Municipal-Agriculture Partnerships for Clean Water

NOVEMBER 2025

SAND COUNTY FOUNDATION

Primary Authors:

Eli Halverson, Sand County Foundation
Haleigh Summers, Ph.D., Sand County Foundation
Tricia Verville, Sand County Foundation
Nasra Mohamed, Sand County Foundation & Yale School of the Environment
Kevin McAleese, Sand County Foundation
Lauren Lurkins, Lurkins Strategies, LLC
Jeff Boeckler, Northwater Consulting, a Spheros Environmental company
James Adamson, Northwater Consulting, a Spheros Environmental company

Recommended Citation:

Sand County Foundation. 2025. "Municipal-Agriculture Partnerships for Clean Water: November 2025". Sand County Foundation, Madison, WI.

Acknowledgements:

The authors express their gratitude to all contributing entities, especially the municipalities for their time and participation in meaningful discussions. Special thanks are also given to Sand County Foundation partners who helped facilitate these conversations, including the Iowa Department of Natural Resources, Lurkins Strategies, LLC, and Northwater Consulting, a Spheros Environmental company. Lastly, the authors thank the Walton Family Foundation for their funding and support of this important work.

Abbreviations

BNWRD	Bloomington-Normal Water Reclamation District
EPA	Environmental Protection Agency
EPIC	Environmental Policy Innovation Center
HTF	Mississippi River/Gulf Hypoxia Task Force
IDALS	Iowa Department of Agriculture and Land Stewardship
IDNR	Iowa Department of Natural Resources
MOU	Memorandum of Understanding
NPDES	National Pollutant Discharge Elimination System
NPS	Non-Point Source(s)
NRE	Iowa Nutrient Reduction Exchange
NRS	Nutrient Reduction Strategy
NRCS	Natural Resource Conservation Service
NTT	Nutrient Tracking Tool
SCF	Sand County Foundation
STAR	Saving Tomorrow's Agriculture Resources
SWOF	Soil and Water Outcomes Fund
TMDL	Total Maximum Daily Load
USEPA	US Environmental Protection Agency
WEA	Water and Environment Association
WiDNR	Wisconsin Department of Natural Resources
WPDES	Wisconsin Pollutant Discharge Elimination System

Sand County Foundation inspires and empowers farmers, ranchers, and forestland owners to ethically care for the land to sustain water resources, build healthy soil, and enhance wildlife habitat.

www.sandcountyfoundation.org

Table of Contents

Executive Summary

Since 2020, Sand County Foundation has promoted Municipal-Agriculture Watershed Partnerships in the Upper Mississippi River Basin, focusing on state-based water quality trading between point and non-point sources. This approach has gained momentum, evidenced by the Iowa Department of Natural Resources (IDNR) approving nine memoranda of understanding (MOUs) and the Illinois Environmental Protection Agency (EPA) approving its first MOU with the Northern Moraine Wastewater Reclamation District.

There are several benefits to water quality trading, including increased funding and technical assistance for farmers, reduced nutrient reduction costs for permittees, and environmental benefits like flood risk reduction and improved wildlife habitat. Progress has been slow, however, due to barriers and inefficiencies. By examining Illinois and Iowa programs, this analysis identifies strategies to overcome these challenges.

Over the past year, Sand County Foundation staff and partners have worked to evaluate the state of water quality partnerships across the Upper Mississippi River Basin. Currently, the biggest challenge to water quality trading is the lack of confidence in the program, process, and regulatory framework. Programs in Illinois and Iowa have struggled to gain traction, with limited success stories and case studies. Even where success has been achieved, questions remain about how credits will benefit the municipalities in the future and if the financial investments were worth it.

This lack of confidence in the benefits of water quality trading programs overwhelms the additional challenges, including the knowledge gaps and social barriers of working with rural stakeholders, or the political barriers to encouraging the use of tax dollars to fund practices outside of the city. Greater confidence in the trading program would alleviate concerns regarding financial investments that may not yield actual benefits.

Meanwhile, in Wisconsin, adaptive management and water quality trading have been successfully implemented since 2015. Municipalities and private dischargers have confidence that the money they spend will provide a benefit towards their current regulations. For Wisconsin permit holders, the main question is how to weigh the benefits of upstream investments against those of traditional infrastructure improvements. Currently, 98 Wisconsin point-source dischargers are using adaptive management or water quality trading to achieve compliance with their Wisconsin Pollutant Discharge Elimination System permits.

To facilitate the successful launch of these programs, state regulatory agencies need to be more transparent regarding the benefits and procedural requirements. Some municipalities have improved water quality by focusing on community engagement, fostering collaboration among stakeholders, and framing nutrient reduction as a collective effort. Key factors for success include securing diverse funding to gain local support, investing in staff capacity for effective data management, and establishing strong partnerships to maintain ongoing support for these initiatives.

Background

Eutrophication, caused by excess nutrients like nitrogen and phosphorus, threatens water quality and aquatic ecosystems, leading to issues such as contaminated drinking water and harmful algal blooms.

In 2011, the US Environmental Protection Agency (USEPA) published Acting Assistant Administrator for the USEPA Office of Water, Nancy Stoner's memorandum titled "Working in Partnership with States to Address Phosphorus and Nitrogen Pollution through Use of a Framework for State Nutrient Reductions" (the "Stoner Memo"), which outlines strategies for states to target and reduce nutrient pollution in water. The memo provided a framework for states to create nutrient reduction strategies, emphasizing the targeting of high-priority watersheds, setting numeric reduction goals, and encouraging voluntary implementation of agricultural best management practices (Stoner, 2011).

The USEPA and the Mississippi River/Gulf Hypoxia Task Force (HTF) aim to combat this water quality problem with nutrient reduction goals (USEPA, 2023). The Harmful Algal Blooms and Hypoxia Research and Control Amendments Act of 2014 directs the USEPA Administrator, through the HTF, to submit a progress report to Congress beginning no later than 12 months after the law's enactment, and biennially thereafter (USEPA, 2023). The HTF's 2014 plan committed to a 20% nutrient reduction by 2025 and a 45% reduction by 2035 to shrink the hypoxic zone to under 5,000 square kilometers (USEPA, 2014).

Nutrient reduction strategies address both point sources and non-point sources. Point sources are regulated by the National Pollutant Discharge Elimination System (NPDES) permits and include industrial and municipal wastewater facilities. Non-point sources (NPS) are largely unregulated and primarily come from agriculture. Modeling and monitoring have indicated that NPS, specifically agriculture, is the largest source of nitrogen and phosphorus, specifically in the central part of the Mississippi River Basin (Robertson & Saad, 2021; Krasovich et al., 2022).

It can take a decade or longer for conservation practices to show significant water quality improvements due to various environmental factors, such as increased precipitation and legacy pollutants in the soil (Sharpley et al., 2013). The reliance on voluntary programs for NPS reduction presents an additional challenge, as it makes scaling up conservation adoption difficult. While some state-specific innovations, like Iowa's "Batch and Build" model or Chesapeake watershed's Pay for Success programs, show promise, they need to be expanded and strategically implemented region-wide. To effectively address these issues, states require increased financial assistance and personnel to support farmers and target specific areas with the most effective conservation practices. Even with federal and state investments, innovative financing approaches are needed to target and scale-up implementation (USEPA, 2023).

Since 2020, Sand County Foundation (SCF) has promoted Municipal-Agriculture Watershed Partnerships in the Upper Mississippi River Basin, making gradual but notable progress in assisting the establishment of state-sanctioned water quality trading between point and non-point sources. This approach has gained traction, with the IDNR approving nine memoranda of understanding

(MOUs) with municipal jurisdictions and the Illinois EPA approving its first MOU with the Northern Moraine Wastewater Reclamation District. Despite this increased interest, challenges and inefficiencies are still present and must be addressed.

Water quality trading offers several potential benefits:

1. Increased funding and technical assistance for NPS entities, especially farmers.
2. Reduced nutrient reduction costs for municipal and industrial NPDES permittees.
3. Generation of environmental and infrastructure co-benefits, such as flood risk reduction, improved fish and wildlife habitat, and enhanced recreational opportunities.

Water quality trading provides an opportunity to reduce pollution from NPS, especially in light of recent reductions in federal funding for agricultural conservation practices. Following up on a proof of concept that watershed partnerships can be effective tools to address NPS nutrient pollution (Huntley & Peterson, 2023), SCF set out to evaluate the current state of water quality partnerships across the Upper Mississippi River Basin. Our aim was to identify existing barriers and future strategies for this vital work, with a specific focus on Illinois and Iowa, states actively engaged on pursuing water quality trading. As current obstacles are addressed and removed, municipal-agriculture partnerships can serve as a flexible strategy for wastewater plants and municipalities to meet regulatory water quality mandates through trading. This trend is already evident in Wisconsin, where water quality trading and adaptive management projects are often recommended by consultants to NPDES permit holders.

To learn more about SCF and partners' previous work with municipal-agriculture watershed partnerships, please visit:

www.sandcountyfoundation.org/municipalag

Iowa Progress

No major progress has been made to date

Iowa's nutrient reduction strategy aims for a **45% reduction in nitrogen and phosphorus,** with a significant emphasis on reducing NPS pollution. To date, no major progress has been made in reducing nitrogen or phosphorus, as numbers have held relatively steady (Iowa State University, 2025). Iowa has declined to set statewide numeric nutrient criteria, citing concerns about stringency and the small percentage of pollution from point sources.

4.8% increase in nitrogen & **35% increase** in total phosphorus

Illinois Progress

The Illinois strategy, managed jointly by the Illinois EPA and the Illinois Department of Agriculture, has successfully reduced phosphorus from the point-source sector, exceeding its interim goals with a 34% decrease (Illinois EPA, 2023). However, Illinois has seen its nutrient levels increase, with a **4.8% rise in nitrogen and a 35% rise in total phosphorus since the 1980-1996 baseline.** With agriculture being a leading cause of nutrient loss, the state needs more targeted, scalable non-point source programs.

Lessons Learned: Iowa

Across Iowa, there is increasing interest and concern regarding water quality, particularly as it relates to human health issues such as cancer and birth defects. Many citizens speculate that agricultural chemicals and declining water quality could be contributing factors to the state's high cancer rates (Essien et al., 2020; Gillam, 2025). Iowa has one of the highest cancer rates in the nation, ranking second, and these rates have risen rapidly in recent years (Iowa Cancer Registry, 2024).

Municipal-rural partnerships have been recommended as a solution for treating NPS and point sources of sediment and nutrients in watersheds. Such partnerships are increasingly important in states such as Iowa, with a majority of nutrient and sediment water quality concerns coming from its predominantly agricultural landscapes (CISWRA report, 2025).

Between 2020 and 2023, nine municipalities negotiated Memorandums of Understanding (MOUs) with the Iowa Department of Natural Resources (IDNR), assisted by SCF and the Environmental Policy Innovation Center (EPIC). The MOUs outlined how cities with NPDES discharge permits can generate nutrient reduction offsets by accelerating conservation practice adoption in their respective watersheds. This process is called the Iowa Nutrient Reduction Exchange (NRE) and was initiated by IDNR in 2020. More details about the MOUs can be found in a report entitled "Progress of Iowa Watershed Partnerships" (Huntley & Peterson, 2023).

Advancing the NRE has been a slow and lagging process, as it took many years for the first credits to get verified. This was primarily due to a lack of staff capacity to verify credits from the Nutrient Tracking Tool (NTT), the web-based nutrient model approved to estimate credits for nutrient loss reduction from practice implementation (Saleh et al., 2011; 2015). Iowa State University and the IDNR also expressed concerns regarding the accuracy of data from the NTT, prompting adjustments to the model from developers to enhance confidence in results. The first credits were approved by IDNR in February of 2024 (US Army Corps of Engineers, 2025).

Approach

In the summer of 2025, SCF staff conducted interviews with ten municipalities across Iowa to evaluate their perspectives on the current state of nutrient reduction credits and overall progress on water quality targets. The primary objective was to collect suggestions on improving water quality programs, explore potential solutions, and pinpoint future investment prospects in water quality infrastructure or practices.

SCF staff reached out to the nine municipalities that hold MOUs, as well as the city of Des Moines. Although Des Moines does not have an MOU, the city has been active in the water quality and nutrient reduction space, and often works in the watershed, outside of its city limits. Interviews were conducted via Zoom, with one through a phone call, using audio recording and transcription software available on the Zoom platform (Version 6.5.9). Consent for recording was obtained prior to each interview. Each call employed a semi-structured approach guided by a fixed set of 20 to 24 questions. This semi-structured format allowed the team to maintain consistency in questioning while providing flexibility for follow-up inquiries as needed.

All interviews were carried out by the same SCF scientist, and the interviewees were primarily city administrators or managers, public works or water facility directors, or watershed coordinators. Immediately following each interview, meeting transcripts were reviewed, and reflexive notes were summarized into one to two pages, highlighting the main response points. Due to the large volume of data in the interview transcripts, SCF focused the analysis on the reflexive summaries. Findings were categorized to create a comprehensive overview of current successes, opportunities, and challenges in the region's water quality and nutrient reduction strategies, with an emphasis on the NRE.

Examples of key questions asked:

- Is the municipality mainly interested in this work to meet nutrient reduction targets for their permit obligation, or does it have other goals in working with ag interests upstream, beyond permit compliance?
- What future plans or projects does your municipality have in place or under consideration to further improve water quality and reduce nutrient pollution?
- Have you submitted any projects to the Iowa NRE, or do you have plans to in the next six months?
- What are the primary concerns or hesitations, if any, that your municipality has regarding the NRE program or water quality trading in general?
- Who is completing the upstream work to coordinate with farmers? In reaching out to farmers, is the city directly involved, or fully outsource this effort to others?
- What suggestions would you give to other cities/plants considering registering projects into the NRE?
- What aspects of the current NRE framework for nutrient reduction and water quality trading could be clarified or strengthened to increase your confidence?
- What opportunities do you see for your municipality to potentially benefit from participating in the NRE program?
- What is your vision for how watershed partnerships will work in the long run?

General Findings

Populations of the ten interviewed cities varied widely between 3,500 to 213,000 people, with a wide variety of water-related priorities and available resources. Overall, there is great interest in protecting and enhancing water resources across these communities, though under many different contexts and priorities. Cities are interested in water quality for reasons such as recreation, drinking water, and complying with current or potential future regulations; and they are interested in controlling water quantity for flood mitigation.

For drinking water, eight of the cities depend on either bedrock aquifers or shallow alluvial aquifers, with alluvial sources being more susceptible to groundwater contamination. The other two cities depend on large rivers for their drinking water source, further increasing the susceptibility of the water source to contamination. Most of the cities have at least one river flowing through or within one mile of the city boundary.

All cities expressed interest in working within their watersheds to reduce non-point nutrient loads. However, many communities have had a difficult time working with rural stakeholders and participating in the NRE. Leveraging city-owned land is generally easier and more manageable in terms of enforcing practice adoption and gathering the necessary data for the nutrient reduction modeling.

Administratively, the NRE continues to be a complicated and rigorous process, which has led to barriers for communities to participate. There has also been a lack of prioritization from the state and insufficient clarification of the benefits of participating. Progress with the MOUs and NRE has been slow in most cases due to social, political, and economic barriers that vary from city to city. Of the interviewed municipalities, only three have registered nutrient credits into the NRE to date.

Challenges with the Nutrient Reduction Exchange

Lack of Clarity on Program Benefits

The biggest challenge with the NRE is the promotion and understanding of the program benefits. Many cities are aware of the Iowa Nutrient Reduction Strategy (NRS) and understand the benefits of cleaner water and increased infiltration upstream. However, cities are still hesitant about the idea of establishing tradable water quality credits to further meet the goals of the NRS. For many cities, the NRE process is not well-understood. Those who have participated in the crediting process expressed concerns over the data, time, and staff requirements needed to submit the credits. Confirming the benefits and a positive return on investment for utilizing the NRE is critical to its future success.

Interview respondents claim that it is not clear how the city or its citizens will benefit from spending money and time facilitating nutrient reduction practices and earning credits on land outside of city boundaries. Some cities that have entered credits do not have full clarity on how they will be used or verified. There is uncertainty at which point the NRE becomes financially beneficial to the city and its constituents.

> *"Does $100,000 of investment in the NRE program move the needle 1% or 10%?*
>
> – a representative from a city that has not submitted credits

It is hard to prove the importance when it does not directly impact the day-to-day life of the average citizen, and even harder to justify spending taxpayer funds outside the city limits. The lack of clarity on the value of credits has caused lower prioritization from city governments, resulting in hesitancy to participate.

A representative from one city described how they believed the NRE process would work: *"They go into the nutrient reduction exchange, and then if our wastewater utility or treatment plant has further restrictions on it in the future for nitrogen/phosphorus, then we can use our banked credits to offset some of those."* However, another city explained that as of now, cities have not been able to apply credits towards their NPDES permits, which has taken away much of the incentive to complete or submit more credits into the NRE. The application and financial benefits have not been transparent, which has led to confusion and an overall lack of

understanding. Cities need to know what they will get back from every dollar invested in practices outside of the city.

State Funding and Prioritization

The Iowa Legislature has also made it difficult to participate in the NRE. Six cities noted that decreased budgets due to property tax cuts have made it difficult to make additional investments in water quality. When budgets are slashed and there is a lack of funding from the state, it conveys a lack of prioritization from the state to support water quality trading, with one city representative noting, *"If you don't fund it, it's not a priority."*

The State Revolving Fund provides low-interest loans to Iowa municipalities for upgrading their water infrastructure. This program is federally supported and administered at the state level. In the past, accrued interest on loans from the State Revolving Fund could be used to support nutrient reduction initiatives, called Sponsored Projects. However, applications for Sponsored Projects stopped being accepted in November of 2023. Alternative State Revolving Fund dollars still exist for NPS water quality projects, but through a different mechanism that is perhaps less accessible to municipalities.

Tightened budgets bring economic challenges, and cities feel like they are asked to do more with fewer financial resources. Spending time and money on practices or improving water treatment infrastructure is a costly endeavor, and cities do not want to pass on extra costs to their citizens, whether it's in the form of increased taxes or water/sewer bills. Without extra funds, working on projects and practices in the watershed is a challenge for cities.

> *"So the state's not gonna do anything, they won't fund anything. But these things still need to happen. And then we get criticized because, you know, we're levying too much property tax."*
>
> – a representative from a small city

Lack of Regulation and Accountability

The lack of regulation on nutrient reduction from non-point sources was brought up by three of the 10 municipalities. Some cities expressed frustration with assuming responsibility for removing nutrients that originate from non-point sources elsewhere in the watershed, outside of city limits. The city must convince its citizens and city government administration that they should dedicate staff time and money towards watershed projects outside of the city, which can create political tension for the city and its interest in nutrient reduction.

> *"We can't justify spending a [redacted] citizen's tax/utility dollar on making public improvements outside of the city limits… There's really not a benefit to do that right now, and the reason there isn't a benefit to do it is because the city has no nutrient reduction requirements… It's hard to justify to the citizen to do something we're not required to do."*
>
> – a representative from a city that has not submitted credits

Some Iowa cities are not required by regulation to meet certain nutrient reduction standards, receiving variances from the state for their discharge requirements due to the high cost of facility upgrades compared to the median household income in the city (Iowa Code section 455B.199B). This law further disincentivizes cities from making investments upstream if they already have a variance and are not required to make changes to keep their NPDES permits in compliance.

Staff Time and Knowledge Gaps

Participation in the NRE is time-consuming, involving significant effort for stakeholder communication and managing data. The substantial staff time required to acquire, interpret, process, and enter data for credits is particularly burdensome when relying on city staff with other responsibilities. To claim nutrient reduction credits from agriculture, NTT demands annual updates of extensive, detailed farm data (e.g., soil test values, fertilizer use, field boundaries, management information), which is crucial for accurate model results but challenging to obtain and interpret due to varied sources and inconsistent formats (Saleh et al., 2011; 2015).

Municipal staff face a learning curve for utilizing the NRE and its associated modeling. The NTT model requires data input that can be complex to understand, especially for individuals without an agricultural background, as is often the case for municipal employees. Additionally, acquiring the required data from stakeholders can be difficult, particularly for staff who may not regularly handle farm management information.

Working with Rural Stakeholders

Working with agricultural producers and forming partnerships in rural areas can be challenging for many cities. City governments often struggle to establish and maintain trust with rural stakeholders, which can sometimes take years to develop. Building and maintaining trust is even more tenuous when it involves changing operational practices or requesting significant amounts of data from farmers. Implementing new or different practices can pose risks to producers, especially given their already narrow profit margins. Trust, along with technical and financial assistance, plays a crucial role in encouraging change, reducing risk, and increasing the success of conservation efforts and nutrient reduction initiatives.

> *"Conversations with farmers is challenge number one. Challenge number two is the labor involved with the NTT."*
>
> – a representative from a mid-sized city

Recommendations for the Nutrient Reduction Exchange

Increase the Clarity of Benefits and Regulations

The IDNR must improve the clarity of the benefits offered to the city from nutrient reduction credits. The cities need assistance in understanding the program's benefits, including what they gain and how it can positively impact taxpayers by investing time and resources beyond city limits. This will help address political barriers to convincing citizens that this program is a worthwhile investment. Elected officials, staff, and citizens must see more examples of how and when the credits will be applied. For many cities, applying credits to their NPDES permits was one of the original goals behind participating in the NRE. One city believed the NRE would see more cities participating if/when credits could be utilized towards their discharge requirements.

Encourage the Use of the NRE to Meet Regulations

If a municipality is failing to meet their NPDES permit, but can show that it is too expensive to upgrade their facilities, they will be given a deferment on meeting permit requirements due to the "Disadvantaged Communities Variance" law (Iowa Code section 455B.199B), which states "A community cannot be required to install a wastewater treatment system if the installation causes substantial and widespread economic and social impact (i.e., the system is unaffordable)" and "Such a community must continue to make reasonable progress toward compliance". With the establishment of the NRE program, municipalities have a cost-effective alternative to expensive brick-and-mortar upgrades. This program is especially beneficial for those cities that struggle to meet their NPDES permits and lack the resources or funding to enhance their facilities. While improvements in water quality in the watershed may not lead to immediate improvements within the municipality, particularly on a large scale, this program offers communities a viable path toward achieving compliance.

Address Knowledge Gaps

The IDNR has historically provided training to cities on the NRE and NTT. More recently, they have developed handouts to assist with collecting NTT-required data and inputting it into the tool and provided one-on-one support to assist in data entry. However, there is continued interest for more training and workshops to increase stakeholder familiarity with the NTT platform. To address any agricultural knowledge gaps of city staff, training sessions could also incorporate primer courses in basic agronomy, as NTT modeling necessitates foundational knowledge in soil science and related agricultural topics.

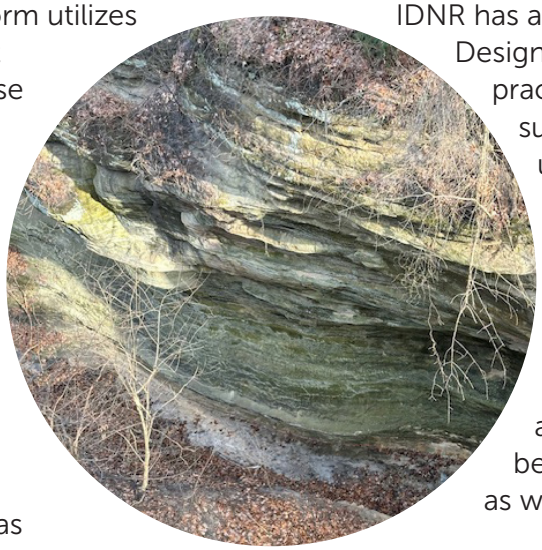
Along with assistance from the state, there are four cities that are further along in the process. With the support of state agencies, cities that have made significant progress in implementing these programs can serve as valuable mentors to those just beginning the process. This peer-to-peer assistance could involve sharing best practices, offering technical guidance, and providing support in navigating the complexities of state regulations and funding opportunities.

Provide Technical Assistance

A few of the interviewed cities said that having dedicated personnel to work with landowners and submit credits to the NRE would be beneficial. Larger cities with MOUs have the capability to hire or designate this task to one staff person, alleviating the risk of spreading other municipality employees too thin. Having a dedicated staff person would alleviate the backlog of credits, and this person could be hired such that they already have the agricultural background and expertise needed to complete the work. Smaller cities with less capacity to hire additional staff suggested that the IDNR could assign a person to work closely with each city to push them across the finish line. As stated before, slashed budgets and funding from the state have made it difficult to accomplish nutrient reduction goals. More commitment to support and fund nutrient reduction would motivate cities to dedicate resources and staff to nutrient reduction and the NRE.

To address some of the knowledge gaps and time concerns, three cities have utilized the assistance of the Soil and Water Outcomes Fund (SWOF). SWOF provides partial up-front payments to farmers for

conservation practices, then provides the complete funding after the practices are implemented (Torre et al., 2023). Along with funding, SWOF provides the necessary technical assistance for achieving success with the practices. SWOF then sells the environmental outcomes from the practices to governmental (e.g., the municipalities) and private entities. SWOF staff are well-versed in working with agricultural data and stakeholders, which has been helpful to cities getting started with nutrient reduction, alleviating some funding and technical assistance hurdles. SWOF's platform utilizes NTT, reducing data management complications. Cities can purchase the outcomes from SWOF to use as credits in the NRE.



An additional avenue could be engaging water treatment engineering firms in watershed work, as they already have a relationship with the municipalities. Water and Environment Association (WEA) events could provide platforms to promote watershed initiatives as point source compliance strategies and highlight offset/trading opportunities. However, municipal clients in urban and suburban areas, despite having resources and motivation, often lack direct ties to agricultural (non-point source) reductions. Regulatory clean-water efforts must also account for the differing capacities and tensions between metropolitan and rural treatment facilities, with rural managers often more cautious due to limited resources and heightened concerns about regulatory scrutiny. Some engineering leaders we interviewed expressed hesitation about endorsing non-traditional solutions, fearing it could affect their credibility within the close-knit treatment engineering community. Ultimately, creating meaningful shifts in the wastewater engineering business model is unlikely at this time. Direct engagement with non-point source/agricultural communities is likely a more effective approach.

Integrate Urban Practices

Many cities have implemented conservation practices on urban lands to mitigate flooding and enhance water quality. Urban solutions such as rain gardens, retention ponds, and bioreactors have been utilized by both citizens and city governments to achieve water quality goals on both private and city-owned land. However, there has been limited guidance within the NRE framework to account for these urban practices, which represents a missed opportunity for cities to register potential credits. The NTT model does not include urban land use or conservation practices in its modeling scenarios, which adds to this hurdle. However, the IDNR has approved the Minimal Impact Design Standards model for urban practice credits. So far, no cities have submitted credits for implementing urban practices; however, this process is available to any city that has a MOU. The IDNR also allows cities to use water monitoring both upstream and downstream of a practice instead of relying on a model. This approach could be particularly beneficial for larger projects, such as wetlands.

As previously mentioned, working on city-owned and managed lands is often easier for implementing conservation efforts and collecting data from private landowners. Expanding the focus from solely agricultural practices to include urban practices would facilitate the generation of more credits from city-owned lands. One of the major challenges in participating in the NRE is convincing city governments and their citizens of the benefits. Therefore, starting with urban practices and obtaining water quality credit could help build trust and commitment among stakeholders. However, care must be taken to ensure that upgrades counted as credits toward wastewater permits are not additionally counted toward upgrades for stormwater compliance.

Build Trust in Rural Partners

There is a growing need for innovative methods to engage and collaborate with farmers to achieve water quality goals. Some cities have been successful in reaching out to agricultural stakeholders. One approach that has shown

promise is the "farmer-led" model of watershed management. In this model, agricultural stakeholders at the watershed scale come together to create a network for peer-to-peer mentoring in conservation practices and technical assistance.

For example, Dubuque County Watersheds, which works with the City of Dubuque, has prioritized this method to achieve its conservation goals. Farmers often rely on each other for information and advice, which has cultivated a strong culture of peer-to-peer learning and mentorship within these communities. The farmer-led model emphasizes and supports these networks, allowing farmers to take charge of community groups and organizations focused on conservation and regional contexts.

These groups collaborate to pool resources and build partnerships both within and outside of watersheds. Municipalities can participate by supporting these communities of farmers. It is essential to bring farmers to the table as collaborators and decision-makers, addressing their concerns while acknowledging their local experiences. This collaboration also provides municipalities with a direct connection to a group of farmers who are already committed to conservation efforts. For example, in Wisconsin, the Yahara Pride Farms, Inc. producer-led group has successfully engaged with Dane County municipal jurisdictions to improve the water quality in the Madison, WI area chain of lakes.

Successes in Water Quality Improvement

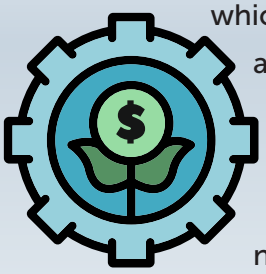
Several cities in Iowa have successfully improved water quality by implementing practical measures and collaborating with both urban and rural stakeholders to promote nutrient reduction, water quality, and conservation. Notably, Dubuque and Storm Lake have achieved success without participating in the NRE framework or using tradable credits. They have effectively engaged their communities around shared goals such as cleaner water, reduced flooding, and environmental stewardship.

Hosting workshops and events within the city has proven effective in motivating urban stakeholders to invest and get involved. Similarly, conducting field days in rural areas has successfully reached farmers and fostered farmer-to-farmer mentorship. Outreach and community involvement help raise awareness about water quality issues and frame nutrient reduction as a challenge that requires collective action from the entire community.

Seven of the ten cities have effectively utilized funding from state agencies such as IDNR and Iowa Department of Agriculture and Land Stewardship (IDALS), federal programs from the Natural Resource Conservation Service (NRCS) and Environmental Protection Agency (EPA), as well as private sources to provide various cost-sharing options for conservation practices. Having additional funding is

Batch and Build

A key innovation in Iowa is the "Batch and Build" model,



which groups multiple projects, such as bioreactors and saturated buffers, to reduce costs and increase efficiency (Iowa Agriculture Water Alliance, 2022; Clayworth, 2023; Patrick, 2024). These practices have the potential to make significant reductions in nitrogen leaching (Johnson et al., 2023), especially when implemented on a large-scale. The "Batch and Build" model has been implemented in other states to increase conservation impact.

crucial for increasing the implementation of these practices on the ground.

However, a city's ability to leverage these funds often depends on its staff capacity. Smaller communities may struggle to provide the same level of technical assistance as larger cities, which typically have more personnel, resources, and established partnerships. Additional funding to support cities and landowners in implementing best management practices can alleviate the strain on water treatment facilities and municipal staff. The most successful cities in nutrient reduction often have supportive city councils that help secure funding and overall city support for these initiatives. Ultimately, much of this success is predicated on the strength and breadth of established collaborations, highlighting the critical role of water quality partnerships.

Building strong partnerships to share the workload and increase available funding for these practices can significantly reduce both financial and staff burdens. Much of the success in water quality improvements has relied on establishing partnerships with entities outside of the city. Partnerships are critical, and types of partners can vary from city to city. A single municipality trying to work one-on-one with farmers throughout a watershed will not work without establishing external partnerships for technical assistance, funding, or guidance. The most successful communities have been able to leverage relationships and gain support by building out their network by working with external partners.

Some examples of external partners:

- Non-governmental organizations (NGOs)
- State agencies (e.g., IDNR)
- County level (soil and water conservation districts)
- Involved citizens
- Landowners/operators
- Agronomists
- Engineers and consultants
- Private industries within cities
- Other city governments that are further along in their MOUs or NRE participation.

Preliminary Iowa Conclusions

Achieving Iowa's water quality goals is a shared priority among stakeholders. Many communities understand that nutrient reduction efforts within their watersheds can result in cleaner water for drinking and recreation, while supporting flood mitigation. This shared understanding will be the critical piece for building partnerships that address non-point and point source pollution. The success of a water quality crediting program will require state program transparency, technical assistance for municipalities and landowners, and timely communication of outcomes. A commitment between urban and rural communities takes trust that can only be built from program transparency.

Lessons Learned: Illinois

SCF consulted with James Adamson and Jeff Boeckler of Northwater Consulting, a Spheros Environmental company, and Lauren Lurkins of Lurkins Strategies, LLC to conduct an assessment of the feasibility of establishing and maintaining a water quality trading program in Illinois. In Illinois MOUs, water quality trading is referred to as a "nutrient offset process." Much of what is presented herein is based on interaction and engagement with the Bloomington Normal Water Reclamation District (BNWRD) and is provided directly from a memo written by the consultants.

Previously, SCF interacted with the Northern Moraine Wastewater Reclamation District for the development of an MOU with the Illinois EPA, leading to an MOU executed in July of 2024. To date, not much has been done to create or purchase outcomes. The district is currently focused on parkland, preserves, state land, and open space.

In the right situations, watershed level nutrient reduction work can provide a means to improve water quality, especially in cases where the technology does not exist, or is not affordable or feasible, to allow a point source discharger to comply with permit nutrient requirements; or where the same or greater nutrient reductions can be achieved more quickly or at lower cost through implementing NPS reducing practices or other nutrient reduction efforts.

Background

In addition to BNWRD leadership and Bloomington-Normal legal counsel, Northwater and Lurkins Strategies, LLC, SCF received input from Attorney Fred Andes, environmental legal counsel for many wastewater treatment plants in Illinois, and Rick Manner, Urbana and Champaign Sanitary District and leader of the Illinois Association of Wastewater Agencies.

The purpose of the discussions with BNWRD is to better understand how Illinois wastewater treatment plants could make wider use of a watershed-based nutrient-reducing offset process anticipated for inclusion in future NPDES permits.

The work that BNWRD is already doing to reduce flooding and ponding, minimize nutrient loading, and support community initiatives is significant. Thus, we perceived them as likely to participate in an offset program, given their willingness to engage outside of their plants' footprints. Work with BNWRD would allow us to evaluate an offset program more broadly across various-sized/resourced districts in the state.

As a test case, BNWRD ultimately indicated a preference for engineered solutions already underway to meet permitted phosphorus limits.

A selection of BNWRD's current projects and initiatives includes:

- $70M investment in infrastructure improvements across both plants, including effluent treatment wetlands and purchase of adjacent cropland for restoration purposes;
- Investment in a sustainability park to improve the community's quality of life;
- Establishment of a septic-to-sewer program to assist residents financially with connecting to available public sanitary sewers;
- Re-connection of 2,630 linear feet of stream to its floodplain with wetland restoration;
- Green infrastructure restoration within a designated Environmental Justice area (a marginalized and/or low-income community that is disproportionately at-risk to environmental risks and hazards);
- Property acquisition and green infrastructure stormwater management to reduce the volume of water entering the combined sewer system;
- Community donations for water education at the local Children's Discovery Museum.

Wastewater Treatment Plant Barriers

Our assessment revealed a series of barriers to program adoption, specific to BNWRD, but applicable to other wastewater treatment plants across the state. These include:

1. As with other wastewater treatment plants, BNWRD is investing in major upgrades to both plants out of necessity due to aging infrastructure. These upgrades will result in substantially lower effluent concentrations, below existing permit limits. A nutrient offset program would not provide compelling additional benefits from a permitting standpoint, and a return on investment is unknown.
2. Short of purchasing property, any program would rely on a third party to fulfill requirements through voluntary adoption of nutrient-reducing practices by private landowners. There is little certainty that landowner buy-in can be achieved even with financial incentives, thus leading to concern over practices not being completed or managed appropriately.
3. Although an MOU only provides a voluntary framework for developing a program, enforcement mechanisms and future administrative costs are unclear. The potential future cost of this uncertainty is a barrier.

Administrative and Policy Barriers

1. There are currently no established standards or regulatory drivers encouraging wastewater treatment plants in Illinois to pursue enhanced treatment methods beyond the minimum requirements. As a result, there is a lack of concerted pressure from state agencies or environmental organizations to adopt stricter effluent quality limits. This absence of incentive hampers progress in reducing contaminants and improving water quality in local waterways, leaving communities at risk and potentially impacting public health and ecosystem integrity.

2. There are concerns despite the potential of having an agreement in place with BNWRD. No offset program guidance has been provided by the Illinois EPA, potentially leading to additional legal and other costs. As a result, BNWRD is cautious about pitching out-of-the-box solutions.

Preliminary Illinois Conclusions

Our assessment may indicate that the nutrient offset program is more applicable to medium or small-sized existing plants in more rural areas of Illinois that are having difficulty meeting current permit limits without substantial additional capital expenditures or without the ability to use chemical precipitation treatment for phosphorus. For those able to meet existing limits, the potential for lower limits in the future is the only incentive; the uncertainty of this occurrence outweighs the need to participate in an offset program now. Water quality trading is not a solution that can be applied broadly to all wastewater treatment plants, given the current policy framework and State agency posture in Illinois at this time.

Although Illinois has experienced a slow start to water quality trading, agricultural and conservation partners in the state are excellent at collaborating towards nutrient loss reduction strategies. In 2017, two Illinois farmers teamed up with the Champaign County Soil and Water Conservation District to design a tool to evaluate conservation progress and address local resource concerns using sound science, producer experience, and conservation expertise. The Saving Tomorrow's Agriculture Resources (STAR; 2025) concept grew to include an implementation framework and was soon adapted and expanded into other Midwestern and Western states to meet their local needs. In September of 2023, STAR made its debut as a national nonprofit and is available to farmers in eight states and is now designated as the official soil health assessment tool for state-funded conservation programs in Illinois (White, 2025).

Illinois farmers designed a tool to evaluate conservation progress and address local resource concerns

Success Spotlight: Johnsonville

Wisconsin has made significant strides to achieve nutrient reduction goals, particularly in phosphorus reduction, achieving a 20% reduction between 1995 and 2018, meeting the HTF's interim target (WiDNR, 2020). The state has been a leader in setting numeric criteria for phosphorus in surface waters. Its strategy focuses on regulating point sources through the Wisconsin Pollutant Discharge Elimination System (WPDES) and offering innovative compliance options like water quality trading and adaptive management, which allow permit holders to fund non-point source reductions. While effective, these programs are not accessible to communities without a WPDES permit, leaving gaps in some regions (WiDNR 2020). The state has seen a 59% increase in nitrate loads in rivers and is struggling with nitrate pollution in private wells, leading it to explore new, non-regulatory strategies (Kaeding, 2021; Campbell et al., 2022; USEPA, 2024; Summers et al., 2025).

In 2023, SCF launched a pilot project in Wisconsin to develop a partnership between Johnsonville, LLC and farmers in the Sheboygan River watershed to achieve water quality goals through on-farm conservation implementation to reduce phosphorus and sediment runoff loss. The goal of the pilot was to enhance Johnsonville's understanding of the potential load reductions that could be obtained from local farms. By understanding the possible phosphorus and sediment reduction potential from farms in the target area, Johnsonville can more effectively pursue feasibility determinations for water quality permit compliance through a water quality trading program or other coordinated efforts with the Wisconsin Department of Natural Resources (WiDNR) and plant engineers.

Johnsonville treats discharges from its manufacturing facility (process wastewater) as well as sanitary wastewater from the Village of Johnsonville and its corporate campus in the Town of Sheboygan Falls. The final effluent is discharged into the Sheboygan River as a point source permitted by the Wisconsin Department of Natural Resources. Johnsonville has been working to reduce phosphorus discharge from its food processing facility for over 10 years. Improved wastewater treatment processes over the last decade cut the average phosphorus concentration in its effluent from about 0.5 mg/L to less than 0.25 mg/L, and Johnsonville now discharges on average less than two pounds of phosphorus per million gallons of water treated. However, Johnsonville's

total phosphorus discharge still exceeds the annual discharge (247 pounds) allocated under the Northeast Lakeshore Total Maximum Daily Load.

Two compliance options available to point-source dischargers like Johnsonville include adding wastewater treatment equipment that removes more phosphorus from the effluent, and creating water quality trading partnerships to reduce phosphorus loads across a larger portion of the watershed (USEPA, 2024). Johnsonville wanted to explore whether cost-sharing with watershed partners could produce better overall outcomes in terms of phosphorus and sediment loading compared to investing in additional wastewater infrastructure.

Performance-based conservation is a system for agricultural conservation delivery that is predicated on planning and modeling whole farm systems to look for management and practice changes or additions that create the highest response to resource concerns. Rather than receiving an incentive payment for implementing a new farming practice, regardless of the benefit, (i.e., paid based on the practice that is added), performance-based conservation applies a direct value to the farmer for the environmental response of the system that has been adopted and provides data on the environmental impact of their change (i.e., price paid per pound of phosphorus or sediment loss prevented by the practice added).

For the pilot project, SCF modeled conservation implementation scenarios that represent a diverse mix of production, including dairy, grain, and livestock from four participating farms. The scenarios include fertilizer and manure management, reduced tillage, buffers, alternative crops, and cover crops. By modeling various options, the team could identify those that provide both agronomic and environmental benefits.

Johnsonville's partnership with four local farms in 2024 achieved remarkable conservation results. A full review of each farm, combined with strategic scenario building, guided the implementation of conservation efforts across 1,432 acres. This led to a reduction of 618 pounds of phosphorus and 64.9 tons of sediment from entering local waterways. The key to this success was a data-driven approach, empowering farms to make management changes tailored to their farm systems. Each farm selected different management changes for retaining phosphorus and sediment. However, the most successful were those who implemented farm-

level changes such as nutrient management strategies or reducing tillage. When practices are too field-specific, there is a greater chance the change does not amount to a measurable difference for crediting.

As the pilot project comes to a close, all of the farms would consider continuing their participation in a performance-based incentivization approach. Johnsonville's next steps will be to decide how to move forward with their relationships with the farms and begin developing a water quality trading plan to mark their intentions with the WiDNR.

Water Quality Trading: Lessons Learned from Johnsonville

- Each conservation practice is accounted for annually by field. As crop rotations and associated management changes, the phosphorus and sediment credits will change.
- Make conservative credit estimates. Due to the uncertainties with farm management, estimate 4x the credits required for compliance when working with agricultural collaborators.
- Build a positive, long-term relationship with each farm. Establish a transparent program that provides a minimum payment to compensate for the farmer's time and commitment.
- Water quality modeling takes time to learn. Within the first five years of a project, it may take more time to set up a program than expected over the program's long-term timeline.

20

Concluding Thoughts & Recommendations

Water quality credit trading can be successful, but point source dischargers (NPDES permit holders) must feel confident in their ability to work in a rural watershed context. Building trust with rural partners, particularly farmers, is crucial for successful collaboration. In our recent analysis, those who have partnerships outside of the city with entities that work directly with farmers (like SCF or SWOF) are more successful. Larger municipalities or industries with more financial capacity can hire a watershed coordinator, whose role is to specifically work with landowners in the associated watershed. Watershed coordinators or conservation agronomists typically have the agricultural background that is vital to effective farm data collection, and they understand the water quality models and data, reducing knowledge gaps. Having a dedicated person to manage the data collection also increases confidence in the credit trading system from the discharger. In Illinois, partners to facilitate the farmer relationships were identified, but had not yet been brought into the work for BNWRD to see a full picture of the project stakeholders.

Social relationships should also be considered. Johnsonville, LLC is a well-known, community-based entity, who was able to foster goodwill and positive relationships with the farmers in their project by offering tours of the facility and an informational FAQ session on why they are investing in their local watershed. Farmers in this project appreciated knowing that a local company with a commitment to community was invested in the watershed, as opposed to the standard practice of using short-term grants to fund conservation. Johnsonville is viewed as a trusted company, rather than an oversight authority, and the community can see the impact within the water resources that they share, furthering the collaborative efforts.

Unfortunately, there can often be a disconnect or discord between those who live in rural versus urban areas, especially when it comes to discussions around water quality and health. Rural areas are often blamed, sometimes publicly, like in the 2015 Des

Moines Water Works lawsuit, where the municipal wastewater facility sued county drainage districts upstream of their drinking water source for high nitrate pollution. While the case was ultimately dropped, it sparked conversations and further disruption between relationships of those who live in Des Moines and those who live in rural Iowa.

One avenue to increasing confidence in water quality credit trading programs as a whole is to include urban conservation practices. Expanding water quality credit trading to include urban conservation practices would allow cities to generate more credits from city-owned lands and build trust among stakeholders. This may be a gateway to building trust in the program and with the process. Many of the cities we spoke with, including Bloomington-Normal in Illinois, have been investing significantly inside the city limits. This method would also build trust with taxpayers in the city, knowing that investments started with them.

Despite challenges, some municipalities have successfully improved water quality through practical measures and collaborations. Key factors necessary for advancing an effective program include **prioritizing community engagement** to motivate stakeholders and frame nutrient reduction as a collective effort, **soliciting diverse funding** to create local buy-in by both private and public parties, and **investing in staff capacity** to efficiently manage agricultural input data and modeled outputs. **Lastly, it is imperative that a strong partnership is established to maintain critical support for these three key factors.**

References

Campbell, T.A., Booth, E.G., Gratton, C., 2022. Agricultural Landscape Transformation Needed to Meet Water Quality Goals in the Yahara River Watershed of Southern Wisconsin. Ecosystems 25, 507–525. https://doi.org/10.1007/s10021-021-00668-y

Clayworth, J., 2023. Polk County's water improvement program being replicated. Axios. https://www.axios.com/local/des-moines/2023/03/16/water-improvement-polk-county-buffer

Essien, E. E., K. Said Abasse, A. Côté, K. S. Mohamed, M. M. F. A. Baig, M. Habib, M. Naveed, X. Yu, W. Xie, S. Jinfang, and M. Abbas. 2020. Drinking-water nitrate and cancer risk: A systematic review and meta-analysis. Arch. Environ. Occup. Health 77(1):51–67. https://doi.org/10.1080/19338244.2020.1842313

Gillam, C., 2025. 'Cancer is just everywhere': Could farming be behind Iowa's unfolding health crisis? The Guardian. https://www.theguardian.com/us-news/2025/jun/18/iowa-farm-chemicals-cancer

Huntley, H., Peterson, T., 2023. Progress of Iowa watershed partnerships. Environmental Policy Innovation Center & Sand County Foundation. https://sandcountyfoundation.org/uploads/publications/Watershed-Partnerships-Progress-Final.pdf

Illinois Environmental Protection Agency, 2023. Illinois nutrient loss reduction strategy: Biennial report 2023. Illinois Environmental Protection Agency. https://epa.illinois.gov/content/dam/soi/en/web/epa/topics/water-quality/watershed-management/excess-nutrients/documents/2023-biennial-report/FINAL_NLRS2023-Web-08-Mar-2024.pdf

Iowa Agriculture Water Alliance, 2022. Batch and build. https://www.iaagwater.org/batch-and-build

Iowa Cancer Registry, 2024. Why does Iowa have the 2nd highest and fastest rising cancer rate in the United States? University of Iowa. https://shri.public-health.uiowa.edu/wp-content/uploads/2024/07/Iowa-Cancer-Registry-Why-Does-Iowa-Have-the-2nd-Highest-and-Fastest-Rising-Cancer-Rate-in-the-US.pdf

Iowa Code § 455B.199B, 2012. https://www.legis.iowa.gov/docs/aco/arc/0529C.pdf

Iowa State University. 2025. Tracking the Iowa Nutrient Reduction Strategy: Interactive data dashboards. Accessed October 16, 2025. https://nrstracking.cals.iastate.edu/tracking-iowa-nutrient-reduction-strategy

Johnson, G., L. Christianson, R. Christianson, M. Davis, C. Díaz-García, T. Groh, T. Isenhart, J. Kjaersgaard, R. Malone, L. A. Pease, and N. Rogovska. 2023. Effectiveness of Saturated Buffers on Water Pollutant Reduction from Agricultural Drainage. J. Nat. Resour. Agric. Ecosyst. 1(1): 49-62. https://doi.org/10.13031/jnrae.15516

Kaeding, D., 2021. Groups say 2017 law prevents Wisconsin DNR from pursuing standards to curb nitrate pollution. WPR. https://www.wpr.org/agriculture/groups-say-2017-law-prevents-wisconsin-dnr-pursuing-standards-curb-nitrate-pollution

Krasovich, E., Lau, P., Tseng, J. Longmate, J., Bell, K., Hsiang, S. 2022. Harmonized nitrogen and phosphorus concentrations in the Mississippi/Atchafalaya River Basin from 1980 to 2018. Sci Data 9, 524. https://doi.org/10.1038/s41597-022-01650-6

McDowell, D. 2024. Secretary Naig Announces Sac County ''Batch and Build'' Water Quality Project. Iowa Department of Agriculture & Land Stewardship. https://iowaagriculture.gov/news/sac-county-batch-and-build

Robertson, D., Saad, D. 2021. Nitrogen and Phosphorus Sources and Delivery from the Mississippi/Atchafalaya River Basin: An Update Using 2012 SPARROW Models. JAWRA 57:3, 357-526. https://doi.org/10.1111/1752-1688.12905

Saleh, A., Gallego, O., Osei, E., Lal, H., Gross, C., McKinney, S., Cover, H., 2011. Nutrient Tracking Tool—a user-friendly tool for calculating nutrient reductions for water quality trading. J. Soil Water Conserv. 66, 400–410. https://doi.org/10.2489/jswc.66.6.400

Saleh, A., Gallego, O., Osei, E., 2015. Evaluating Nutrient Tracking Tool and simulated conservation practices. J. Soil Water Conserv. 70, 115A-120A. https://doi.org/10.2489/jswc.70.5.115A

Saving Tomorrow's Agricultural Resources (STAR), 2025. https://illinoisstar.org/home

Sharpley, A., Jarvie, H.P., Buda, A., May, L., Spears, B., Kleinman, P., 2013. Phosphorus Legacy: Overcoming the Effects of Past Management Practices to Mitigate Future Water Quality Impairment. J. Environ. Qual. 42, 1308-1326. https://doi.org/10.2134/jeq2013.03.0098

Stoner, N., 2011. Working in partnership with states to address phosphorus and nitrogen pollution through use of a framework for state nutrient reductions. United States Environmental Protection Agency. https://www.epa.gov/sites/default/files/documents/memo_nitrogen_framework.pdf

Summers, H., Eckberg, J. O., Peterson, H. M., 2025. Glass half full: A framework for setting realistic water quality conservation targets. J. Environ. Qual. 1, 1–21. https://doi.org/10.1002/jeq2.70064

Torre, J., Mason S., Warnell, K., 2023. Case Study: Soil and Water Outcomes Fund. Nature-Based Solutions Financing Working Group Project. Nicholas Institute for Energy, Environment & Sustainability, Duke University. https://nicholasinstitute.duke.edu/project/green-banksand-community-lenders-financing-nature-based-solutions

US Army Corps of Engineers, 2025. Regulatory In-Lieu Fee and Bank Information Tracking System (RIBITS): Nutrient Reduction Exchange Registry. Accessed Sept 18, 2025. https://ribits.ops.usace.army.mil/ords/f?p=107:462:1706366451367::NO

US Environmental Protection Agency, 2014. Mississippi River Gulf of Mexico watershed nutrient task force new goal framework. U.S. Environmental Protection Agency. https://www.epa.gov/sites/default/files/2015-07/documents/htf-goals-framework-2015.pdf

US Environmental Protection Agency, 2023. Mississippi River/Gulf of Mexico Watershed Nutrient Task Force 2023 Report to Congress. https://www.epa.gov/ms-htf/hypoxia-task-force-reports-congress

US Environmental Protection Agency, 2024. Water Quality Trading Case Study — Wisconsin's Statewide Water Quality Trading Program. EPA-833-F-22-010. https://www.epa.gov/system/files/documents/2024-10/wqt-case-study-wisconsin.pdf

White, Jared. 2025. Illinois designates STAR Tool as official soil health assessment for conservation programs. Brownfield Ag News. https://www.brownfieldagnews.com/news/illinois-designates-star-tool-as-official-soil-health-assessment-for-conservation-programs/

Wisconsin Department of Natural Resources, 2020. Guidance for Implementing Water Quality Trading in WPDES Permits. Guidance #3800-2020-0010 (ed. 2). https://apps.dnr.wi.gov/swims/Documents/DownloadDocument?id=83858832