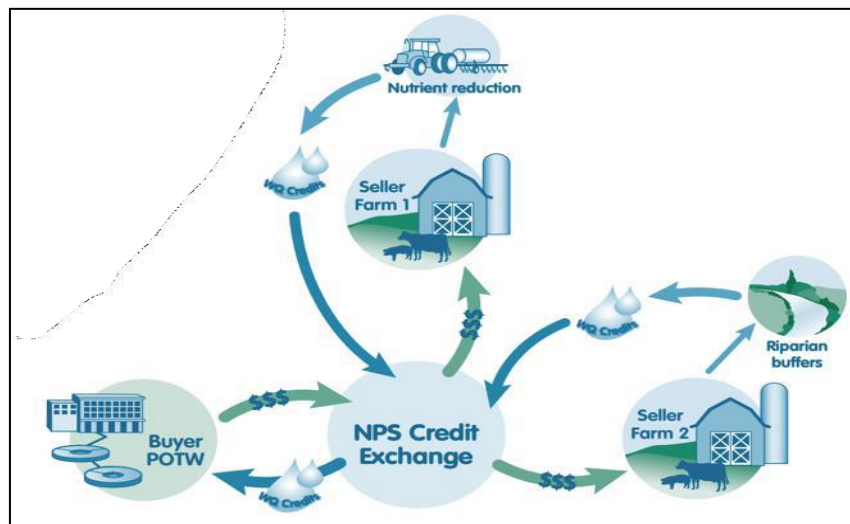


Figure 9. Nonpoint source credit exchange.¹⁰⁰

When properly designed and implemented, such a program can lead to environmental compliance that is better, cheaper, faster, and more sustainable. That has certainly been the case with major air market-based programs.

99. USEPA, Water Quality Trading Toolkit for Permit Writers, at 18 (June 2009), https://www3.epa.gov/npdes/pubs/wqtradingtoolkit_fundamentals.pdf.

100. *Id.* at 19.

VII. Illinois Nutrient Trading Initiative as a Potential State Strategy

Inspired by the NLRS's discussion of the potential for the development of a "watershed-scale total phosphorus trading program" and the reality that little progress had been made in meeting the goals of the 2008 Gulf Hypoxia Action Plan, the Illinois Nutrient Trading Initiative (INTI) was launched in 2018.

INTI grew out of discussions originated by the Illinois Pollution Control Board, the Metropolitan Water Reclamation District and other stakeholders in 2016. Current's mission to accelerate solutions to pressing and complex water challenges through multi-stakeholder collaborations made it a natural convening partner to continue these discussions. A Current-organized conference in June 2017 brought together stakeholders focused on policy, economics, engineering and technology opportunities presented by a statewide or regional approach. The University of Chicago's Abrams Environmental Law Clinic had been advising the Pollution Control Board on a variety of environmental matters, including legal aspects regarding trading. The University's Coase-Sandor Institute provided substantial experience and expertise in environmental markets. The Illinois Association of Wastewater Agencies, environmental and conservation groups, agricultural organizations, environmental trading and finance firms and others indicated a strong interest in a stakeholder-based collaborative process that would explore the development of a statewide framework for using market-based mechanisms to address the State's significant nutrient management problem. Consensus around this potential was based on a number of factors present in Illinois and conducive to a successful market-based approach.

Due to an advantageous accident of geography, Illinois seemed to be uniquely suited to the creation and maintenance of a successful market-based trading program. The Illinois River comprises about 75 percent of the State's water flow into the Mississippi and a similar proportion of its nutrient pollution. Unlike most other river systems that have been the focus of water quality trading initiatives, the Illinois River drainage area has most of its large point sources at the beginning of the river system, i.e., the Chicago metropolitan area. Downstream from the Chicago area lie millions of acres of agricultural land, the source of a significant portion of Illinois' nutrient problem. With a focus on reducing the State's phosphorous loadings flowing into the Mississippi, nutrient reductions from agriculture BMPs, etc. could offset required reductions from points sources further upstream while reducing contributions to Gulf Hypoxia.

The nature of Illinois' agricultural sources also provided promising opportunities. More than 10 million acres of Illinois farmland has tiled drainage, about 40 percent of the acreage under cultivation.¹⁰¹ Tile drainage consists of a network of below-ground perforated pipes that allow subsurface water into the tile line, removing excess water from soil below the surface of agricultural fields. Water flowing through tile lines is often deposited into surface water points—lakes, streams, and rivers—located at a lower elevation than the source. Illinois also has many large dairy farm operations and concentrated animal feeding operations.¹⁰² Both tile drainage and large animal operations provide ready options for monitoring and verification of nutrient reductions—key elements of any viable trading system.

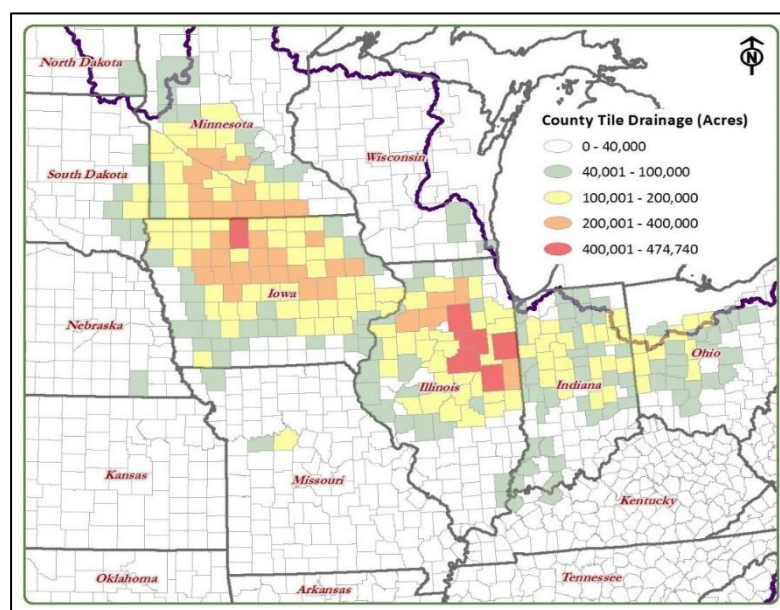


Figure 10. Estimates of tile drainage by county.¹⁰³

Since the per-unit costs of reducing nutrients by nonpoint agricultural sources can be less than 20 percent of technology-based reductions from point sources,¹⁰⁴ there are significant benefits for both point and nonpoint sources at hand. Point sources could obtain reductions of nutrients at significantly lower costs, while farmers could benefit from a second income stream.

101. See Carl Zulauf and Ben Brown, Use of Tile, 2017 US Census of Agriculture, 9 Farmdoc Daily 141, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign (Aug. 1, 2019), <https://farmdocdaily.illinois.edu/2019/08/use-of-tile-2017-us-census-of-agriculture.html> (last visited Aug. 10, 2020).

102. IEPA, et al., *supra* note 8, at 5-6.

103. Mississippi River Basin / Gulf Hypoxia Initiative, The Conservation Fund for U.S. Fish and Wildlife Service, at 16 (2016), https://lccnetwork.org/sites/default/files/Resources/ghi_conservation_blueprint_report.pdf.

104. S. Friedman, et al., Farming for clean water: Innovative solutions to reduce Chesapeake Bay farm runoff, Center for Conservation Incentives, Environmental Defense, New York (2007).

Evidence from several smaller-scale projects indicates that agricultural projects could reduce nutrients at significantly lower per-unit costs than investments in point source reduction technology, which also tended to have substantial ongoing operating costs.¹⁰⁵ At that time, few large point sources of phosphorous—mostly wastewater treatment facilities—had committed to large capital projects to achieve nutrient reductions.

Illinois also has a legal and regulatory framework that could facilitate the development and implementation of a market-based trading system. Since the 1980s, Illinois has been a leader in the development and implementation of environmental trading programs, including lead credit trading (linked to the phaseout of lead in gasoline), Sulphur Dioxide (Acid Rain) trading, as well as trading programs for NO_x and volatile organic compounds (VOCs). The Illinois Pollution Control Board has authorized several small-scale nutrient trading projects.¹⁰⁶ Preliminary legal research indicates that no statutory changes would be necessary for the Board to consider the authorization of a water quality trading program.

The specific state laws that create POTWs should not be a barrier to water quality trading. POTWs are largely organized as “Sanitary Districts” (SDs) in Illinois and are broadly governed by three Sanitary District Acts that were passed by the Illinois General Assembly in 1907,¹⁰⁷ 1917,¹⁰⁸ and 1936.¹⁰⁹ Each SD also has chartering documents associated with its incorporation.¹¹⁰ These acts do not address whether SDs have authority to participate in water quality trading programs but do not appear to foreclose such participation. For example, the 1917 and 1936 acts allow SDs to contract with entities outside of their territory to receive and treat sewage, which could be viewed as similar to purchasing water quality credits from outside of their jurisdiction.¹¹¹ While the general SD authorizing acts are silent on, if likely amenable to, water quality trading, the State passed an amendment to the Metropolitan Water Reclamation Act explicitly allowing the State’s largest POTW, MWRD, to participate in water quality trading and spend funds outside of its jurisdiction.¹¹² Given that MWRD’s preexisting statutory authority matched closely to that of other SD acts, similar statutory amendments to the 1907, 1917, and 1936 acts may be desirable to conclusively clarify that SDs are allowed to purchase credits generated beyond their territorial jurisdiction.

105. Chemical based nutrient systems require ongoing purchase of chemical reagents and the proper disposal to the nutrients removed.

106. See Great Rivers Land Trust, Piasa Creek Watershed Home Page, <http://www.greatriverslandtrust.com/piasa-creek-watershed/> (last visited Aug. 5, 2020).

107. 70 ILCS 2205.

108. *Id.* 2405.

109. *Id.* 2805.

110. See *id.* 2205/1, 70 ILCS 2405/1, 70 ILCS 2805/1.

111. SDs have the “right to permit territory lying outside its limits whether within any other sanitary district or not to drain into and use any channel or drain made by it, upon such payments, terms and conditions as may be mutually agreed upon.” 70 ILCS 2405/17; 70 ILCS 2805/26.

112. 70 ILCS 2605/57.

Finally, as discussed above, signals from federal environmental policymakers also suggest that the time could be right to seriously consider a more ambitious framework to market-based approaches for nutrient reduction in Illinois.

Recognizing these geographic, agricultural, economic, and legal preconditions led to the question underlying the INTI discussions: whether it was time to rethink the prevailing approach to nutrient loss reduction and implement a water-quality trading framework. Of the market-based water quality programs established to date, few had generated significant momentum, and many had seen only limited or even no activity. Given the lack of progress, among the issues posed in preliminary discussions were:

1. How does Illinois position itself to achieve long-term nutrient reduction trends?
2. Are stakeholders trying to solve local problems (e.g., within a limited portion of a river or stream watershed) or national ones (e.g., focused on Gulf Hypoxia)?
3. Relatedly, is there a danger in thinking too small? Should the relevant geographic market be defined more broadly? For example, because a bigger market means more opportunities for credit trading (and therefore presumably higher overall savings), should the entire Illinois River drainage be considered as one watershed for nutrient trading purposes?

VIII. Illinois Nutrient Trading Initiative Approach

Illinois has successfully used multi-stakeholder collaborative processes in the development of energy and environmental policy, including the creation of the NLRS. The INTI approach sought to build on that tradition to develop the basis for an appropriate, enforceable, and transparent program. Bringing together a broad array of key stakeholders, the project sought to produce a consensus-based framework for sound phosphorus trading program design, which would establish a strong basis for a subsequent regulatory rulemaking process. The goal was to establish a conceptual agreement regarding the key design questions necessary to develop a robust trading platform in Illinois that would deliver environmental performance and ensure regulatory compliance, including all appropriate monitoring/verification and reporting requirements. Specifically, the platform would facilitate cost-effective phosphorus reductions sought by the NLRS through a market that enables and incentivizes trades among point and nonpoint sources. Ideally, the framework could be tailored and expanded to include other constituents, like nitrogen, that have their own reduction targets.

The approach sought to identify more clearly the problem, the needs of various stakeholder groups and the opportunities for implementing innovative and effective solutions. In particular, these included:

1. The potential for more stringent regulation of nutrients produced by point sources, particularly wastewater treatment facilities;
2. The need to create incentives (both financial and operational) to drive reductions in nutrient run-off by nonpoint sources, particularly agriculture; and
3. The necessity of addressing other issues, including avoidance of local hot spots, encouragement of alternative methods of waterway improvements (dam removals, etc.), and local waterway recreation.

Given that Illinois' primary focus on targeted phosphorous reductions at point sources provided the regulatory driver for the creation of a market-based program, INTI limited its initial focus to that specific nutrient issue.

IX. Illinois Nutrient Trading Initiative Development and Process

INTI was convened in early 2018 by Current, the University of Chicago, and Gerald Keenan, former Chairman of the Illinois Pollution Control Board. In the first few months, the MWRD played a leadership role. Once the project's process was established, the team recruited stakeholders to participate in the working group. Steve Frenkel, the Current Executive Director at the time, and Mark Templeton, Clinical Professor of Law at the University of Chicago, served as co-conveners.

Stakeholder representatives reflected a broad spectrum of interests, including wastewater treatment facilities, agricultural organizations, environmental and conservation organizations, and environmental market finance entities.¹¹³ To facilitate coordination, a smaller Steering Committee was formed from the larger group. Representatives of Current's Research Consortium (including Argonne National Laboratory, the University of Illinois, Northwestern University, and the University of Chicago) were also engaged in the process.

The process design included the expectation that INTI would engage national and local experts to ensure the INTI framework would be grounded in sound science, as well as an understanding of the efforts at market-based approaches already underway in other states.

A. Phase 1

The initial stakeholder meeting was convened at Argonne National Laboratory on April 25, 2018, during which the overall INTI framework was presented. Stakeholders shared experiences with market-based approaches to environmental problems, and participants discussed a proposed timetable for the INTI process. Areas discussed included the overall legal and regulatory background for market-based trading under the CWA, current and developing USEPA policy, specific perspectives and goals related to Illinois, and the possible characteristics of a trading program that could meet Illinois' needs.

113. The following institutions were represented throughout the INTI process: Current, Palmer Bellevue, LLC, University of Chicago Law School, The Sierra Club, Illinois Chapter, Northern Moraine Wastewater Reclamation District, Newtrient, Illinois Farm Bureau, Openlands, Downers Grove Sanitary District, Metropolitan Water Reclamation District, University of Chicago Coase-Sandor Institute, Greeley and Hansen, The Nature Conservancy, Incubex, and the Illinois Fertilizer and Chemical Association.

A subsequent stakeholder meeting was held at the University of Chicago Law School on June 19, 2018. The meeting featured a presentation on current projects focused on market-based approaches to nutrient management by Mark Kieser of Kieser & Associates, one of the leading experts in this field. Following the presentation, a full and complete discussion was held about the retention of a facilitator for the process going forward, as well as the timetable options.

While discussions on the INTI process continued via conference calls among conveners and steering committee members, changes in leadership at the MWRD and the approaching November 2018 Illinois elections prompted a shift to a more thorough examination of the experiences from other states, particularly Iowa and Wisconsin.

B. Phase 2

In this phase, the INTI working group benefitted from two excellent presentations via a conference call related to the development of the Iowa Nutrient Reduction Exchange and an innovative legislative proposal to increase trading opportunities in Wisconsin. An additional discussion by the conveners was held with the developers of a program in the Ohio River Basin.

i. Iowa Nutrient Reduction Exchange

Dustin Miller, former General Counsel of the Iowa League of Cities, discussed the Iowa Nutrient Reduction Exchange, developed in collaboration with the Iowa Department of Natural Resources. The Exchange permits point sources (usually municipal wastewater treatment facilities) to invest in agricultural or other nonpoint source projects that reduce nutrient pollution, thereby offsetting the need to make reductions at one or more facilities. The program uses a web-based Nutrient Tracking Tool developed by USDA that models nutrient run-off for particular projects through a geospatial interface, using inputs from existing terrain, soil, weather and land use databases. The results are then validated by Iowa State University scientists and registered for credits in the program database. Ongoing inspection and verification may be required to maintain the flow of credits.

When the conservation practice is implemented, credits are generated for the reduction in nitrogen and phosphorus entering the watershed. The point source can then use the credits to meet NPDES permit requirements or trade them to another point source within the watershed.

At the time of the presentation, however, the municipal entities funding these conservation practices were not doing so to meet compliance obligations via direct investment or credit purchase. Rather, funding for investments by municipal agencies has been motivated by

complementary goals, such as flood mitigation, and provided by the State's revolving loan fund and by funds made available through Iowa's Water Excise Tax, which is directing \$280 million of water utility tax payments for water quality initiatives.

The development of the Exchange indicates that verification and tracking of BMPs can be implemented. Further, the ability to create nutrient reductions (recognized as credits) by leveraging funds that also provide other public benefits (e.g., flood control) highlights the opportunities for creativity in the development of market-based approaches.

ii. Development of a Phosphorous Trading Exchange in Wisconsin

Unlike Illinois, Wisconsin has addressed impaired waterways through the use of both strict, numeric nutrient limits in POTW permits and through TMDLs for particular water bodies. TMDLs for the Fox and Wisconsin Rivers have included significant nutrient reduction requirements from point sources. Wisconsin permitted bilateral trading within the TMDL boundaries, but parties found that the transaction costs and complexity of individual bilateral trading significantly limited trading activity.

Chris Kopman of Newtrient LLC discussed the group's work with Wisconsin dairy farmers. Newtrient, comprising 14 leading dairy organizations (nearly all US dairy farmers), works to reduce the environmental footprint of dairy operations and make it economically viable to do so. Newtrient's research found that farms can achieve the same phosphorus reductions for about 10 percent of the cost to municipalities and wastewater stream permit holders. The significant savings per pound of phosphorus reduced can be used to incentivize farmers and other landowners to invest in phosphorus reduction practices and technologies. Focusing on the significant phosphorous reductions required by Wisconsin River Basin's TMDL, Newtrient sought to facilitate greater participation by Wisconsin's dairy farmers by lowering transaction costs, facilitating transactions and increasing regulatory certainty.

Wisconsin legislation initiated by Newtrient and passed by the Wisconsin Legislature,¹¹⁴ with strong support from Wisconsin's dairy and cheese industries and The Nature Conservancy, sought to increase participation in water quality programs by enabling a third-party clearinghouse to facilitate Wisconsin's existing water quality trading programs. The clearinghouse will provide an extra element of certainty and accessibility needed for farms, industry and wastewater treatment plants to work together toward shared water quality goals.

114. Wis. Stat. § 283.84, et seq., 16.9685.

Experience to date in Wisconsin demonstrates that binding limits on point source nutrient discharges create incentives to engage in market-based trading, but doing so solely through bilateral transactions entails large transaction costs, thus diminishing the potential benefit of market-based approaches that can lower costs and drive environmental performance.

iii. EPRI's Ohio River Basin Trading Project

In August 2012, Ohio, Indiana, and Kentucky signed an interstate Pilot Trading Plan in the Ohio River Basin. The Ohio River Basin Trading Project, which is run by the Electric Power Research Institute (EPRI), a non-profit research organization, is entirely voluntary and includes both point and nonpoint sources. Through the project, EPRI is working with farmers to implement verifiable nonpoint reduction strategies through revenues from credit sales and grants. While EPRI has had some success securing grant funding for nonpoint projects that have generated robustly verified nutrient reductions, there is a demonstrable lack of true 'buyers' for credits and, therefore, almost no actual trading activity. Without a potential set of credit 'buyers' driven by regulatory compliance obligations, EPRI has turned to focus on offering stewardship credits to multinational corporations that have operations in the Ohio River Basin and that are seeking to mitigate supply chain environmental impacts and meet corporate sustainability targets. Despite the minimal demand for credits to date, EPRI is hopeful that future demand will be driven by international buyers seeking to meet sustainability goals that are broader, more flexible, and subject to less government oversight than specific regulatory compliance obligations related to nutrient pollution.¹¹⁵

C. Phase 3

Concurrently with the work in Phase 2, the INTI team had ongoing conversations with IEPA and USEPA officials concerning INTI efforts and developing USEPA policies and initiatives to foster market-based trading initiatives for nutrient reductions.

In May 2019, a group of INTI stakeholders and the co-conveners met with USEPA's Office of Water Principal Assistant Deputy Administrator Anna Wildeman. In addition to encouraging the pursuit of the INTI, she strongly indicated that USEPA supported a broad definition of the term "watershed," in a way that could include an entire river drainage, as the INTI had raised in regard to the Illinois River. Significant discussion about the 2019 USEPA Memorandum ensued related to expanding market-based approaches to nutrient pollution, potential federal funding and other pertinent issues. Principal Assistant Deputy

¹¹⁵ Discussion between EPRI and the Abrams Environmental Law Clinic regarding the Ohio River Basin Trading Project (July 30, 2019).

Administrator Wildeman strongly encouraged INTI to continue its development work, given the support from USEPA for expanding market-based trading to address nutrient pollution.

X. Illinois Nutrient Trading Initiative Findings and Outcomes

A. Areas of Consensus

The INTI process has developed several areas of consensus, which provide a solid foundation on which future work can be built. These include the following:

1. Excess nutrients are a very serious issue in national and Illinois waterways and need to be addressed. Despite substantial expenditure of effort and money, the lack of significant progress is evident—Gulf Hypoxia and Lake Erie’s annual algae blooms are just two prime examples.
2. Market-based approaches, including trading, could be a viable approach if designed and implemented correctly. Primary concerns are:
 - a. Monitoring and verification of credits – Important to maintain the value of tradable credits and ensure environmental performance.
 - b. Hotspot identification and prevention – Structure the program to prevent the development of hotspots and ensure that the ability of regulators to address any hotspots that do develop is maintained; other environmental trading systems (e.g., SOx and NOx) had similar provisions as key elements of the market framework.
 - c. Effects on local waterways – Nutrient trading might allow POTWs to continue discharging nutrients at higher levels than the application of enforceable point source controls. Since POTWs are mostly located in more densely populated and upstream parts of the State, further attention needs to be given to the effects on overall local water quality related to recreation and fishing.
3. An exchange model is highly preferred to bilateral trades, as the latter have to be individually negotiated, which experience in Wisconsin has shown to be expensive and time-consuming.

While a market comprising only point sources—POTWs and industry—could be successful, such a focus is likely to result in significantly higher per-unit costs than if opportunities provided by agriculture and other nonpoint sources are included. A point-to-point market would also fail to deliver benefits to the farm economy and likely produce lower overall reductions in nutrient loadings.

B. Persistent Barriers and Questions

In addition, several areas were identified that require further information and research.

1. **Technical open questions** – How market-ready are agricultural and nonpoint nutrient reduction technologies and strategies? What would it take to get widespread recognition and standardization of assigned reduction values to particular technologies or strategies? What are the critical frontier technologies to achieve reduction in both point and nonpoint sources and to improve measurement and verification of reductions?
2. **Geographic scope** – Is it appropriate to designate the entire Illinois River drainage as the trading market? Such a wide geographic reach could create a very broad market with many upstream buyers and downstream sellers, particularly if the focus is on reductions of nutrients contributing to Gulf Hypoxia. However, both legal and policy questions require further research and evaluation, including how to prevent hot spots.
3. **Economic analysis** – What are the real potential costs for point source reductions faced by POTWs, and at what price could credits be produced viably through alternative practices? Individual POTWs and watershed groups are already generating some of this information through the current permit conditions requiring Optimization and Feasibility studies, but more study and aggregate analysis may need to be done. Some agricultural practices that could generate credits could also increase farmers' yields or lower their costs; other credit-generating practices may be financially lucrative only if the credit price covers any implementation costs and any offsetting reduction in yields. Additional analysis is needed here, too.
4. **Opportunities for multiple revenue streams** – In addition to the economic benefits from a nutrient trading system, participants may be able to participate in other environmental markets, such as those for greenhouse gas reductions. Further careful study of these possibilities is warranted, particularly with respect to existing barriers, such as those in some USDA soil and water conservation programs.
5. **Further legal analysis** – In order to participate fully in a market-based system, Illinois POTWs may want to invest in projects outside of their territory and/or purchase nutrient reduction credits created by other entities, requiring additional clarity on potential statutory changes. In addition, as mentioned above, USEPA's 2003 Guidance creates uncertainty by emphasizing that the credit "buyer" must remain legally liable for the pollution-reducing actions it uses to demonstrate compliance. The viability of the exchange model might be questioned without further clarification on this point.

C. Opportunities for Innovation

INTI's collaboration with members of the Current Research Consortium and others has identified opportunities for innovation that would reduce transaction costs as well as increase the certainty of environmental performance. Integration of existing or near-horizon technologies, particularly those leveraging ubiquitous wireless data communications infrastructure, ability to store and manage ever-increasing amounts of data in real-time (e.g., cloud computing), and advanced analytics, is the key for establishing a successful market.

Potential areas of innovation include:

1. **In-situ nutrient sensors and analyzers deployed for continuous real-time monitoring of nutrients in waterways.** These technologies can be used for:
 - a. Verifying nutrient trading program effectiveness in achieving nutrient loss reductions;
 - b. "Hot spot" detection and monitoring;
 - c. Verifying effectiveness of nutrient loss reduction strategies at nonpoint sources; and
 - d. Improving accuracy of environmental models.
2. **Remote sensing and control technologies to manage discharges from farm field tile drainage.** These technologies can be used in systems that capture and store nutrient-containing run-off to be later reused for irrigation, thus returning the nutrients to the crops. Due to the ability to measure the avoided nutrient loading in such systems, the market is likely to ascribe a higher level of certainty to these reductions.
3. **Advanced edge-of-field technologies that incorporate high-capacity and high-selectivity adsorbent media designed to capture nutrients and return them to the field.** Credits generated by these technologies should have a high level of certainty due to the ability to calculate the exact amount of adsorbed nutrients based on established properties of the adsorbent media.
4. **Advanced agricultural waste processing technologies.** Such processes can extract nutrients and incorporate them into valuable fertilizer products that can be sold or applied on site. Such technologies are often compatible with anaerobic digestion, which is well-suited for generating heat and electricity from agricultural waste. The amount of extracted nutrient can be easily measured.
5. **Next generation fertilizer technologies.** These technologies deliver nutrients "on-demand" and prevent them from being washed out without compromising yield. These technologies are termed Enhanced Efficiency Fertilizers (EEF) and can be compared to the conventional ones on the rate of loss basis. EEF implementation does not require additional capital investment from farmers and has no maintenance costs, thus substantially lowering the overall cost of nutrient reductions.

6. **Artificial intelligence technologies.** These technologies identify and assess watershed features, nutrient content of soils, and water quality impairments using non-invasive methods, such as satellite scanning data and imagery. Information obtained with these technologies can be used to evaluate the effectiveness of the proposed and implemented practices, enabling smart investing decisions.
7. **Blockchain technologies.** In a large enough market, these technologies could substitute a central registry of nutrient credit trades with distributed ledgers, significantly reducing transaction and recordkeeping costs. This approach also increases transparency of both quantities traded and pricing. Blockchain technologies are already being tested in financial markets.¹¹⁶

116. See *What Blockchain Is and What It Can Do*, Wall St. J. (June 19, 2016), <https://www.wsj.com/articles/what-blockchain-is-and-what-it-can-do-1466388185> (last visited August 5, 2020).

Conclusion

First, in the nearly 20 years since the first Gulf Action Plan, the Gulf Dead Zone problems have gotten worse, not better, with the Dead Zone size exceeding the long-term average in four of the past five years. Looking at nutrient pollution data, NOAA forecast a Dead Zone of 7,769 square miles in 2020, nearly four times the Action Plan goals. Overall, no reductions in the nitrate loading from the Mississippi River to the Gulf of Mexico have occurred in the last few decades.

Clearly, the current approaches are not working. As regulators pull the only lever available—more stringent point source nutrient limits—customers of POTWs across the Mississippi River Basin are required to pay ever-increasing prices for the installation of nutrient reduction technology that seemingly has done too little to reduce the Hypoxia problem.

By creating a warmer Gulf, climate change is accelerating growth in the size of the Dead Zone. The Gulf has consistently had above-average water temperatures since 1988. June 2019 water temperature was the warmest ever for the Gulf, with temperatures 2.2 degrees Fahrenheit (1.2 degrees Celsius) higher than the long-term average.¹¹⁷ The trend continued in 2020, with April's Gulf temperature measuring 1.7 degrees Fahrenheit higher than the long-term average.¹¹⁸ A 2017 study indicated that a 1.1 degree Celsius increase in water temperature in the Gulf Dead Zone will worsen its average yearly extent and duration by 8 percent and 10 percent, respectively.¹¹⁹

Research indicates that the longer a region suffers from regularly recurrent hypoxia, the harder it is to bring it back to life.¹²⁰ Once the ecosystem is degraded, the level of sustained reductions required to restore it to health will be even greater than that of the 2008 Gulf Hypoxia Action Plan. Time is of the essence. The most recent update of the INLRS shows increases in both nitrate and phosphorous loading in Illinois waterways. While more recent point source reductions may have mitigated those increases somewhat, the fact is that overall nutrient loadings have not decreased in Illinois, despite significant expenditures—more than \$300 million in the 2017-18

117. See Caitlin Looby, *Gulf of Mexico Just Endured its Hottest June Ever, New Report Says*, Nola.com (July 19, 2019), https://www.nola.com/news/environment/article_38d15394-aa4b-11e9-be4a-0b43e9e22441.html (last visited July 24, 2020).

118. See Brian K. Sullivan, *World's Oceans Now Warmest on Record, Increasing Risk of Hurricanes, Wildfires Risks*, Bloomberg (Apr. 18, 2020), <https://www.bloomberg.com/news/articles/2020-04-18/warmest-oceans-on-record-could-set-off-a-year-of-extreme-weather> (last visited July 24, 2020).

119. John C. Lehrter, et al., *Predicted Effects of Climate Change on Northern Gulf of Mexico Hypoxia*, Springer (May 4, 2019), https://link.springer.com/chapter/10.1007/978-3-319-54571-4_8.

120. Donald F. Boesch, *Global Warming and Coastal Dead Zones*, National Wetlands Newsletter, Environmental Law Institute at 12 (2008), https://www.umces.edu/sites/default/files/pdfs/db_WarmingDeadZones.pdf.

period. While some progress in local watersheds had been demonstrated, no overall progress in discharges into the Mississippi River has been demonstrated.

Second, despite USEPA's efforts to encourage greater use of market-based mechanisms and the assertions in the INLRS that new approaches like market-based trading are needed, little has occurred in Illinois in these areas. While market-based mechanisms are likely to bring benefits, the existing regulatory framework does not provide enforceable, binding limits on point source nutrient discharges necessary to make such a system successful. As demonstrated in Wisconsin, the imposition of strict binding limits on point sources, along with a market-based trading framework, can drive point sources to fund or purchase credits generated by lower-cost nutrient reduction opportunities for agricultural and livestock producers.

Third, it is generally accepted that the per-unit cost of nutrient reductions is generally significantly less for nonpoint sources than for point sources. Federal and State programs provide some funding for implementation of BMPs, but this funding is limited in duration and size. Farmers have very little economic incentive to implement these reductions, as they have no regulatory reduction requirements. Further, the agriculture sector is cash-constrained due to low commodity prices. Investments that do not provide a return are unlikely to occur. If there was a market for nutrient reductions, farmers and/or other investors would be more likely to invest in capital projects that would reduce nutrient run-off.

Fourth, the most likely buyers, POTWs, continue to invest significant dollars in reduction removal technologies—\$212 million in 2017/18 alone. Since reductions potentially could be made more cheaply on Illinois farms, those funds could have gone further if they had been invested in changing agricultural practices. The current regulatory framework encourages a misallocation of resources. Illinois needs a framework that allows reductions to be harvested in the most cost-efficient manner, with a sharp focus on environmental performance, including monitoring and verification.

Fifth, in order to do so, state policy needs to change to promote the efficient allocation of financial resources to those activities where the greatest reductions can be made at the lowest overall per-unit costs. This would include:

1. Strict, binding limits on point source nutrient discharges that are imposed in the near term;
2. Required statutory and regulatory changes that will facilitate the development of market-based trading frameworks;

3. Permitting POTWs to use low-cost loans from IEPA to invest directly in nutrient reduction projects at nonpoint sources, from which the POTWs would receive nutrient reduction credits; and
4. Focusing federal and state grant money for soil and water conservation on projects that maximize nutrient reduction and provide farmers and landowners with associated nutrient reduction credits.

One of the strengths of the NLRS is the willingness of partners to leverage existing programs and resources to create new ones to achieve Strategy goals. While progress has been made and collective stakeholder momentum has been generated in the five years of the NLRS, new technology, innovation, financial incentives, and market-based mechanisms are needed to accelerate progress towards the NLRS goals.

Thoughtfully designed market-based solutions create incentives that can spur innovation in technology and its applications to solve complex problems. We cannot create a 21st-century solution to the nutrient problem by relying on 20th-century technologies and regulatory approaches. The key is ensuring that the regulatory framework encourages technological, financial and market structure innovation while requiring pollution reduction performance. If we get the regulatory framework, incentives and technologies right, Illinois could become a leader in nutrient reduction in the Mississippi River Basin.